CURRICULUM 2024
AUTONOMOUS

B.Tech
ELECTRONICS AND COMMUNICATION ENGINEERING

JAWAHARLAL COLLEGE OF ENGINEERING AND TECHNOLOGY

(Approved by AICTE, Autonomous Institution Affiliated to APJ Abdul Kalam Technological University, Jawahar Gardens, Mangalam(po),
Ottappalam, Palakkad - 679301

CURRICULUM

FOR

B. TECH DEGREE PROGRAMME

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

2024 SCHEME

(AUTONOMOUS)

JAWAHARLAL COLLEGE OF ENGINEERING AND TECHNOLOGY

(Approved by AICTE, Autonomous Institution Affiliated to APJ Abdul Kalam Technological University), Jawahar gardens, Mangalam (PO), Ottapalam, Palakkad, Kerala – 679301

Phone: 0466 2344800

Web: www.jawaharlalcolleges.com

Mail: hodece@jawaharlalcolleges.com

JAWAHARLAL COLLEGE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

B.TECH DEGREE PROGRAMME

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

CURRICULUM AND FIRST YEAR SYLLABI

2024 SCHEME

ITEM	BOARD OF STUDIES (BOS)	ACADEMIC COUNCIL (AC)
DATE OF APPROVAL	14-10-2024	17-10-2024

HEAD OF THE DEPARTMENT — PRINCIPAL

Chairman, Board of Studies — Chairman, Academic Council

JAWAHARLAL COLLEGE OF ENGINEERING AND TECHNOLOGY

VISION OF THE INSTITUTE

Emerge as a center of excellence for professional education to produce high quality engineers and entrepreneurs for the development of the region and the Nation.

MISSION OF THE INSTITUTE

- To become an ultimate destination for acquiring latest and advanced knowledge in the multidisciplinary domains.
- To provide high quality education in engineering and technology through innovative teaching-learning practices, research and consultancy, embedded with professional ethics.
- To promote intellectual curiosity and thirst for acquiring knowledge through outcome based education.
- To have partnership with industry and reputed institutions to enhance the employability skills of the students and pedagogical pursuits.
- To leverage technologies to solve the real life societal problems through community services.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VISION OF THE DEPARTMENT

To become a Centre of Academic Excellence and Research in the field of ECE to raise Engineers with standards and ethical values with the ability to apply acquired knowledge to find solutions for technologically challenging practical problems.

MISSION OF THE DEPARTMENT

- To impart high-quality education through innovative and comprehensive instructional materials.
- Establishing suitable environment for students to nurture talent and to obtain entrepreneurial skills and leadership qualities for self and social development.

- To develop research linkage with leading organisations in India.
- To cultivate a committed group of faculty striving for excellence in teaching and research.
- To provide ethical and value-based education for promoting a sense of responsibility towards nation-building, social causes and environment conservation

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

1. **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem Analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern Tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

6. **The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and Team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PEOs OF THE DEPARTMENT

- To provide a solid foundation in Electronics and Communication Engineering essentials with an attitude to pursue higher education, participation in Research & Development activities, and involvement in lifelong learning & professional development.
- Obtain in-depth knowledge of the core discipline of Electronics & Communication Engineering so that they will be able to establish Engineering Standards and overcome realistic constraints in systematic engineering processes with the incorporation of industries' expectations and design socially accepted and economically feasible solutions in the respective fields.
- To make the student Communicate effectively, lead a team with good leadership traits, and exhibit professional conduct.

PSOs OF THE DEPARTMENT

Graduates will be able to

- Apply Science & Mathematics through Differential and Integral Calculus; To Solve Complex Electronics and Communication Engineering Problems.
- Attain the Ability to Interpret the Basic Concepts and Methods of Electronic Systems and Technical Specifications to Provide Accurate Solutions.
- Utilize Electronic Current Advances (Both Software and Hardware) for the Design and Analysis of Complex Electronic Frameworks in Research Activities.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

B. TECH IN ELECTRONICS AND COMMUNICATION ENGINEERING

For the students admitted from 2024

SCHEDULING OF COURSES

Knowledge Segments and Credits

Every course of B. Tech Programme is placed in one of the nine categories as listed in the following table. No semester shall have more than six lecture-based courses and two laboratory courses, and/or drawing/seminar/project courses in the curriculum.

SL NO	CATEGORY	CATEGORY CODE	CREDIT
1.	Basic Science Courses	BSC	20
2.	Engineering Science Courses	ESC	16
3.	Programme Core Courses, Comprehensive Course Work and Viva Voce	PCC	44
4.	Programme Core Labs	PCL	16
5.	Programme Core – Project Based Learning	PCC-PBL	9
6.	Programme Elective Courses	PEC	15
7.	Humanities and Social Sciences including Management Courses	HMC	1
8.	Open Elective Courses	OEC	9
9.	Project Work and Seminar	PWS	16
10.	Skill Enhancement Course	SEC	9
11.	Ability Enhancement Course	AEC	10
12.	Value Added Courses	VAC	8
13.	Mandatory Student Activities (P/F)	MSA	3
TOTAL MANDATORY CREDIT			**176**
14	HONOURS - MOOC		10

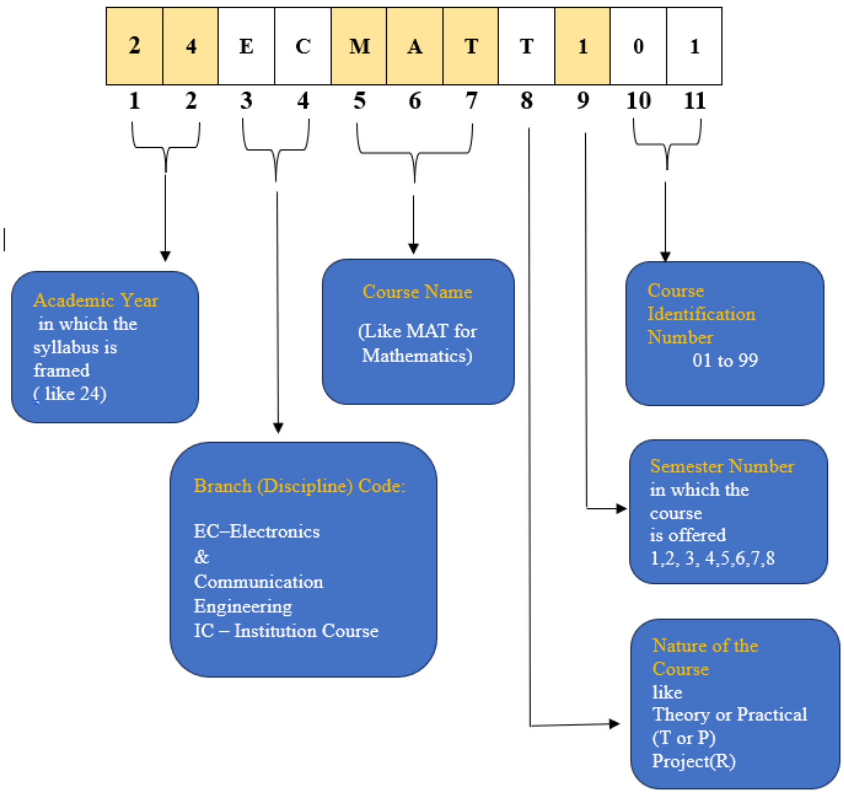
Semester-wise Credit Distribution

SEMESTER	I	II	III	IV	V	VI	VII	VIII	TOTAL
CREDIT	22	22	22	22	22	22	22	22	176
TOTAL	44		44		44		44		

PROGRAM STRUCTURE:

SEMESTER	COURSE CREDIT													
	BSC	ESC	PCC	PCL	PCC-PBL	PEC	HMC	OEC	PWS	SEC	AEC	VAC	MSA	TOTAL
I.	7	8	-	-	-	-	-	-	-	4	1	2	-	22
II.	7	8	4	-	-	-	-	-	-	2	1	-	-	22
III.	3	-	8	4	-	-	-	-	-	3	2	2	-	22
IV.	3	-	10	4	3	-	-	-	-	-	2	-	-	22
V.	-	-	11	4	3	3	1	-	-	-	-	-	-	22
VI.	-	-	6	4	3	3	-	3	-	-	1	2	-	22
VII.	-	-	3	-	-	6	-	3	8	-	2	-	-	22
VIII.	-	-	2	-	-	3	-	3	8	-	1	2	3	22
TOTAL	20	16	44	16	9	15	1	9	16	9	10	8	3	176

COURSE CODE:



SEMESTER 1									
Sl. No	Course Code	Category Code	Course Name	Credit Structure				Credits	Hrs./ Week
				L	T	P	R		
1	24ICMATT101	BSC	Linear Algebra, Multivariable Calculus and Series	3	0	0	0	3	3
2	24ICPHYT122	BSC	Semiconductor Physics	3	0	2	0	4	5
3	24ICEGCT103	ESC	Engineering Graphics and Computer-Aided Drawing.	2	0	2	0	3	4
4	24ICIEET104	ESC	Introduction to Electrical & Electronics Engineering (Part 1: Electrical Engineering)	2	0	0	0	4	4
			(Part 2: Electronics Engineering)	2	0	0	0		
5	24ICATPT105	SEC	Algorithmic Thinking with Python	3	0	2	0	4	5
6	24ICLPCT106	AEC	Life Skills and Professional Communication	2	0	0	0	1	2
7	24ICBEEP107	ESC	Basic Electrical and Electronics Engineering Workshop	0	0	2	0	1	2
8	24ICVACP108	VAC	Web and Graphic Design	0	0	4	0	2	4
Total								**22**	**29**

SEMESTER 2									
Sl. No	Course Code	Category Code	Course Name	Credit Structure				Credits	Hrs./ Week
				L	T	P	R		
1	24ICMATT201	BSC	Vector Calculus, Ordinary Differential Equations and Transforms	3	0	0	0	3	3
2	24ICCHET222	BSC	Chemistry for Electronics Engineers	3	0	2	0	4	5
3	24ICFCTT203	ESC	Foundations of Computing: From Hardware Essentials to Web Design	2	0	2	0	3	4
4	24ICPGCT204	ESC	Programming in C	2	0	2	0	4	5
5	24ECBADT205	PCC	Basics of Analog and Digital Electronics	3	1	0	0	4	4
6	24ICEEIT206	SEC	Engineering Entrepreneurship & IPR	2	0	0	0	2	2
7	24ICHAWT207	AEC	Health and wellness	1	0	1	0	1	2
8	24ICITWP208	ESC	IT Workshop	0	0	2	0	1	2
Total								**22**	**27**

SEMESTER 3									
Sl. No	Course Code	Category Code	Course Name	Credit Structure				Credits	Hrs./ Week
				L	T	P	R		
1	24ICMATT301	BSC	Partial Differential Equations and Complex Variable	3	0	0	0	3	3
2	24ECNAST302	PCC	Network Analysis and Synthesis	3	1	0	0	4	4
3	24ECCLIT303	PCC	Circuits & Linear ICs	3	1	0	0	4	4
4	24ICIAIT304	SEC	Introduction to Artificial Intelligence and Data Science	3	0	0	0	3	3
5	24ICEEST305	AEC	Engineering Ethics and Sustainable Development	2	0	0	0	2	2
6	24ECSCIP306	PCL	Scientific Computing Lab	0	0	3	0	2	3
7	24ECCASP307	PCL	Circuits and Simulation Lab	0	0	3	0	2	3
8	24ECVACP308	VAC	Computational Tool for Engineers	0	0	3	0	2	3
Total								**22**	**25**

SEMESTER 4									
Sl. No	Course Code	Category Code	Course Name	Credit Structure				Credits	Hrs./ Week
				L	T	P	R		
1	24ICMATT421	BSC	Probability Distributions, Random Process and Numerical Methods	3	0	0	0	3	3
2	24ECSAST402	PCC	Signals and Systems	3	1	0	0	4	4
3	24ECPCET403	PCC	Principles of Communication Engineering	3	0	0	0	3	3
4	24ECDSDT404	PCC	Digital System Design	3	0	0	0	3	3
5	24ECMEST405	PCC PBL	Microcontroller & Embedded System Design	3	0	0	1	3	4
6	24ICIEFT406	AEC	Industrial Economics & Foreign Trade	2	0	0	0	2	2
7	24ECDIGP407	PCL	Digital Electronics Lab	0	0	3	0	2	3
8	24ECCOMP408	PCL	Communication Lab	0	0	3	0	2	3
Total								**22**	**25**

SEMESTER 5									
Sl. No	**Course Code**	**Category Code**	**Course Name**	**Credit Structure**				**Credits**	**Hrs./ Week**
				L	**T**	**P**	**R**		
1	24ECEATT501	PCC	Electromagnetics & Antenna Theory	3	1	0	0	4	4
2	24ECVDET502	PCC	VLSI Design	3	1	0	0	4	4
3	24ECDSPT503	PCC	Digital Signal Processing	3	0	0	0	3	3
4	24ECIOTT504	PCC PBL	IoT Devices	3	0	0	1	3	4
5	24ECXXXT5N5	PEC	PE-1	3	0	0	0	3	3
6	24ICCOIT506	HMC	Constitution of India (MOOC)	-	-	-	-	1	0
7	24ECDSPP507	PCL	Digital Signal Processing Lab	0	0	3	0	2	3
8	24ECMESP508	PCL	Microcontroller and Embedded System Lab	0	0	3	0	2	3
Total								**22**	**24**

Programme Elective Courses		
SEMESTER 5	**PE-1**	**CREDITS**
24ECMEIT515	Medical Instrumentation	3
24ECFORT525	Fundamentals of Robotics	3
24ECMIST535	Measurements and Instrumentation Systems	3
24ECSDMT545	Semiconductor Device and Modelling	3
24ECCOAT545	Computer Architecture	3

SEMESTER 6

Sl. No	Course Code	Category Code	Course Name	Credit Structure				Credits	Hrs./ Week
				L	T	P	R		
1	24ECCSET601	PCC	Control Systems Engineering	2	1	0	0	3	4
2	24ECSOCT602	PCC	Satellite and Optical Communication	2	1	0	0	3	4
3	24ECDIPT603	PCC-PBL	Digital Image Processing	3	0	0	1	3	4
4	24ECXXXT6N4	PEC	PE-2	3	0	0	0	3	3
5	24ICDPDT605	AEC	Design Thinking and Product Development	1	0	1	0	1	2
6	24OEXXXT6N6	OEC	OE-1	3	0	0	0	3	3
7	24ECEMTP607	PCL	Electromagnetics Lab	0	0	3	0	2	3
8	24ECIMPP608	PCL	Image Processing Lab	0	0	3	0	2	3
9	24ECVACP609	VAC	Electronic System Design & Automation	0	0	3	0	2	3
			Total					**22**	**29**

Programme Elective Courses		
Semester 6	**PE2**	**Credits**
24ECESMT614	Embedded Systems in Medicine	3
24ECAIRT624	AI in Robotics	3
24ECPRCT634	Process Control	3
24ECASDT644	ASIC Design	3
24ECCONT654	Computer Networks	3

Open Elective Courses		
Semester 6	**OE1**	**Credits**
24OEMOCT616	Mobile Computing	3
24OEMEMT626	MEMS Technology	3

SEMESTER 7										
Sl. No	Course Code	Category Code	Course Name	Credit Structure				Credits	Hrs./
				L	T	P	R		
1	24ECMWCT701	PCC	Mobile and Wireless Communication	2	1	0	0	3	4
2	24ECXXXT7N2	PEC	PE-3	3	0	0	0	3	3
3	24ECXXXT7N3	PEC	PE-4	3	0	0	0	3	3
4	24OEXXXT7N4	OEC	OE-2	3	0	0	0	3	3
5	24ICXXXT7N5	AEC	AEC Elective	2	0	0	0	2	2
6	24ECSEMP706	PWS	Seminar	0	0	0	3	2	3
7	24ECPROR707/ 24ECINTR707	PWS	Option 1: Major Project Option 2: Internship (4-6 Months) Option 3: Major Project Phase -I (For the students who have not opted for internship in S7/S8)	0	0	0	6	6	8
Total								**22**	**26**

Programme Elective Courses		
Semester 7	**PE3**	**Credits**
24ECBSPT712	Biomedical Signal Processing	3
24ECIRAT722	Industrial Robotics and Automation	3
24ECINIT732	Industrial Instrumentation	3
24ECCADT742	CMOS analog IC design	3
24ECRTOT752	RTOS	3

Programme Elective Courses		
Semester 7	**PE4**	**Credits**
24ECMIET713	Medical informatics and Expert systems	3
24ECSADT723	Sensor and Actuator Devices for Robotics	3
24ECIPAT733	Industrial Process Automation Systems	3
24ECLPVT743	Low Power VLSI Design	3
24ECDSAT753	Data Structures and Algorithms	3

Open Elective Courses		
Semester 7	**OE2**	**Credits**
24OEESDT714	Electronic System Design	3
24OEESAT724	Embedded Systems and Applications	3

AEC Electives		
Semester 7	**AEC ELECTIVE**	**Credits**
24ICPMPT715	Project Management: Planning, Execution, Evaluation And Control	2
24ICPCFT725	Proficiency Course in French. (MOOC) (B1 Level)	2
24ICPCGT735	Proficiency Course in German (B1 Level). (MOOC)	2
24ICPCST745	Proficiency Course In Spanish (B1 Level) (MOOC)	2
24ICIJLT755	Introduction to Japanese Language and Culture (N5 Level). (MOOC)	2

SEMESTER 8									
Sl. No	Course Code	Category Code	Course Name	Credit Structure				Credits	Hrs./ Week
				L	T	P	R		
1	24ECXXXT8N1	PEC	PE-5	3	0	0	0	3	3
2	24OEXXXT8N2	OEC	OE-3	3	0	0	0	3	3
3	24ICOBBT803	AEC	Organizational Behaviour and Business Communication	2	0	0	0	1	2
4	24ECPROR804/ 24ECINTR804	PWS	Option 1: Major Project Option 2: Internship (4-6 Months) Option 3: Major Project Phase -II (For the students who have not opted for internship in S7/S8)	0	0	0	8	8	8
5	24ECCOVT805	PCC	Comprehensive Viva	0	0	0	2	2	2
6	24ICMSAP806	MSA	Mandatory Student Activity	0	0	0	0	3	0
7	24ECVACP807	VAC	RTL Coding and FPGA Design	0	0	3	0	2	3
					Total			**22**	**21**

Programme Elective Courses		
Semester 8	**PE5**	**Credits**
24ECBITT811	Biotelemetry	3
24ECMORT821	Mobile Robotics	3
24ECISDT831	Instrumentation System Design	3
24ECHIVT841	High Speed Interconnects for VLSI Design	3
24ECCYST851	Cybersecurity	3

Open Elective Courses		
Semester 8	**OE3**	**Credits**
24OEBMIT812	Biomedical Instrumentation	3
24OEREST822	Renewable Energy System	3

MSA				
SL NO	**GROUP**	**COURSES**	**CREDIT**	**YEAR OF COMPLETION**
1	**1**	NSS, NCC, NSO (National Sports Organization)	**1 (40 points)**	**4**
2		Arts/Sports/Games		
3		Union/Club Activities/ Field Work		
1	**2**	English Proficiency Certification (TOEFL, IELTS, BEC etc)	**1 (40 points)**	**4**
2		Aptitude Proficiency Certification (GRE, CAT, GMAT etc)/Valid Gate Score		
3		Short Term Internship (Minimum 4 weeks), Conference/Workshop Activities/ Hackathons/Professional Body Activities/ Field Work with Output		
1	**3**	Conference, Seminar	**1 (40 points)**	**4**
2		Journal Publication, Patent, Incubation etc		
3		Skilling Certificates (Approved by the University)		

SEMESTER-I

24ICMATT101	LINEAR ALGEBRA, MULTIVARIABLE CALCULUS AND SERIES	Category	L	T	P	Credit
		BSC	**3**	**0**	**0**	**3**

Preamble

This course introduces students to some basic mathematical ideas and tools which are at the core of any engineering course. A brief course in Linear Algebra familiarizes students with some basic techniques in matrix theory which are essential for analyzing linear systems. The calculus of functions of one or more variables taught in this course is useful in modeling and analyzing physical phenomena involving continuous change of variables or parameters and has applications in engineering.

Prerequisite

Basic mathematics at plus two-level which includes single-variable calculus and multivariate calculus.

Course Outcomes

After the completion of the course the student will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Apply the matrix concepts to solve problems for system of equation in engineering (Applying)	20
CO2	Employing the partial derivatives to find the maxima and minima of multivariable functions (Applying)	20
CO3	Apply the concepts of double integrals to find the areas and volumes (Applying)	20
CO4	Utilizing the concepts of d triple integrals to find the volumes of geometrical shapes (Applying)	20
CO5	Understand the power series expansion of a given function and apply it in engineering (Understanding)	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1*	PSO2*	PSO3*
CO1	3	3	3	3	-	3	-	-	1	-	-	3	-	-	-
CO2	3	3	3	3	-	3	-	-	1	-	-	3	-	-	-
CO3	3	3	3	3	-	3	-	-	1	-	-	3	-	-	-
CO4	3	2	3	2	-	3	-	-	1	-	-	3	-	-	-
CO5	3	3	3	3	-	3	-	-	1	-	-	3	-	-	-
AVG	**3**	**2.8**	**3**	**2.8**	**-**	**3**	**-**	**-**	**1**	**-**	**-**	**3**	**-**	**-**	**-**

1-Low; 2-Medium; 3- Strong

* The faculty handling a particular programme should map the Course Outcomes (COs) with the applicable programme Specific outcomes (PSOs)

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30
Applying	50	50	50	50	50
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance	: 6 marks
Continuous Assessment Test (2 numbers)	: 20 marks
Assignment/Quiz/Course project	: 14 marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks;** **Duration =90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks;** **Duration =150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment

Course Outcome 1 (CO1):

1. Solve the system of equations by Gauss elimination method x+2y+3z=1
2x+3y+2z=2
3x+3y+4z=1

2. Consider the matrix: $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$. Find the eigenvalues and eigenvectors of the matrix. Then, use them to diagonalize the matrix A.

3. Determine the rank of the matrix $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ 1 & 2 & 5 \end{bmatrix}$.

4. If 2 is an eigen value of $\begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$ without using characteristic equation find the other eigen values.

5. For what values of a and b do the system of equation $x + y + z = 6$
$x + 2y + 3z = 10$
$x + 2y + az = b$

Course Outcome 2(CO2):

1. The temperature distribution in a metal plate is given by the function $T(x, y) = \frac{xy}{x^2+y^2}$ for$(x, y) \neq (0,0)$ and $T(0,0) = 0$. Investigate the continuity of the function at the point (0,0). Does the limit exist as$(x, y) = (0,0)$? Is the function continuous at that point?
2. A cylindrical tank's volume **V** depends on its radius **r** and height **h** according to the formula$V = \pi r^2 h$. The radius and height of the tank both change with time $t\ as\ r(t) = 2 + t$ and $h(t) = 5 - t$. Using the chain rule,find the rate of change of volume of the tank with respect to time t at $t = 1$.
3. Find the absolute maximum and minimum values of the function$f(x, y) = x^2 + y^2 - 2x - 4y$ on the closed and bounded triangular region with vertices at$(0,0), (2,0)\ and\ (0,2)$. Analyse the function on the boundaries and at the vertices to determine these values.
4. A production model for a company is given by $P(x, y) = x^2y + 3xy^2$, where x and y represent the amounts of two different resources used. The resources x and y are functions of time t, given by $x(t) = 2t$ and $y(t) = 3 + t^2$. Compute the total derivative of the production P with respect to time $t = 2$.
5. Consider the function $f(x, y) = x^2 - 3x + y^2$ Determine the critical points of f and use the second partial derivative test to classify each critical point as a relative maximum, relative minimum, or saddle point.

Course Outcome 3 (CO3):

1. A lamina occupies the region bounded by $y = \sqrt{x}$ and $= x$. he density function is given by$\delta(x, y) = 3x + 2y$. Find the mass and the coordinates of the center of gravity of the lamina.
2. A swimming pool is circular with a 40-meter diameter. The depth is constant along east-west lines and increases linearly from 2 meters at the south end to 7 meters at the north end. Find the volume of the pool.
3. Change the order of integration and evaluate the integral $\int_0^1 \int_{x^2}^1 e^{y^2} dydx$.
4. Using double integral to find the area enclosed by the cardioid $r = 1 + cos\theta$. Set up and evaluate the corresponding double integral.
5. Using triple integral find the volume of the solid bounded by the cylinder $r = 2$ and the planes$z = 0$ and $z = 3r$. Set up and evaluate the triple integral in cylindrical coordinates.

Course Outcome 4 (CO4):

1. A scientist records the population of a bacterial culture each hour. The population forms a geometric sequence with the first term $a = 500$ and a common ratio $r = 0.8$. Determine if the sequence converges, and if so, find its limit. Additionally, sum the first 10 terms of this sequence.
2. Determine the convergence or divergence of the series $\sum_{n=1}^{\infty} \frac{3n}{n^2+1}$. using the comparison test.
3. Consider the series $\sum_{n=1}^{\infty} \frac{n!}{n^n}$. Use the ratio test to determine if the series converges or diverges.
4. Investigate the series $\sum_{n=1}^{\infty} \frac{(-1)^n}{\sqrt[n]{n}}$ for absolute and conditional convergence. Does the series converge absolutely, conditionally, or diverge?
5. Use the Leibniz test to determine the convergence of the alternating series$\sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n^2+1}$. Also, determine if the series converges absolutely or conditionally

Course Outcome 5(CO5):

1. Find the Taylor series representation of the function $f(x) = ln\,(1 + x)$ centered at $x = 0$. Determine the radius of convergence of this series.

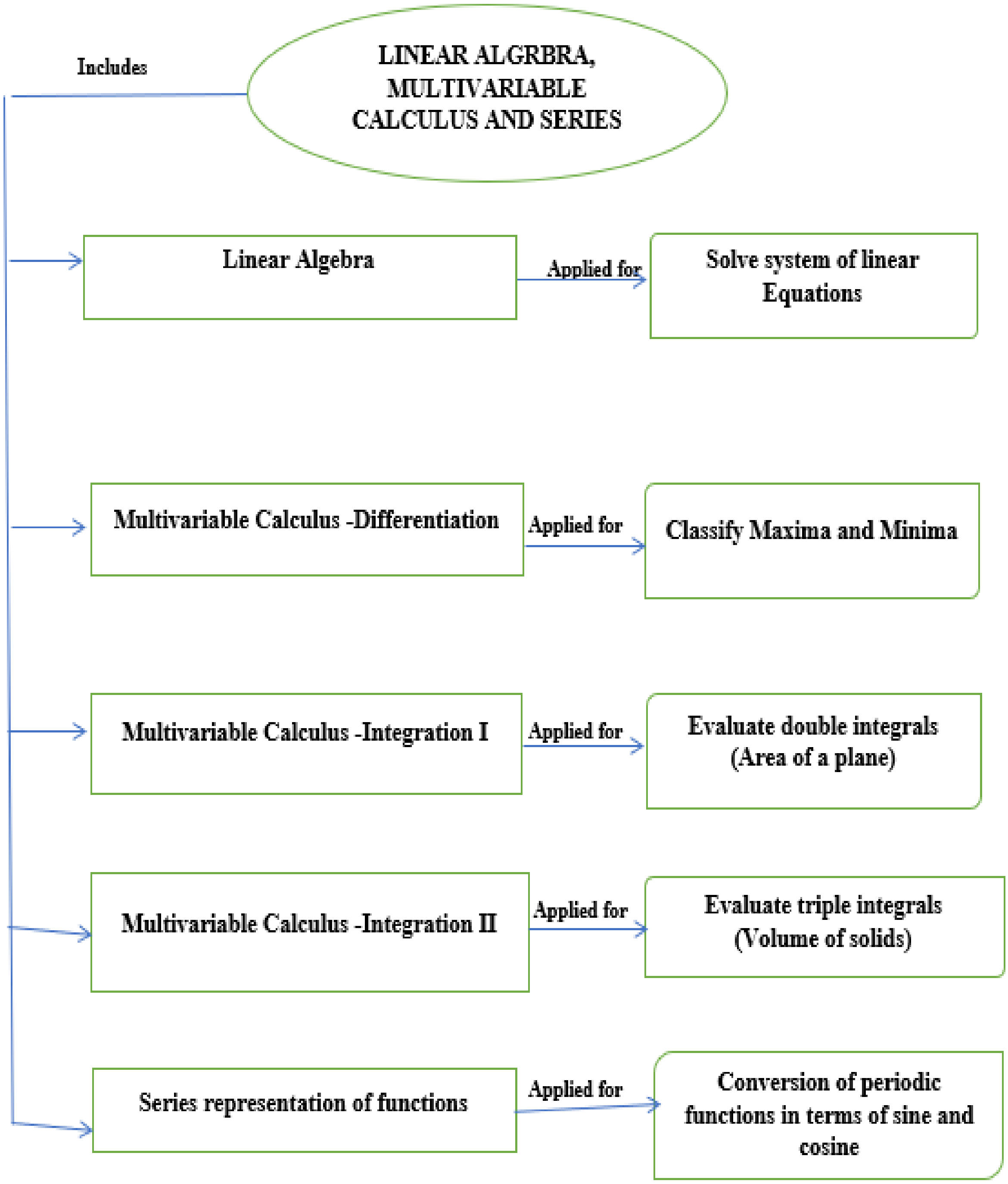
2. Express the function $g(x) = e^x sinx$ as a power series centered at $x = 0$. Combine the known series representations of $e^x\ and\ sinx$ to write the first five non-zero terms of the series.

3. Verify if the Fourier series of the function $f(x) = |x|$ defined on the interval $[-\pi, \pi]$ converges to$f(x)$ for all x. Check if the function satisfies Dirichlet's conditions for convergence of its Fourier series.

4. Consider the function $f(x) = x$ defined on the interval $[-\pi, \pi]$. Find its Fourier series representation using Euler formulas. Clearly identify the coefficients for the sine and cosine terms.

5. Given the function $f(x) = x(2 - x)$ on the interval$[0,2]$, find the half-range cosine series representation of $f(x)$. Write out the first three non-zero terms of the series

Concept Map


Includes
LINEAR ALGRBRA, MULTIVARIABLE CALCULUS AND SERIES
Linear Algebra
Applied for
Solve system of linear Equations
Multivariable Calculus -Differentiation
Applied for
Classify Maxima and Minima
Multivariable Calculus -Integration I
Applied for
Evaluate double integrals (Area of a plane)
Multivariable Calculus -Integration II
Applied for
Evaluate triple integrals (Volume of solids)
Series representation of functions
Applied for
Conversion of periodic functions in terms of sine and cosine

Syllabus

MODULE 1

Systems of linear equations - Solution by Gauss Elimination Row echelon form-finding rank from row echelon form fundamental theorem for linear systems - Diagonalization of matrices - Eigen values and eigen vectors

MODULE 2

Concept of limit and continuity of functions of two variables, partial derivatives, chain rule, total derivative, Differentials, Local Linear approximations, Relative maxima and minima

MODULE 3

Double integrals, Reversing the order of integration in double integrals, change of coordinates in double integrals (Cartesian to polar), Finding areas and volume using double integrals, mass and center of gravity of plane laminas.

MODULE 4

Triple integrals, volume calculated as triple integral, triple integrals in cartesian coordinates, triple integrals in cylindrical coordinates,

MODULE 5

Series Representation of Functions - Taylor series –Fourier Series - Fourier series Euler formulas Half range sine and cosine series,properties.

Learning Resources

TEXT BOOKS

Sl.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Erwin Kreyszig	Advanced Engineering Mathematics	10th Edition	John Wiley & Sons	2020
2	H Anton, I Biven, S Davis	Calculus	12th Edition	Wiley	2024

REFERENCE BOOKS

Sl.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	J. Stewart	Essential Calculus	2nd Edition	Cengage Learning	2017
2	B.V Ramana	Higher Engineering Mathematics	39th Edition	McGraw-Hill Education	2023
3	Howard,Anton,Chris Rorres	Elementary Linear Algebra	11th Edition	Wiley	2019

On line study materials:

1. https://nptel.ac.in/courses/112105123/
2. https://youtu.be/XzaeYnZdK5o?si=2IyMWT5JNmtmzMEn
3. https://youtu.be/md5UCR7mcIY?si=jh94s18XP-LBw8F3
4. https://youtu.be/4QFsiXfgbzM?si=K0oM3ilxYXkCy_bH

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1	**Linear Algebra**	**9**	CO1
1.1	Systems of Linear Equations	1	
1.2	Solution by Gauss Elimination Row echelon form-finding rank from row echelon form	3	
1.3	Eigen values and Eigen vectors	2	
1.4	Diagonalization of matrices	3	
2	**Multivariable calculus-Differentiation**	**9**	CO2
2.1	Concept of limit and continuity of functions of two variables, partial derivatives	2	
2.2	Differentials	1	
2.3	Local Linear approximations	2	
2.4	Chain rule	1	
2.5	Total derivative	1	
2.6	Maxima and minima	2	
3	**Multivariable calculus-Integration -I**	**9**	CO3
3.1	Double integrals (Cartesian)-evaluation	2	
3.2	Change of coordinates (Cartesian to polar),	2	
3.3	Reversing the order of integration	2	
3.4	Finding areas and volumes	1	
3.5	Mass and center of gravity of plane laminas	2	
4	**Multivariable calculus-Integration -II**	**9**	CO4
4.1	Triple integrals	2	
4.2	Volume calculated as triple integrals	2	
4.3	Triple integrals in Cartesian coordinates	3	
4.4	Triple integrals in cylindrical coordinates	2	
5	**Series representation of functions**	**9**	CO5
5.1	Taylor series	1	
5.2	Series representation of exponential, trigonometric, logarithmic functions	2	
5.3	Fourier series	2	
5.4	Euler formulas	1	
5.5	Half range sine and cosine series	3	
Total Hours		**45**	

COURSE DESIGNED BY	VERIFIED BY
Ms. Dayana K Asst. Professor, BS & H, JCET E Mail ID: dayanak@jawaharlalcolleges.com	Prof. K R Vijayakumaran Pillai Professor and Head, BS & H, JCET E Mail ID:krvijay@jawaharlalcolleges.com

24ICPHYT122	SEMICONDUCTOR PHYSICS	Category	L	T	P	Credit
		BSC	3	0	2	4

Preamble

The aim of the Engineering Physics program is to offer students a solid background in the fundamentals of Physics and to impart that knowledge in Electronics Engineering. The program is designed to make the students gain practical knowledge to correlate with the theoretical studies and use the principles in the right way to implement the modern technology.

Prerequisite

Higher secondary level Physics- Concepts of Oscillations and waves, Semiconductor, Nano scale, basics of magnetism, phenomena of light, Differential equations

Course Outcomes

On the successful completion of the course students will be able to

COs	Course Outcome Statement	Weightage in %
CO1	Explain the fundamentals of Semiconductor Physics (Understanding)	20
CO2	Analyze the behavior of semiconductor materials in various semiconductor devices, and validate their characteristics through experimental verification. (Analyzing)	20
CO3	Analyze the behavior of matter in the atomic and subatomic level through the principles of quantum mechanics to perceive the microscopic processes in electronic devices and apply the knowledge of nanotechnology in various applications (Analyzing)	20
CO4	Classify the properties of magnetic materials, apply vector calculus to analyze static magnetic fields, and utilize Maxwell's equations to solve various engineering problems, corroborating these findings through experimental verification. (Understanding)	20
CO5	Analyze the underlying principles of various photonic devices, explain the operation of solid-state lighting devices and fiber optic communication systems, and validate their functionality through experiments. (Analyzing)	20

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	-	3	2	-	2	1	3	-	-	3	1	-	-
CO2	3	3	3	-	3	-	2	1	3	-	-	3	1	-	-
CO3	2	3	-	2	3	-	2	1	3	-	-	3	1	-	-
CO4	3	1	-	-	1	-	2	1	3	-	-	3	1	-	-
CO5	3	1	1		2	1	2	1	3	-	-	3	1	-	-
Avg	**2.6**	**2.2**	**2**	**2.5**	**2.2**	**1**	**2**	**1**	**3**	**-**	**-**	**3**	**1**	**-**	**-**

1-Low; 2-Medium; 3- Strong

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	**2**	1	2	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30
Applying	50	40	50	40	40
Analyzing		10		10	10
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	Practical
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Total Mark	CIA	ESE	ESE Duration
100	60	40	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 9 Marks

Continuous Assessment Test (2 numbers) : 24 Marks

Practical : 27 Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks;** **Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 40 Marks** **Duration = 150 Minutes** Part A: 5 X 8 = 40 Marks

Sample Questions for Course Outcome Assessment*

Course Outcome 1 (CO1):

1. Explain the significance of the energy gap in semiconductors and how it affects their electrical properties..
2. Derive the expression for electrical conductivity using the Classical Free Electron Theory.
3. The Fermi energy of a metal at absolute zero is 5.5 eV. Calculate the probability that an electron occupies a state with energy 5.6 eV at a temperature of 300 K.

Course Outcome 2(CO2):

1. What is the difference between a half-wave and a full-wave rectifier? Explain.
2. Explain the mechanism of Zener breakdown and Avalanche breakdown. How are they different?
3. Describe the role of a MOSFET in power electronics applications.

Course Outcome 3 (CO3):

1. Analyze the physical significance of the wave function, exploring its implications in advanced practical applications
2. What is the difference between the time-dependent and time-independent forms of the Schrodinger equation?
3. What are some potential applications of graphene and carbon nanotube-based devices?

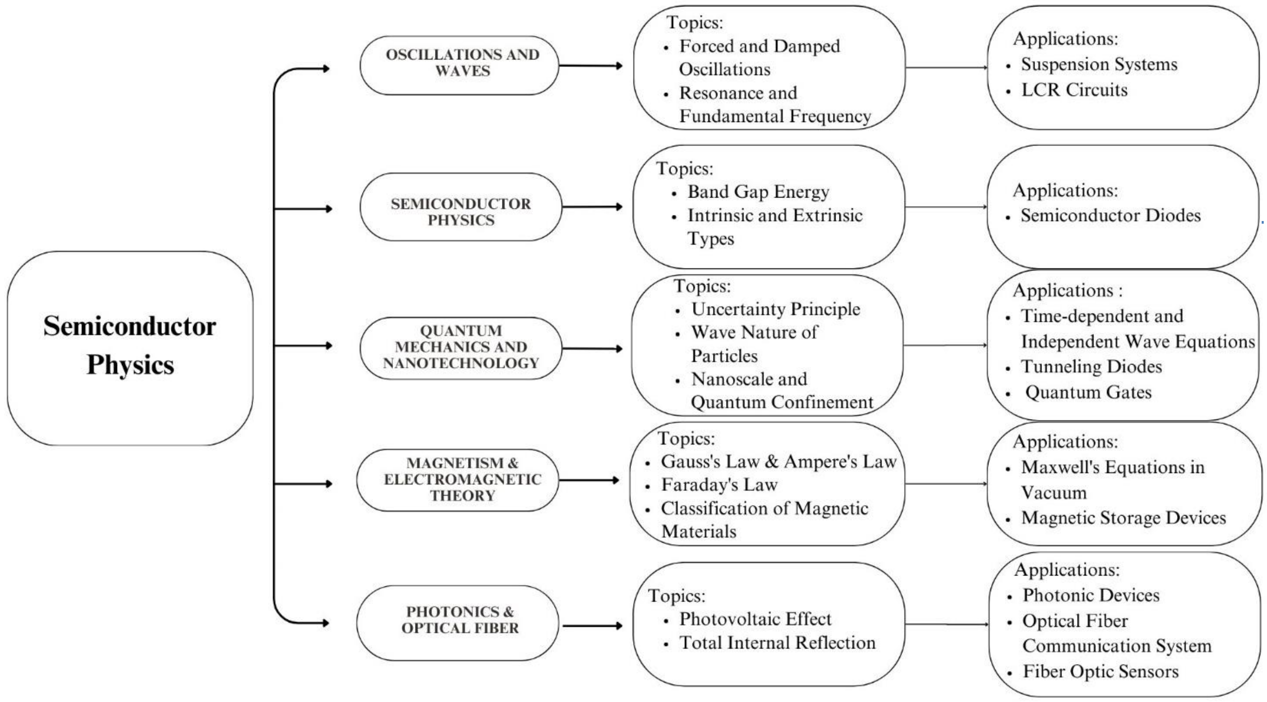
Course Outcome 4 (CO4):

1. How can Ampère's Circuital Law be utilized to determine the magnetic field strength generated by a current-carrying wire loop of complex geometry? Discuss the practical implications of applying this law in the design and analysis of electromagnetic devices such as transformers or solenoids
2. Using the equation of continuity, Gauss's divergence theorem, and Stokes's theorem, deduce Maxwell's equations.
3. An electromagnetic wave is described by $E = 100\ e^{[8\pi i\ [10\ 14\ t - (10\ 6\ z / 3)]}$ V/m. Find the direction of propagation of the wave, speed of the wave and magnetic flux density in the wave.

Course Outcome 5 (CO5):

1. Illuminate the operational dynamics of a solar cell.
2. In what scenarios would you recommend implementing photodiodes over other light-detection devices, considering factors such as working principle, sensitivity, response time, and spectral range?
3. Calculate the numerical aperture and acceptance angle of a fiber with a core refractive index of 1.54 and a cladding refractive index of 1.50 when the fiber is inside water of refractive index 1.33

Concept Map



Syllabus

Module 1

Introduction to Semiconductor Physics

Classification of materials- conductors, semiconductors insulators, Classical free electron Theory, Electric conductivity, Fermi Dirac distribution, Variation of Fermi function with temperature, Semiconductors- Intrinsic and extrinsic semiconductors, P-N junction Diode, Diode equation (Derivation).

Module 2

Semiconductor devices and its Applications

Rectifiers- Full wave and Half wave, Zener breakdown and Avalanche breakdown, Applications of Zener diode, Transistor, FET, MOSFET (qualitative aspects).

Module 3

Quantum Mechanics and Nanotechnology

Introduction for the need of Quantum mechanics, Wave nature of Particles, Uncertainty principle, Applications-Absence of electrons inside a nucleus, Wave function. Formulation of time dependent and independent Schrodinger wave equations

Introduction to Nano science and technology, Increase in surface to volume ratio for nano materials, Carbon nanotube, Graphene and carbon nanotube devices, General applications of nanotechnology.

Module 4

Magnetism & Electromagnetic Theory

Magnetic field and Magnetic flux density, Gauss's law for Magnetic flux density, Ampere's Circuital law, Faraday's laws, Magnetic permeability and susceptibility, Gauss divergence theorem & Stokes' theorem, Equation of continuity, Derivation of Maxwell's Four equations in vacuum.

Module 5

Photonics and fiber optics

Introduction to photonics-Photonic Devices-Light Emitting Diode, Photo detectors -Junction and PIN photodiodes, phototransistors, Solar cells Voltage- Current Characteristics Optic fiber -Principle of propagation of light, Types of fibers- Step index and Graded index fibers, Acceptance Angle, Numerical aperture, fiber optic communication system (block diagram), Optical Fiber Sensors – Intensity and Phase Modulated Sensors, Applications of optical fiber in various fields.

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	M.N.Avadhanulu, P.G.Kshirsagar,TVS Arun Murthy	A Text book of Engineering Physics	New Edition	S.Chand &Co	2019
2	H.K.Malik , A.K. Singh	Engineering Physics	Second Edition	McGraw Hill Education	2019

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
4	Dominic and. A. Nahari	A Text Book of Engineering physics	New Edition	Owl Books Publishers,	2018
5	Premlet B.,	Advanced Engineering Physics	Tenth Edition	Phasor Books	2017
6	Simen Sze	Semiconductor Physics and devices	Third Edition	Wiley publiications	2021

7	**M.N.Avadhanulu, A.A.Dani and Pokely P.M**	**Experiments in Engineering Physics**	**Second**	**S.Chand&Co**	**2008**
8	**Dr Ruby Das (Author), C S Robinson (Author), Rajesh Kumar (Author**	**A Textbook for Engineering Physics Practical**	**Second**	**Laxmi Publications Pvt Ltd**	**2014**
9	**S. K. Gupta,**	**Engineering physics practicals**	**Second**	**Krishna Prakashan Pvt. Ltd**	**2014**

On line study materials:

1. https://youtube.com/playlist?list=PLcwp2fRcIXJVaQ3AuNElHIPGTBknaCSMe&si=ITUg97R-Mdm5aHFm
2. https://youtube.com/playlist?list=PLQzUXa8lZVq8lfZN5836sohUpRCt2b6oB&si=JqGaMS3-Wku8Cwhy
3. https://youtu.be/Z_RtYSnuVOo?si=GENvPLsz0roapXAJ
4. https://youtu.be/BuBOsyl84Ao?si=FvHJeLm-91m-wsAG
5. https://youtu.be/ZRmXM2FL5s4?si=qMIIztluiOrwcl3r
6. https://youtu.be/xE70wbPonZc?si=JX_V5Ps6tQa-yrYu
7. https://youtu.be/cEi-fT_KSIM?si=LLmf-gFeIeYI8Ga6

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**Introduction to Semiconductor Physics**	**9**	CO1
1.1	Classification of materials- conductors, semiconductors insulators	1	
1.2	Classical free electron Theory	1	
1.3	Electric conductivity	1	
1.4	Fermi Dirac distribution,	1	
1.5	Variation of Fermi function with temperature,	2	
1.6	Semiconductors	1	
1.7	Intrinsic and extrinsic semiconductors	1	
1.8	P-N junction Diode, Diode equation (Derivation)	1	
2.	Semiconductor devices and its Applications	**9**	
2.1	Rectifiers	1	
2.2	Full wave and Half wave	1	
2.3	direct and indirect band gap semiconductors, Carrier concentration in intrinsic semiconductors	1	

2.4	Zener breakdown	2	CO2
2.5	Avalanche breakdown	1	
2.6	Applications of Zener diode,	1	
2.7	Transistor, FET(qualitative aspects)	1	
2.8	MOSFET (qualitative aspects)	1	
3	**Quantum Mechanics & Nanotechnology**	**9**	CO3
3.1	Introduction for the need of Quantum mechanics, Wave nature of Particles	1	
3.2	Uncertainty principle, Applications-Absence of electrons inside a nucleus.	1	
3.3	Physical Meaning of wave function	1	
3.4	Formulation of time dependent Schrodinger wave equation -	1	
3.5	Formulation of Schrodinger's time independent wave equation	1	
3.6	Introduction to Nano science and Technology	2	
3.7	Increase in surface to volume ratio for nano material, Carbon nanotube.	1	
3.8	Graphene and carbon nanotube devices, General applications of nanotechnology	1	
4	**Magnetism & Electro Magnetic Theory**	**9**	CO4
4.1	Magnetic field and Magnetic flux density, Gauss's law for Magnetic flux density, Ampere's Circuital law,	1	
4.2	Faraday's law in terms of Electromotive force produced by changing magnetic flux.	1	
4.3	Magnetic permeability and susceptibility	1	
4.4	Gauss divergence theorem & Stokes' theorem of integrals	2	
4.5	Equation of continuity	1	
4.6	Derivation of Maxwell's First equation in vacuum	1	
4.7	Derivation of Maxwell's Second and Third equations in vacuum	1	
4 8	Derivation of Maxwell's Fourth equation in vacuum	1	
5	**Photonics and Fiber optics**	**9**	CO5
5.1	Introduction to photonics-Photonic Devices-Light Emitting Diode.	1	
5.2	Photo detectors -Junction and PIN photodiode, phototransistors	1	
5.3	Solar cells - Current-Voltage Characteristics	1	
5.4	Optic fiber-Principle of propagation of light	1	
5.5	Types of fibers-Step index and Graded index fibers	2	
5.6	Acceptance angle, Numerical aperture –Derivation	1	
5.7	Fiber optic communication system (block diagram)	1	

5.8	Optical Fiber Sensors – Intensity and Phase Modulated Sensors Industrial, Medical and Technological applications	1	
	TOTAL	45 hours	

PHYSICS LAB

Expt No	Name of the Experiment	No. of Hours
1	Voltage - Current Characteristics of p-n junction diode	2
2	Voltage - Current Characteristics of Zener diode	2
3	Deflection Magnetometer- Determination of Moment of Magnet- Tan A and Tan B Position.	2
4	Determination of Magnetic field along axis of a current carrying coil - Stewart and Gee's Apparatus	2
5	Voltage - Current Characteristics of Light Emitting diode	2
6	Drawing of voltage current characteristics of a Solar cell and the determination of maximum power	2
7	Determination of Acceptance angle and numerical aperture of fiber optic cable.	2

COURSE DESIGNED BY	VERIFIED BY
Ms. Sreevidya P Asst. Professor, B S and H Dept, JCET E. Mail ID: sreevidya3923.phy@jawaharlalcolleges.com	Ms. Sandhya N S Asst. Professor, B S and H Dept, JCET E. Mail ID: sandhya.physic@jawaharlalcolleges.com

24ICEGCT103	ENGINEERING GRAPHICS AND COMPUTER AIDED DRAWING	Category	L	T	P	Credit
		ESC	2	0	2	3

Preamble

To enable the student to effectively perform technical communication through graphical representation as per global standards.

Prerequisite

None

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Draw the projection of points and lines located in different quadrants manually and using CAD tools. (Applying)	20
CO2	Prepare multi view orthographic projections of objects by visualizing them in different positions manually and using CAD tools (Applying)	20
CO3	Draw sectional views and develop surfaces of a given object manually and using CAD tools (Applying).	20
CO4	Prepare pictorial drawings using the principles of isometric projections to visualize objects in three dimensions manually and using CAD tools (Applying).	20
CO5	Prepare pictorial drawings using the principles of perspective projections to visualize objects in three dimensions and Convert 3D views to orthographic views and vice versa using both manual drawing and CAD tools (Applying).	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	3	-	-	-	-	1	-	-	-	-	-
CO2	3	2	-	-	3	-	-	-	-	1	-	-	-	-	-
CO3	3	2	-	-	3	-	-	-	-	1	-	-	-	-	-
CO4	3	2	-	-	3	-	-	-	-	1	-	-	-	-	-
CO5	3	2	-	-	3	-	-	-	-	1	-	-	-	-	-
Avg	**3**	**2**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**

3- Strong; 2-Medium; 1-Low

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering					
Understanding	20	20	40	20	20
Applying	80	80	60	80	80
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	CAD Practice
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	60	40	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 9 marks
Continuous Assessment Test (2 numbers) : 24 marks
Assignment/Quiz/ Practical : 27 marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks;** **Duration =90 Minutes** **Theory Evaluation** 5 X 6 = 30 Marks **Practical Evaluation** 2 X 8 = 16 Marks 1X 4 = 4 Marks
End Semester Exam	**Total = 40 Marks;** **Duration =150 Minutes** Part A: 5 X 8 = 40 Marks

Sample Questions for Course Outcome Assessment

(Questions may be framed based on the outline given under each course outcome)

Course Outcome 1 (CO1):

1. Locate points in different quadrants as per given conditions.
2. Problems on lines inclined to both planes.
3. Find True length, Inclinations and Traces of lines.
4. Prepare drawings using CAD

Course Outcome 2 (CO2)

1. Draw orthographic views of solids and combination solids
2. Draw views of solids inclined to any one reference plane.
3. Draw views of solids inclined to both reference planes.
4. Prepare drawings using CAD

Course Outcome 3 (CO3):

1. Draw views of solids sectioned by a cutting plane
2. Find location and inclination of cutting plane given true shape of the section
3. Draw development of lateral surface of solids and also its sectioned views
4. Prepare drawings using CAD

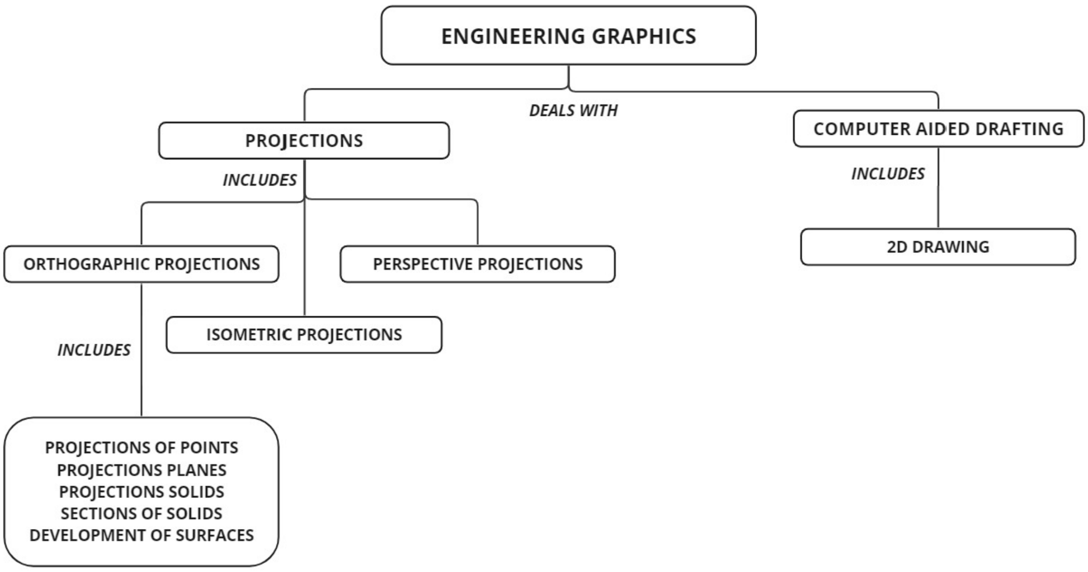
Course Outcome 4 (CO4):

1. Draw Isometric views/projections of solids
2. Draw Isometric views/projections of combination of solids
3. Prepare drawings using CAD

Course Outcome 5 (CO5):

1. Draw Perspective views of Solids.
2. Draw Orthographic views of solids from given three dimensional view
3. Prepare drawings using CAD.

Concept Map



Syllabus

MODULE 1

Introduction: Relevance of technical drawing in engineering field. Types of lines, Dimensioning, BIS code of practice for technical drawing. Orthographic projection of Points and Lines: Projection of points in different quadrants, Projection of straight lines inclined to one plane and inclined to both planes. Trace of line. Inclination of lines with reference planes True length of line inclined to both the reference planes. Application Problems. (Minimum 10 manual drawings and 5 CAD drawings compulsory)

MODULE 2

Orthographic projection of planes. (Introduction only). Orthographic projection of Solids: Projection of Simple solids such as Triangular, Rectangle, Square, Pentagonal and Hexagonal Prisms, Pyramids, Cone and Cylinder. Projection of solids in simple position including profile view. Projection of solids with axis inclined to one of the reference planes and with axis inclined to both reference planes. (Minimum 10 manual drawings and 5 CAD drawings compulsory)

MODULE 3

Sections of Solids: Sections of Prisms, Pyramids, Cone, Cylinder with axis in vertical position and cut by different section planes. True shape of the sections. Also locating the section plane when the true shape of the section is given. Development of Surfaces: Development of surfaces of the above solids and solids cut by different section planes. Also finding the shortest distance between two points on the surface. (Minimum 10 manual drawings and 5 CAD drawings compulsory)

MODULE 4

Isometric Projection: Isometric View and Projections of Prisms, Pyramids, Cone, Cylinder, Frustum of Pyramid, Frustum of Cone, Sphere, Hemisphere and their combinations. (Minimum 10 manual drawings and 5 CAD drawings compulsory)

MODULE 5

Perspective Projection: Perspective projection of Prisms and Pyramids with axis perpendicular to the ground plane, axis perpendicular to picture plane. Conversion of Pictorial Views: Conversion of pictorial views into orthographic views.(Minimum 10 manual drawings and 5 CAD drawings compulsory

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Bhatt, N., D.	Engineering Drawing	Fifth Oneth Edition	Charotar Publishing House Pvt Ltd.	2022
2	Varghese, P. I.	Engineering Graphics	Thirty Fourth edition	V I P Publishers	2023

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR

1	John, K. C.	Engineering Graphics	Ninth Edition	Prentice Hall India Publishers	2009
2	Anilkumar, K. N.	Engineering Graphics	Second Edition	Adhyuth Narayan Publishers	2016
3	Venugopal, K	Engineering Drawing & Graphics	Ninth edition	New Age International Publishers	2011
4	T. Jeyapoovan	Engineering Graphics using AutoCAD	Third Edition	7/e Vikas Publication	2015
5	Dr.H. Ganesan, Sreejith K V and Ragesh P R	Engineering Graphics	First edition	Sree Krishna Publication	2016

ONLINE STUDY MATERIALS:

1. https://onlinecourses.nptel.ac.in/noc24_me140/preview
2. https://onlinecourses.nptel.ac.in/noc23_me144/preview

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**Basics and Projections of Straight Lines**		CO1
1.1	Introduction to graphics, types of lines, Dimensioning	1	
1.2	Concept of principle planes of projection, different quadrants, locating points on different quadrants	1	
1.3	Projection of lines, inclined to one plane. Lines inclined to both planes, trapezoid method of solving problems on lines.	1	
1.4	Problems on lines using trapezoid method	1	
1.5	Line rotation method of solving, problems on line rotation method	2	
1.6	CAD Practice	6	
2	**Projections of Solids**		CO2
2.1	Introduction to projections of planes	1	
2.2	Introduction of different solids, Simple position plan and elevation of solids	1	
2.3	Problems on views of solids inclined to one plane	1	
2.4	Problems on views of solids inclined to both planes	2	
2.5	Practice problems on solids inclined to both planes	1	

2.6	CAD Practice	6	
3	**Sections of Solids and Development of Surfaces**		CO3
3.1	Introduction to section planes. AIP and AVP. Principle of locating cutting points and finding true shape	1	
3.3	Problems on sections of different solids	2	
3.4	Problems when the true shape is given	1	
3.5	Principle of development of solids, sectioned solids	2	
3.6	CAD Practice	6	
4	**Isometric projection**		CO4
4.1	Principle of Isometric View and Projection, Isometric Scale. Problems on simple solids	2	
4.2	Isometric problems on Frustum of solids, Sphere and Hemisphere	2	
4.3	Problems on combination of different solids	2	
4.4	CAD Practice	6	
5	**Perspective projections**		CO5
5.1	Introduction to perspective projection, different planes, station point etc. Perspective problems on pyramids	2	
5.2	Perspective problems on prisms	2	
5.3	Practice on conversion of pictorial views into orthographic views	2	
5.4	CAD Practice	6	
	TOTAL	**60 hours**	

COURSE DESIGNED BY	VERIFIED BY
Mr. Ragesh P R Asst. Professor, ME Dept, JCET E. Mail ID: rageshpr@jawaharlalcolleges.com	Dr. Sujesh G Asso. Professor, Aero Dept, JCET E. Mail ID: sujeshg@jawaharlalcolleges.com

24ICIEET104	INTRODUCTION TO ELECTRICAL AND ELECTRONICS ENGINEERING	Category	L	T	P	Credit
		ESC	**4**	**0**	**0**	**4**

Preamble

This course aims to prepare the students on the fundamentals of DC and AC circuits, basic principles of electrical circuits and machines. It also provides a better knowledge to understand the concept of Semiconductor devices, basic electronic circuits and the technologies used in communication systems paving the way for exploring its applications across diverse domains.

Prerequisite

Basic knowledge of Physics.

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Apply fundamental concepts DC and AC circuits (Applying)	15
CO2	Apply the fundamental laws of Electromagnetic Induction and the Analysis of simple AC circuits (Applying)	20
CO3	Apply the fundamentals of 3-phase AC systems and electrical Machines (Applying)	15
CO4	Describe the working of BJT, FET, RISC, and CISC processors (Understanding)	15
CO5	Outline the principle of rectifiers, amplifiers, and oscillators (Applying)	20
CO6	Explain the principle of radio and cellular communication (Understanding)	15

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	3	1	-	-	-	-	-	-	-	-	-	2	-	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	2	-	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	2	-	-	-
CO5	2	1	-	-	-	-	-	-	-	-	-	2	-	-	-
CO6	2	1	-	-	-	-	-	-	-	-	-	2	-	-	-
AVG	2.3	1	-	-	-	-	-	-	-	-	-	2	-	-	-

1-Low; 2-Medium; 3- Strong

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	20	20	-	-	20
Understanding	40	40	-	-	40
Applying	40	40	100	100	40
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution:

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 hours

Continuous Internal Assessment Pattern:

Attendance : 6 marks
Continuous Assessment Test (2 numbers) : 20 marks
Assignment/Quiz/Course project : 14 marks

Question Paper Pattern:

Type of Test	Pattern	Mark Division
Internal Series Test I	**Total = 50 Marks;** **Duration =90 Minutes** Part A: 6 X 3 = 18 Marks Part B: 4 X 5 = 20Marks : 2X 6 = 12 Marks	Part A: 3 questions each from Module 1 & 4 Part B: 2 questions each from Module 2 & 5; 1 question each from Module 1 & 4
Internal Series Test II	**Duration =90 Minutes** Part A: 6 X 3 = 18 Marks Part B: 4 X 5 = 20Marks : 2X 6 = 12 Marks	Part A: 3 questions each from Module 3 & 6, Part B: 2 questions each from Module 2 & 5; 1 question each from Module 3 & 6
End Semester Exam	**Total = 60 Marks;** **Duration =150 Minutes** Part A: 8 X 3 = 24 Marks	Part A: 1 question each from Module 1,3,4 & 6 2 questions each from Module 2& 5

	Part B: 6X 6= 36 Marks	Part B: 1 question from each Modules

Sample Questions for Course Outcome Assessment

Course Outcome 1 (CO1):
1. Solve problems based on current division rule.
2. Solve problems with Mesh/node analysis.
3. Solve problems on fundamentals of alternating current**.**

Course Outcome 2 (CO2):
1. Problems on electromagnetic induction.
2. Problems on different AC circuits.
3. Problems related to single phase AC power**.**

Course Outcome 3 (CO3):
1. Problems on three phase AC circuits.
2. Problems related to Star and Delta connections.
3. Explanation of different types of machines.

Course Outcome 4 (CO4):
1. Define the operating point in the context of a BJT amplifier.
2. Why is it required to have a FET in amplifiers**?**
3. Compare RISC and CISC processors.

Course Outcome 5 (CO5):
1. Draw the block diagram of DC power supply.
2. Explain the concept of feedback?
3. Explain the working principle of operation of oscillators.

Course Outcome 6 (CO6):
1. What is the working principle of an antenna when used in a radio transmitter?
2. Explain the need for two separate sections RF and IF sections in a superheterodyne receiver.
3. What is meant by a cell in cellular communication?

Concept Map

Basic Electrical Engineering

Deals with

1. DC Circuits & Alternating Current Fundamentals
2. Electromagnetic Induction & Analysis of simple AC circuits
3. Three phase AC systems & Electrical Machines

Includes

1.1 Ohm's law,& Kirchhoff's laws
1.2 series and parallel connection of circuit elements,
1.3 Star-delta conversion
1.4 Node voltage analysis
1.5 Mesh current analysis
1.6 Generation of alternating voltages
1.7 frequency, period, Average, RMS values and form factor
1.8 sinusoidal, half wave rectified and full wave rectified waveforms

Includes

2.1 Faraday's laws, problems, Lenz's law

2.2 statically induced and dynamically induced emfs

2.3 coefficient of coupling

2.4 Purely resistive, inductive & capacitive circuits

2.5 Inductive and capacitive reactance, concept of impedance. Average Power Power factor

2.6 Analysis of RL, RC and RLC series circuits-active, reactive and apparent power.

2.7 Simple numerical problems.

Includes

3.1 Generation of three phase voltages & advantages of three phase systems

3.2 star and delta connections

3.3 relation between line and phase voltages & line and phase currents

3.4 Numerical problems

Application

3.5 Principle of operation, Types and applications of DC machines

3.6 Transformers and Induction Machines.

Basic Electronics Engineering

Deals with

1 Introduction to semiconductor devices

Includes

1.1 Principles of BJT
1.2 Principles of FET
1.3 Integrated Circuits
1.4 RISC & CISC Processors

Deals with

2. Power supplies, Amplifiers & Oscillators

Includes

2.1 Zener Voltage Regulator

2.2 RC Coupled Amplifier

Deals with

3. Communication systems

Includes

3.1 Amplitude Modulation

3.2 Frequency Modulation

3.3 SHR Receiver

3.4 Principles of Antenna

3.5 Cellular & GSM communication

Syllabus

MODULE 1:

DC Circuits & Alternating Current Fundamentals

Basic circuit elements and sources, Ohm's law, Kirchoff's laws, series and parallel connection of circuit elements, Star-delta conversion (resistive networks only- derivation not required)-problems. Node voltage analysis, Mesh current analysis

Alternating Current fundamentals: Generation of alternating voltages-Representation of sinusoidal waveforms: frequency, period, Average, RMS values and form factor of waveforms-(sinusoidal, half wave rectified and full wave rectified waveforms)

MODULE 2:

Electromagnetic Induction & Analysis of simple AC circuits

Electromagnetic Induction: Faraday's laws, problems, Lenz's law- statically induced and dynamically induced emfs - Self-inductance and mutual inductance, coefficient of coupling

Analysis of simple AC circuits: Purely resistive, inductive & capacitive circuits; Inductive and capacitive reactance, concept of impedance. Average Power Power factor. Analysis of RL, RC and RLC series circuits-active, reactive and apparent power. Simple numerical problems.

MODULE 3:

Three phase AC systems & Electrical Machines

Three phase AC systems: Generation of three phase voltages; advantages of three phase systems, star and delta connections (balanced only), relation between line and phase voltages, line and phase currents- Numerical problems

Electrical Machines: Principle of operation, Types and applications of DC machines, AC machines-Transformers, Synchronous and Induction Machines. (Only an elementary qualitative treatment is envisaged.)

MODULE 4

Introduction to Semiconductor devices:

Passive and Active Components, Bipolar Junction Transistors: PNP and NPN structures, Principle of operation, relation between current gains in CE, CB and CC, input and output characteristics of common emitter configuration. Junction Field Effect Transistor, Structure, Types, Parameters, Principle of operation, characteristics, Integrated Circuits-SSI, MSI, LSI, VLSI and ULSI. Introduction to RISC and CISC processors

MODULE 5

Basic electronic circuits:

Block diagram description of a dc power supply, working of a full wave rectifier, capacitor filter (no analysis), working of simple Zener voltage regulator, Concept of Feedback in Amplifiers and Oscillators, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response, Working of RC Phase Shift Oscillator.

MODULE 6

Introduction to Communication Systems: Elements of Communication System, Principle of AM & FM, frequency bands used for various communication systems, block diagram of super heterodyne receiver, Principle of antenna – radiation from accelerated charge. Mobile communication: basic principles of cellular communications, principle and block diagram of GSM.

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	D P Kothari, I J Nagrath	Basic Electrical Engineering	Fourth edition	Tata McGraw Hill	2019
2	Chinmoy Saha	Basic Electronics Principles and Applications	First edition	Cambridge University Press	2018

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
3	Leonard S Bobrow	Fundamentals of Electrical Engineering	Second edition	Oxford University Press	2005
4	NN Bhargava	Basic electronics and Linear Circuits	Second edition	McGraw Hill	2017

Online study materials:

1. https://www.youtube.com/watch?v=w8Dq8blTmSA
2. https://youtu.be/3TR_DS_7z2w

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**DC Circuits & Alternating Current Fundamentals**	9	CO1
1.1	Basic circuit elements and sources, Ohm’s law, Kirchoff's laws,	1	
1.2	series and parallel connection of circuit elements, Star-delta conversion	2	
1.3	Node voltage analysis, Mesh current analysis	2	
1.4	Alternating Current fundamentals: Generation of alternating voltages-Representation of sinusoidal waveforms: frequency, period	2	
1.5	Average, RMS values and form factor of waveforms-Numerical Problems	2	
2	**Electromagnetic Induction & Analysis of simple AC circuits**	7	CO2
2.1	Electromagnetic Induction: Faraday's laws, problems,	1	
2.2	Lenz's law- statically induced and dynamically induced emfs - Self-inductance and mutual inductance, coefficient of coupling	2	
2.3	Purely resistive, inductive & capacitive circuits; Inductive and capacitive reactance, concept of impedance	2	
2.4	Reactive and Apparent power. Simple numerical problems	1	
	Average Power Power factor. Analysis of RL, RC and RLC series circuits	1	
3	**Three phase AC systems & Electrical Machines**	14	CO3
3.1	Three phase AC systems: Generation of three phase voltages; advantages of three phase systems,	2	
3.2	Star and delta connections	2	
3.3	Relation between line and phase voltages, line and phase currents- Numerical problems	2	
3.4	Analysis of simple AC circuits: Purely resistive, inductive & capacitive circuits;	1	
3.5	Inductive and capacitive reactance, concept of impedance.	2	
3.6	Average Power Power factor. Analysis of RL, RC and RLC series circuits-active, reactive and apparent power. Simple numerical problems.	2	
3.7	Electrical Machines: Principle of operation, Types and applications of DC machines,	1	
3.8	Transformers and Induction Machines	2	
4	**Introduction to Semiconductor devices:**	10	CO4
4.1	Bipolar Junction Transistors: PNP and NPN structures, Principle of operation	2	
4.2	Relation between current gains in CE, CB and CC, input and output characteristics of common emitter configuration	2	
4.3	Junction Field Effect Transistor, Structure, Types, Parameters,	2	
4.4	Principle of operation, characteristics.	2	

5.5	Integrated Circuits, Introduction to RISC and CISC processors	2	
5	**Basic electronic circuits**	10	CO5
5.1	Block diagram description of a dc power supply, Working of a full wave rectifiers	2	
5.2	capacitor filter, working of simple zener voltage regulator	2	
5.3	Concept of Feedback in Amplifiers and Oscillators	2	
5.4	Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response	2	
5.5	Working of RC Phase Shift Oscillator	2	
6	**Introduction to Communication Systems**	10	CO6
6.1	Elements of Communication System, Principle of AM & FM,	2	
6.2	frequency bands used for various communication systems, block diagram of super heterodyne receiver	2	
6.3	Principle of antenna – radiation from accelerated charge	2	
6.4	Mobile communication: basic principles of cellular communications.	2	
6.5	principle and block diagram of GSM	2	
TOTAL HOURS		**60**	

COURSE DESIGNED BY	**VERIFIED BY**
Mr. Sanish V. S. Asst. Professor, ECE Dept, JCET E. Mail ID: sanishvs@jawaharlalcolleges.com Ms. Sayana M. Asst. Professor, ECE Dept, JCET E. Mail ID: sayanam@jawaharlalcolleges.com	Mr. Jayesh T. P. Asst. Professor, ECE Dept, JCET E. Mail ID: jayesh4205.ece@jawaharlalcolleges.com Ms. Aswathy J. Asst. Professor, ECE Dept, JCET E. Mail ID: aswathy4088.ece@jawaharlalcolleges.com

24ICSATPT105	ALGORITHMIC THINKING WITH PYTHON	Category	L	T	P	Credit
		SEC	3	0	2	4

Preamble

This course introduces students to algorithmic thinking and problem-solving using Python programming. It emphasizes breaking down complex problems into simpler sub-problems and designing efficient algorithms to solve them. Students will learn Python programming basics, control structures, data structures, and libraries, enabling them to develop and implement effective solutions for real-world problems.

Prerequisite

None

Course Outcomes

After the completion of the course the student will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Interpret the fundamentals of problem-solving and algorithm design. (Understanding)	20
CO2	Develop Python programs using basic programming concepts. (Applying)	20
CO3	Define and utilize functions for data manipulation in Python. (Applying)	20
CO4	Manipulate and operate on arrays using Python and NumPy. (Applying)	20
CO5	Perform file handling operations in Python with exception handling. (Applying)	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	-	-	-	-	-	-	1	2	-	2
CO2	2	2	3	1	3	-	-	-	-	-	-	1	2	-	2
CO3	1	1	3	2	3	-	-	-	-	-	-	-	2	-	1
CO4	2	2	2	3	3	-	-	-	-	-	-	-	1	-	2
CO5	1	1	2	2	3	-	-	-	-	-	-	-	1	-	1
AVG	**2**	**2**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**-**	**2**

1-Low; 2-Medium; 3- Strong

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	20	20	20		20
Understanding	40	40	40	40	40
Applying	40	40	40	60	40
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	
Set	Practical
Guided Response	Tutorial
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	60	40	2.5 Hours

Continuous Internal Assessment Pattern:

Attendance : 9 marks
Continuous Assessment Test (2 numbers) : 24 marks
Assignment (Case study) / Practical (Activity) : 27 marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks;** **Duration =90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 40 Marks;** **Duration =150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 5 = 25 Marks

Sample Questions for Course Outcome Assessment

Course Outcome 1 (CO1):

1. Classify the various types of algorithms and explain their importance in programming.
2. Outline the steps involved in designing an algorithm to perform the sum and average of n numbers.
3. Explain different programming problem-solving techniques.
4. Develop an algorithm to control the functioning of traffic lights at a busy intersection. The lights should change every 60 seconds for each direction, and there should be a 5-second all-red signal for pedestrian crossing between each light change.

Course Outcome 2 (CO2):

1. Write a Python program to demonstrate the use of different data types, including lists, tuples, strings, sets, frozen sets, and dictionaries.
2. Write a Python program to set up the Python programming environment and create a simple program that prints "Hello, World!" and performs a basic arithmetic operation.

Course Outcome 3 (CO3):

1. Identify the different types of function arguments in Python, including positional arguments, keyword arguments, and default arguments. Provide scenarios where each type is useful.
2. Define the term "return value" in the context of functions. Describe how functions return data to the calling code, and what the benefits of using return values are.
3. Discuss the use of global variables in Python functions. Describe how global variables can be modified and accessed within functions, and the best practices for using them.

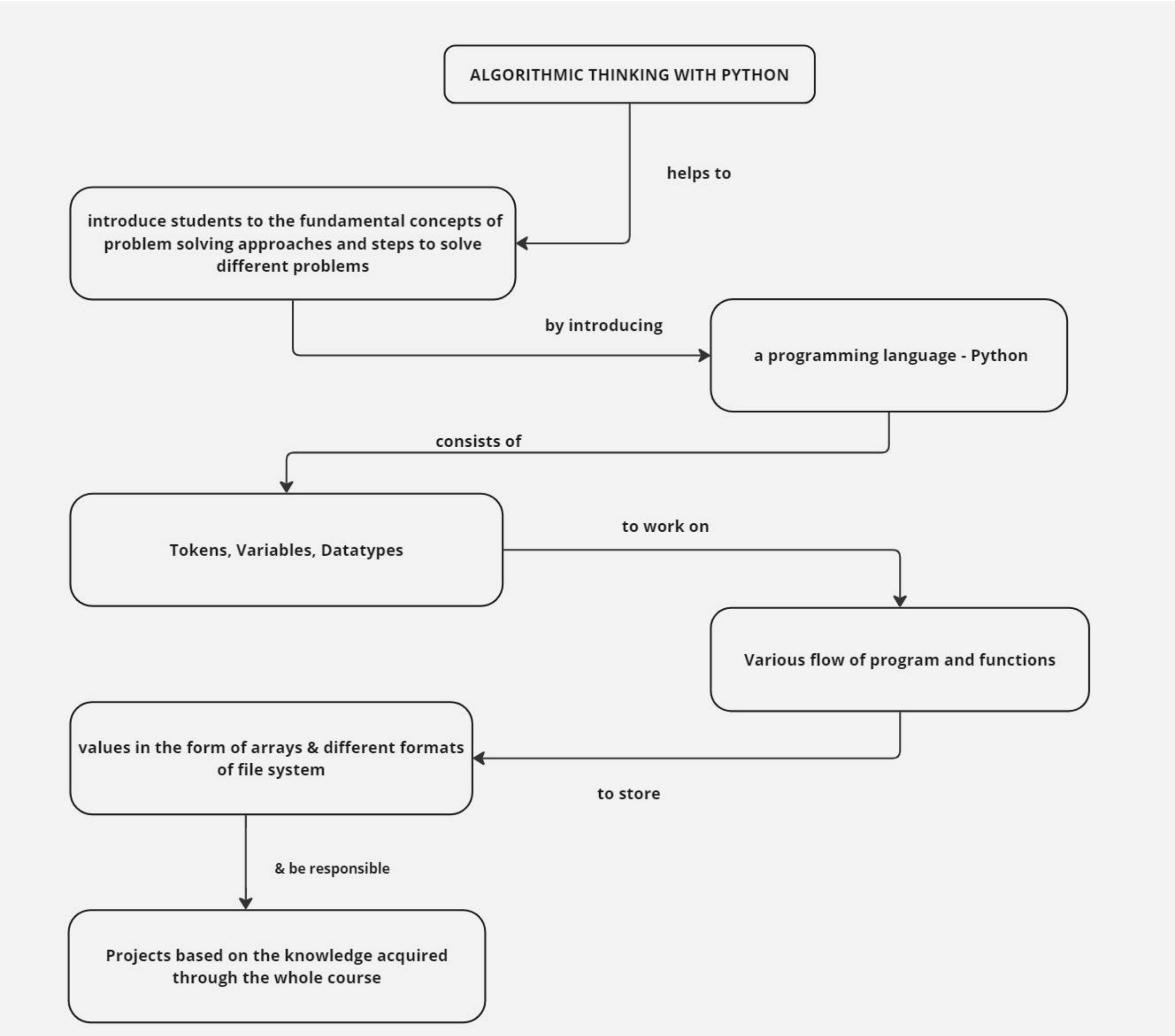
Course Outcome 4 (CO4):

1. Compare and contrast Python lists and NumPy arrays in terms of functionality.
2. Write a Python code snippet to create a NumPy array and demonstrate indexing and slicing.
3. Explain how to perform arithmetic operations on NumPy arrays with examples.

Course Outcome 5 (CO5):

1. Write a Python program to append new data to an existing text file without overwriting the existing content. Handle exceptions that may arise during file operations.
2. Create a CSV file containing student records with attributes like name, age, and grade. Implement a Python script to read this CSV file, perform data analysis, and generate a summary report.

Concept Map



Syllabus

MODULE I

Introduction to Problem Solving - Problems-Problem solving strategies- Trial and Error, Heuristics, Means End Analysis, Backtracking-Approaches in problem Solving- Top-Down, Bottom Up

Problem Solving Process-Breaking a Problem into Subproblems, Overview of Solution by Writing Step-by-Step Procedures (Algorithms), Types of algorithms- Sequential, Selective, Iterative. Representation of Procedures by Flowchart, Implementation of Algorithms, Case Study for Problem-Solving Concepts.

MODULE II

Introduction to Python Programming -Python -Setting Up Python Programming Environment - Program structure- Character set, Token, Variables, Overview of Datatypes, Flow of Control - Decision making statements, Looping Statements, Jumping Statements

MODULE III

Introduction to Functions & **Data Collections Manipulation** -

Defining a Function- Applications, Scopes inside a program, Global, Local, Instance Variables, Types of Functions, Inbuilt Functions- Data Structure Manipulation using inbuilt functions, Modules.

Introduction to User-defined Functions, Parts and Types, Recursion.

MODULE IV

Introduction to Arrays- Arrays, Importance of arrays in numerical computing. Difference between Python lists and NumPy arrays, Setting up NumPy. Creating arrays, Indexing and slicing, Arithmetic & Mathematical Operations, Transposing, Splitting and Copying Arrays.

MODULE V

File Handling -Files - Text, Binary & CSV Files- Operation on files types- reading, writing & appending- Exceptions.

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Maureen Sprankle, Jim Hubbard	Problem Solving and Programming Concepts	Seventh Edition	Pearson	**2011**
2	Mark Summerfield	Programming in Python 3: A Complete Introduction to the Python Language	**2nd Edition**	Pearson Education,	**2018**

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Mark Lutz,	Python Pocket Reference	Fifth Edition	O Reilly	**2014**

2	Eric Matthes	Python Crash Course A Hands-On, Project - Based Introduction to Programming	2nd Edition	No Starch Press, Inc	**2019**

Online study materials:

1. https://nptel.ac.in/courses/106106145
2. https://nptel.ac.in/courses/106106182
3. https://nptel.ac.in/courses/106106182
4. https://onlinecourses.swayam2.ac.in/cec22_cs20/preview

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**Introduction to Problem Solving**	**9 hrs**	CO1
1.1	Problems and problem-solving strategies	1	
1.2	Problems Solving Techniques	1	
1.3	Writing Step-by-Step Procedures (Algorithms)	1	
1.4	Types of Algorithms- Sequential Flow	1	
1.5	Selective Flow Control Algorithms	1	
1.6	Iterative Flow Control Algorithms	1	
1.7	Implementation of Algorithms with examples	1	
1.8	Representing Procedures with Flowcharts	1	
1.9	Case Study of Real-World problems	1	
2.	**Introduction to Python Programming**	**9 hrs**	
2.1	Setting Up Python Programming Environment,	1	
2.2	Introduction to Variable Sets -Token,	1	
2.3	Tokens- Keywords, Identifiers, Literals, Punctuators	1	
2.4	Variables, Overview of Datatypes	1	

2.5	Operators- Arithmetic, Relational, Membership, Identity, Logical	1	CO2
2.6	Operator Precedence, Expressions	1	
2.7	Flow of Control - Decision making statements	1	
2.8	Looping Statements	1	
2.9	Jumping Statements		
3.	**Introduction to Functions & Data Collections Manipulation**	**9 hrs**	CO3
3.1	Defining a Function- Applications, Types of function	1	
3.2	Scopes inside a program, Global, Local, Instance Variables	1	
3.3	List Manipulation using inbuilt functions	1	
3.4	Tuple Manipulation using inbuilt functions	1	
3.5	String Manipulation using inbuilt functions	1	
3.6	Dictionary Manipulation using inbuilt functions	1	
3.7	Modules	1	
3.8	Introduction to User-defined Functions, Parts and Types	1	
3.9	Recursion	1	
4.	**Introduction to Arrays**	**9 hrs**	CO4
4.1	Arrays, Importance of arrays in numerical computing	1	
4.2	Difference between Python lists and NumPy arrays, Setting up NumPy	1	
4.3	Creating arrays	1	
4.4	Indexing and slicing arrays	1	
4.5	Array Arithmetic & Mathematical Operations	1	
4.6	Reshaping and Transposing arrays	1	
4.7	Stacking and Splitting arrays	1	
4.8	Copying Arrays- Different types of Copying technique	1	
4.9	Case study of arrays in real world scenario	1	

5.	**File Handling and Exceptions**	**9 hrs**	CO5
5.1	Introduction to Files and its types - Text, Binary & CSV Files	1	
5.2	Text File - Reading the text data	1	
5.3	Text File - Writing & Appending the text data	1	
5.4	Binary File - Reading data	1	
5.5	Binary File - Writing data	1	
5.6	CSV File - Reading data	1	
5.7	CSV File - Writing data	1	
5.8	Exceptions	1	
5.9	Handling Exceptions	1	
	Total	45 hours	

LAB QUESTIONS

SL NO.	QUESTIONS	HOUR
	MODULE 1	
1	**You are tasked with designing a calculator that performs basic arithmetic operations (addition, subtraction, multiplication, division). **Task**: • Implement the calculator using the **Top-Down approach** by breaking down the operations into subproblems (e.g., input handling, operation execution, output display). • Implement the same calculator using the **Bottom-Up approach**, starting with basic functions for each operation and then building the entire solution. • Compare the two approaches in terms of ease of implementation and scalability. • Write a flowchart for each approach and explain your process.	2
2	**You are developing a program to manage a simple library system. The system allows the user to: • Search for a book by title (sequential algorithm)	2

	• Check if a user is eligible for membership based on age (selective algorithm - if age >= 18, eligible; else, not eligible) • Keep track of borrowed books with a maximum limit of 5 books (iterative algorithm to ensure no more than 5 books are borrowed). **Task**: • Write the algorithms for each functionality. • Represent the algorithms in a flowchart. • Implement the algorithms in Python and test them using sample inputs.	
3	You are developing a program to manage a simple library system. The system allows the user to: • Search for a book by title (sequential algorithm) • Check if a user is eligible for membership based on age (selective algorithm - if age >= 18, eligible; else, not eligible) • Keep track of borrowed books with a maximum limit of 5 books (iterative algorithm to ensure no more than 5 books are borrowed). ** **Task**: • Write the algorithms for each functionality. • Represent the algorithms in a flowchart. • Implement the algorithms in Python and test them using sample inputs.	2
4	A delivery company needs to find the shortest route to deliver packages across three cities (A, B, and C). The distance between the cities is known: • A to B = 50 km • A to C = 70 km • B to C = 30 km **Task**: Use means-end analysis to determine the best delivery route that minimizes travel distance. **Steps**: • Break the problem down into subproblems. • Write a step-by-step algorithm showing how means-end analysis is used to find the shortest path. • Create a flowchart representing the algorithm and implement it using Python or pseudocode.	2
MODULE 2		
5	** Write a Python program that takes the age of a user as input and determines the life stage they are in based on the following conditions:	2

<table>
<tr><td></td><td>0–12 years: "Child"
13–19 years: "Teenager"
20–35 years: "Young Adult"
36–60 years: "Adult"
Above 60 years: "Senior"</td><td></td></tr>
<tr><td>6</td><td>**: Write a Python program that takes a string input from the user and counts the number of vowels and consonants in the string.
Use variables and appropriate data types to store and manipulate the input.
Display the results, showing the counts of vowels and consonants separately.</td><td>2</td></tr>
<tr><td>7</td><td>Write a python program to generate multiplication table of a number given by the user.</td><td>2</td></tr>
<tr><td>8</td><td>Write a Python program that accepts a number from the user and checks if it is even or odd.
If the number is even, display "Even Number,"otherwise display "Odd Number."
Use decision-making statements (<code>if-else</code>) to determine the output.</td><td>2</td></tr>
<tr><td>9</td><td>Write a simple Python program to take two numbers as input from the user and perform basic arithmetic operations (addition, subtraction, multiplication, division, modulus, floor division, exponentiation).
Display the results for each operation.</td><td>2</td></tr>
<tr><td colspan="3" align="center">MODULE 3</td></tr>
<tr><td>10</td><td>**Write a Python program to define a function that calculates the factorial of a number provided by the user.
Use a for loop to calculate the factorial.
Demonstrate how to call the function in the main program and display the result.</td><td>2</td></tr>
<tr><td>11</td><td>**Write a Python program that defines a recursive function to calculate the sum of all integers from 1 to a given number n.</td><td>2</td></tr>
<tr><td>12</td><td>Write a Python program that takes a list of numbers and performs the following operations using inbuilt functions:
Find the maximum and minimum numbers in the list.
Sort the list in ascending and descending order.</td><td>2</td></tr>
</table>

	• Find the sum and average of the numbers in the list.	
13	Write a Python program that defines a global variable and a function that declares a local variable with the same name. • Show how to access and modify the global variable both inside and outside the function. • Display the value of the local and global variables separately.	2
MODULE 4		
14	** Write a Python program to create two NumPy arrays of the same shape. • Perform element-wise addition, subtraction, multiplication, and division on the arrays. • Display the results of each operation.	2
15	Write a Python program to create a 2D NumPy array (matrix) and perform the following: • Transpose the matrix. • Create a copy of the original matrix and modify the copied matrix without affecting the original.	2
16	**Write a Python program to create a 2D NumPy array and perform the following operations: • Calculate the mean, median, and standard deviation of the array. • Use NumPy functions for these calculations and display the results.	2
17	Write a Python program to create a 1D NumPy array with 12 elements and reshape it into a 3x4 2D array. • Display both the original and the reshaped arrays.	2
MODULE 5		
18	**Write a Python program to read a text file containing a list of names (one name per line) and display the names on the console. • Handle exceptions for file not found.	2
19	Write a Python program that takes user input to create a list of favorite foods and writes this list to a text file. • Each food item should be on a new line in the file.	2

20	**Write a Python program to create a CSV file containing student names and their grades. • Then, read the CSV file and display its contents.	2
21	Write a Python program that appends a new food item to the existing text file created in the previous task. • Ensure that the program checks if the file exists before appending.	2
** Questions are mandatory, 3 questions from each module should be implemented during the laboratory session.		
TOTAL		**30 hrs**

COURSE DESIGNED BY	**VERIFIED BY**
Ms. Divya Visakh Asst. Professor, CSE Dept, JCET E. Mail ID: divya3954.cse@jawaharlalcolleges.com	Mr. Ambarish A Asst. Professor, CSE Dept, JCET E. Mail ID: ambarish4056.cse@jawaharlalcolleges.com

24ICLPCT106/ 24ICLPCT207	LIFESKILLS AND PROFESSIONAL COMMUNICATION	Category	L	T	P	Credit
		AEC	1	0	1	1

Preamble

Life Skills and Professional Communication provide the means for an individual to be resourceful and positive while taking on life's vicissitudes. Development of one's personality by being aware of the self, connecting with others, reflecting on the abstract and the concrete, leading and generating change, and staying rooted in time-tested values and principles is being aimed at. This course is designed to enhance the employability and maximize the potential of the students by introducing them to the principles that underlie personal and professional success, and help them acquire the skills needed to apply these principles in their lives and careers.

Prerequisite:

None

Course Outcomes: On the successful completion of the course students will be able to:

CO Number	Course Outcome Statement	Weightage in %
CO1	Define and identify key life skills necessary for personal and professional success. (Understanding)	20
CO2	Explain the importance of cultivating good habits through moral and value-based practices, managing stress, and navigating emotions with structured approaches for healthier regulation. (Understanding)	20
CO3	Enhance understanding of cognitive processes, thinking styles, critical and creative thinking, and proficiency in problem-solving, along with essential 21st-century skills for innovative and analytical reasoning. (Understanding)	20
CO4	Utilize skills and knowledge effectively in group discussions and apply career planning strategies to contribute meaningfully to collaborative work environments. (Applying)	20
CO5	Acquire the requisite knowledge and skills to communicate with clarity and impact, and to contribute positively in collaborative work environments. (Applying)	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1 *	PSO2 *	PSO3 *
CO1	1	-	-	-	-	2	-	1	2	2	1	3	-	-	-
CO2	-	-	-	-	-	-	-	-	3	-	-	2	-	-	-
CO3	-	1	1	1	-	2	1	1	2	2	-	2	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO5	-	-	-	-	-	2	-	-	2	3	-	3	-	-	-
AVG	**1**	**1**	1	1	-	2	1	1	2.2	2.3	1	**2.4**	-	-	-

1-Low; 2-Medium; 3- Strong
* The faculty handling a particular programme should map the Course Outcomes (COs) with the applicable programme Specific outcomes (PSOs)

Assessment Pattern: Continuous Internal Evaluation

Cognitive Levels	Continuous Assessment Test 1	Continuous Assessment Test 2	Regular Assessment		
			Group Discussion	Presentation Skills	Case Study
Remembering	20	20	20	20	20
Understanding	60	60	20	20	20
Applying	20	20	40	40	20
Analysing	-	-	20	20	40
Evaluating	-	-	-	-	-
Creating	-	-	-	-	-

Assessment Pattern: Psychomotor

Psychomotor Skill	Practical Component
Perception	Communication Skills, Subject Clarity and Impact
Set	Stress Management
Guided Response	Group Discussion Skills and Group Dynamics
Mechanism	Problem-solving Techniques
Complex Overt Responses	Emotional Regulation
Adaptation	Behaviour, Mannerisms, Platform Skills and Professional Environment
Origination	

Assessment Pattern: Cognitive Domain

Total Marks	CIA	Duration
100	100	2 Hours

Continuous Internal Assessment Pattern

Attendance: **15**
Continuous Assessment Test: **35**
Activity and Case Study: **50**
Total: **100**

Question Paper Pattern

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration =90 Minutes** Part A: 5 X 4 = 20 Marks Part B: 5 X 6 = 30 Marks

Sample Questions for Course Outcome Assessment

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Highlight the significance of self-awareness in personal development?
2. Elucidate how effective communication can improve interpersonal relationships?
3. Distinguish between critical thinking and creative thinking?
4. Expound the importance of setting goals and achieving them in professional growth?
5. In what ways can authoritative, affiliative, coaching, coercive, democratic, and pace-setting leadership styles influence team dynamics and performance?

Course Outcome 2 (CO2)

1. Illustrate a scenario where you cultivated values such as integrity or empathy. How did this experience shape you and those around you?
2. Enumerate the four A's of stress management and elucidate how each can be utilized to handle stress in a high-pressure situation.
3. Elaborate on how a stress journal can be utilized to recognize your individual stress triggers and the accompanying physical or emotional symptoms.
4. Detail effective relaxation techniques for coping with stress and emotions. Describe how you would incorporate one of these methods into your daily routine.
5. Delve into the ways in which practicing integrity, honesty, and empathy can contribute to effective stress and emotional management.

Course Outcome 3(CO3):

1. How do convergent and divergent thinking vary from each other?
2. What are the mind mapping techniques used to solve a given problem?

3. What roles do the left brain and right brain play in cognitive functions?
4. Do different thinking techniques affect problem-solving efficiency?
5. Give a plan to enhance creative thinking within a team, specifically using the six thinking hats method.

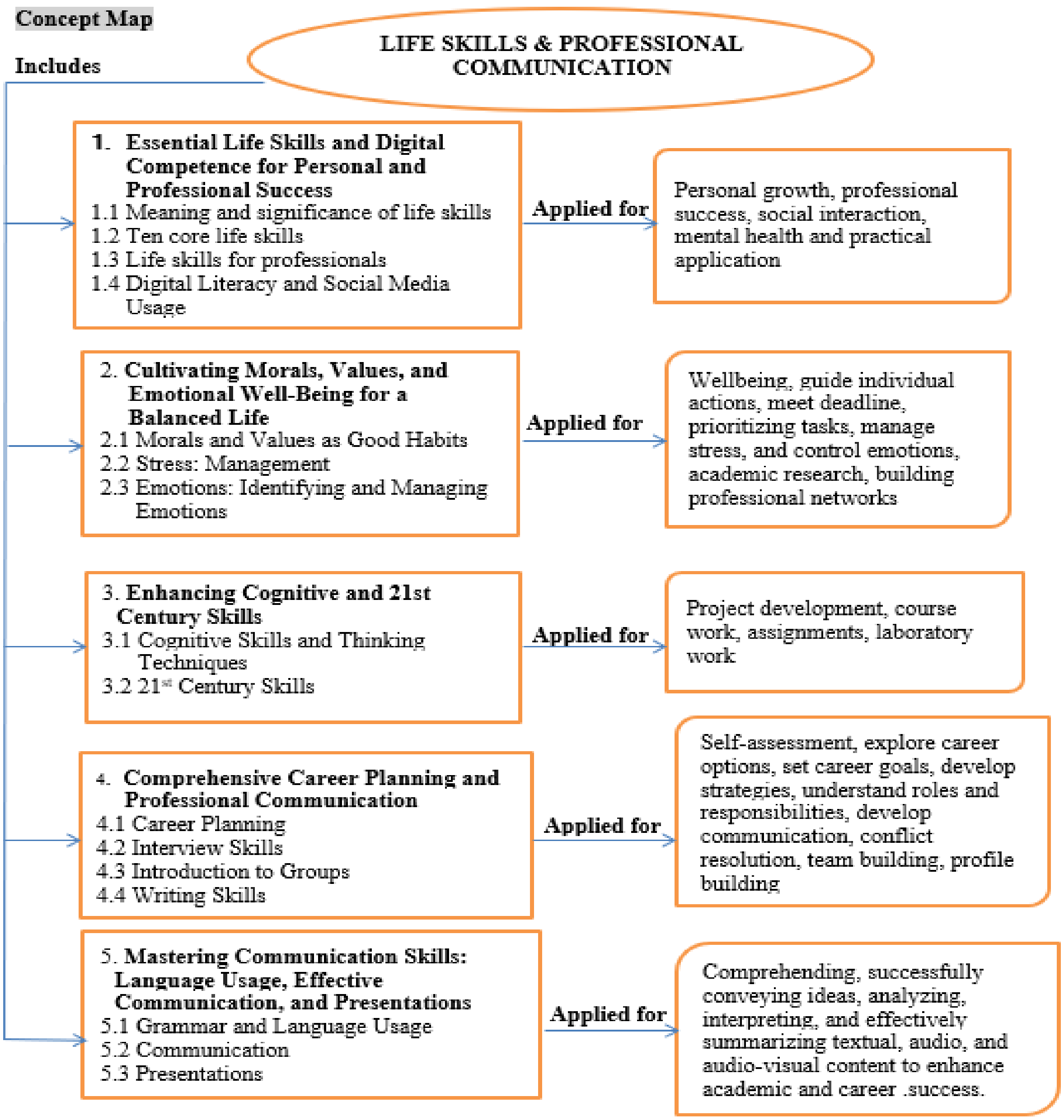
Course Outcome 4 (CO4):

1. In what ways do sources of career information empower students to explore various career paths and opportunities?
2. Harness the key distinctions between technical writing and literary style, and elaborate on how understanding these differences empower students for diverse communication tasks?
3. Elaborate on how students' proficiency in composing letters, CVs, and resumes enables them to effectively present themselves in various professional contexts.
4. Discuss the importance of interview etiquette and how mastering it prepares students to make a positive impression on potential employers.
5. Can you provide examples of how nonverbal cues can impact the interpretation of a message in a professional setting?

Course Outcome 5 (CO5):

1. **Demonstrate** the key elements of an effective presentation. Discuss the importance of structure, content, and delivery in engaging an audience.
2. Elucidate the significance of effective communication across diverse facets of both personal and professional spheres.
3. Delineate the communication process and explicate how information flows within an organization?
4. Complete the sentence with a suitable verb: The group of students ____________ eager to participate in the project.
5. The team completed the project ahead of schedule. Change the voice

Concept Map


Concept Map
Includes
LIFE SKILLS & PROFESSIONAL COMMUNICATION
1. Essential Life Skills and Digital Competence for Personal and Professional Success
1.1 Meaning and significance of life skills
1.2 Ten core life skills
1.3 Life skills for professionals
1.4 Digital Literacy and Social Media Usage
Applied for
Personal growth, professional success, social interaction, mental health and practical application
2. Cultivating Morals, Values, and Emotional Well-Being for a Balanced Life
2.1 Morals and Values as Good Habits
2.2 Stress: Management
2.3 Emotions: Identifying and Managing Emotions
Applied for
Wellbeing, guide individual actions, meet deadline, prioritizing tasks, manage stress, and control emotions, academic research, building professional networks
3. Enhancing Cognitive and 21st Century Skills
3.1 Cognitive Skills and Thinking Techniques
3.2 21st Century Skills
Applied for
Project development, course work, assignments, laboratory work
4. Comprehensive Career Planning and Professional Communication
4.1 Career Planning
4.2 Interview Skills
4.3 Introduction to Groups
4.4 Writing Skills
Applied for
Self-assessment, explore career options, set career goals, develop strategies, understand roles and responsibilities, develop communication, conflict resolution, team building, profile building
5. Mastering Communication Skills: Language Usage, Effective Communication, and Presentations
5.1 Grammar and Language Usage
5.2 Communication
5.3 Presentations
Applied for
Comprehending, successfully conveying ideas, analyzing, interpreting, and effectively summarizing textual, audio, and audio-visual content to enhance academic and career .success.

Syllabus

Module 1

Essential Life Skills and Digital Competence for Personal and Professional Success

Life Skills: Meaning and significance, Life skills identified by WHO: 1. Social Skills: Self-awareness, Empathy, Effective communication, Interpersonal relationship. 2.Thinking Skills: Critical thinking, Creative thinking, Decision making, Problem solving, 3. Emotional Skills: Coping with stress and emotions.

Life Skills for Professionals: Positive thinking, Setting goals and achieving them, Motivation (self and others), Leadership (Types and styles)

Digital Literacy: Basics of Digital & Social Media Usage, Creating LinkedIn profiles, Networking online.

Module 2

Cultivating Morals, Values, and Emotional Well-Being for a Balanced Life

Morals and Values as Good Habits: Practicing integrity, Caring and sharing, Honesty, Respect for others, Empathy, Courage, Commitment, Self-confidence, Time management, Avoiding procrastination.

Stress: Understanding and Identifying Stress: reasons and effects, Recognizing signs and symptoms of stress, Personal triggers, Stress Management Techniques: stress diaries, the four A's of stress management.

Emotions: Identifying Emotions, Managing Emotions, Harmful Ways of Dealing with Emotions, Relaxation Techniques.

Module 3

Enhancing Cognitive and 21st Century Skills

Cognitive Skills and Thinking Techniques: Functions of left brain & right brain, Critical thinking, Creative thinking, Analytical thinking, Lateral thinking, Logical thinking, Problem solving techniques, Mind mapping.

21st Century Skills: Creativity (sources of creativity), Collaboration, Innovation, Six thinking hats for brainstorming.

Module 4

Comprehensive Career Planning and Professional Communication
Career Planning: Need and importance of career guidance, Sources of career information, Career guidance centres, Applying for job, Non-verbal communication.

Interview Skills: Types of interviews, Interview etiquette, Group discussions

Introduction to Groups: Composition, Formation, Cycle, Thinking, Consensus, Team, Virtual teams, Managing team performance and conflicts.

Writing Skills: Technical and literary style. CV and Resume writing, Report writing, E-mails, memos.

Module 5

Mastering Communication Skills: Language Usage, Effective Communication, and Presentations

Grammar and Language Usage: Common errors in English usage, commonly misspelled words, Voice, Reported speech, Sentence Structure, Subject-verb agreement, Punctuations.

Communication: Definition, Importance of effective communication, Process, Flow, Barriers, Overcoming barriers, Types of communication.

Presentation: Types with emphasis on visual presentation, audio-visual presentation and podcasts.

LEARNING RESOURCES

Text Books

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Dr. Anubhuti Dubey & Prof Aradhana Shukla	Communication Skills and Personality Development	First	Laxmi Publications Pvt. Ltd.	2023
2	Matt Abrahams	Think Faster, Talk Smarter: How to speak successfully when you are put on the spot	First	Macmillan Business	2023

Reference Books

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Raymond Murphy	English Grammar in Use	Fifth	Cambridge University Press	2023
2	Maithry Shinde	Life Skills & Personality Development	First	Cambridge University Press	2022
3	Remesh S, Vishnu R G	Life Skills	First	Northstar	2021
4	Sabina Pillai and Agna Fernandez	Soft Skills & Employability Skills	First	Cambridge University Press	2018
5	R Hobb	Create to learn: Introduction to digital literacy	First	Wiley	2017
6	Ashraf Rizvi	Effective Technical Communication	Second	McGraw Hill Education	2017
7	Kalyana	Soft Skill for Managers	First	Wiley	2015
8	Shalini Verma	Development of Life Skills and Professional Practice	First	Sultan Chand (G/L) & Company	2014

On line study materials

1	https://www.berkeleywellbeing.com › life-skills
2	https://www.mindinthemaking.org › life-skills
3	https://www.britishcouncil.gr › life-skills ›
4	https://www.skillsyouneed.com › general › life-skills
5	https://ethicsunwrapped.utexas.edu/
6	Stress management strategies: Ways to Unwind - https://www.youtube.com/watch?v=0fL-pn80s-c
7	Signs of Stress https://www.youtube.com/watch?v=n3G0n7HoTr4
8	What is Civic Virtue? - YouTube https://www.youtube.com › watch?v=ANl4MqtHBxg (Levels of Leadership)
9	https://www.youtube.com/watch?v=j6FSaHVufZc (Styles of Leadership)
10	https://www.mhanational.org/helpful-vs-harmful-ways-manage-emotions
11	https://www.edweek.org/teaching-learning/what-is-digital-literacy/2016/11

Methodologies to Transact Life Skills and Professional Communication

Sl. No.	Techniques	Description
1	Discussion	Involves exchange and sharing of ideas, experiences, facts and opinions on a given topic. Can be used in large and small groups.
		A discussion involving two opposing parties with each group expressing

2	Debate	opinions or views about a given topic or subject.
3	Role Play	Short drama episodes or simulations in which participants experience how a person feels in a similar real life situation.
4	Brainstorm	Free expression of ideas among participants on a given issue or question.
5	Story Telling	Telling of narratives with a particular theme, based on actual events.
6	Song and Dances	Musical compositions on topical issues and themes.
7	Drama	Composition in verse or prose intended to portray life, character or to tell a story. It involves presenting conflicts and portraying emotions through action and dialogue.
8	Case Study	True or imaginary story which describes a problem, a situation or a character. May also be a dilemma in which the participants should come up with opinions on how they would resolve the conflict.
9	Miming	Acting without words by the use of gestures, signs, physical movements and facial expressions. The whole idea is communicated through actions.
10	Poetry & Recitals	Compositions which capture events, themes and situations in a short and precise manner. Used in communicating feelings, opinions, ideas, habit and other experiences. Can be in the form of songs, recitations, chants or be dramatized to enhance the acquisition of various Life Skills.
11	Question & Answer	A teacher or learner tries to find information through asking questions and getting answers from the respondent. An effective method of transacting Life Skills Education as it stimulates a learner's thinking and creativity.
12	Games	A structured play can sometimes be used as an educational tool for the expression of aesthetic or ideological elements. It involves mental and physical simulation, and often both.
13	Team Work	Students may be organized to work in pairs or small groups in the classroom. Promotes the maximum participation of all students as they are involved in "thinking and doing" and cooperative skills, such as, listening and communication skills, problem solving and sharing of tasks.
14	Simulation	Students assume / imitate a particular appearance or for- they engage in the act or process of pretending.
15	Demonstration	A method of teaching by examples rather simple explanation or an act of showing or making evident.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1	**Essential Life Skills and Digital Competence for Personal and Professional Success**	**4**	CO 1
1.1	Life Skills: Meaning and significance, Life skills identified by WHO: 1. Social Skills: Self- awareness, Empathy, Effective communication, interpersonal relationship.	1	
1.2	2. Thinking Skills: Critical thinking, Creative thinking, Decision making, problem solving, 3. Emotional Skills: Coping with stress, coping with emotion.	2	
1.3	Life Skills for Professionals: Positive thinking, Setting goals and achieving them, Motivation (self and others), Leadership (Types and styles)	1	
1.4	Digital Literacy: Basics of Digital & Social Media Usage, Creating LinkedIn profiles, Networking online.	2	
2	**Cultivating Morals, Values, and Emotional Well-Being for a Balanced Life**	**6**	CO 2
2.1	Morals and Values as Good Habits: Practicing integrity, Caring and sharing, Honesty, Respect for others, Empathy, Courage, Commitment, Self-confidence, Time management, Avoiding procrastination.	2	
2.2	Stress: Understanding and Identifying Stress: reasons and effects, Recognizing signs and symptoms of stress, Personal triggers, Stress Management Techniques: stress diaries, the four A's of stress management.	2	
2.3	Emotions: Identifying Emotions, Managing Emotions, Harmful Ways of Dealing with Emotions, Relaxation Techniques.	2	

	.		
3	**Enhancing Cognitive and 21st Century Skills for Innovation and Problem Solving**	**6**	CO 3
3.1	Cognitive Skills and Thinking Techniques: Functions of left brain & right brain.	1	
3.2	Critical thinking, Creative thinking, Analytical thinking, Lateral thinking, Logical thinking.	2	
3.3	Problem solving techniques, Mind mapping.	1	
3.4	21st Century Skills: Creativity (sources of creativity), Collaboration, Innovation, Six thinking hats for brainstorming	1	
4	**Comprehensive Career Planning and Professional Communication Skills**	**6**	CO 4
4.1	Career Planning: Need and importance of career guidance, Sources of career information, Career guidance centres, Applying for job, Non-verbal communication.	2	
4.2	Interview Skills: Types of interviews, Interview etiquette, Group discussions	1	
4.3	Introduction to Groups: Composition, Formation, Cycle, Thinking, Consensus, Team, Virtual teams, Managing team performance and conflicts.	1	
4.4	Writing Skills: Technical and literary style. CV and Resume writing, Report writing, E-mails, memos.	2	
5	**Mastering Communication Skills: Language Usage Effective Communication, and Presentations**	**6**	CO 5
5.1	Grammar and Language Usage: Common errors in English usage, commonly misspelled words, Voice.	1	
5.2	Reported speech, Sentence Structure, Subject-verb agreement, Punctuations.	2	
5.3	Communication: Definition, Importance of effective communication, Process, Flow, Barriers, Overcoming barriers, Types of communication.	1	
5.4	Presentation: Types with emphasis on visual presentation, audio-visual presentation and podcasts.	2	
	TOTAL	30 hours	

Activities

<table>
<tr><th>Sl. No</th><th>Activity</th></tr>
<tr><td>1</td><td>Essential Life Skills and Digital Competence for Personal and Professional Success

1. Gantt Chart
Description: Create a Gantt chart representing a project timeline, showing tasks, their durations, and dependencies. Does it help teams plan, schedule, and monitor progress efficiently.

Objective: To enhance time management and project organization by breaking tasks into smaller, manageable steps with clear deadlines and responsibilities.

2. Social Media Impact Analysis
Description: Have students analyze the impact of social media on personal and professional life, discussing both positive and negative aspects.

Objective: Develop critical thinking about social media usage and its implications.

3. Creating a Professional Online Presence
Description: Guide students in creating or improving their LinkedIn profiles, emphasizing the importance of a professional online presence.

Objective: Teach students how to build and maintain a professional online identity.</td></tr>
<tr><td>2</td><td>Cultivating Morals, Values, and Emotional Well-Being for a Balanced Life

4. Caring and Sharing Circle:
Description: Participants share personal stories of acts of kindness they've experienced or done.

Objective: Foster a culture of caring and sharing.

5. Personal Triggers -Journaling:
Description: Journaling to identify personal stress triggers and maintaining stress diaries to log daily stressors and responses.

Objective: Understand personal stressors and track and analyse stress patterns</td></tr>
<tr><td>3</td><td>Enhancing Cognitive and 21st Century Skills

6. Mind mapping Exercise:
Description Create a mind map that outlines your top three professional goals for</td></tr>
</table>

	the next two years. For each goal, include the essential skills you need to develop and specific actions you will take to achieve these goals. Objective: Help students visualize and organize their goals and the professional skills required to achieve them using a mind map. **7. Problem solving (utilising logical and creative thinking)** Description: Select a real-life problem (eg. Improving Water Management in Urban Areas) that requires a technical solution and list the study materials needed Objective: Improve thinking and problem solving skills
4	**Comprehensive Career Planning and Professional Communication Skills** **8. Create a LinkedIn Account** Description: Students should create a LinkedIn account, using a personal email. Objective: Help students create a professional LinkedIn profile that effectively showcases their skills, experiences, and career aspirations. **9. Write a Report** Description: Imagine you participated in a group discussion on the topic 'Strategies for Enhancing Team Collaboration in Project Management'. Prepare a report based on the discussions held in class regarding this topic. Objective: To develop students' skills in summarizing group discussions and documenting effective strategies for improving team collaboration in project management.
5	**Mastering Communication Skills: Language Usage Effective Communication, and Presentations** **10. Self-Introduction** Description: Prepare a self-introduction video Objective: Equip students to build their profiles. **11. Nonverbal Communication Charades** Description: Write down different emotions and messages on slips of paper. Students take turns drawing a slip and using only nonverbal communication (gestures, facial expressions, body language) to convey the emotion or message to the class. The class guesses what is being communicated. **Objective**: Enhance awareness and understanding of the importance and types of nonverbal communication.

COURSE DESIGNED BY	VERIFIED BY
Ms. K Rajini Asst. Professor, BS&H Dept., JCET E-mail ID: krajini@jawaharlalcolleges.com	Prof. K R Vijayakumaran Pillai Professor and Head, BS&H Dept., JCET E-Mail ID: krvijay @jawaharlalcolleges.com

24ICBEEP107	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING WORKSHOP	Category	L	T	P	Credit
		ESC	0	0	2	1

Preamble

This is the foundation practical course for the students of circuit branches. The aim of this course is to impart fundamental hands-on skill in carrying out experiments at higher semester practical courses.

Prerequisite

None

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Demonstrate safety measures against electric shocks and identify the tools used for electrical wiring, electrical accessories, wires, cables, batteries and standard symbols (Applying)	16.67
CO2	Develop the connection diagram, identify the suitable accessories and materials necessary for wiring simple lighting circuits for domestic buildings.(Applying)	16.67
CO3	Understand the concepts of Earthing and Assembling of electrical devices. (Applying)	16.67
CO4	Identify and test various electronic components. (Remembering)	16.67
CO5	Draw circuit schematics with EDA tools. (Applying)	16.67
CO6	Assemble and test electronic circuits on boards. (Applying)	16.67

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	3	-	-	-	-	-	1	-	-	-
CO2	2	-	-	1	-	1	-	1	2	-	-	3	-	-	-
CO3	2	-	-	-	-	3	-	-	-	-	-	3	-	-	-
CO4	3	-	-	-	2	-	-	-	-	-	-	2	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO6	3	-	-	-	2	-	-	-	-	-	-	1	-	-	-
AVG	**2.5**	**-**	**-**	**1**	**2**	**2.3**	**-**	**1**	**2**	**-**	**-**	**2**	**-**	**-**	-

3- Strong; 2-Medium; 1-Low

***The faculty handling a particular programme should map the Course Outcomes (COs) with the applicable Program Specific Outcomes (PSOs)

Assessment Pattern:

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	
Set	Practical
Guided Response	Practical
Mechanism	Practical
Complex Overt Responses	
Adaptation	
Origination	

Mark distribution

Total Marks	CIA Marks	ESE Marks	ESE Duration
100	60	40	2.5 Hours

Continuous Internal Assessment (CIA) Pattern:

Attendance	9 Marks
Regular class work/tutorials/assignments	27 Marks
Continuous Assessment Test (Minimum 2 numbers)	24 Marks

Syllabus

ENGINEERING WORKSHOP

1. a) Demonstrate the precautionary steps adopted in case of Electrical shocks.

b) ldentify different types of cables, wires, switches, fuses, fuse carriers, MCB, ELCB and MCCB with ratings.

2. Wiring of simple light circuit for controlling light/ fan point (PVC conduit wiring)

3. Wiring of light/fan circuit using Two-way switches. (Staircase wiring)

4. Wiring of Fluorescent lamps and light sockets (6A) with a power circuit for controlling power device. (16A socket)

5. Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, main switch and Energy meter.

6. a) ldentify different types of batteries with their specifications.

b) Demonstrate the Pipe and Plate Earthing Schemes using Charts/Site Visit.

7. Assembling of Extension Board

8. Wiring of a Single Phase Distribution Board

9. Familiarization/Identification of electronic components with specification (Functionality, type, size, colour coding, package, symbol, cost etc. [Active, Passive, Electrical, Electronic, Electro-mechanical, Wires, Cables, Connectors, Fuses, Switches, Relays, Crystals, Displays, Fasteners, Heat sink etc.)

10. Drawing of electronic circuit diagrams using BIS/IEEE symbols and introduction to EDA tools (such as EasyEDA, XCircuit), Interpret data sheets of discrete components and IC’s, Estimation and costing.

11. Familiarization/Application of testing instruments and commonly used tools. [Multimeter, Function generator, Power supply, DSO etc.] [Soldering iron, Desoldering pump, Pliers, Cutters, Wire strippers, Screw drivers, Tweezers, Crimping tool, Hot air soldering and de-soldering station etc.]

12. Testing of electronic components [Resistor, Capacitor, Diode, Transistor and JFET using multimeter.]

13. Inter-connection methods and soldering practice. [Bread board, Wrapping, Crimping, Soldering - types - selection of materials and safety precautions, soldering practice in connectors and general-purpose PCB, Crimping.]

14. Printed circuit boards (PCB) [Types, Single sided, Double sided, PTH, Processing methods, Design and fabrication of a single sided PCB for a simple circuit with manual etching (Ferric chloride) and drilling.]

15. Assembling of electronic circuit/system on general purpose PCB, test and show the

functioning (Any Two circuits).

(i) Fixed voltage power supply with transformer, rectifier diode, capacitor filter, Zener /IC regulator.

(ii) Square wave generation using IC 555 timer in IC base.
(iii) Sine wave generation using IC 741 OP-AMP in IC base.
(iv) RC coupled amplifier with transistor BC107.

16. a) Familiarization of Arduino IDE

b) LED blinking with different ON/OFF delay timings with i) inbuilt LED ii) Externally interfaced LED

LIST OF EXERCISES

(All experiments mandatory)

No.	Topic	No. of Hours	Course Outcome
1	a) Demonstrate the precautionary steps adopted in case of Electrical shocks. b) ldentify different types of cables, wires, switches, fuses, fuse carriers, MCB, ELCB and MCCB with ratings.	2	CO1
2	Wiring of simple light circuit for controlling light/ fan point (PVC conduit wiring)	2	CO2
3	Wiring of light/fan circuit using Two-way switches. (Staircase wiring)	2	CO2

4	Wiring of Fluorescent lamps and light sockets (6A) with a power circuit for controlling power device. (16A socket)	2	CO2
5	Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, main switch and Energy meter.	2	CO2
6	a) ldentify different types of batteries with their specifications. b) Demonstrate the Pipe and Plate Earthing Schemes using Charts/Site Visit.	2	CO1 CO3
7	Assembling of Extension Board	2	CO3
8	Wiring of a Single phase Distribution Board	2	CO3
9	Familiarization/Identification of electronic components with specification (Functionality, type, size, colour coding, package, symbol, cost etc. [Active, Passive, Electrical, Electronic, Electro-mechanical, Wires, Cables, Connectors, Fuses, Switches, Relays, Crystals, Displays, Fasteners, Heat sink etc.)	2	CO4
10	Drawing of electronic circuit diagrams using BIS/IEEE symbols and introduction to EDA tools (such as EasyEDA, XCircuit), Interpret data sheets of discrete components and IC's, Estimation and costing.	2	CO5
11	Familiarization/Application of testing instruments and commonly used tools. [Multimeter, Function generator, Power supply, DSO etc.] [Soldering iron, Desoldering pump, Pliers, Cutters, Wire strippers, Screw drivers, Tweezers, Crimping tool, Hot air soldering and de-soldering station etc.]	2	CO4
12	Testing of electronic components [Resistor, Capacitor, Diode, Transistor and JFET using multimeter.]	2	CO4
13	Inter-connection methods and soldering practice. [Bread board, Wrapping, Crimping, Soldering - types - selection of materials and safety precautions, soldering practice in	2	CO6

	connectors and general-purpose PCB, Crimping.]		
14	Printed circuit boards (PCB) [Types, Single sided, Double sided, PTH, Processing methods, Design and fabrication of a single sided PCB for a simple circuit with manual etching (Ferric chloride) and drilling.	2	CO6
15	Assembling of electronic circuit/system on general purpose PCB, test and show the functioning (Any Two circuits). (i) Fixed voltage power supply with transformer, rectifier diode, capacitor filter, Zener /IC regulator. (ii) Square wave generation using IC 555 timer in IC base. (iii) Sine wave generation using IC 741 OP-AMP in IC base. (iv) RC coupled amplifier with transistor BC107.	2	CO6
16	a) Familiarization of Arduino IDE b) LED blinking with different ON/OFF delay timings with i) inbuilt LED ii) Externally interfaced LED	2	CO5
	TOTAL	**32** hours	

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	J B Gupta	Basic Electronics	Second	Katson Books	2013
2	B L Theraja, A K Theraja	A Textbook of Electrical Technology Volume I Basic Electrical Engineering	Third	S Chand	2014

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Paul B Zbar, Albert P Malvino, Michael A Miller	Basic Electronics A Text Lab Manual	Seventh	Tata McGraw Hill	2015
2	M S Sukhija, T K Nagsarkar	Basic Electrical and Electronics Engineering	First	Oxford Higher Education	2012

On line study materials:

1. http://vlabs.iitkgp.ac.in/be/
2. https://www.youtube.com/watch?v=JRT-KTFmiQo&list=PL2Q_0aXptwl1foD9eKFGXo3iQfOriDmp5
3. https://www.youtube.com/playlist?list=PL7qxHC_-XSZkFfFzFKwx9iKc1IlgqXU8C
4. https://www.youtube.com/playlist?list=PL9Q_x6Cmsav8z4sVCwx0X2hiGMSYC0Ffg
5. https://youtu.be/jZsSzhhBQ-c?si=dhWlrJA6yLf4bEHw

COURSE DESIGNED BY	VERIFIED BY
Mr, Srikanth K. Asst. Professor, ECE Dept, JCET E. Mail ID: srikanth4019.ece@jawaharlalcolleges.com Ms. Sayana M. Asst. Professor, ECE Dept, JCET E. Mail ID: sayanam@jawaharlalcolleges.com	Mr. Jayesh T. P. Asst. Professor, ECE Dept, JCET E. Mail ID: tpjayesh123@gmail.com Ms. Aswathy J. Asst. Professor, ECE Dept, JCET E. Mail ID: aswathy4088.ece@jawaharlalcolleges.com

24ICVACP108	WEB AND GRAPHIC DESIGN	Category	L	T	P	Credit
		VAC	**0**	**0**	4	**2**

Preamble

This is a value-added course that offers students hands-on experience in creating a website using WordPress. This course also covers fundamental HTML structures and focuses on poster creation using the Canva tool.

Prerequisite

None

Course Outcomes

On the successful completion of the course students will be able to:

CO Number	Course Outcome Statement	Weightage in %
CO1	Understand the basic HTML tags and web development process (Understanding)	22
CO2	Familiarize the use of CSS and JavaScript in developing a website and basics of website hosting. (Understanding)	28
CO3	Familiarize with the WordPress platform and be able to create a basic website (Understanding)	12
CO4	Add hyperlinks, images to their website using WordPress features. (Applying)	21
CO5	Create customized posters using Canva (Applying)	17

Mapping of Course Outcomes with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	1	-	1	-	-	1	-	-	-	1	-	-	2
CO2	2	-	-	-	3	-	-	1	-	-	-	2	-	-	2
CO3	2	-	2	-	3	-	-	1	-	2	-	2	-	-	2
CO4	2	-	2	-	3	-	-	1	-	3	-	2	-	-	2
CO5	2	-	-	-	3	-	-	1	-	3	-	3	-	-	2
AVG	**2**	-	**1.6**	-	**2.6**	-	-	**1**	-	**2.6**	-	**2**	-	-	**2**

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	
Set	Hands-on Sessions
Guided Response	Exercises
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	100	-	-

Continuous Internal Evaluation Pattern:

Attendance	: 15 marks
Practical	: 50 marks
Assessment Test	: 35 marks

Syllabus

MODULE 1

Introduction to HTML. Tags in HTML, Attributes in Tags, Forms in HTML, Multimedia in HTML, URLs- Basic concepts, Relative URLs, URL Challenges and beyond URLs, Introduction to Cascading Style Sheets, Style Inclusion methods, Applying Style to the document, Selectors in CSS, CSS Strings and Keywords, Properties in CSS

MODULE 2

Browser Specific features, Character Entities and Fonts, Major Themes of CSS, Frameworks of CSS, Introduction to JavaScript, Technology Stack, Front End Frameworks and Back End layers, Introduction to Data and Database, Server and deployment and Web Browsers, Content Management System, Web development Process, Test a website, Website Hosting., Sessions and Cookies, Website Post-Launch Checklist

MODULE 3

Introduction To Wordpress, Getting started with WordPress- Creating a WordPress Site (Installing WordPress), Installing WordPress with a Web Host's "1-Click Install"- Logging Into the WordPress Admin & General Site Settings, General WordPress Settings- Writing Posts & Formatting Text- Posts versus Pages, Creating a New Blog Post-Using the Visual Editor, Pasting Without Formatting & Clearing Formatting, Formatting Heading, Publishing a Post Deleting a Post Restoring a Post from the Trash, Publishing a Post (Making it Live), Adding a Read More Link to a Post

MODULE 4

Creating Links (Hyperlinks), Adding Images & Managing the Media Library, adding an Image Gallery, Adding Video, Categories, Tags, & Reading Settings, Widgets Editing & Adding Widgets, Menus About Menus & Locations Adding & Removing Links in Menus Creating Submenus, Opening Menu Links in a New Tab, Installing Themes, Customizing Theme Appearance, WordPress Plugins: About, Installing, & Updating.

MODULE 5

Introduction To Canva, Logging / Setup Canva Account -Layouts & Templates- Learn how to use the pre-designed layouts -Downloading your work - Working with text- Adding pages to a design-Image-Text features and Charts, Fonts, Colors, and Images- Typography and font pairing -Using icons effectively -Organizing the dashboard - Sharing designs -Adding links- Color codes - Color scheme, Brand Kit - Magic Resize -Paid Elements - Folders for Element, Background Remover - Teams, Exporting and Scheduling - Learn more advanced techniques - Learn how to create a logo from scratch

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Robin Krambröckers	Create Your Own Website: Learn Web Design with HTML & CSS	Edition	Robin Krambröckers	2020
2	Julie C. Meloni Jennifer Kyrnin	HTML, CSS, and JavaScript All in One	3rd Edition	Pearson Education	2020

REFERENCE BOOKS

Sl.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Selynna Payne	Practical WordPress for	1st Editio.n	Independently published	2022

		Beginners: A Guide on How to Create and Manage Your Website (PQ Unleashed: Practical Skills)			
2	Catherine B. Barrientos	HOW TO USE CANVA: A Comprehensive Guide To Graphic Design, Providing Detailed Step-by-step Methods Tailored For Beginners, Marketers, And Entrepreneurs.	1st Edition	Kindle Edition	2024

Online study materials:

https://learn.wordpress.org/courses/
https://www.canva.com/

Course contents and Lecture Schedule

Module No.	Topic	No. of Hours	CO
1	**BASICS OF WEB DEVELOPMENT**	13	CO1
1.1	Introduction to HTML	1	
1.2	Tags in HTML	1	
1.3	Attributes in Tags	1	
1.4	Forms in HTML	1	
1.5	Multimedia in HTML	1	
1.6	URLs- Basic concepts, Relative URLs	1	
1.7	URL Challenges and beyond URLs	1	
1.8	Introduction to Cascading Style Sheets	1	
1.9	Style Inclusion method	1	
1.10	Applying Style to the document	1	

1.11	Selectors in CSS	1	
1.12	CSS Strings and Keywords	1	
1.13	Properties in CSS	1	
2	**CSS and its features**	17	
2.1	Browser Specific features	1	CO2
2.2	Character Entities and Fonts	1	
2.3	Major Themes of CSS	1	
2.4	Frameworks of CSS	1	
2.5	Introduction to JavaScript	1	
2.6	Technology Stack	1	
2.7	Front End Frameworks and Back End layers	1	
2.8	Introduction to Data and Database	1	
2.9	Server and deployment and Web Browsers	1	
2.10	Content Management System	1	
2.11	Web development Process Introduction	1	
2.12	Web development Process Application	1	
2.13	Test a website	1	
2.14	Website Hosting introduction	1	
2.15	Website Hosting application	1	
2.16	Sessions and Cookies	1	
2.17	Website Post-Launch Checklist	1	
3	**INTRODUCTION TO WORDPRESS**	7	
3.1	Getting started with WordPress- Creating a WordPress Site (Installing WordPress)	1	

3.2	Installing WordPress with a Web Host's "1-Click Install"- Logging Into the WordPress Admin & General Site Settings	1	CO3
3.3	General WordPress Settings- Writing Posts & Formatting Text- Posts versus Pages-	1	
3.4	Creating a New Blog Post-Using the Visual Editor Pasting Without Formatting & Clearing Formatting Formatting Heading	1	
3.5	Publishing a Post Deleting a Post Restoring a Post from the Trash	1	
3.6	Publishing a Post (Making it Live)	1	
3.7	Adding a Read More Link to a Post	1	
4	**Creating Links (Hyperlinks)**	13	CO4
4.1	Adding Images	1	
4.2	Managing Libraries	1	
4.3	Adding an Image Gallery	1	
4.4	Adding Video	1	
4.5	Categories, Tags, & Reading Settings	1	
4.6	Reading the settings	1	
4.7	Widgets Editing & Adding Widgets	1	
4.8	Menus About Menus & Locations Adding & Removing Links in Menus Creating Submenus Opening Menu Links in a New Tab	1	
4.9	Installing Themes	1	
4.10	Customizing Theme Appearance	1	
4.11	Customizing the themes with multimedia	1	
4.12	WordPress Plugins: About, Installing, & Updating	1	
5	**INTRODUCTION TO CANVA**	10	CO5
5.1	Logging / Setup Canva Account -Layouts & Templates- Learn how to use the pre-designed layouts -	1	

5.2	Downloading your work - Working with text- Adding pages to a design-Image-Text features and Charts	1	
5.3	Fonts, Colors, and Images- Typography and font pairing -Using icons effectively	1	
5.4	Organizing the dashboard - Sharing designs -Adding links- Color codes - Color scheme	1	
5.5	Brand Kit - Magic Resize -Paid Elements	1	
5.6	Folders for Element	1	
5.7	Background Remover - Teams, Exporting and Scheduling	1	
5.8	Learn more advanced techniques - Learn how to create a logo from scratch	1	
5.9	Videos Overview / Editing - Video Tools	1	
5.10	Animations - Animated Presentation	1	
	Total Hours	**60**	

COURSE DESIGNED BY	**VERIFIED BY**
Mr. Ambarish A Asst. Professor, CSE Dept, JCET E. Mail ID: ambarish4056.cse@jawaharlalcolleges.com	Dr. R Satheesh Kumar Professor and Head, CSE Dept, JCET E. Mail ID: hodcse@jawaharlalcolleges.com

SEMESTER-II

24ICMATT201	VECTOR CALCULUS, ORDINARY DIFFERENTIAL EQUATIONS AND TRANSFORMS	Category	L	T	P	Credit
		BSC	3	0	0	3

Preamble

This course introduces the concepts and applications of differentiation and integration of vector valued functions, differential equations, Laplace and Fourier Transforms. The objective of this course is to familiarize the prospective engineers with some advanced concepts and methods in Mathematics which include the Calculus of vector valued functions, ordinary differential equations and basic transforms such as Laplace and Fourier Transforms which are invaluable for any engineer's mathematical tool box. The topics treated in this course have applications in engineering.

Prerequisite

Basic mathematics at Plus two-level which includes single-variable calculus and multivariate calculus

Course Outcomes

After the completion of the course the student will be able to

COs	Course Outcome Statement	Weightage in %
CO1	Compute the derivatives and line integrals of vector functions and learn their applications (Applying)	**20**
CO2	Understand the concept of surface and volume integrals and learn t h e i r inter-relations and applications (Understanding)	**20**
CO3	Solve homogeneous and non-homogeneous linear differential equation with constant coefficients (Applying)	**20**
CO4	Compute Laplace transform and apply them to solve ordinary differential equations arising in engineering (Applying)	**20**
CO5	Understand Fourier transforms of functions and apply them to solve problems arising in engineering (Understanding)	**20**

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1 *	PSO2 *	PS03 *
CO1	3	3	3	3	2	1						2			
CO2	3	3	3	3	2	1						2			
CO3	3	3	3	3	2	1						2			
CO4	3	3	3	3	2	1						2			
CO5	3	3	3	3	2	1						2			
Avg	3	3	3	3	2	1						2			

1-Low; 2-Medium; 3- Strong

* The faculty handling a particular programme should map the Course Outcomes (COs) with the applicable programme Specific outcomes (PSOs)

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30
Applying	50	50	50	50	50
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks

Continuous Assessment Test (2 numbers) : 20 Marks

Assignment/Quiz/Course project : 14 Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks;** **Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks;** **Duration =150 Minutes** **Part A: 5 X 3 = 15 Marks** **Part B: 5 X 9 = 45 Marks**

Sample Questions for Course Outcome Assessment

Course Outcome 1 (CO1):

1. How would you calculate the speed, velocity and acceleration at any instant of a particle moving in space whose position vector at time t is (t)?
2. Find the work done by the force field $F = (e^x - y^3) + (\cos y + x^3)j$ on a particle that travels once around the unit circle centered at origin having radius 1
3. When do you say that a vector field is conservative? What are the implications if a vector field is conservative?

Course Outcome 2(CO2):

1. Evaluate the flux of the vector field) $f = (x, y, z)$ through the surface of the paraboloid $z = 1 - x^2 - y^2$ for $0 \leq z \leq 1$ of the vector field $F\ (x, y, z) = z\boldsymbol{k}$ across the sphere $x^2 + y^2 + z^2 = a^2$
2. For $\mathbf{F}=(xy^2,yz^2,x^2z)$, use the divergence theorem to evaluate $\iint \mathbf{F}\cdot d\mathbf{S}$ where S is the sphere of radius 3 centered at origin..
3. Calculate $\oint_C -x^2y\, dx + xy^2dy$, where C is the circle of radius 2 centered on the origin.

Course Outcome 3 (CO3):

1. Solve the differential equation $y'' + y = 0.001x^2$ using method of undetermined coefficient.
2. Solve the differential equation of $y''' - 3y'' + 3y' - y = e^x - x - 1$.
3. Use spherical coordinates to evaluate $\iiint (x^2 + y^2 + z^2)^3$ dv where B is the unit ball defined by $B = \{(x, y, z): x^2 + y^2 + z^2 \leq 1\}$

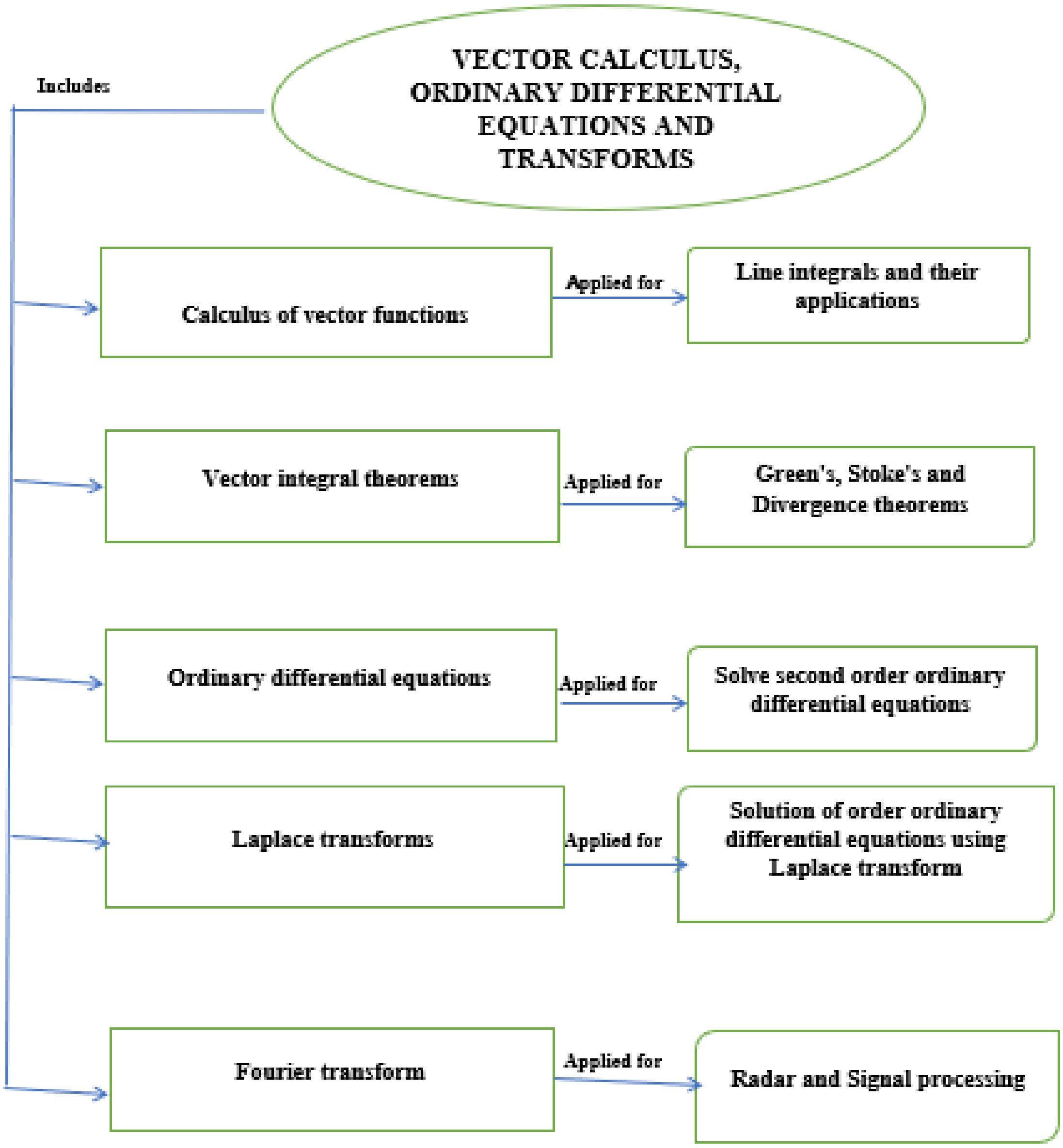
Course Outcome 4 (CO4):

1. Find Laplace Transform of Unit step function.
2. Solve the differential equation of $y^{11} + 9y = (t - \pi)$? Given $y\ (0) = 2$, $y'\ (0) = 0$
3. What is the inverse Laplace Transform of $F(s) = \frac{1}{S^2+4}$. ?

Course Outcome 5 (CO5):

1. Find the Fourier integral representation of function defined by $f(x) = e^{-x}$ for $x > 0$ and $f(x) = 0$ for$x < 0$.
2. What are the conditions for the existence of Fourier Transform of a function $f(x)$?
3. Find the Fourier transform of $f(x) = 1$ for $|x| < 1$ and $f(x) = 0$ otherwise.

Concept Map


VECTOR CALCULUS, ORDINARY DIFFERENTIAL EQUATIONS AND TRANSFORMS
Includes
Calculus of vector functions
Applied for
Line integrals and their applications
Vector integral theorems
Applied for
Green's, Stoke's and Divergence theorems
Ordinary differential equations
Applied for
Solve second order ordinary differential equations
Laplace transforms
Applied for
Solution of order ordinary differential equations using Laplace transform
Fourier transform
Applied for
Radar and Signal processing

SYLLABUS

MODULE 1

Vector valued function of single variable, derivative of vector function, motion along a curve-velocity, speed and acceleration. Concept of scalar and vector fields, Gradient, divergence and curl, Line integrals of vector fields, work as line integral, Conservative vector fields, independence of path and potential function (results without proof).

MODULE 2

Green's theorem (for simply connected domains, without proof) and applications to evaluating line integrals and finding areas, Flux integrals over surfaces using divergence theorem (without proof) and its applications to finding flux integrals, Stokes' theorem (without proof) and its applications to finding line integrals of vector fields and work done.

MODULE 3

Homogenous linear differential equation of second order, superposition principle, general solution, homogenous linear ODEs with constant coefficients-general solution. Existence and uniqueness (without proof). Non homogenous linear ODEs-general solution, solution by the method of undetermined coefficients (for the right-hand side of the Form (x^n, e^{kx}, $\sin ax$, $\cos ax$), Method of variation of parameters.

MODULE 4

Laplace Transform and its inverse, Existence theorem (without proof), linearity, Laplace transform of basic functions, first shifting theorem, Laplace transform of derivatives and integrals, solution of differential equations using Laplace transform, Unit step function, Second shifting theorems. Convolution theorem (without proof) and its application to finding inverse Laplace transform of products of functions, Solution of ordinary differential equation using Laplace transform.

MODULE 5

Fourier integral representation, Fourier sine and cosine integrals. Fourier sine and cosine transforms, inverse sine and cosine transform. Fourier transform and inverse Fourier transform, basic properties. The Fourier transforms of derivatives, Convolution theorem.

Learning Resources

TEXT BOOKS

Sl. No.	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	H. Anton, I. Biven, S.Davis	Calculus	12th Edition	Wiley	2024
2	Erwin Kreyszig	Advanced Engineering Mathematics	10th Edition	John Wiley & Sons	2016

REFERENCE BOOKS

Sl. No.	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	B.V Ramana	Higher Engineering Mathematics	39th Edition	McGraw-Hill Education	2023
2	J. Stewart	Essential Calculus	2nd Edition	Cengage	2017
3	Maurice D. Weir, Joel Hass, Christopher Heil Przemyslaw Bogacki	Thomas Calculus	15th Edition	Pearson	2024

Online study materials:

1. https://youtu.be/0ph5PU3Fsdc?si=2yKCoxkguw7OdsT4
2. https://youtu.be/ksS_yOK1vtk?si=C_Tbsb7OBjNGBfo1
3. https://youtu.be/NBcGLLU90fM?si=ddSFB0Y0B5zzjvx3
4. https://youtu.be/d7NF-_8vVv4?si=2Tuom3pi2Uo_adgC
5. https://youtu.be/HoGNkZclxDU?si=tcWwE5CYZ50D5CAj

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1	**Calculus of vector functions**	9	CO1
1.1	Vector valued function of a scalar variable - derivative of vector valued function of scalar variable t-geometrical meaning	2	
1.2	Motion along a curve-speed, velocity, acceleration	2	
1.3	Gradient, directional derivative, divergent and curl	2	
1.4	Line integrals with respect to arc length, line integrals of vector fields. Work done as line integral	2	
1.5	Conservative vector field, independence of path, potential function	1	
2	**Vector integral theorems**	9	CO2
2.1	Green's theorem and it's applications	3	
2.2	Flux integral and their evaluation using divergence theorem	2	
2.3	Divergence theorem and applications	2	
2.4	Stokes theorem and applications	2	
3	**Ordinary Differential Equations**	9	
3.1	Homogenous linear equation of second order, Superposition principle, general solution	2	CO3
3.2	Homogenous linear ODEs of second order with constant coefficients	2	
3.3	Second order Euler-Cauchy equation	1	
3.4	Non homogenous linear differential equations of second order with constant coefficient-solution by undetermined coefficients	2	
3.5	Solution by variation of parameters.	2	

4	**Laplace Transform**	9	CO4
4.1	Laplace Transform, inverse Transform, Linearity, First shifting theorem, transform of basic functions	2	
4.2	Transform of derivatives and integrals	1	
4.3	Solution of Differential equations, Initial value problems by Laplace transform method.	2	
4.4	Unit step function	1	
4.5	Second shifting theorem	2	
4.6	Convolution and related problems.	1	
5	**Fourier Transform**	9	CO5
5.1	Fourier integral representation	2	
5.2	Fourier Cosine and Sine integrals and transforms	2	
5.3	Complex Fourier integral representation, Fourier transform and its inverse transforms, basic properties	3	
5.4	Fourier transform of derivatives, Convolution theorem	2	
	TOTAL HOURS	**45**	

COURSE DESIGNED BY	**VERIFIED BY**
Ms. Dhanya P B Asst. Professor, BS & H, JCET E Mail ID: pbdhanya@jawaharlalcolleges.com	Prof. K R Vijayakumaran Pillai Professor and Head, BS & H, JCET E Mail ID:krvijay@jawaharlalcolleges.com

24ICCHET222	CHEMISTRY FOR ELECTRONICS ENGINEERS	Category	L	T	P	Credit
		BSC	3	0	2	4

Preamble

The aim of Chemistry for Electronics Engineers is to enable the students to enhance the knowledge in the concepts of chemistry for engineering applications and to familiarize the students with different application oriented topics like spectroscopy, electrochemistry, Photochemistry, instrumental methods etc. This course introduces scientific approach and to familiarize with the experiments in chemistry relevant for research projects in higher semesters.

Prerequisite

Concepts of chemistry introduced at the plus two levels.

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Apply the basic concepts of electrochemistry and storage device to explore its possible application in various engineering field(Applying)	20
CO2	Apply the various spectroscopic techniques like UV-Visible, IR and its application (Applying)	20
CO3	Understand the different analytical methods for characterizing a chemical mixture or a compound and the basic concept of nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications(Understanding)	20
CO4	Understand types of conducting polymers and advanced polymers in engineering (Understanding)	20
CO5	Understand the different display systems and sensors used in electronic devices. (Understanding)	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	3	3		2			3	1	2	2
CO2	3	2	2	2	2	3	3		2			3	1	2	2
CO3	3	2	3	2	2	3	3		2			3		2	2
CO4	3	2	3	2	2	3	3	2	2			3		2	3
CO5	3	2	3	2	2	3	2	1	2			3		3	3
Avg	**3**	**2**	**2.8**	**2**	**2**	**3**	**2.8**	**1.5**	**2**			**3**	**1**	**2.2**	**2.4**

1-Low; 2-Medium; 3-Strong

Assessment Pattern: Cognitive Domain

Cognitive Levels	**Continuous Assessment Tests**		**Assignment**		**Terminal Examination**
	1	**2**	1	2	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30
Applying	50	40	50	40	40
Analyzing		10		10	10
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	**Mini project/Assignment/Practical Component**
Perception	Assignment
Set	
Guided Response	Practical
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Total Mark	CIA	ESE	ESE Duration
100	60	40	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance	:	9 Marks
Continuous Assessment Test (2 numbers)	:	24 Marks
Practical	:	27 Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks;** **Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 40 Marks** **Duration = 150 Minutes** Part A: 5 X 8 = 40 Marks

Sample Questions for Course Outcome Assessment

Course Outcome 1(CO1):

1. In redox titration using Potassium permanganate as oxidising agent, dilute Hydrochloric acid cannot be used to provide acidic medium, whereas dilute sulphuric acid can be used, explain using standard reduction potentials.
2. A Zn rod is dipped in 0.3 M $CuSO_4$ solution at 25 ^{0}C. Displacement reaction takes place then it attains equilibrium. Find the Equilibrium constant for this reaction.
3. Explain the construction and application of SHE.

Course Outcome 2 (CO2):

1. Most of the organic compounds shows a strong and broad absorption around 3000cm^{-1} .Assign this absorption.
2. Account for the fact that acetyl acetone exhibits bands at 1613cm $^{-1}$ and 1725 cm^{-1}due to carbonyl stretching mode and also broad band at 3000-2700cm^{-1} for OH stretching.
3. State Beer Lambert's law. Deduce it mathematical and graphical representation.

Course Outcome 3 (CO3):

1. How nanomaterials are classified on the basis of materials.
2. Describe a technique used for surface characterization of a sample.
3. Summarize the principle and working involved in Gas chromatography.

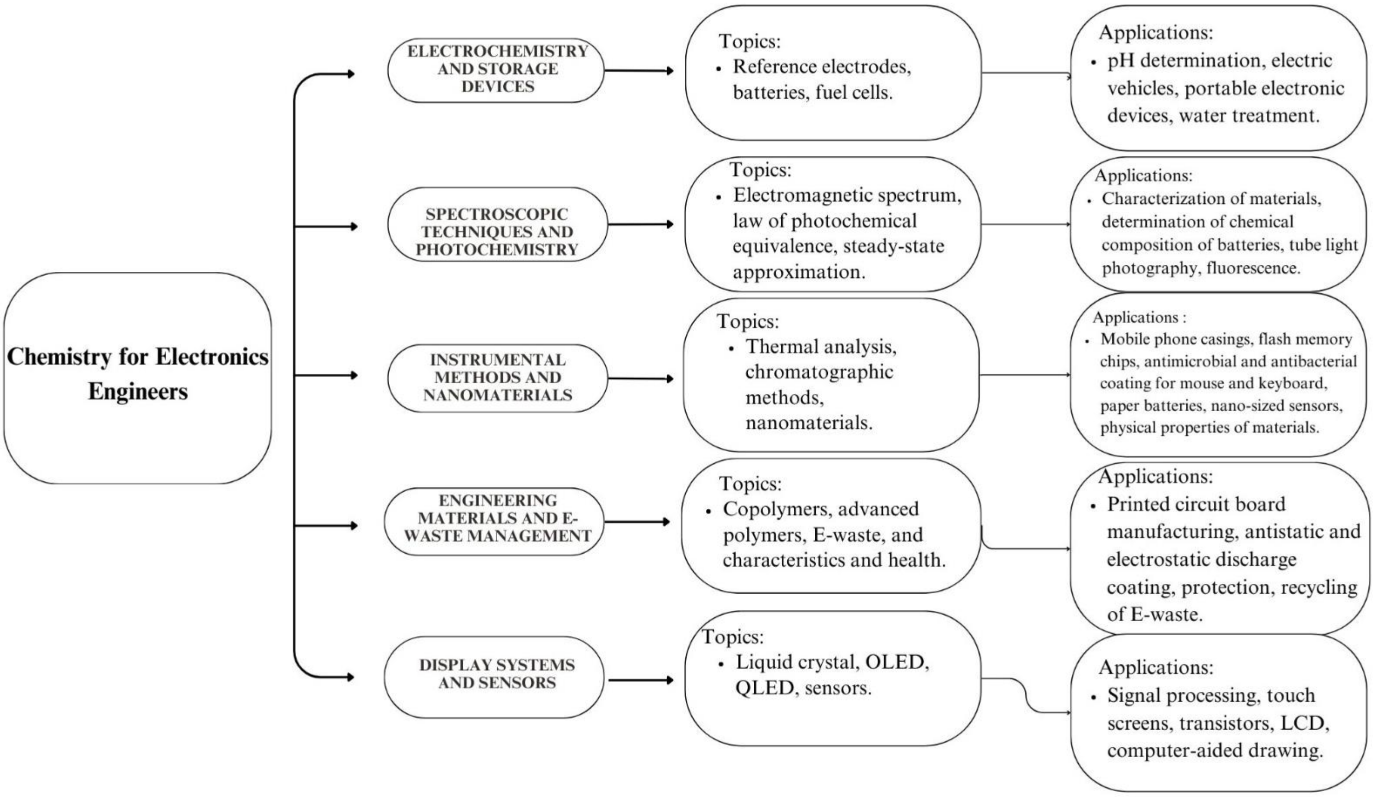
Course Outcome 4 (CO4):

1. Describe the synthesis, properties and application of a polymer which is used in making light weight military equipment.
2. Give the synthesis and application of ABS.
3. Describe the classification of copolymers.

Course Outcome 5 (CO5):

1. Demonstrate the working and construction of OLED with a neat diagram.
2. Outline advantages of QLED.
3. Explain the classification of liquid crystals and any two applications in detail.

Concept Map



Syllabus

Module 1
Electrochemistry and Storage devices

Introduction - Differences between electrolytic and electrochemical cells. Reference electrodes –SHE, Glass Electrode - Construction and Working-Determination of pH using glass electrode. Nernst Equation ,single electrode potentials and cell (Numericals) - Potentiometric titration - Introduction –Acid and base titration only. Batteries: – lithium-ion battery

Module 2
Spectroscopic Techniques

Introduction- Types of spectrum - electromagnetic spectrum - molecular energy levels – BeerLambert's law (Numericals). UV-Visible Spectroscopy – Principle - Types of electronic transitions - Instrumentation of UV-Visible spectrometer and applications. IR-Spectroscopy – Principle- Application of IR spectroscopy.

Module 3
Instrumental Methods and Nanomaterials

Thermal analysis –TGA- Principle, instrumentation (block diagram) and applications – TGA of $CaC_2O_4 .H_2O$ and polymers. DTA-Principle, instrumentation (block diagram) and applications - DTA of $CaC_2O_4 .H_2O$. Chromatographic methods - Basic principles and applications of TLC-Retention factor.
Nanomaterials - Definition - Classification - Chemical methods of preparation - Hydrolysis and Reduction - Applications of nanomaterials - Surface characterisation -SEM – Principle and instrumentation (block diagram).

Module 4
Engineering Materials

Copolymers - Definition - Types - Random, Alternating, Block and Graft copolymers - ABS - preparation, properties and applications. Kevlar-preparation, properties and applications.Conducting polymers -Polyaniline- preparation, properties and applications.

Module 5
Display systems and Sensors.

Liquid crystals-Introduction, classification and Applications of liquid crystal displays -Properties and application of OLED's and QLED's.
Sensors-Introduction to sensors-Principle, working and applications of Electrochemical sensors.

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Arun Lal Srivastav, Abhishek Kumar,Ananthkumar, Vishal Dutt, Pramod Rathore	Sustainable Management of electronic waste	First edition	Wiley	2024
2	Muhammed Arif	Engineering Chemistry Lab Manual	Third Edition	Owl Publishers.	2019
3	Sunita Rattan	Engineering Chemistry Lab manual	First Edition	SK Kataria& sons Publications	2023
4	Dr.A.Ravikrishnan	Engineering Chemistry with Laboratory Manual	Second Edition	Sri Krishna Hi tech	2023

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Syed E Hasan	Introduction to waste Management	First edition	Wiley	2022
2	Guangye Zhang, Chen Xie, Peng You	Introduction to organic electronic devices	First edition	Springer	2022
3	G. Svehla, B. Sivasankar	Vogel's Qualitative Inorganic Analysis	Seventh edition	Pearson	2023
4	Payal B Joshi	Lab Manual of Engineering Chemistry	First edition	Wiley publishers	2020

Online study materials:

- https://youtu.be/7jOSbtR8mTs?si=cSHQ4CxGiIgP3p7f
- https://youtu.be/0EWCqCIsFOA?si=iYBSZXU8DNJm6qwl
- https://youtu.be/EJeTOUSmkBE?si=z2BS_UkaXfECpYkM
- https://youtu.be/jSNlmOwpxYg?si=bhfgsqroNjKobrhg
- https://youtu.be/a2laTxZn7OA?si=Si3VwL6BY2vTG2w7
- https://youtu.be/SmoBK4-ydvs?feature
- https://youtu.be/wy9MnaTyYpQ?feature
- .https://youtu.be/0OYcPP94Xx8?feature
- https://youtu.be/ZypZbxL3jf0?feature
- https://youtu.be/ok4iEcmF8WQ?feature

Course Contents and Lecture Schedule

No	Topic	No.of Lectures(hrs)	Course Outcome
1	**Electrochemistry and Storage devices**	**9**	
1.1	Introduction - Differences between electrolytic and electrochemical cells. Reference electrodes –SHE.	2	CO1
1.2	Glass Electrode - Construction and Working-Determination of pH using glass electrode.	3	
1.3	Nernst Equation, single electrode potentials and cell (Numerical) - Potentiometric titration - Introduction –Acid and base titration only	2	
1.4	Batteries: lithium-ion battery	2	
2	**Spectroscopic Techniques**	**9**	
2.1	Introduction-Types of spectrum-electromagnetic spectrum-molecular energy levels-Beer Lambert's law (Numerical).	3	CO2
2.2	UV-Visible Spectroscopy – Principle - Types of electronic transitions –	2	
2.3	Instrumentation of UV-Visible spectrometer and applications.	2	
2.4	IR-Spectroscopy – Principle –Applications.	2	
3	**Instrumental Methods and Nanomaterials**	**9**	
3.1	Thermal analysis –TGA- Principle, instrumentation (block diagram) and applications – TGA of $CaC_2O_4.H_2O$ and polymers. DTA-Principle, instrumentation (block diagram) and applications - DTA of CaC_2O_4 .H_2O.	2	

3.2	Chromatographic methods - Basic principles and applications of column and TLC	2	
3.3	GC and HPLC -Principle, instrumentation (block diagram) - retention time and applications.	2	CO3
3.4	Nanomaterials - Definition - Classification - Chemical methods of preparation -Hydrolysis and Reduction - Applications of nanomaterials – Surface characterisation - SEM – Principle and instrumentation (block diagram).	3	
4	**Engineering Materials**	**9**	
4.1	Copolymers - Definition - Types - Random, Alternating, Block and Graft copolymers.	2	
4.2	ABS -preparation, properties and applications.	2	**CO4**
4.3	Kevlar-preparation, properties and applications.	2	
4.4	Conducting polymers - Doping -Polyaniline -preparation properties and applications.	3	
5	**Display systems and Sensors.**	**9**	
5.1	Liquid crystals-Introduction, classification and Applications of liquid crystal displays	3	
5.2	Properties and application of OLED's and QLED'S	3	
5.3	Sensors-Introduction to sensors, Electrochemical sensors.	3	**CO5**
	TOTAL	**45 HOURS**	

ENGINEERING CHEMISTRY LAB

LIST OF EXPERIMENTS (MINIMUM 7 MANDATORY)

1. Estimation of dissolved oxygen by Winkler's method
2. Potentiometric titration of HCl and NaOH
3. Calibration of p^H meter and determination of p^H of a solution
4. Synthesis of polymers (a) Urea-formaldehyde resin (b) Phenol-formaldehyde resin
5. Determination of cell constant and conductance of unknown solution using conductivity cell
6. Estimation of Iron in Iron ore.
7. Preparation of nanoparticle (ZnO) by Sol-gel method
8. Estimation of Ferric ion using Colorimetry.

LECTURE SCHEDULE

SL.NO	EXPERIMENTS	NO OF HOURS
1.	Estimation of Dissolved oxygen by Winkler's method	2
2.	Potentiometric titration of HCl and NaOH	2
3.	Calibration of PH meter and determination of PH of a solution.	2
4.	Synthesis of polymers (a) Urea-formaldehyde resin (b) Phenol-Formaldehyde resin.	2
5.	Determination of Cell constant and conductance of unknown solution using conductivity cell	2
6.	Estimation of Iron in Iron ore.	2
7.	Preparation of nanoparticle (ZnO) by Sol-Gel method.	2
8.	Estimation of ferric ion using Colorimetry.	2

COURSE DESIGNED BY	**VERIFIED BY**
Ms. Sharamol PK Asst. Professor, BS & H, JCET E. Mail ID: shara@jawaharlalcolleges.com	Prof.V.N. Madhusudhasan Asst. Professor, BS & H, JCET E. Mail ID: vnmadhusudhanan@jawaharlalcolleges.com

24ICFCTT203	FOUNDATIONS OF COMPUTING FROM HARDWARE ESSENTIALS TO WEB DESIGN	Category	L	T	P	Credit
		ESC	2	0	2	3

Preamble

This course objective is to provide the comprehensive knowledge and practical skills in assembling, maintaining, troubleshooting and upgrading the computer hardware components. Develop foundational skills in HTML, CSS and JavaScript to create responsive, user-friendly and visually appealing websites.

Prerequisite

None

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Describe the fundamental components of a desktop computer and familiarize with them (Understanding**)**	20
CO2	Demonstrate assembling of a desktop computer system with the given components and peripherals and setting up BIOS **(**Understanding**)**	20
CO3	Understanding of various hardware components that facilitate and enhance connectivity in networks and devices **(**Understanding**)**	20
CO4	Understanding basic HTML tags & apply these concepts to web designing (Understanding**)**	20
CO5	Understanding basic CSS elements and developing responsive, visually appealing, and user-friendly websites using HTML and CSS and JavaScript**(**Understanding**)**	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	-	-	-	1	*	*	*
CO2	2	-	-	-	-	-	-	3	-	-	-	1	-	-	-
CO3	2	-	-	-	-	-	-	2	-	-	-	-	-	-	-
CO4	2	-	-	-	2		-	-	-	-	-	-	-	-	-
CO5	2	-	-	-	2		-	-	-	-	-	-	-	-	-
AVG	2	-	-	-	2		-	-	-	-	-	1	-	-	-

1-Low; 2-Medium; 3- Strong

* The faculty handling a particular programme should map the Course Outcomes (COs) with the applicable programme Specific outcomes (PSOs)

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests			Assignment			ESE
	1	2	3 (Tutorial)	1	2	3	
Remembering	50	40	-	50	40	-	40
Understanding	50	60	-	50	60	-	60
Applying							
Analyzing							
Evaluating							
Creating							

The assessment indicators are in percentages. The continuous internal assessment will carry 40 marks and the external examination, referred to as End Semester Examination, will carry 60 marks.

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	
Set	Practical Sessions
Guided Response	Tutorials
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	60	40	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance	: 9 marks
Continuous Assessment Test (2 numbers)	: 24 marks
Assignment (Case study) / Practical (Activity)	: 27 marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks;** **Duration =90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 40 Marks;** **Duration =150 Minutes** Part A: 5 X 3 = 15 Marks Part B : 5 X 5 = 25 Marks

Question Paper Pattern

Sample Questions for Course Outcome Assessment

Course Outcome 1(CO1):

1. Explain the basic principles of the Von Neumann architecture. How does it differ from the Harvard architecture?
2. Differentiate between primary memory and secondary memory, providing examples of each. Compare and contrast SRAM and DRAM in terms of speed, cost, and typical usage

Course Outcome 2 (CO2):

1 Illustrate the process of connecting peripheral devices to a newly assembled desktop computer, and highlight the key factors that ensure successful operation.

2 Demonstrate the complete process of assembling a desktop computer system, from installing the motherboard, CPU, RAM, storage devices, and power supply, to setting up the BIOS and ensuring all components are functioning correctly

Course Outcome 3(CO3):

1 Apply the TCP/IP protocol structure to explain how data flows across a network, and discuss the critical role of connectivity hardware in supporting seamless communication

2 Examine how different types of connectivity hardware function together to support network communication and analyze their roles within the OSI and TCP/IP layer frameworks.

Course Outcome 4(CO4):

1 Design a personal portfolio web page using HTML that includes a main heading, a brief introduction about yourself in two paragraphs, a list of your skills or interests with at least three items, a table showcasing your projects (with project name and description as columns), a hyperlink to your LinkedIn profile or personal blog, and an image of yourself or a relevant graphic. Add an appropriate title for your web page.

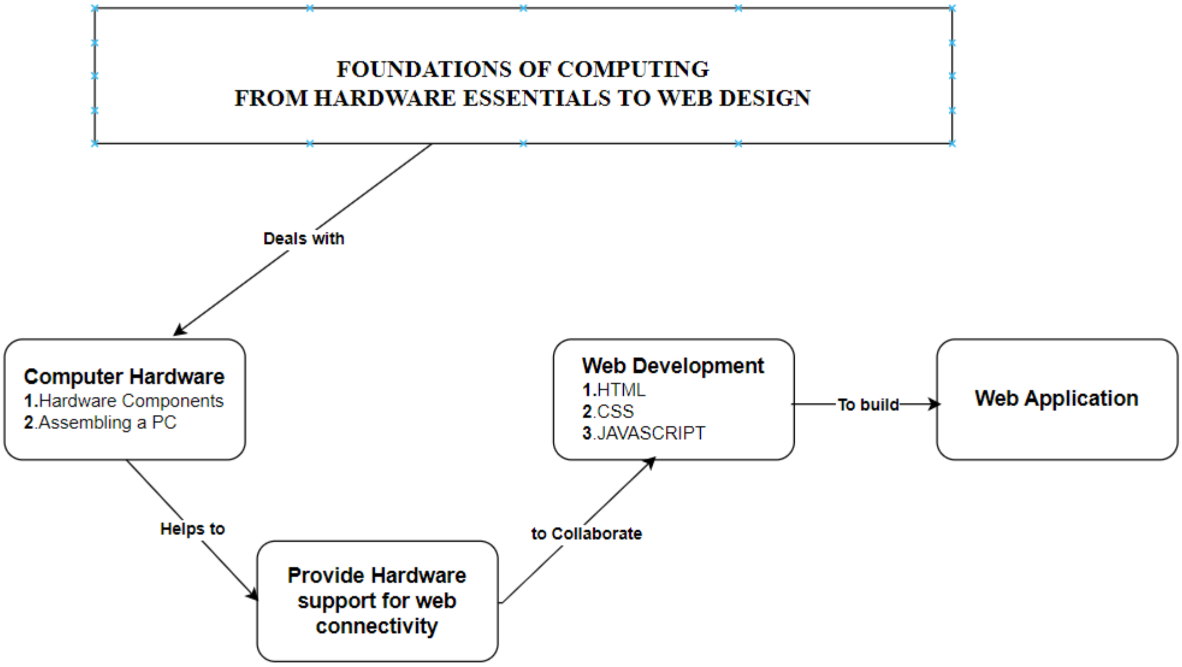
2 Create a simple event announcement web page using HTML that includes a main heading for the event title, at least two paragraphs detailing the event (such as date, time, location, and description), an unordered list of activities or speakers involved with a minimum of three items, a table displaying registration information (with columns for name and contact details), a hyperlink to the event registration page, and an image related to the event. Be sure to include a descriptive title for your web page

Course Outcome 5(CO5):

1 Create a web page for an online workshop that incorporates a CSS menu using inline, embedded, and external stylesheets. Add JavaScript for form validation to ensure attendees provide their name and email address correctly. Additionally, outline the process for setting up a local host server with Apache Tomcat to preview your web page before deploying it to a live server

2 Build a web page for a local book club that includes a navigation menu styled with CSS and a registration form that uses JavaScript for validation. Explain how to set up a local host server using Apache Tomcat to test your web page before making it publicly accessible

Concept Map



Syllabus

Module 1: Introduction to Computer Hardware

Overview of desktop computer Components-Importance of hardware knowledge-Von Neumann architecture & Output Devices-Types and specification-CPU, Memory devices-types primary and Secondary-Cache memory-SRAM-DRAM-EPROM-PROM System Software and Application Software-High Level Language-Low Level Language-Compiler-Assembler-Interpreter

Module 2: Assembling of a desktop computer system & BIOS

Operating System-Types-Concept of booting- POST (Power on Self-Test)- Motherboard-Form factors- (ATX, Micro-ATX, Mini-ITX)- Key components and their functions -CPU socket, RAM slots, PCI slot- Cooling system in a computer- SMPS & UPS-Assembling of a desktop computer

Module 3: Hardware Support for Connectivity

Overview of Connectivity Hardware-Network Devices-Network Interface Card-Router-Modem-Switch-hub-access point-gateway-bridge- OSI Layer-TCP/IP layers

Module 4: Fundamentals of World Wide Web and HTML

World Wide Web-Web Server-Client to web server Communication-Web server to web server communication-DNS Server-Static and dynamic web Pages-Scripts-Client side scripting-Server side scripting-Introduction to web development- Basic structure of an HTML document-HTML tags-HTML elements-inserting images-Lists in HTML

Module 5: Web designing using HTML, CSS &JavaScript

Cascading Style sheet-inline-embedded-external style sheet-building CSS menu-creating user style sheets- Introduction to JavaScript- Adding JavaScript to an HTML page- Simple form validation using JavaScript

Introduction to Web Servers- local host server- Hosting a website on a Server- localhost of Apache Tomcat

Learning Resources

TEXT BOOKS

Sl. No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	K. L. James	Computer Hardware: Installation, Interfacing, Troubleshooting and Maintenance	Third Edition	Tata McGraw Hill	2013
2	Jennifer Niederst Robbins	Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics	5th Edition	O'Reilly Media	2018
3	HTML, CSS, and JavaScript All in One, Sams Teach Yourself	Julie C. Meloni Jennifer Kyrnin	First Edition	Pearson	2020

REFERENCE BOOKS

Sl.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Scott Mueller	Upgrading and Repairing PCs	22nd Edition	Que Publishing	2015
2	David A. Patterson, John L. Hennessy	Computer Organization and Design: The Hardware/Software Interface	5th Edition	Morgan Kaufmann	2017
3	Jon Duckett	Web Design with HTML, CSS, JavaScript and Jquery	First	Wiley	2014

Online Study Materials

1. https://onlinecourses.swayam2.ac.in/aic20_sp11/
2. https://nptel.ac.in/courses/106106156
3. https://onlinecourses.nptel.ac.in/noc22_cs48/
4. https://www.shiksha.com/online-courses/networking-and-hardware-courses-certification-training-by-nptel-st615

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1	**Introduction to Computer Hardware**	**6 Hrs**	CO1
1.1	Overview of desktop component-computer hardware, Von-Neuman architecture	1	
1.2	Input devices & output devices, CPU	1	
1.3	Memory -primary, secondary, cache memory	1	
1.4	SRAM, DRAM, EPROM, PROM	1	
1.5	System software, application software, High level and low-level	1	

	language		
1.6	Compiler, Assembler, Interpreter	1	
2	**Assembling of a desktop computer system & BIOS**	**6 Hrs**	CO2
2.1	Operating system-types, Booting-BIOS-POST	1	
2.2	Motherboard-form factors-components	1	
2.3	CPU socket, RAM slots, PCI slot	1	
2.4	Cooling system in computer, SMPS	1	
2.5	Assembling of a desktop computer-lecture 1	1	
2.6	Assembling of a desktop computer-lecture 2	1	
3	**Hardware Support for Connectivity**	**6 Hrs**	CO3
3.1	Overview of Connectivity Hardware	1	
3.2	Introduction to networking devices-NIC	1	
3.3	Router, modem, switch	1	
3.4	Hub. access point, gateway bridge	1	
3.5	OSI layers -functions	1	
3.6	TCP Layers-functions	1	
4	**Fundamentals of World Wide Web and HTML**	**6 Hrs**	CO4
4.1	World Wide web, Web server-communication	1	
4.2	DNS server, Static and dynamic pages	1	
4.3	Client-side scripting & Server-side scripting	1	
4.4	Introduction to web design-HTML	1	
4.5	The basic structure of an HTML document, HTML tags	1	
4.6	HTML elements, inserting images, lists	1	
5	**Web designing using HTML, CSS & JavaScript**	**6 Hrs**	CO5
5.1	Cascading Style sheet-Embedded CSS	1	
5.2	CSS menu-selectors	1	
5.3	JavaScript	1	
5.4	Form validation using JavaScript	1	
5.5	Webserver	1	
5.6	Localhost of Apache Tomcat	1	
	TOTAL	**30 hours**	

LABORATORY HOURS

1	EPROM, PROM,SRAM,DRAM	**2**
2	Familiarization of CPU components	2
3	Describe the initial steps in assembling a desktop computer, including preparing the case, installing the motherboard, and securing the power supply.	2
4	Assembling a computer	2
5	Familiarization of five types of connectivity hardware in a computer	2
6	HTML-web page, paragraph.	2
7	HTML list	2
8	HTML Table, image	2
9	HTML-tags	2
10	CSS-inline	2
11	CSS-Font, style	2
12	CSS-image	2
13	Web page using HTML and CSS	2
14	Javascript	2
15	Form validation using Javascript	2
	TOTAL HOURS	**30**

COURSE DESIGNED BY	VERIFIED BY
Ms. Resmi C. S. Asst. Professor, CSE Dept, JCET E. Mail ID: resmi4086.cse@jawaharlalcolleges.com	Ms. Akhila E. Asst. Professor, CSE Dept, JCET E. Mail ID : mailtoakhilasathish@gmail.com

24ICPGCT204	PROGRAMMING IN C	Category	L	T	P	Credit
		ESC	3	0	2	4

Preamble

This course objective is to provide theoretical and practical experience on fundamentals of C programming as well as the design of simplified computer solutions to real-world problems. Programming concepts, data types, conditional and control structures, functions, arrays, recursion, file handling, and preprocessor directives are all projected in solving the engineering and real-life problems.

Prerequisite

None

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Describe the fundamentals of C language and infer the computer related programs using algorithms and flowcharts. (Understanding)	20
CO2	Introduce the basic concepts of C programming like operators and control statements to understand the structure of a C program. (Understanding)	20
CO3	Describe the concepts of arrays and functions to basic C program (Understanding)	20
CO4	Apply the concept of function, recursion, Structures in writing a C program (Applying)	20
CO5	Handle and Implement file operations and pre-processor directives for a given application (Applying)	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	-	-	-	-	2	-	-	*	*	*
CO2	3	2	-	-	-	-	-	-	-	2	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	2	-	1	-	-	-
CO4	3	3	2	-	-	-	-	-	-	2	-	1	-	-	-
CO5	3	2	2	-	-	-	-	-	-	2	-	1	-	-	-
AVG	**2.8**	**2.2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**1**	**-**	**-**	**-**

* The faculty handling a particular programme should map the Course Outcomes (COs) with the applicable programme Specific outcomes (PSOs)

1-Low; 2-Medium; 3- Strong

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests			Assignment			ESE
	1	**2**	**3 (Tutorial)**	1	2	3	
Remembering	50%	20%		50%	20%	-	20%
Understanding	50%	40%	30%	50%	40%	-	60%
Applying		40%	70%		40%	-	40%
Analyzing							
Evaluating							
Creating							

The Assessment indicators are in percentages. Continuous Internal Assessment will carry 40 marks and the external examination, referred as ESE, will carry 60 marks.

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	
Set	Practical Sessions
Guided Response	Tutorials
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance	:	6 Marks
Continuous Assessment Test (2 numbers)	:	20 Marks
Assignment/Quiz/Course project	:	14 Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks;** **Duration =90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks;** **Duration =150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment

Course Outcome 1(CO1):

1. Write an algorithm to check whether largest of 3 natural numbers is prime or not. Also, draw a flowchart for solving the same problem
2. Write an algorithm and draw its corresponding flowchart to find the sum of n numbers.

Course Outcome 2 (CO2):

1. Write an easy-to-read C program to process a set of n natural numbers and to find the largest even number and smallest odd number from the given set of numbers. The program should not use division and modulus operators.

Course Outcome 3(CO3):

1. Write an easy-to-read C program to process the marks obtained by n students of a class and prepare their rank list based on the sum of the marks obtained. There are 3 subjects for which examinations are conducted and the third subject is an elective where a student is allowed to take any one of the two courses offered

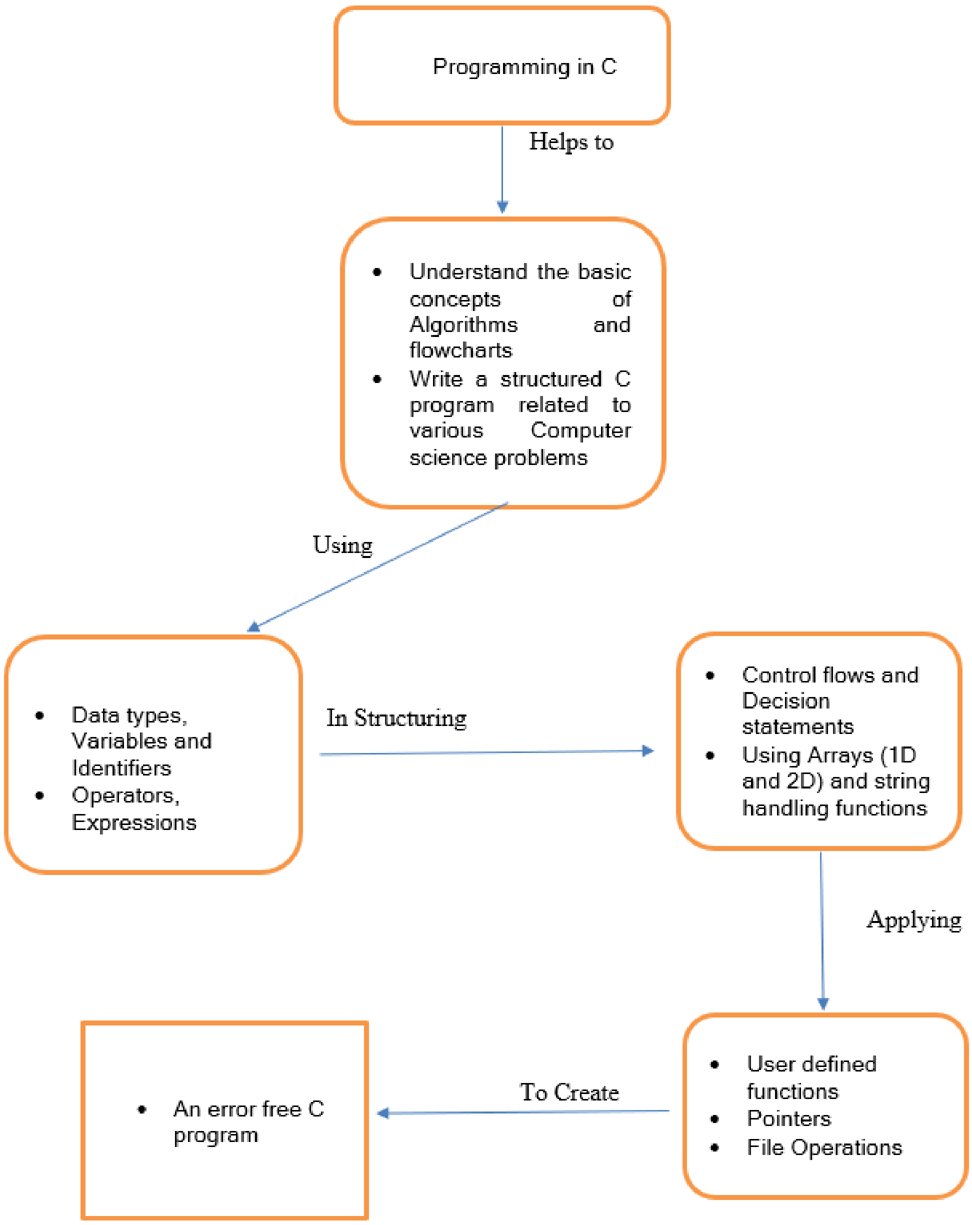
Course Outcome 4(CO4):

1. Write an easy-to-read C program to find the value of a mathematical function f which is defined as follows. f(n) = n! / (sum of factors of n), if n is not prime and f(n) = n! / (sum of digits of n), if n is prime.

Course Outcome 5(CO5):

1. Write an easy-to-read C program to sort a set of n integers and to find the number of unique numbers and the number of repeated numbers in the given set of numbers. Use a function which takes an integer array of n elements, sorts the array using the Bubble Sorting Technique and returns the number of unique numbers and the number of repeated numbers in the given array.

Concept Map



Syllabus

Module 1:

Overview

and

Introduction to C

Introduction to computing: Algorithms and flowcharts- Art of programming through algorithms and flowcharts- Algorithmic notations and Flowchart symbols- Conceiving simple problems using algorithms and flow charts (Small problems is preferred).

Overview of C: History and its importance- Basic structure of a C program- Executing a basic C program with algorithms and flowcharts.

Character set: C tokens- Keywords and Identifiers- Constants- Variables- Data types- Declaration of variables- Assigning Values to variables.

Managing Input and Output Operations: Reading a character- Writing a character- Formatted Input and Output.

Module 2: Operators and Control flow

Operators: Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators, Special Operators, Arithmetic Expressions, Evaluation of Expressions, Precedence of Arithmetic Operators- Type Conversions in Expressions, Operator Precedence and Associativity.

Control Flow statements: Decision making using IF statements- Switch Statement, Unconditional Branching using goto statement, While Loop, Do While Loop, For Loop, Break and Continue statements. (Simple programs covering control flow)

Module 3: Arrays and strings

Arrays: One-dimensional Arrays, Declaration of One-dimensional Arrays, Initialization of One-dimensional Arrays, Example programs- Bubble sort, Selection sort, Linear search, Two-dimensional Arrays, Declaration of Two-dimensional Arrays, Initialization of Two-dimensional Arrays, Example Programs-Matrix operations.

Strings: Introduction to Character array- Declaring and Initializing String Variables, Reading Strings from Terminal- String handling functions (strlen, strcpy, strcat and strcmp, puts, gets)- Example Programs (with and without using built-in string functions)

Module 4: Working with functions

Introduction to modular Programming: Functions- Need for functions, Elements of User-defined Functions, Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions, No Arguments and no Return Values, Arguments

but no Return values, Arguments with Return Values, No Arguments but Returns a Value, Passing Arrays to Functions, Recursion, The Scope, Visibility and Lifetime of variables. Structure, Union and Storage Classes.

Module 5: Pointers and Files

Basics of Pointer: Declaring pointers, accessing data though pointers, NULL pointer, array access using pointers, pass by reference effect File Operations: open, close, read, write, append Sequential access and random access to files: In built file handling functions (rewind (), fseek (), ftell (), feof (), fread (), fwrite ()). Sample programs related to files.

Learning Resources

TEXT BOOKS

Sl.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Gottfried B.S	Programming with C	Third	Tata McGraw Hill	2019
2	E. Balagurusamy	Programming in ANSI C	Eighth	McGraw Hill	2019

REFERENCE BOOKS

Sl.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Anita Goel and Ajay Mittal	Computer fundamentals and Programming in C	Fifth	Pearson	2015
2	Brian W. Kernighan and Dennis M. Ritchie	C Programming Language	Third	Pearson	2008
3	Jacqueline A Jones and Keith Harrow	Problem Solving with C	Second	Pearson Education	2001

Online study materials:

1. https://nptel.ac.in/courses/106105171

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	COs
1.	**Overview and Introduction to C (9 Hours)**		CO1
1.1	Introduction to computing- Algorithms and flow charts-	1	
1.2	Art of programming through algorithms and flowcharts	1	
1.3	Algorithmic notations and Flow chart symbols-	1	
1.4	Conceiving simple problems using algorithms and flow charts	1	
1.5	Overview of C- History and its importance- Basic structure of a C program-	1	
1.6	Executing a basic C program with algorithms and flowcharts	1	
1.7	Character set- C tokens- Keywords and Identifiers- Constants- Variables-	1	
1.8	Data types- Declaration of variables- Assigning Values to variables.	1	
1.9	Reading a character- Writing a character- Formatted Input and Output.	1	
2	**Operators and Control flow (9 Hours)**		CO2
2.1	Various Operators and its uses	1	
2.2	Operators and its examples	1	
2.3	Evaluation of Expressions, Precedence of Arithmetic Operators-	1	
2.4	Type Conversions in Expressions, Operator Precedence and Associativity.	1	
2.5	Decision Making and Branching: Decision making using IF statements-	1	
2.6	Decision making: Switch Statement	1	
2.7	Unconditional Branching using goto statement, While Loop	1	
2.8	Do While Loop, For Loop, Break and Continue statements.	1	
2.9	Simple programs covering control flow	1	
3	**Arrays and strings (9 Hours)**		CO3
3.1	Arrays Declaration and Initialization, 1-Dimensional Array	1	
3.2	Example programs- Bubble sort, Selection sort.	1	
3.3	Example programs- Linear Search	1	

3.4	Two-dimensional Arrays, Declaration of Two-dimensional Arrays, Initialization of Two-dimensional Arrays.	1	
3.5	Example programs-Matrix Multiplication, Transpose of a matrix.	1	
3.6	Character Arrays and Strings: Declaring and Initializing String Variables.	1	
3.7	Reading Strings from Terminal	1	
3.8	String handling functions (strlen, strcpy, strcat and strcmp, puts, gets)	1	
3.9	Example Programs (with and without using built-in string functions)	1	
4	**Working with functions (9 Hours)**		CO4
4.1	Introduction to modular programming, writing functions	1	
4.2	User-defined Functions, Definition of Functions, Return Values and their Types.	1	
4.3	Function Calls, Function Declaration.	1	
4.4	Category of Functions, No Arguments and no Return Values	1	
4.5	Arguments but no Return values, Arguments with Return Values	1	
4.6	Passing Arrays to Functions, Recursion, The Scope	1	
4.7	Visibility and Lifetime of variables	1	
4.8	Structure, Union and Storage Classes.	1	
4.9	Sample programs	1	
5	**Pointers and Files (9 Hours)**		CO5
5.1	Basics of Pointer: declaring pointers.	1	
5.2	Accessing data through pointers	1	
5.3	NULL pointers and declarations	1	
5.4	Array access using pointers	1	
5.5	File Operations: open, close, read, write,	1	
5.6	Append Sequential access and random access to files	1	
5.7	In built file handling functions (rewind (), fseek (), ftell (), feof ()	1	
5.8	Operations - fread (), fwrite ())	1	

5.9	Simple programs covering pointers and files.	1	
	TOTAL	45 hours	
SAMPLE PROGRAMS FOR TUTORIALS**			
T1	Write a C program to print the name and address of the candidate.	1	
T2	Draw the flowchart and write algorithm to check if the number is prime or not.	1	
T3	Draw the flowchart and write algorithm to print the sum of n natural numbers.	1	
T4	Write a C program to simulate a Calculator using Switch statement	1	
T5	Write a C program to check whether given number is Armstrong or not.	1	
T6	Write a C program for pattern printing using loops.	1	
T7	Write a C Program to do a Linear Search and bubble sort	1	
T8	Write a C program to check if the given number is palindrome.	1	
T9	Write a C program to do the Matrix operations	1	
T10	Write a C program to calculate the factorial of a number using recursion.	1	
T11	Write a C program to calculate the factorial of a number using recursion	1	
T12	Write a C program to implement Call by value and Call by reference. (The choice of the program is to be done by the faculty)	1	
T13	Write a C program to implement the concept of Pointers	1	
T14	Write a C program to do file operations (Read and write)	1	
T15	Write a C program to do fseek() and other operations	1	

		TOTAL	15 Hours	

** The tutorial sessions are being conducted on the laboratory.

COURSE DESIGNED BY	**VERIFIED BY**
Mr. Ambarish A. Asst. Professor, CSE Dept, JCET E. Mail ID: ambarish4056.cse@jawaharlalcolleges.com	Ms. Nisna Haneefa K. Asst. Professor, CSE Dept, JCET E. Mail ID: nisna4043.cse@jawaharlalcolleges.com

24ECBADT205	BASICS OF ANALOG AND DIGITAL ELECTRONICS	Category	L	T	P	Credit
		PCC	3	1	0	4

Preamble

The course has been designed to introduce fundamental principles of analog and digital electronics.The students completing this course will understand basic analog and digital electronics, including semiconductor properties, operational amplifiers, combinational and sequential logic and analog-to-digital digital-to-analog conversion techniques.

Prerequisite

Introduction to Basic Electronics

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Introduce components such as diodes and to analyze the diode characteristics and the biasing techniques (Understanding)	20
CO2	Introduce BJTs and to analyze the Bipolar Junction Transistor characteristics and the biasing techniques. (Understanding)	20
CO3	Introduce FETs and to analyze the Field Effect Transistor characteristics and the biasing techniques(Understanding)	20
CO4	Apply the binary and hexadecimal number systems including operation of basic logic gates(Applying)	20
CO5	Understand the concept and to utilize digital design tools such as Boolean algebra and Karnaugh maps and analyze, design and optimize digital systems. (Understanding)	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	2	-	3	-
CO2	3	3	-	-	3	-	-	-	-	-	-	2	-	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	2	-	3	-
CO4	3	3	3	-	3	-	-	-	-	-	-	2	2	3	-
CO5	3	3	3	-	3	-	-	-	-	-	-	2	-	3	-
Avg	**3**	**3**	**3**	-	**3**	-	-	-	-	-	-	**2**	**2**	**3**	-

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30
Applying	50	50	50	50	50
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) : 20 Marks
Assignment/Quiz/Course project : 14 Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1(CO1):

1. Classify the types of Diode Clippers.
2. Compare PN junction diode and zener diode.
3. List the applications of LASER diodes.

Course Outcome 2(CO2):

1. Define Q Point and stability factors of BJT
2 . Draw the generalized hybrid model for BJT amplifier.
3. Analyze voltage divider biasing of B JT

Course Outcome 3 (CO3):

1.Explain the structure and working of JFET.
2.Draw the input output characterstic of CS JFET.
3.Draw the SPICE model of RC integrator.

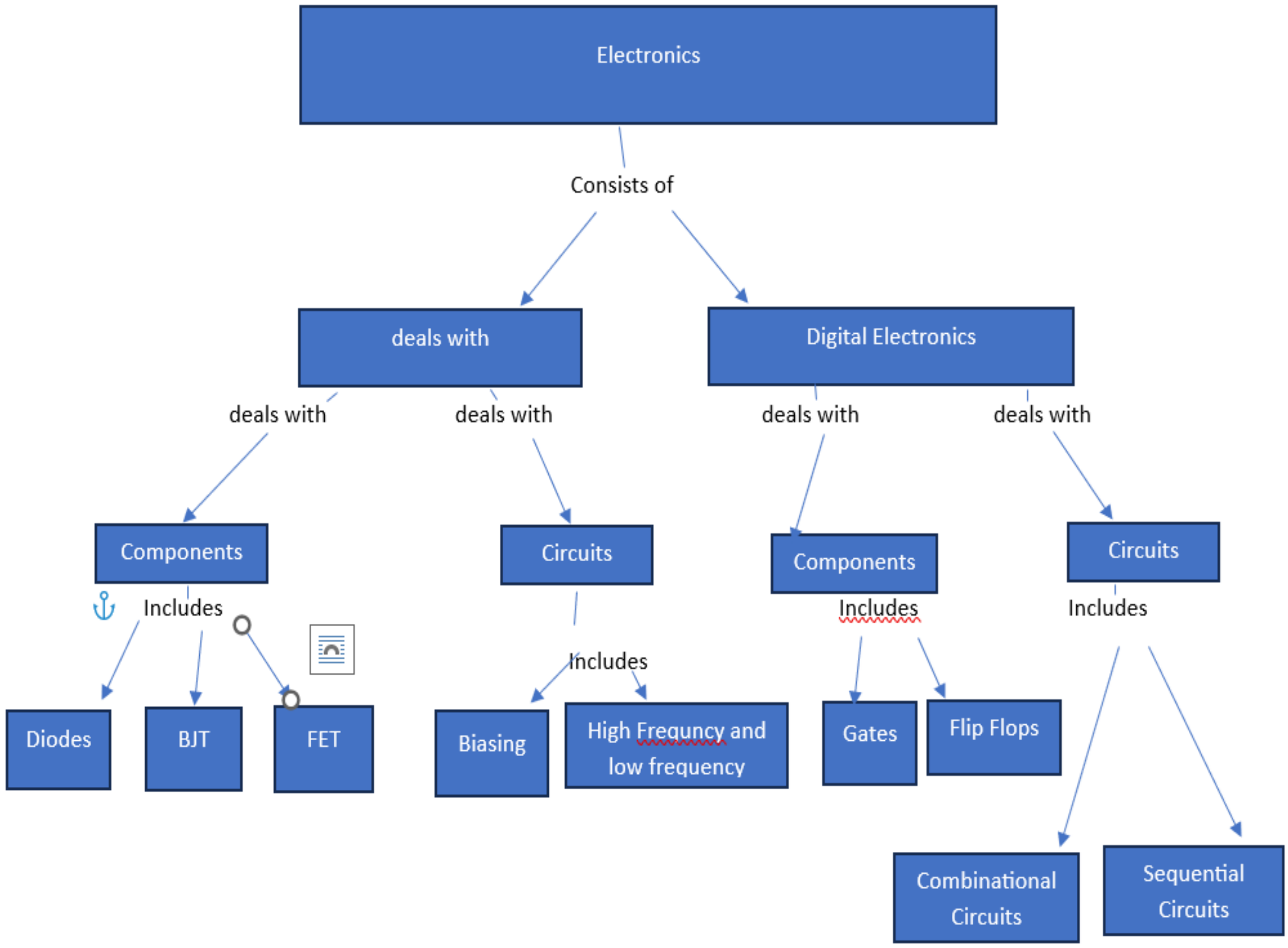
Course Outcome 4 (CO4):

1. Convert $(10110)_2$ in to decimal,octa decimal and hexadecimal numbers.
2. State and prove D'Morgans law .
3. Compare the performance of various logic families.

Course Outcome 5(CO5):

1. Minimize the SOP $F[A,B,C,D]=\sum(1,4,7,9,11,14)$.
2. Implement a full subractor using universal gates.
3. Design and implement a synchronous UP DOWN counter using J K flip flop .

Concept Map



Syllabus

Module 1

Basic Concepts of P-N Junctions

P-N Junctions: Diode theory, forward and reverse-biased junctions, reverse-bias breakdown, load line analysis, diode applications - Limiters, clippers, clampers, voltage multipliers, RC circuits-Differentiator and Integrator, Special purpose diodes - Zener diode, Varactor, light emitting diodes, Laser diodes.

Module 2

Basic Concepts of Bipolar Junction Transistors (BJT):

Bipolar Junction Transistors (BJT): Transistor fundamentals, transistor configurations, DC operating point, BJT characteristics & parameters, High frequency and low frequency analysis.

Fixed bias, emitter bias with and without emitter resistance, voltage divider bias, analysis of above circuits and their design, variation of operating point and its stability.

Module 3

Basic Concepts of Field Effect Transistors:

Field-Effect Transistors (FET): JFET- current-voltage characteristics, effects in real devices, high-frequency and high-speed issues, ; Structure and working of JFET and MOSFET;configurations, output and transfer characteristics, Applications of JFET and MOSFET, SPICE models of circuits.

Module 4

Introduction to Number Systems and Boolean Algebra

Number Systems: Decimal, binary, octal, hexadecimal number system and conversion , binary weighted codes, signed numbers, 1s and 2s complement codes, Binary arithmetic, Binary logic functions , Boolean laws, truth tables, associative and distributive properties, De Morgans theorems, realization of switching functions using logic gates.

Logic levels, propagation delay time, power dissipation fan-out and fan-in, noise margin, logic families and their characteristics TTL, LSTTL CMOS and ECL integrated circuits and their performance comparison.

Module 5

Introduction to Combinational and sequential circuits:

Combinational Logic: Switching equations, canonical logic forms, sum of product & product of sums, Karnaugh maps, two, three and four variable Karnaugh maps, simplification of expressions, Full Adder and Full subractor, mixed logic combinational circuits, multiple output functions **.**

Sequential circuits: flip-flops, clocked and edge triggered flipflops, timing specifications, asynchronous and synchronous counters, counter design with state equations, Registers , serial in serial out shift registers, tristate register, timing considerations.

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Floyd T. L	“Digital Fundamentals	11th Edition	Pearson International Education,	2017
2	Milliman, J., Halkias, C., and Jit, S	Electronics Devices and Circuits	2nd Edition	McGraw Hill Education,	2008

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	J Neil Storey	Electronics A Systems Approach,	4th Edition	Pearson Education Publishing Company Pvt Ltd.	2014
2	Jaccob Millman,	“Integrated Electronics: Analog and Digital Circuits and Systems	2nd Edition	Oxford University Press	2007
3	Jain R.P	“Modern Digital Electronics	3rd edition	Tata Mc GrawHill.	2003

Online study materials:
https://nptel.ac.in/courses/117/103/117103063/
(Use of Standard and approved Steam Table, Mollier Chart is permitted)

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**Basic Concepts of Analog Electronics**	12	CO1
1.1	P-N Junctions: Diode theory, forward and reverse-biased junctions, reverse-bias breakdown.	2	
1.2	load line analysis-AC and DC analysis	2	
1.3	Limiters, clippers, clampers, RC circuits-Differentiator and Integrator, voltage multipliers,.	4	
1.4	Special purpose diodes - Zener diode, Varactor, light emitting diodes, Laser diodes .	4	
2	**Basic Concepts of Bipolar Junction Transistors (BJT)**	12	CO2
2.1	Transistor fundamentals, transistor configurations, DC operating point,	3	
2.2	BJT characteristics & parameters-High frequency and low frequency analysis	3	
2.3	fixed bias, emitter bias with and without emitter resistance, analysis of above circuits and their design	3	
2.4	voltage dividerbias	1	
2.5	variation of operating point and its stability.	2	
3.	**Introduction to Field-Effect Transistors (FET)**	12	

3.1	JFET- current-voltage characteristics	2	CO3
3.2	Effects in real devices, high-frequency and high-speed issues	2	
3.3	Structure and working of JFET and MOSFET;configurations, output and transfer characteristics	2	
3.4	Applications of JFET and MOSFET	2	
3.5	SPICE models of circuits	4	
4.	**Introduction to Number Systems and Boolean Algebra**	12	CO4
4.1	Number Systems: Decimal, binary, octal, hexadecimal number system and conversion , binary weighted codes	3	
4.2	signed numbers, 1s and 2s complement codes, Binary arithmetic, Binary logic functions , Boolean laws, truth tables, associative and distributive properties.	3	
4.3	Logic levels, propagation delay time, power dissipation fan-out and fan-in, noise margin, De Morgans theorems, realization of switching functions using logic gates	3	
4.4	Logic families and their characteristics :TTL, LSTTL CMOS and ECL integrated circuits and their performance comparison	3	
5.	**Introduction to Combinational and sequential circuits**	12	CO5
5.1	Combinational Logic: Switching equations, canonical logic forms, sum of product & product of sums, Karnaugh maps, two, three and four variable Karnaugh maps, simplification of expressions	3	
5.2	Full Adder and Full subractor, mixed logic combinational circuits, multiple output functions	3	
5.3	Sequential circuits: flip-flops, clocked and edge triggered flipflops, timing specifications,	2	
5.4	asynchronous and synchronous counters, counter design with state equations,	2	
5.5	Registers , serial in serial out shift registers, tristate register, timing considerations	2	
	TOTAL	**60 Hours**	

Course Designers:

COURSE DESIGNED BY	**VERIFIED BY**
Mr.Sanish V S Asst. Professor, ECE, JCET E Mail ID: sanishvs@jawaharlalcolleges.com	Dr.Sandeep C S Asso. Professor and HoD, ECE, JCET E Mail ID:hodece@jawaharlalcolleges.com

24ICEEIT206	**ENGINEERING ENTREPRENEURSHIP AND INTELLECTUAL PROPERTY RIGHTS**	**Category**	**L**	**T**	**P**	**Credit**
		SEC	**2**	**0**	**0**	**2**

Preamble

To provide awareness, develop the skills of entrepreneurship & to encourage the students to become an entrepreneur

Prerequisite

None

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Students will develop an entrepreneurial mindset, characterized by creativity, risk-taking, and the ability to identify and seize business opportunities within the engineering sector. (Understanding)	20
CO2	Students will learn techniques for fostering innovation and creativity in engineering design and product development. (Understanding)	20
CO3	Students will develop the ability to critically assess and validate their business ideas through market research, feasibility studies, and feedback from potential customers and stakeholders. (Understanding)	20
CO4	Students will gain a comprehensive understanding of the various types of institutional support available to entrepreneurs. (Understanding)	20
CO5	Students will gain a thorough understanding of the various types of intellectual property, including patents, trademarks, copyrights, and trade secrets.(Understanding)	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	1	1	1	2	2	2	1	-	-	-
CO2	1	3	2	1		-	-	1	1	1	1	-	-	-	-
CO3	-	-	-	-	-	-	-	2	1	1	1	-	-	-	-
CO4	-	-	-	-	-	-	-			1	2	1	-	-	-
CO5	-	-	-	-	-	-	-		1	1	1	1	-	-	-
AVG	**1**	**3**	**2**	**1**		**1**	**1**	**1.33**	**1.66**	**1.2**	**1.4**	**1**	**-**	**-**	**-**

3- Strong; 2-Medium; 1-Low

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	**2**	1	2	
Remembering	20	20			**20**
Understanding	80	80	100	100	80
Applying					
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component/ Industry Connect
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment/ Industry Connect
Complex Overt Responses	
Adaptation	
Origination	

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance : 6 marks
Continuous Assessment Test (2 numbers) : 20 marks
Assignment/Quiz/Course project : 14 marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks;** **Duration =90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks;** **Duration =150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks

Sample Questions for Course Outcome Assessment**

(Questions may be framed based on the outline given under each course outcome)

Course Outcome 1 (CO1):

1. Entrepreneurs Characteristics, Types and Motivation
2. Entrepreneurial process.
3. Enterprise- Definition and Classification

Course Outcome 2 (CO2)

1. Generating ideas
2. Define Feasibility analysis, Industry and Competitor analysis
3. Developing effective business model.

Course Outcome 3 (CO3):

1. Project Identification, Market Survey
2. Various Business Planning Methods
3. Writing a Business Plan

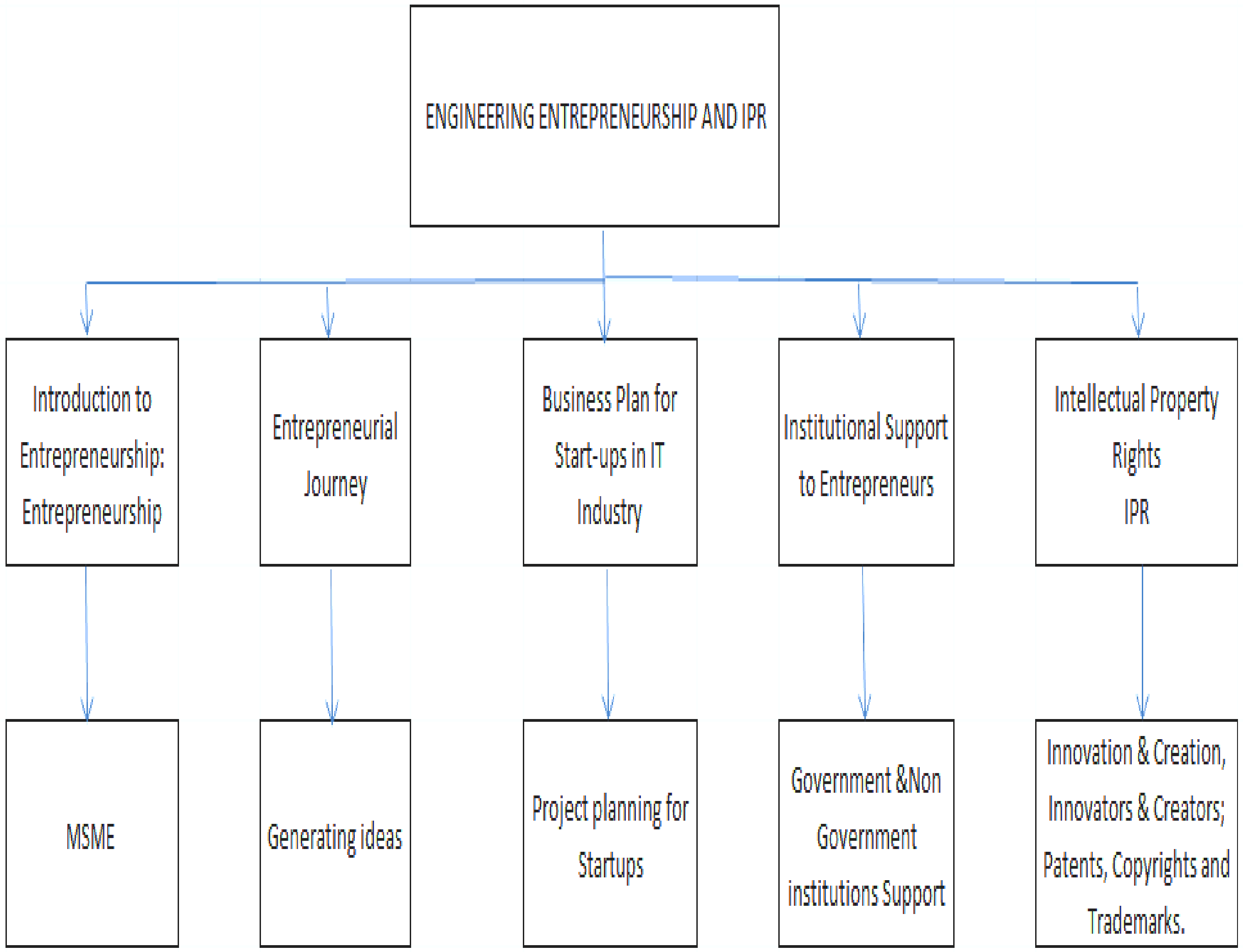
Course Outcome 4 (CO4):

1. Institutional Support to Entrepreneurs
2. Need for Institutional support different Government &Non Government institutions
3. Support Entrepreneurs like, NSIC, SIDO, SSIB, SSIDC, SISIs

Course Outcome 5 (CO5):

1. Introduction of IPR
2. General Provisions & Basic principles of IPR
3. IPR like Innovation & Creation, Innovators & Creators; Patents Copyrights and Trademarks

Concept Map



Syllabus

MODULE 1
Introduction to Entrepreneurship: Entrepreneurship- Concept, Nature, Functions and Importance; Entrepreneurs Characteristics, Types and Motivation; Entrepreneurial process; Enterprise- Definition and Classification (MSME Micro, Small & Medium Enterprises).

MODULE 2
Entrepreneurial Journey: Creativity and Innovation, Recognizing opportunities and Generating ideas, Feasibility analysis, Industry and Competitor analysis, developing effective business model.

MODULE 3
Business Plan for Start-ups in IT Industry: Project Identification, Market Survey, Production plan, Operational plan, Marketing plan, Organizational plan and financial plan; writing a

business plan.

MODULE 4

Institutional Support to Entrepreneurs: Need for Institutional support different Government &Non Government institutions to support Entrepreneurs like, NSIC, SIDO, SSIB, SSIDC, SISIs , DTICs, Industrial Estates, Specialized Institutions.

MODULE 5

Intellectual Property Rights: Introduction of IPR, General Provisions & Basic principles of IPR, various perspective of IPR like Innovation & Creation, Innovators & Creators; Patents, Copyrights and Trademarks.

(Learn how to start an enterprise and design business plans those are suitable for funding by considering all dimensions of business. Understand entrepreneurial process by way of studying different cases and performing class activities.)

Learning Resources

BOOKS RECOMMENDED:

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Robert D. Hisrich, Mathew J. Manimala, Michael P Peters and Dean A. Shepherd .	Entrepreneurship	9th Edition	Tata Mc-graw Hill Publishing Co.ltd.-new Delhi	2014
2	Bruce R. Barringer and R. Duane Ireland	Entrepreneurship	4th Edition,	Pearson Publications, New Delhi	2011
3	N.K. Acharya	Text book on intellectual Property Rights	New Edition	Asha Law House New Delhi	2001

Online study materials:

https://archive.nptel.ac.in/courses/109/105/109105176/
https://www.youtube.com/watch?v=Hgj_kRrvbhQ&t=3s
https://www.youtube.com/watch?v=p7vhcob-YkI

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**Entrepreneurship**	5	CO1
1.1	Introduction to Entrepreneurship	1	
1.2	Entrepreneurship- Concept, Nature, Functions and Importance	1	
1.3	Entrepreneurs Characteristics, Types and Motivation; Entrepreneurial process	1	
1.4	Enterprise- Definition and Classification (MSME Micro, Small & Medium Enterprises).	1	
1.5	Case Study: Success and Failure stories of entrepreneurs and discussing their characteristics and reasons for success/failure.	1	
2	**Entrepreneurial Journey**	6	CO2
2.1	Entrepreneurial Journey	1	
2.2	Creativity and Innovation, Recognizing opportunities	1	
2.3	Generating ideas	1	
2.4	Feasibility analysis, Industry and Competitor analysis	1	
2.5	Developing effective business model.	1	
2.6	Idea generation by students.	1	
3	**Business Plan for Start-ups in IT Industry**	5	CO3
3.1	Project Identification	1	
3.3	Market Survey	1	
3.4	Production plan, Operational plan, Marketing plan, Organizational plan and financial plan	1	
3.5	writing a business plan.	1	
3.6	Class Activity: Students asked to finalize on their ideas and start writing business plans	1	

4	**Institutional Support to Entrepreneurs**	5	
4.1	Need for Institutional support different Government &Non Government institutions	1	

4.2	Support Entrepreneurs like, NSIC, SIDO, SSIB, SSIDC, SISIs, DTICs,	2	CO4
4.3	Industrial Estates, Specialized Institutions	2	
5	**Intellectual Property Rights**	9	CO5
5.1	Introduction of IPR	1	
5.2	General Provisions & Basic principles of IPR	2	
5.3	Various perspective of IPR like Innovation & Creation, Innovators & Creators	2	
5.4	Patents, Copyrights and Trademarks.	2	
5.5	Case Study on IPR	2	
	TOTAL	**30 hours**	

Course Designers:

1. tpongik@nehrucolleges.com
2. 2. Dr.Shine K, hodme@jawaharlalcolleges.com

COURSE DESIGNED BY	VERIFIED BY
Mr Sathish Kumar M TPO, JCET E. Mail ID : tpongik@nehrucolleges.com	Dr. Shine K. Professor, HOD M.E. E. Mail ID: hodme@jawaharlalcolleges.com

24ICHAWT106/ 24ICHAWT207	**HEALTH AND WELLNESS**	**Category**	**L**	**T**	**P**	**Credit**
		AEC	**1**	**0**	**1**	**1**

Preamble

Health and Wellness integrates the multifaceted aspects of wellbeing into the framework of engineering education. It aims to equip students with a comprehensive understanding of physical, mental, emotional, and spiritual well-being, emphasizing the importance of a balanced and healthy lifestyle in both personal and professional contexts. The subject not only enhances the personal health of students but also empowers them to contribute to the broader goals of public health and sustainability, reflecting the core values of engineering ethics and lifelong learning.

Prerequisite:

None

Course Outcomes:

On the successful completion of the course students will be able to:

COs	Course Outcome Statement	Weightage in %
CO1	Identify the principles and practices that contribute to physical health, through exercise, nutrition, emotional regulation and preventive healthcare measures(Remembering)	20
CO2	Understand key nutritional principles, including nutrient functions, balanced diet components, and the health risks associated with junk food. (Understanding)	20
CO3	Discuss common diseases and lifestyle diseases, including their causes and prevention strategies. (understanding)	20
CO4	Demonstrate the principles and benefits of yoga for physical, mental, emotional, and spiritual well-being. (Applying)	20
CO5	Design and implement diverse fitness activities and their contributions to physical health, emphasizing the significance of regular engagement in planned fitness routines for overall well-being. (Applying)	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1 *	PSO2 *	PS03 *
CO1	-	-	-	-	-	2	2	1	-	-	-	2	-	-	-
CO2	-	-	1	-	-		2	-	-	-	-	1	-	-	-
CO3	-	-	1	-	-	2	2	2	2	-	-	2	-	-	-
CO4	-	-	-	-	-		2	-	2	-	-	3	-	-	-
CO5	-	-	-	-	1		2	-	1	-	-	2	-	-	-
AVG	**-**	**-**	**1**	**-**	**1**	**2**	**2**	**1.5**	**1.6**	**-**	**-**	**2**	**-**	**-**	-

1-Low; 2-Medium; 3- Strong

*The faculty handling a particular programme should map the Course Outcomes (COs) with the applicable Programme Specific Outcomes (PSOs).

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Test		Regular Assessment		
	1	2	Practical Demonstrations	Journal Recording Daily Basis	Case Study
Remembering	20	20	20	20	20
Understanding	60	60	20	20	20
Applying	20	20	40	40	20
Analysing	-	-	20	20	40
Evaluating	-	-	-	-	-
Creating	-	-	-	-	-

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini Project/Assignment/Practical Component
Perception	Observation
Set	Introduction sessions, Goal setting
Guided Response	Imitation
Mechanism	Demonstrations, Assignment
Complex Overt Responses	Independent Practise
Adaptation	Scenario based exercise
Origination	Innovation projects

Assessment Pattern: Cognitive Domain

Total Marks	CIA	Duration
100	100	2 Hours

Continuous Internal Assessment Pattern

Attendance: **15**
Continuous Assessment Test: **35**
Activity and Case Study: **50**
Total: **100**

Question Paper Pattern

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration =90 Minutes** Part A: 5 X 6 = 30 Marks Part B: 5 X 4 = 20 Marks

Sample Questions for Course Outcome Assessment

Course Outcome 1 (CO1):

1. Imagine you are a fitness coach for a group of middle-aged clients. Design a weekly exercise program that promotes cardiovascular health, muscular strength, and flexibility. Explain how each component of the program benefits these aspects of physical health.

2. Employ your expertise as a nutritionist to create a meal plan for a family with diverse dietary needs and preferences. Develop a balanced weekly menu that ensures optimal physical health for all family members. Discuss how the different components of the diet support their overall well-being.

3. Implement your understanding of stress management to lead a workshop at a corporate wellness retreat. Create a detailed outline for a session that teaches stress management techniques and coping strategies. Explain how these techniques can be used in daily life to enhance physical health and overall well-being.

4. Leverage your knowledge as a public health advisor to develop a community outreach program that educates the public on preventive healthcare measures. Outline the key components of this program and describe specific preventive practices. Discuss how each practice contributes to disease prevention and promotes long-term physical health.

Course Outcome 2 (CO2)

1. Analyse the roles of macronutrients (carbohydrates, proteins, and fats) and micronutrients (vitamins and minerals) in the body. How do these nutrients interact to support overall bodily functions and maintain health? Provide examples of foods rich in each type of nutrient and discuss their specific contributions to bodily processes.

2. Examine the components of a balanced diet, including carbohydrates, proteins, fats, vitamins, minerals, and water. For each component, analyse why it is essential for maintaining good health and how deficiencies or excesses can impact bodily functions. Use case studies or scenarios to illustrate the effects of an imbalanced diet on health.

3. Investigate the health risks associated with high consumption of sugar, salt, and saturated fats. How do these dietary components contribute to the development of chronic diseases such as obesity, cardiovascular disease, and diabetes? Analyse the physiological mechanisms through which excessive intake of these substances affects the body.

4. Assess the importance of incorporating nutrient-rich foods like fruits, vegetables, whole grains, and lean proteins into the diet. Analyse how these foods contribute to overall health and prevent chronic diseases. Compare and contrast the health outcomes of diets rich in nutrient-dense foods versus diets high in processed and junk foods.

Course Outcome 3(CO3):

1. Evaluate the impact of communicable diseases (such as influenza and malaria) versus non-communicable diseases (such as diabetes and hypertension) on global health. Compare and contrast their causes, and assess which type of disease poses a greater threat to public health in different regions. Provide evidence to support your evaluation.

2. Assess the relative influence of lifestyle factors (diet, physical activity, smoking) versus genetic factors in the development of lifestyle diseases such as heart disease and type 2 diabetes. Support your evaluation with examples.

3. Critically evaluate the effectiveness of various prevention strategies for diseases such as influenza, malaria, diabetes, and hypertension. How do vaccination, hygiene practices, and lifestyle modifications compare in terms of their ability to reduce disease risk? Discuss any limitations and challenges associated with these prevention strategies

4. Evaluate the concept of herd immunity and its effectiveness in preventing the spread of communicable diseases within a population. Discuss the conditions necessary for herd immunity to be achieved and maintained, and analyse the potential consequences of declining vaccination rates on community health. Use real-world examples to illustrate your points.

Course Outcome 4 (CO4):

1. Illustrate your understanding of yoga by defining what it is and explaining its origins. How has yoga evolved over time, and what are its key principles? Provide examples of historical developments and key practices that illustrate this evolution.

2. Show how practicing yoga can lead to physical benefits by describing exercises that improve flexibility, strength, and balance. Provide a demonstration of specific yoga poses or sequences that target these areas and explain their effects on the body.

3. Highlight the mental and emotional benefits of yoga, such as stress reduction and improved focus. Give examples of yoga practices, such as breathing exercises and meditation techniques, and explain how they strengthen emotional resilience and well-being.

4. Explain and show how yoga can contribute to spiritual well-being by promoting self-awareness, mindfulness, and inner peace. Provide examples of yoga practices that encourage these aspects, and discuss their impact on an individual's spiritual health.

Course Outcome 5 (CO5):

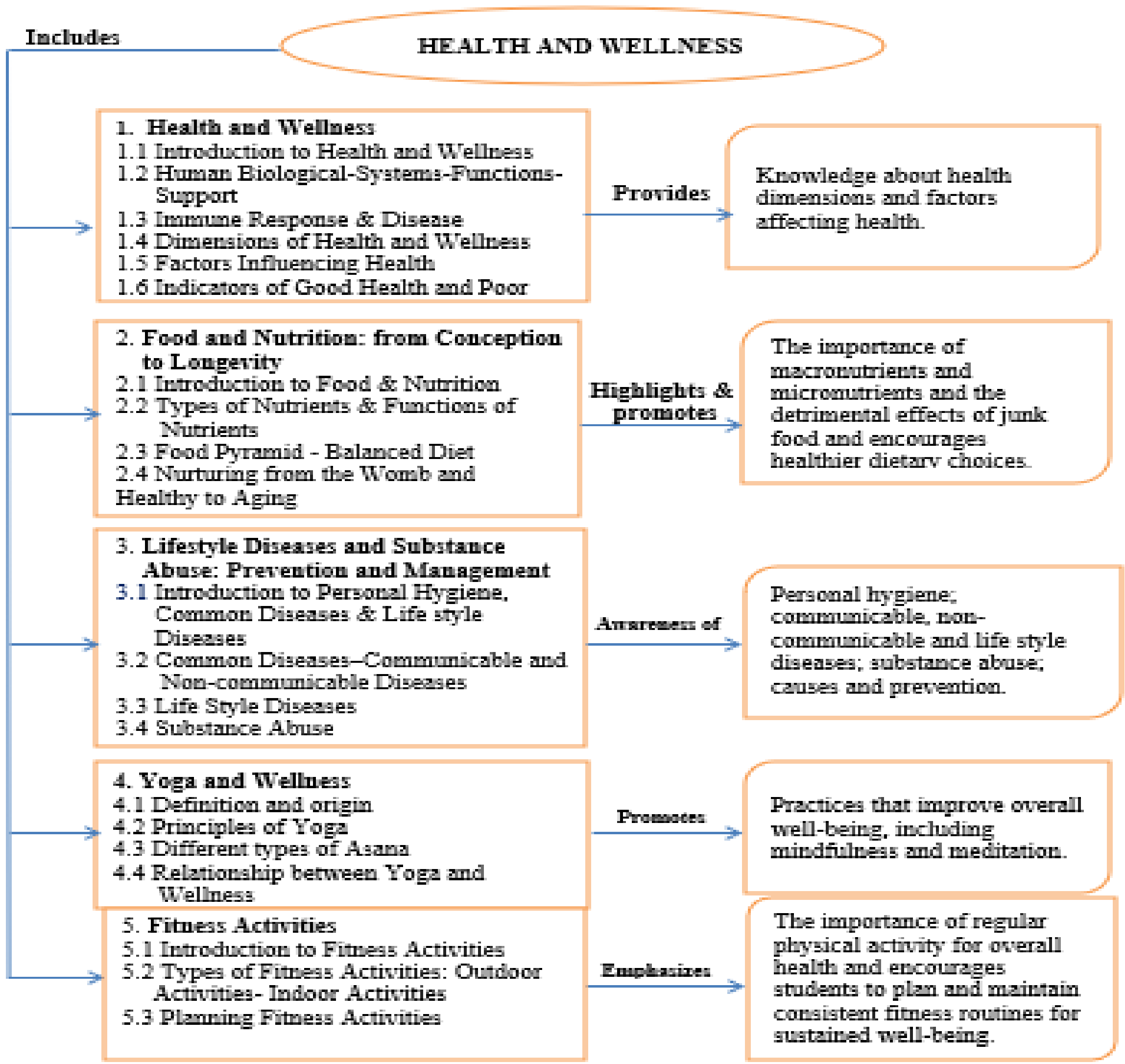
1. Create a balanced and diverse fitness routine. Why is it imperative to integrate various types of exercises into your workout regimen to ensure comprehensive fitness?

2. Implement regular physical activity to promote physical health, mental well-being, and overall vitality. How does a consistent exercise regimen facilitate disease prevention and support longevity?

3. Execute the FITT principle (frequency, intensity, time, and type) to formulate customized fitness programs tailored to individual objectives and needs. How can the FITT framework be utilized to design effective and personalized fitness regimens?

4. Design a variety of fitness activities, encompassing aerobic exercises, strength training, flexibility exercises, and recreational sports. How do these activities synergistically contribute to overall physical health?

Concept Map



Module 1: Health and Wellness

Introduction to Health and Wellness: Meaning and Dimensions of Health and Wellness
Human Biological System: Key Systems and Their Functions, How these Systems Support Overall Health.
Immune Response & Disease: Recognition and response to foreign agents, Mechanisms of overcoming infection, Consequences of failure to eliminate pathogens.
Dimensions of Health and Wellness: Physical Health, Mental Health, Social Health, Environmental Health, Occupational Health, Intellectual Health, Spiritual Health
Factors Influencing Health, Healthcare Services: Accessibility and quality of healthcare.
Indicators of Good Health: Longevity and life expectancy, Low infant mortality rate, High rates of immunization, Adequate nutrition and balanced diet, Regular physical activity.

Indicators of Poor Health: High prevalence of chronic diseases, High rates of communicable diseases, Malnutrition and under nutrition, Poor mental health statistics, High infant and maternal mortality rates.

Module 2: Food and Nutrition: from Conception to Longevity

Introduction to Food and Nutrition: Nutrients and their functions in maintaining good health
Types of nutrients: 1. Macronutrients: Carbohydrates, Proteins, Fats 2. Micronutrients: Vitamins, Minerals.
Functions of Nutrients: Carbohydrates (Primary source of energy)
Proteins (Essential for growth, repair, and maintenance of body tissues)
Fats (Provide energy, support cell growth, protect organs, and keep the body warm),
Vitamins (Facilitate various biochemical reactions in the body; Vitamin A: Vision, immune function; Vitamin C: Antioxidant, skin health; Vitamin D: Bone health, calcium absorption)
Minerals (Structural and functional roles in the body)
Calcium (Bone health, muscle function)
Iron (Oxygen transport, energy production)
Food Pyramid: Meaning and Importance, Components and Sources of a Balanced Diet:
Grains: Provide energy, fiber. Sources: Wheat, rice, oats.
Vegetables: Supply vitamins, minerals, fiber. Sources: Leafy greens, carrots, broccoli.
Fruits: Provide vitamins, minerals, antioxidants. Sources: Apples, bananas, berries.
Proteins: Essential for tissue repair and growth. Sources: Meat, beans, nuts.
Dairy: Important for bone health. Sources: Milk, cheese, yogurt.
Fats and Oils: Necessary for energy and cell function, should be consumed in moderation.
Sources: Olive oil, butter, nuts.
Millets: Provide nutrients, fiber. Sources: Pearl millet (bajra), finger millet (ragi), sorghum (jowar), foxtail millet (kangni), and little millet (kutki).
Nurturing from the Womb to Healthy Aging: Food and Age Groups with special emphasis to Adolescent Health and Wellbeing.
Harmful Effects of Junk Food: Characteristics of Junk Food, Health Impacts of Junk Food.

Module 3: Lifestyle Diseases and Substance Abuse: Prevention and Management

Introduction to Personal Hygiene, Common Diseases & Life style Diseases
Communicable Diseases: Causes (Bacteria, viruses, fungi, parasites), Prevention (Vaccination, hygiene, public health measures)
Non-communicable: Diseases: Alzheimer's disease, Strokes, Heart diseases, Chronic Kidney disease, etc.
Life style Diseases: Obesity: Aetiology(Poor diet, lack of physical activity, genetic factors), Prevention (Healthy diet, regular exercise).
Cardiovascular Disorders: Aetiology (Hypertension, high cholesterol, smoking), Prevention (Healthy lifestyle, regular check-ups),
Diabetes: Aetiology (Insulin resistance, obesity, genetic predisposition), Prevention (Diet management, physical activity, weight control), Glycemic Index,
Liver Diseases: Aetiology (Alcohol abuse, hepatitis, fatty liver disease), Prevention (Avoiding alcohol, healthy diet, vaccination)
Cancer: Aetiology (smoking, radiation, viruses, carcinogens, obesity, hormones, chronic inflammation, a lack of exercise), Prevention: (Avoid alcohol, exercise, healthy diet)

Osteoporosis: Aetiology (reduced bone density & strength, hormonal changes, Poor diet, lack of vitamin C & D, lack of Physical activity)
Back pain: Aetiology (improper lifting, poor posture and lack of regular exercise), Prevention (exercise, right posture etc.)
Substance Abuse: Understanding of substance abuse, Types of substances (Alcohol, Tobacco, pharmaceutical drugs, glue, kerosene, morphine, cannabis, MDMA etc.), Aetiology (Addiction, dependency, health risks), Prevention (Education, counselling, rehabilitation programs.

Module 4: Yoga and Wellness

Definition and origin
Principles of Yoga: Asanas and Pranayama
Benefits of Yoga: Physical, Mental & Emotional, Spiritual.
Different Types of Asana: Padmasana, Bhujangasana, Halasana, Shalabhasana, Dhanurasana, Vajrasana, Chakrasana, Shavasana, Pawanmuktasana, Mandukasana and Uttanpadasana.
Relationship between Yoga and Wellness (Spiritual, Mental, Emotional, Physical).

Module 5: Fitness Activities

Introduction to Fitness Activities
Types of Fitness Activities: Outdoor Activities: Running, jogging, cycling, swimming, Indoor Activities:– Aerobics, Dance (Zumba), Spin Classes
Planning Fitness Activities: Choosing Activities, Creating a Balanced Fitness Routine (Combining cardio, strength training, and flexibility exercise; set goals and track progress), Monitoring Progress, Safety and Preparation (necessary equipment, warm-up, cool-down, prevent injury), Mental Aspects of Fitness (Transforming Negative Thoughts).

LEARNING RESOURCES

Text Books

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Gordon Edlin, Eric Golanty	Health and Wellness	Fourteenth	Jones and Bartlett Publishers	2023
2	Ross and Wilson	Anatomy and Physiology in Health and Wellness	Fourteenth	Oswaal Books And Learning Private Limited	2022

Reference Books

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Nashay Lorick	Mental Health Workbook for Women: Exercises to Transform Negative Thoughts and Improve Well Being	Workbook	Rockridge Press	2022

2	Dr. M Swaminathan	Handbook of Food and Nutrition	Third	The Bangalore Printing and Publishing Co. Ltd.	2022
3	Dr. Melody Daniel	Substance Use Disorder: The Detrimental Impact on our Mental Health and Strategies for Overcoming it	Kindle		2022
4	Advika Singh	A Health and Wellness Handbook : 11 Secrets You Should Know to Save a Life	First	Notion Press	2021
5	Emily Attached and Marzia Fernandez	Mental Health Workbook	First	Charlie Creative Lab	2020
6	Alton L. Thygerson	Fitness to be Well: Essential Concepts	Lab Manual	Jones & Bartlett Learning	2018
7	Cliff Nyambichu and Jeff Lumiri	Life Style Diseases: Life Style Disease Management	Kindle		2018
8	Angela Clow, Sarah Edmunds	Physical Activity and Mental Health	First	Human Kinetics	2013
9	Claude Bouchard, Steven N. Blair, William L. Haskell	Physical Activity and Health	Second	Human Kinetics	2012
10	Daryl Siedentop and Hans van der Mars	Introduction to Physical Education, Fitness and Sport	Eighth	McGraw-Hill Education	2012
11	B K S Iyengar	Light on Yoga		Thorsons	2006
12	Puri K, Chandra S.S.	Health and Physical Education		Surjeet Publications	2005
13	Les Snowdown, Maggie Humphrey	Fitness walking		Orient Paperbacks	2005

On line study materials:

1	https://www.medicinenet.com/what_is_health_and_wellness/article.htm
2	https://www.who.int/data/gho/data/major-themes/health-and-well-being
3	https://eatrightindia.gov.in/eatrightschool/assets/resource/file/health-wellness-learning-material.pdf
4	https://www.studocu.com/in/document/christ-deemed-to-be-university/health-psychology/health-and-wellness-notes/27511845
5	https://study.com/academy/course/health-and-wellness.html
6	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5508938/
7	https://portal.ct.gov/-/media/dmhas/skillbuilding/dana/health-and-wellness-full-revised.pdf
8	https://cpacollege.ac.in/assets/uploads/1647505766physical_education_pdf.pdf
9	https://www.centrum.com/learn/articles/18-wellness-tips-for-a-healthier-you/
10	https://portal.ct.gov/-/media/dmhas/skillbuilding/dana/health-and-wellness-full-

	revised.pdf
11	https://occmed.sanfordhealth.org/resources/article-library/the-difference-between-health-and-wellness

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1	**Health and Wellness**	**6**	
1.1	Introduction to Health and Wellness: Meaning and Dimensions of Health and Wellness	1	CO 1
1.2	Human Biological System: Key Systems and Their Functions , How these Systems Support Overall Health, Immune Response & Disease: Recognition and response to foreign agents, Mechanisms of overcoming infection, Consequences of failure to eliminate pathogens.	1	
1.3	Dimensions of Health and Wellness: Physical Health, Mental Health, Social Health, Environmental Health, Occupational Health, Intellectual Health, Spiritual Health	1	
1.4	Factors Influencing Health Healthcare Services: Accessibility and quality of healthcare.	1	
1.5	Indicators of Good Health: Longevity and life expectancy, Low infant mortality rate, High rates of immunization, Adequate nutrition and balanced diet, Regular physical activity.	1	
1.6	Indicators of Poor Health: High prevalence of chronic diseases, High rates of communicable diseases, Malnutrition and under nutrition, Poor mental health statistics, High infant and maternal mortality rates.	1	
2	**Food and Nutrition**	**6**	
2.1	Introduction to Food and Nutrition	1	

2.2	Nutrients and Their Functions in Maintaining Good Health: Types of nutrients: 1. Macronutrients: Carbohydrates, proteins, fats 2. Micronutrients: Vitamins, Minerals. Functions of Nutrients: Carbohydrates (Primary source of energy), Proteins (Essential for growth, repair, and maintenance of body tissues), Fats (Provide energy, support cell growth, protect organs, and keep the body warm), Vitamins (Facilitate various biochemical reactions in the body; Vitamin A: Vision, immune function; Vitamin C: Antioxidant, skin health; Vitamin D: Bone health, calcium absorption), Minerals (Structural and functional roles in the body), Calcium (Bone health, muscle function), Iron (Oxygen transport, energy production)	2	CO 2
2.3	Food Pyramid: Meaning and Importance, Components and Sources of a Balanced Diet: Grains: Provide energy, fiber. Sources: Wheat, rice, oats. Vegetables: Supply vitamins, minerals, fiber. Sources: Leafy greens, carrots, broccoli. Fruits: Provide vitamins, minerals, antioxidants. Sources: Apples, bananas, berries. Proteins: Essential for tissue repair and growth. Sources: Meat, beans, nuts. Dairy: Important for bone health. Sources: Milk, cheese, yogurt. Fats and Oils: Necessary for energy and cell function, should be consumed in moderation. Sources: Olive oil, butter, nuts. Millets: Provide nutrients, fiber. Sources: Pearl millet (bajra), finger millet (ragi), sorghum (jowar), foxtail millet (kangni), and little millet (kutki)..	1	
2.4	Nurturing from the Womb to Healthy Aging: Food and Age Groups with special emphasis to Adolescent Health and Wellbeing.	1	
2.5	Harmful Effects of Junk Food: Characteristics of Junk Food, Health Impacts of Junk Food	1	
3	**Lifestyle Diseases and Substance Abuse: Prevention and Management**	**6**	
3.1	Introduction to Personal Hygiene, Common Diseases & Life style Diseases	1	
3.2	Communicable Diseases: Causes (Bacteria, viruses, fungi, parasites), Prevention (Vaccination, hygiene, public health measures), Non-communicable Diseases	1	

3.3	Life style Diseases: Obesity: Aetiology(Poor diet, lack of physical activity, genetic factors), Prevention (Healthy diet, regular exercise). Cardiovascular Disorders: Aetiology (Hypertension, high cholesterol, smoking), Prevention (Healthy lifestyle, regular check-ups), Diabetes: Aetiology (Insulin resistance, obesity, genetic predisposition), Prevention (Diet management, physical activity, weight control). Liver Diseases: Aetiology (Alcohol abuse, hepatitis, fatty liver disease), Prevention (Avoiding alcohol, healthy diet, vaccination) Cancer: Aetiology (smoking, radiation, viruses, carcinogens, obesity, hormones, chronic inflammation, a lack of exercise), Prevention: (Avoid alcohol, exercise, healthy diet) Osteoporosis: Aetiology (reduced bone density & strength, hormonal changes, Poor diet, lack of vitamin C & D, lack o Physical activity) Back pain: Aetiology (improper lifting, poor posture and lack of regular exercise), Prevention (exercise, right posture etc.)	2	CO 3
3.4	Substance Abuse: Understanding of substance abuse, Types of substances (Alcohol, Tobacco, pharmaceutical drugs, glue, kerosene, morphine, cannabis, MDMA etc.), Aetiology (Addiction, dependency, health risks), Prevention (Education, counselling, rehabilitation programs.	2	
4	**Yoga and Wellness**	**6**	CO 4
4.1	Definition and origin	1	
4.2	Principles of Yoga: Asanas and Pranayama Benefits of Yoga: Physical, Mental & Emotional, Spiritual.	2	
4.3	Different types of asanas : Padmasana, Bhujangasana, Halasana, Shalabhasana, Dhanurasana, Vajrasana, Chakrasana, Shavasana, Pawanmuktasana, Mandukasana and Uttanpadasana.	2	
4.4	Relationship between Yoga and Wellness (Spiritual, Mental, Emotional, Physical)	1	
5	**Fitness Activities**	**6**	
5.1	Introduction to Fitness Activities	1	

5.2	Types of Fitness Activities: Outdoor Activities: Physical Exercises, Running, jogging, cycling, swimming, Indoor Activities: Aerobics, Dance (Zumba), Spin Classes etc.	2	CO 5
5.3	Planning Fitness Activities: Choosing Activities Creating a Balanced Fitness Routine, Monitoring Progress, Safety and Preparation (necessary equipment, warm-up, cool-down, prevent injury)	2	
5.4	Mental Aspects of Fitness	1	
	TOTAL	**30 hours**	

Activities:

Sl. No	Activity
1	**Health and Wellness** **1. Environmental Health Scavenger Hunt** Activity: Conduct a scavenger hunt where students look for environmental factors in their community that can affect health, such as parks, sources of pollution, recycling centers, and community gardens. Have them present their findings. Explanation: Understanding environmental health factors helps students appreciate how their surroundings impact their well-being and the importance of maintaining a healthy environment. **2. Sleep Hygiene Diary** Activity: Have students maintain a sleep diary for a week, recording their sleep duration, quality, and any pre-sleep activities. Discuss the importance of good sleep hygiene and its effects on overall health. Explanation: Good sleep is essential for physical health, cognitive function, and emotional well-being. Tracking sleep habits can help students identify patterns and improve their sleep quality. **3. Health Journaling** Activity: Assign students to keep a health journal for a week, documenting their diet, exercise, sleep patterns, and stress levels. At the end of the week, have them reflect on their habits and identify areas for improvement. Objective: To promote self-reflection and mindfulness about lifestyle choices and their impact on health.

2	**Food and Nutrition** **4. Healthy Recipe Meal/ Balanced Healthy Recipe & Meal for a week** Activity: Ask students to create a healthy recipe using a balanced mix of macronutrients and micronutrients. They should prepare a written recipe and explain the nutritional benefits of each ingredient. Objective: To encourage practical application of nutritional knowledge and creativity in meal planning. **5. Junk Food vs. Healthy Food (Debate)** Activity: Divide the class into two groups. One group will argue in favor of junk food, while the other will argue for healthy food. Each side should present facts about the nutritional content and health impacts of their assigned food type. Objective: To develop critical thinking and understanding of the harmful effects of junk food and the benefits of healthy eating. **6. Morning Hydration Challenge** Activity: Encourage students to drink a tumbler of water every morning for a week and record any changes they notice in their digestive system and overall well-being. Explanation: Drinking water first thing in the morning stimulates the digestive system, hydrate the body after a night's sleep, and improve metabolism. A healthy gut can enhance nutrient absorption, which supports overall health.
3	**Lifestyle Diseases and Substance Abuse: Prevention and Management** **7. Substance Abuse Awareness Workshops** Activity: Invite guest speakers, to conduct Substance Abuse Awareness workshops on topics related to causes, effects, signs and symptoms, prevention, treatment and rehabilitation, impact on families etc. Objective: To educate students about the dangers of substance abuse, the types of substances commonly abused, and strategies for prevention and seeking help. **8. BMI** (Body Mass Index) Activity: Students measure their height and weight to calculate BMI manually or using online tools. Exercise and fitness tracking should be adopted and gradually transformed into habits to achieve a healthy BMI. Objective: To assess weight, Screen for health risks and promote health awareness. **9. Self-Reflection Questionnaire**

	Activity: The students can take 15-20 minutes to answer the questions thoughtfully and honestly. Objective: Encourage participants to reflect on their thoughts, emotions, habits, and aspirations to foster self-awareness and personal growth.
4	**Yoga and Wellness** **10. Yoga Workshop** Activity: Organize a yoga workshop led by a certified yoga instructor. Students will participate in a series of yoga sessions focusing on different aspects such as asanas (poses), pranayama (breathing techniques), and meditation. The instructor can explain the principles and benefits of each practice. Objective: To introduce students to various yoga techniques and provide hands-on experience in practicing yoga for overall wellness. **11a. Yoga Pose Challenge (Any One: 11a or 11b)** Activity: Organize a yoga pose challenge where students take turns leading a group in demonstrating various yoga poses. Each participant can choose their favorite pose or one they want to learn. The challenge can be held outdoors for added fun. Objective: To encourage teamwork, creativity, and exploration of different yoga poses in a playful environment. **11b**. **Yoga Photo Booth** Activity: Set up a yoga-themed photo booth with props such as yoga mats, blocks, straps, and inspirational signs or banners. Students can take fun and playful photos posing in various yoga poses or expressing their love for yoga. Objective: To create lasting memories and celebrate the joy of yoga through creative Photography.
5	**Fitness Activities** **12 Fitness Activity (Students can choose any Two)** **12a. Sprint Relay** Description: Teams race to complete a designated distance – 100/1000 meters, with each team member running a segment of the relay. Objective: Enhance teamwork, speed, and endurance in a competitive and engaging environment. **12b. V Sit Reach Test**

	Description: The V Sit Reach Test is a flexibility assessment used to measure the flexibility of the hamstrings and lower back. In this test, the individual sits on the floor with legs extended in a V shape and reaches forward along a measuring tape to see how far they can stretch. The distance reached is recorded, with higher scores indicating better flexibility. This test is commonly used in fitness settings to monitor flexibility and track improvements over time. Objective: Assess the flexibility of the hamstrings and lower back. **12 c. Push ups** Description: To do push-ups, start in a plank position with your hands placed slightly wider than shoulder-width apart, lower your body by bending your elbows until your chest nearly touches the floor, and then push back up to the starting position while keeping your body in a straight line from head to heels. Objective: Strengthens and builds endurance in the chest, shoulders, triceps, and core muscles. **12 d. Dance-off Competition** Description: Host a dance-off competition where students showcase their dance skills and creativity in various styles such as hip-hop, salsa, or freestyle. Judges or the audience can vote for their favourite performances, and prizes can be awarded for the most impressive dancers. Objective: Promote self-expression, confidence, and enjoyment of movement through dance.

COURSE DESIGNED BY	VERIFIED BY
Ms. K Rajini Asst. Professor, BS&H Dept., JCET E-mail ID: krajini@jawaharlalcolleges.com	Prof. K R Vijayakumaran Pillai Professor and Head, BS&H Dept., JCET E-Mail ID: krvijay @jawaharlalcolleges.com

24ICITWP208	IT WORKSHOP	Category	L	T	P	Credit
		ESC	-	-	2	1

Preamble

This is a foundational practical course that introduces students to basic ideas of information technology in order to improve their skills and abilities for the successful completion of a technology-based course.

Prerequisite

None

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Recognize the different peripherals in a computer system and get to familiarize with different operating systems being used. (Remembering)	20
CO2	Identify different networking devices and have an introduction to the basic cloud storage platforms. (Remembering)	20
CO3	Articulate their presentations using advanced presentation tools like LaTeX (Understanding)	20
CO4	Understand about the different attacks and data breaches in communication networks. (Understanding)	20
CO5	Summarize the emerging technologies like AR and VR and also able to be aware of Cyberethics. (Understanding)	20

Mapping of Course Outcomes with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	1	3	-	-	-	-	-	2	*	*	*
CO2	-	-	-	-	3	1	-	-	1	-	-	2	-	-	-
CO3	2	-	2	-	3	-	-	-	-	-	-	2	-	-	-
CO4	1	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO5		-	-	-	3	-	-	3	-	-	-	3	-	-	-
AVG	1.5	-	2	-	2.5	2	-	3	1	-	-	2.2	-	-	-

1-Low; 2-Medium; 3- Strong;

* The faculty handling a particular programme should map the Course Outcomes (COs) with the applicable programme Specific Outcomes (PSOs).

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project/ Assignment/ Practical Component
Perception	
Set	Practical
Guided Response	Practical
Mechanism	
Complex Overt Responses	
Adaptation	
Origination	

Assessment Pattern:

Attendance	: 15 marks
Class work and record evaluation/Viva-voce (CIE)	: 35 marks
Two Assessment Tests	: 50 marks

List of Experiments

1. Introduction to components in CPU. Familiarization of peripherals in computer, different type of cables, ports, and other hardware devices and its functions.

2. Introduction to operating systems like Linux, Windows, Macintosh, Android etc. and familiarization of command prompt and shell. Basic Linux commands such as creating a file, deleting a file, moving a file, and more.

3. Introduction to types of networks, internet, web browsers. Different types of web users. Customize web browsers with the LAN proxy settings, bookmarks, search toolbars and pop-up blockers.

4. Memory devices- Primary and secondary storage devices, cloud and virtual storage options. Introduction to cloud service providers such as AWS, MS Azure, Google etc

5. Productivity tools in Windows - Crafting professional word documents, excel spread sheets, power point presentations and personal web sites using the Microsoft suite of office tools and its versions.

6. Advanced Presentation tools – overview of LaTeX and Microsoft (MS) office equivalent (FOSS) tool word: Importance of LaTeX and MS office equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using LaTeX and word — Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

7. Cyber Hygiene - Different types of attacks, Data leakage and different types of intrusions like in cyber world, malicious transactions, network traffic, and detailed session on Antivirus, Firewalls and IDS and IPS.

8. Security Aspects - From strong passwords to BlockChain - protection to defend internet-connected devices and services from malicious attacks by hackers, spammers, and cybercriminals. Protection against phishing schemes, ransomware attacks, identity theft, data breaches, and financial losses.

9. Introduction to emerging technologies. (Augmented reality (AR), virtual reality (VR), big data, advanced analytics, blockchain, cleantech, the Internet of Things (IoT), and robotics)

10. Cyberethics- moral, legal, and social issues at the intersection of computer/information and communication technologies in cyber world. Introduction to Pen Testing tools.

Learning Resources

TEXT BOOKS

Sl.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Peter Norton	Introduction to Computers	7th Edition	McGraw Hill Education	2017
2	Rajkimar Buyya James Broberg Andrzej Goscinski	Cloud Computing: Principles and Paradigms	1st Edition	Wiley	2013
3	Frank Mittelbach Ulrike Fischer	The LaTeX Companion	3rd Edition	Addison-Wesley Professional	2023
4	Joan Lambert Joyce Cox	MOS Study Guide for word, Excel, Powerpoint & Outlook	1st Edition	MS	2011

REFERENCE BOOKS

S.No		AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1		Anand Shinde	Introduction to Cyber Security : Guide to the World of Cyber Security	1st Edition	Notion Press	2021
2		Akhil Jabbar Meerja, Mamun Bin Ibne Reaz, Ana Maria Madureira	Emerging Technologies and Applications for a Smart and Sustainable World	1st Edition	Bentham Books	2022
3		Richard A. Spinello	Cyberethics: Morality and Law in Cyberspace	3rd Edition	Jones and Barlett publications	2016

Course contents and Experiment Schedule

Exp.No.	Topic	No. of Hours	CO
1a.	Introduction to components in CPU. Familiarization of peripherals in computer, different type of cables, ports, and other hardware devices and its functions.	1	CO1
1b.	Familiarization of cables, hardware devices and assembling	1	
2a.	Introduction to operating systems like Linux, Windows, Macintosh, Android etc. and familiarization of command prompt and shell.	1	
2b.	Basic Linux commands such as creating a file, deleting a file, moving a file, and more.	1	
3a.	Introduction to types of networks, internet, web browsers. Different types of web users.	1	CO2
3b.	Customize web browsers with the LAN proxy settings, bookmarks, search toolbars and pop-up blockers.	1	
4a.	Memory devices- Primary and secondary storage devices, cloud and virtual storage options.	1	

4b.	Introduction to cloud service providers such as AWS, MS Azure, Google etc.	1	
5a.	Productivity tools in Windows - Crafting professional word documents, excel spread sheets	1	
5b.	Power point presentations and personal web sites using the Microsoft suite of office tools and its versions.	1	
6a.	Advanced Presentation tools – overview of LaTeX and Microsoft (MS) office equivalent (FOSS) tool word: Importance of LaTeX and MS office equivalent (FOSS) tool Word as word Processors	1	CO3
6b.	Details of the four tasks and features that would be covered in each, Using LaTeX and word	1	
6c.	Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.	1	
7a.	Cyber Hygiene - Different types of attacks	1	CO4
7b.	Data leakage and different types of intrusions like in cyber world, malicious transactions	1	
7c.	Network traffic, and detailed session on Antivirus	1	
7d.	Firewalls and IDS and IPS.	1	
8a.	Security Aspects - From strong passwords to BlockChain - protection to defend internet	1	
8b.	Introduction to Cybertools	1	
8c.	Protection against phishing schemes, ransomware attacks, identity theft, data breaches, and financial losses.	1	
9a.	Introduction to Emerging Technologies: AR	1	CO5
9b.	Introduction to Emerging Technologies: VR	1	
9c.	Introduction to Emerging Technologies: Big Data	1	
9d.	Introduction to Emerging Technologies: IoT	1	
9e.	Introduction to Emerging Technologies: Cleantech and Robotics	1	

10a.	Introduction to Cyberethics	1	
10b.	Cybertools: For ethical uses	1	
10c.	Legal and social issues	1	
10d.	Cyberethics: Handling of data	1	
10e.	Introduction to Pen Testing tools	1	
	Total Hours	30	

Online study materials

https://www.geeksforgeeks.org/blockchain-technology-introduction/

https://www.nature.com/articles/s41377-021-00658-8

https://www.ibm.com/topics/ransomware

COURSE DESIGNED BY	VERIFIED BY
Ms. Ambarish A. Asst. Professor, CSE Dept, JCET E. Mail ID: ambarish4056.cse@jawaharlalcolleges.com	Mr. Manoj M. Asst. Professor, CSE Dept, JCET E. Mail ID: manojm@jawaharlalcolleges.com

SEMESTER-III

24ICMATT301	PARTIAL DIFFERENTIAL EQUATIONS AND COMPLEX ANALYSIS	Category	L	T	P	Credit
		BSC	3	0	0	3

Preamble

This course introduces basic ideas of partial differential equations which are widely used in the modelling and analysis of a wide range of physical phenomena and has got application across all branches of engineering. To understand the basic theory of functions of a complex variable, residue integration and conformal transformation.

Prerequisite

A basic course in partial differentiation and complex numbers.

Course Outcomes

After the completion of the course the student will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Understand the concept and the solution of partial differential equation.	20
CO2	Analyze and solve one dimensional wave equation and heat equation.	20
CO3	Understand complex functions, its continuity differentiability with the use of Cauchy-Riemann equations.	20
CO4	Evaluate complex integrals using Cauchy's integral theorem and Cauchy's integral formula, understand the series expansion of analytic function.	20
CO5	Understand the series expansion of complex function about a singularity. Apply residue theorem to compute several kinds of real integrals.	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1 *	PSO2 *	PSO3 *
CO1	3	3	3	3	-	2	-	-	-	-	-	3	-	-	-
CO2	3	3	3	3	-	3	-	-	-	-	-	3	-	-	-
CO3	3	3	3	3		2	-	-	-	-	-	3	-	-	-
CO4	3	3	3	3	-	2	-	-	-	-	-	3	-	-	-
CO5	3	3	3	3	-	2	-	-	-	-	-	3	-	-	-
Avg	3	3	3	3	-	2.2	-	-	-	-	-	3	-	-	-

1-Low; 2-Medium; 3- Strong

* The faculty handling a particular programme should map the Course Outcomes (COs) with the applicable programme Specific outcomes (PSOs)

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	**2**	1	2	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30
Applying	50	50	50	50	50
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution:

Total Mark	CIE	ESE	ESE Duration
100	40	60	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance : 6 marks
Continuous Assessment Test (2 numbers) : 20 marks
Assignment/Quiz/Course project : 14 marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks;** **Duration =90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks;** **Duration =150 Minutes** Part A: 5X 3 = 15 Marks Part B: 5 X 9= 45 Marks

Sample Questions for Course Outcome Assessment

Course Outcome 1 (CO1):

1. How do partial differential equations differ from ordinary differential equations?
2. Given the function $z = ax + by + c$, where a, b, and c are arbitrary constants, form a partial differential equation by eliminating these constants.
3. Given the function $z = f(x + y)$, where f is an arbitrary function, form a partial differential equation by eliminating the arbitrary function f.
4. Solve the PDE $\frac{\partial u}{\partial x} = x + y$.

Course Outcome 2(CO2):

1. Analyze the characteristics of the one-dimensional wave equation. How do the properties of the medium (such as tension and linear density) affect the speed of wave propagation? Provide a detailed explanation.
2. Derive the one-dimensional heat equation $\frac{\partial u}{\partial t} = \alpha \frac{\partial^2 u}{\partial x^2}$ and analyse the physical significance of each term in the equation.
3. Explain the physical assumptions made in deriving the one-dimensional wave equation for a stretched string.
5. Derive the one-dimensional heat equation for a rod with constant thermal conductivity. Analyse the influence of different boundary conditions on the derivation and solution.

Course Outcome 3 (CO3):

1. Determine the image of the unit circle under the transformation$w = \frac{1}{z}$. What happens to points inside and outside the unit circle?
2. Explain the mapping $w = e^z$ and describe how it transforms vertical and horizontal lines in the complex plane.
3. Given$u(x, y) = e^x cosy$, find the harmonic conjugate $v(x, y)$ such that $f(z) = u(x, y) + iv(x, y)$ is analytic.
4. Describe the effect of the mapping$w = z^2$ on the complex plane. What happens to the unit circle under this transformation?

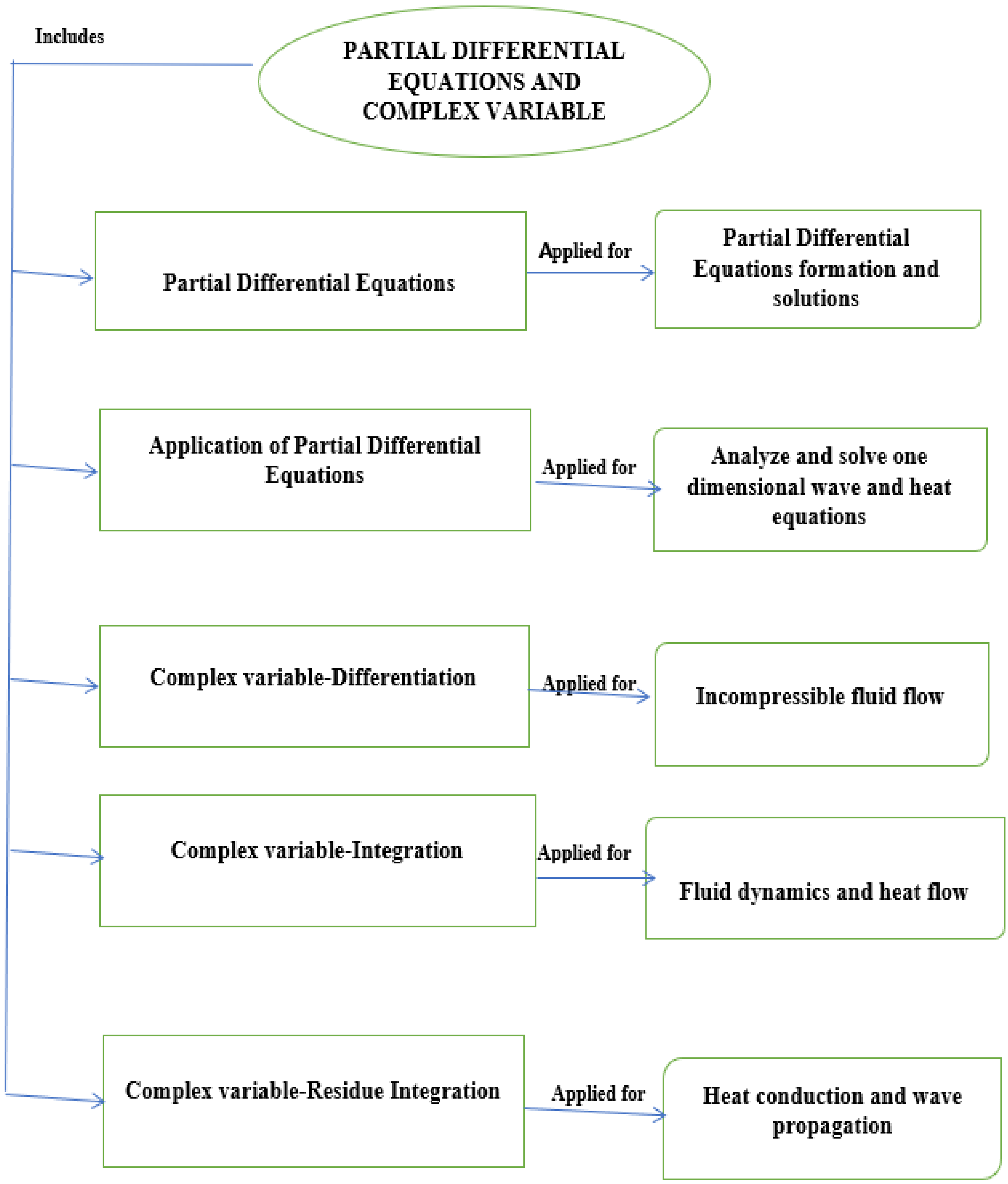
Course Outcome 4 (CO4):

1. Evaluate the integral $\int_0^1 3x^2 + 2x + 1dx$
2. Evaluate the integral$\int_C (z^2 + 1)dz$ where C is the line segment from$z = 0$ to$z = 1 + i$.
3. Evaluate the integral$\int_C \frac{1}{z-2}dz$ where C is the contour consisting of $|z| = 3$ excluding$|z| = 1$.
4. Use the Cauchy integral theorem to evaluate$\int_{|z|=2} \frac{1}{z-1}dz$ on a simply connected domain.

Course Outcome 5(CO5):

1. Classify the singularity at$z = 0$ for the function$f(z) = \frac{sinz}{z^2}$.
2. Identify and classify the singularities of $f(z) = \frac{e^z}{(z-1)^2(z+2)}$.
3. Use the residue theorem to evaluate $\int_{-\infty}^{\infty} \frac{1}{x^2+1}dx$.

Concept Map


Includes
PARTIAL DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLE
Partial Differential Equations
Applied for
Partial Differential Equations formation and solutions
Application of Partial Differential Equations
Applied for
Analyze and solve one dimensional wave and heat equations
Complex variable-Differentiation
Applied for
Incompressible fluid flow
Complex variable-Integration
Applied for
Fluid dynamics and heat flow
Complex variable-Residue Integration
Applied for
Heat conduction and wave propagation

Syllabus

MODULE 1

Partial differential equations, Formation of partial differential equations –elimination of arbitrary constants-elimination of arbitrary functions, Solutions of a partial differential equations, Equations solvable by direct integration, Linear equations of the first order- Lagrange's linear equation

MODULE 2

One dimensional wave equation- vibrations of a stretched string, derivation, solution of the wave equation using method of separation of variables, One dimensional heat equation, derivation, solution of the heat equatio**n**

MODULE 3

Complex function, limit, continuity, derivative, analytic functions, Cauchy-Riemann equations, harmonic functions, finding harmonic conjugate, Conformal mappings- mappings $w = z^2$,

$w = e^z$, Linear fractional transformation $\frac{1}{z}$

MODULE 4

Complex integration, Line integrals in the complex plane, Basic properties, First evaluation method-indefinite integration and substitution of limit, second evaluation method-use of a representation of a path, Contour integrals, Cauchy integral theorem (without proof) on simply connected domain, Cauchy integral theorem (without proof) on multiply connected domain Cauchy Integral formula (without proof), Cauchy Integral formula for derivatives of an analytic function

MODULE 5

zeros of analytic functions, singularities, poles, removable singularities, essential singularities, Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral using residue theorem, Residue integration of real integrals – integrals of rational functions of $cos\theta$ and $sin\theta$, integrals of improper integrals of the form

Learning Resources

TEXT BOOKS

Sl.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	B.S. Grewal	Higher Engineering Mathematics	45th Edition	Khanna Publishers	2020
2	Erwin Kreyszig	Advanced Engineering Mathematics	10thEdition	John Wiley & Sons	2020

REFERENCE BOOKS

Sl.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
3	Peter V. O'Neil	Advanced Engineering Mathematics	7th Edition	Cengage	2012
4	B.S. Grewal	Higher Engineering Mathematics	36 Edition	Khanna Publishers	2010
5	J. Stewart	Essential Calculus	2nd edition	Cengage	2017

On line study materials:

1. https://youtu.be/U51lQtlzvA0?si=wozx3V4a0I4xPvTx
2. https://youtu.be/G4GAQlMo2Us?si=nP_MlTNrbsILrq_s
3. https://youtu.be/ksS_yOK1vtk?si=gjaqGnXutk-dQY4b
4. https://youtu.be/uliv9TzeD6o?si=XUShJ_rJ7ytxs5Lz

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1	**Partial Differential Equations**	**9**	CO1
1.1	Partial differential equations	1	
1.2	Formation of PDE by eliminating arbitrary constants.	2	
1.3	Formation of PDE by eliminating arbitrary functions.	2	
1.4	Solution of PDE by direct integration.	2	
1.5	Linear equations of the first order- Lagrange's linear equation.	2	
2	**Applications of Partial Differential Equations**	**9**	
2.1	One dimensional wave equation derivation	2	CO2
2.2	vibrations of a stretched string	1	
2.3	solution of the wave equation using method of separation of variables.	2	
2.4	One dimensional heat equation, derivation	2	
2.5	solution of the heat equation. (excluding problems in steady state conditions)	2	
3	**Complex Variable – Differentiation**	**9**	
3.1	Complex function	1	CO3
3.2	limit, continuity, derivative	1	
3.3	Analytic functions	1	
3.4	Cauchy-Riemann equations	1	
3.5	harmonic functions, finding harmonic conjugate	1	
3.6	Conformal mappings	1	
3.7	mappings $w = z^2, w = e^z$	2	
3.8	Transformation w=1/z	1	
4	**Complex Variable – Integration**	**9**	

4.1	Line integrals in the complex plane	1	CO4
4.2	First evaluation method-indefinite integration	1	
4.3	second evaluation method	1	
4.4	Cauchy integral theorem	2	
4.5	Cauchy integral formula	2	
4.6	Cauchy Integral formula for derivatives of an analytic function	2	
5	**Complex Variable – Residue Integration**	**9**	
5.1	zeros of analytic functions,	2	
5.2	singularities, poles	1	
5.3	Residues, Cauchy Residue theorem	2	
5.4	Evaluation of definite integral using residue theorem	2	
5.5	Residue integration of real integrals and integrals of improper integrals	2	
	Total	45 Hours	

COURSE DESIGNED BY	**VERIFIED BY**
Ms. Ramya R Asst. Professor, BS & H, JCET E Mail ID: ramyar@jawaharlalcolleges.com	Ms.Dayana K Asst. Professor, BS & H, JCET E Mail ID:dayanak@jawaharlalcolleges.com

24ECNAST302	NETWORK ANALYSIS AND SYNTHESIS	Category	L	T	P	Credit
		PCC	3	1	0	4

Preamble

This course aims to analyze the linear time invariant electronic circuits.

Prerequisite

EST130 Basics of Electrical and Electronics Engineering
MAT102 Vector Calculus, Differential Equations and Transforms (Laplace Transform)

Course Outcomes

On the successful completion of the course students will be able to

COs	Course Outcome Statement	Weightage*** in %
CO1	Apply Mesh / Node analysis to DC and AC networks to obtain steady state response of the linear time invariant networks.	20
CO2	Apply Network Theorems to obtain steady state response of the linear time invariant networks.	20
CO3	Apply Laplace Transforms to determine the transient behavior of RLC networks.	20
CO4	Understand the significance of Poles and Zeros of network functions	20
CO5	Apply Network Parameters to analyze the single port and two port networks.	20

*** Weightage depends on Bloom’s Level, number of contact hours,

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3											2	2	
CO2	3	3											2	2	
CO3	3	3											2	2	
CO4	3	3											2	2	
CO5	3	3											2	2	
Avg	3	3											2	2	

1-Low; 2-Medium; 3- Strong

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	**2**	1	2	
Remembering	20	30	20	40	20
Understanding	20	30	40	20	30
Applying	40	40	40	40	50
Analyzing	20				
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks

Continuous Assessment Test (2 numbers) : 20 Marks

Assignment/Quiz/Course project : 14 Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks;** **Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1(CO1):

1. Enumerate different types of sources in electronic networks.
2. Solve networks containing independent and dependent sources using Mesh / Node Analysis.
3. Evolve the steady-state AC analysis of a given network using Mesh or Node analysis.

Course Outcome 2(CO2):

1. Determine the branch current of the given network with dependent source using superposition theorem.
2. State and prove Maximum Power Transfer theorem.
3. Find the Thevenin's / Norton's equivalent circuit across the port of a given network having Dependent source.

Course Outcome 3 (CO3):

1. The switch is opened at t = 0 after steady state is achieved in a given network. Find the expression for the transient output current.
2. Find the Laplace Transform of a given waveform.
3. In the given circuit, the switch is closed at t = 0 , connecting an energy source to the R,C,L circuit. At time , it is observed that capacitor voltage has an initial value. For the element values given, determine expression for output voltage after converting the circuit into transformed domain.

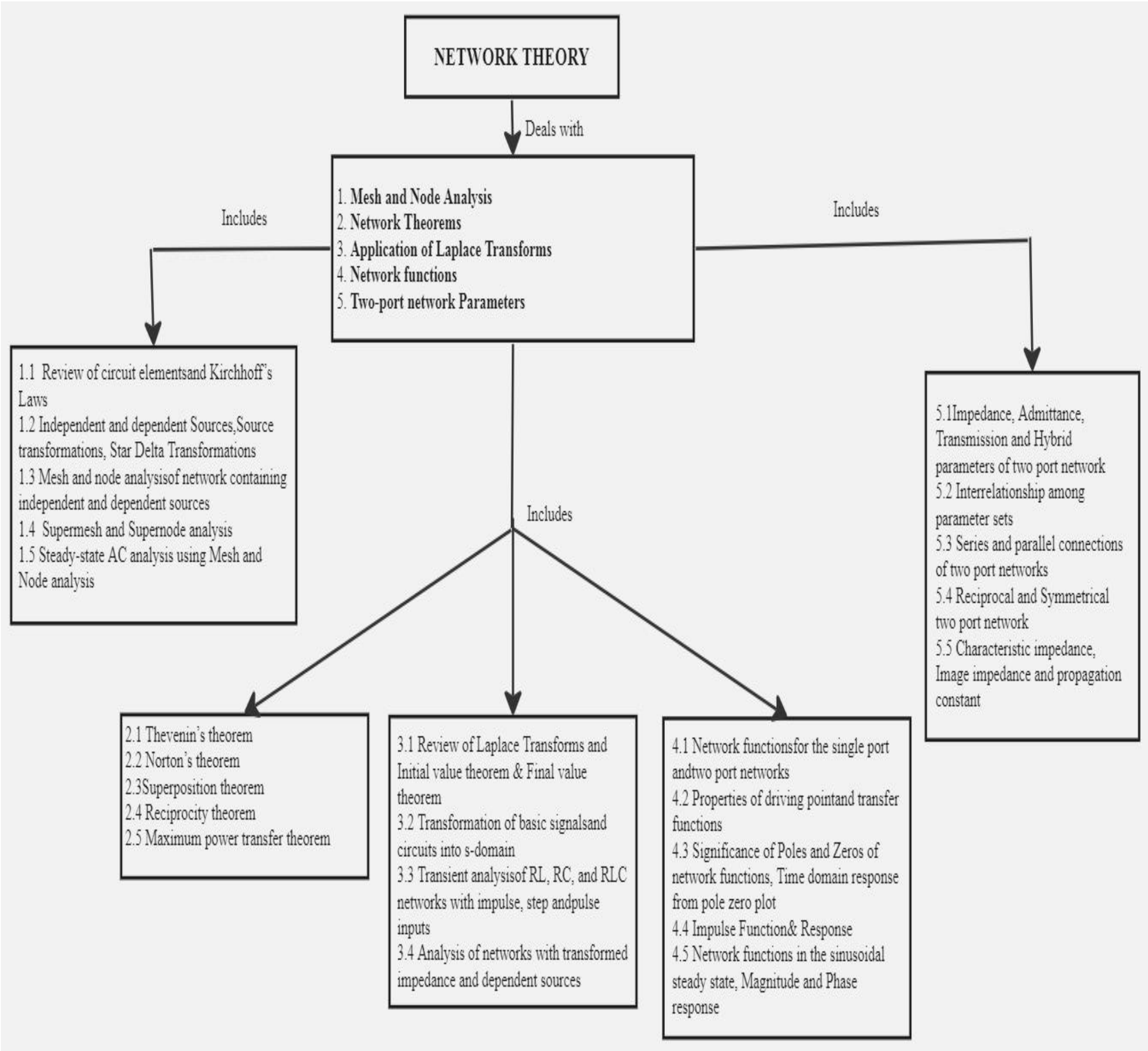
Course Outcome 4 (CO4):

1. What are the necessary conditions for a network Driving point function and Transfer functions?
2. Evaluate the Driving point function and Transfer function for the given network,
3. Plot the poles and zeros of the given network.

Course Outcome 5(CO5):

1. Deduce the transmission parameters of two port network in terms of two port network parameters.
2. Define the condition for a two-port network to be reciprocal.
3. Two identical sections of the given networks are connected in parallel. Obtain the two port network parameters of the combination.

Concept Map


NETWORK THEORY
Deals with
1. Mesh and Node Analysis
2. Network Theorems
3. Application of Laplace Transforms
4. Network functions
5. Two-port network Parameters
Includes
Includes
Includes
1.1 Review of circuit elementsand Kirchhoff's Laws
1.2 Independent and dependent Sources,Source transformations, Star Delta Transformations
1.3 Mesh and node analysisof network containing independent and dependent sources
1.4 Supermesh and Supernode analysis
1.5 Steady-state AC analysis using Mesh and Node analysis
5.1Impedance, Admittance, Transmission and Hybrid parameters of two port network
5.2 Interrelationship among parameter sets
5.3 Series and parallel connections of two port networks
5.4 Reciprocal and Symmetrical two port network
5.5 Characteristic impedance, Image impedance and propagation constant
2.1 Thevenin's theorem
2.2 Norton's theorem
2.3Superposition theorem
2.4 Reciprocity theorem
2.5 Maximum power transfer theorem
3.1 Review of Laplace Transforms and Initial value theorem & Final value theorem
3.2 Transformation of basic signalsand circuits into s-domain
3.3 Transient analysisof RL, RC, and RLC networks with impulse, step andpulse inputs
3.4 Analysis of networks with transformed impedance and dependent sources
4.1 Network functionsfor the single port andtwo port networks
4.2 Properties of driving pointand transfer functions
4.3 Significance of Poles and Zeros of network functions, Time domain response from pole zero plot
4.4 Impulse Function& Response
4.5 Network functions in the sinusoidal steady state, Magnitude and Phase response

Syllabus

Module 1: Mesh and Node Analysis

Mesh and node analysis of network containing independent and dependent sources, Star Delta Transformations. Super mesh and Super node analysis. Steady-state AC analysis using Mesh and Node analysis.

Module 2: Network Theorems

Thevenin's theorem, Norton's theorem, Superposition theorem, Reciprocity theorem, Maximum power transfer theorem. (applied to both dc and ac circuits having dependent source).

Module 3: Application of Laplace Transforms

Review of Laplace Transforms and Inverse Laplace Transforms, Initial value theorem & Final value theorem, Transformation of basic signals and circuits into s-domain. Transient analysis of RL, RC, and RLC networks with impulse and step (with and without initial conditions). Analysis of networks with transformed impedance and dependent sources.

Module 4: Network functions

Network functions for the single port and two port network. Properties of driving point and transfer functions. Significance of Poles and Zeros of network functions, Time domain response from pole zero plot. Impulse Function & Response. Network functions in the sinusoidal steady state, Magnitude and Phase response.

Module 5: Two-port network Parameters

Impedance, Admittance, Transmission and Hybrid parameters of two port networks. Interrelationship among parameter sets. Series and parallel connections of two-port networks. Reciprocal and Symmetrical two-port network. Characteristic impedance, Image impedance and propagation constant (derivation not required).

Learning Resources

TEXT BOOKS

Sl. No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Valkenburg V	Network Analysis	Third	Pearson	2019
2	Ravish R	Network Analysis and Synthesis	Second	McGraw Hill	2015

REFERENCE BOOKS

Sl. No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Sudhakar A, Shyammohan S. P.	Circuits and Networks-Analysis and Synthesis	Fifth	McGraw Hill	2015
2	K. S. Suresh Kumar	Electric Circuits and Networks	Third	Pearson	2008
3	Edminister	Electric Circuits – Schaum's Outline Series	Seventh	McGraw-Hill	2009

Online study materials:

1. https://archive.nptel.ac.in/courses/108/105/108105159/ 2.
2. https://nptel.ac.in/courses/106105154

(Use of Standard and approved Steam Table, Mollier Chart is permitted)

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**Mesh and Node Analysis**		CO1
1.1	Review of circuit elements and Kirchhoff's Laws	2	
1.2	Independent and dependent Sources, Source transformations, Star Delta Transformations	2	
1.3	Mesh and node analysis of network containing independent and dependent sources	5	
1.4	Super mesh and Super node analysis	3	
1.5	Steady-state AC analysis using Mesh and Node analysis	3	
2	**Network Theorems (applied to both dc and ac circuits having dependent source)**		CO2
2.1	Thevenin's theorem	3	
2.2	Norton's theorem	2	
2.3	Superposition theorem	2	
2.4	Reciprocity theorem	2	
2.5	Maximum power transfer theorem	2	
3	**Application of Laplace Transforms**		CO3
3.1	Review of Laplace Transforms	1	
3.2	Initial value theorem & Final value theorem (Proof not necessary)	1	
3.3	Transformation of basic signals and circuits into s-domain	3	

3.4	Transient analysis of RL, RC, and RLC networks with impulse, step and pulse inputs	4	
3.5	Analysis of networks with transformed impedance and dependent sources	2	
4	**Network functions**		CO4
4.1	Network functions for the single port and two port networks	2	
4.2	Properties of driving point and transfer functions	1	
4.3	Significance of Poles and Zeros of network functions, Time domain response from pole zero plot	2	
4.4	Impulse Function & Response	1	
4.5	Network functions in the sinusoidal steady state, Magnitude and Phase response	3	
5	**Two port network Parameters**		CO5
5.1	Impedance, Admittance, Transmission and Hybrid parameters of two port network	5	
5.2	Interrelationship among parameter sets	3	
5.3	Series and parallel connections of two port networks	2	
5.4	Reciprocal and Symmetrical two port network	2	
5.5	Characteristic impedance, Image impedance and propagation constant (derivation not required)	2	
	TOTAL	**60 hours**	

COURSE DESIGNED BY	VERIFIED BY
Ms. Sayana M Asst. Professor, ECE Dept, JCET E. Mail ID: sayanam@jawaharlalcolleges.com	Dr Sandeep C S Asso. Professor/HoD IC, ECE Dept, JCET E. Mail ID: sandeepcs4080.ece@jawaharlalcolleges.com

24ECCLIT302	CIRCUITS AND LINEAR ICs	Category	L	T	P	Credit
		PCC	3	1	0	4

Preamble

This is one of the core course that describe the physical principles, which govern BJT and MOSFET operation and the development of small signal equivalent circuits. It enables the learners to understand the popular Analog and Linear ICs, its fabrication requirement in Very Large Scale Integration Technology. The term integrated circuit reflects the capabilities of semiconductor industry to fabricate complex electronic circuit consisting of a large number of components on a single substrate. The operational amplifier is the most versatile active element amongst the linear ICs. The applications and operations of various ICs are experimentally verified.

Prerequisite

Basics of Analog & Digital Electronics
Network Theory

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Analyse basic amplifiers using BJT and MOSFET.	20
CO2	Apply the principle of oscillator & Feed Back in amplifiers	20
CO3	Analyse Multistage and Power Amplifier circuits.	20
CO4	Design operational amplifier circuits for various applications	20
CO5	Explain the working and applications of timer, Voltage Regulator and PLL ICs	20

*** Weightage depends on Bloom‟s Level, number of contact hours,

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO12	PSO 1	PSO2	PSO 3
CO1	3	3	3	2								1			
CO2	3	3	3	2								1			
CO3	3	3	3	2								1			
CO4	3	3	3	2								1			
CO5	3	3	3	2								1			
Avg	3	3	3	2								1			

1-Low; 2-Medium; 3- Strong;;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	20	30	20	40	20
Understanding	20	30	40	20	30
Applying	40	40	40	40	50
Analyzing	20				
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution:

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Assessment Pattern:

Attendance : 6 Marks

Continuous Assessment Test (2 numbers) : 20 Marks

Assignment/ Quiz/ Course project : 14 Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks;** **Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks

End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1(CO1):

1. Design a RC coupled amplifier for a given gain.
2. Analyse the frequency response of BJT RC coupled amplifier using hybrid π model.
3. Perform DC analysis of MOSFET circuits.

Course Outcome 2(CO2):

1. Design oscillator using BJT to generate sine wave for the given frequency.
2. Derive the expression for oscillation frequency of RC Phase shift Oscillator.
3. Deduce the expression for voltage gain, input impedance and output impedance of the four feedback amplifier topologies.

Course Outcome 3 (CO3):

1. Explain the effect of cascading on Gain and Bandwidth of amplifier.
2. Deduce the expression for maximum efficiency of class B power amplifiers.
3. How to eliminate cross over distortion in class-B power amplifier?

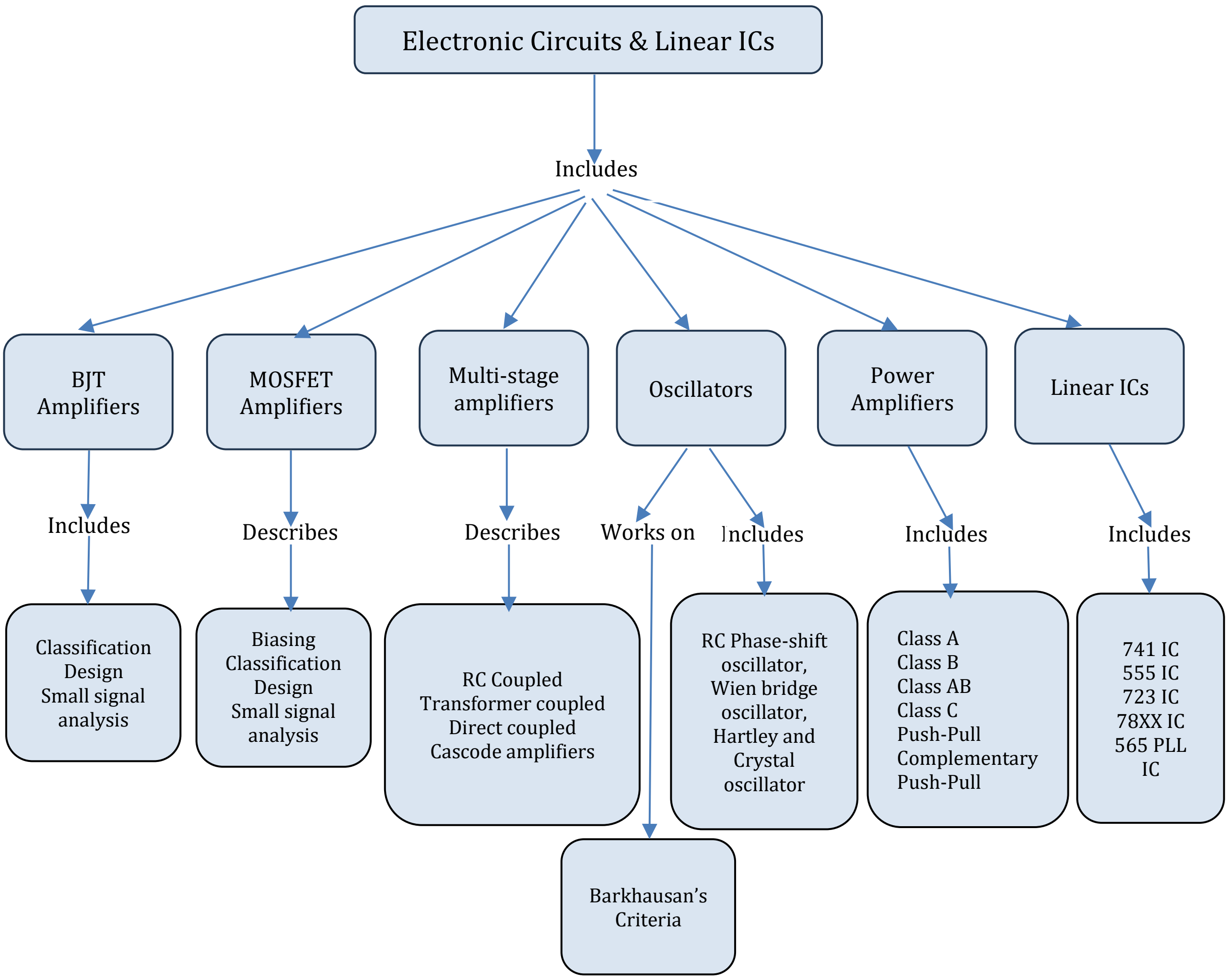
Course Outcome 4 (CO4):

1. Design an opamp circuit to obtain an output voltage V0= -(2V1+4V2 + 3V3)
2. A 741C op-amp is used as an inverting amplifier with a gain of 50. The voltage gain vs frequency curve of 741C is flat upto 20kHz.What maximum peak to peak input signal can be applied without distorting the output?
3. With the help of a neat circuit diagram, derive the equation for the output voltage of an Instrumentation amplifier.

Course Outcome 5(CO5):

1. With the help of internal diagram explain the monostable operation of timer IC 555. Draw the input and different output waveforms. Derive the equation for pulse width.
2. Explain the operation of Phase Locked Loop. What is lock range and capture range? Realize a summing amplifier to obtain a given output voltage.
3. Design a circuit to multiply the incoming frequency by a factor of 5 using 565 PLL.

Concept Map



Syllabus

Module 1

BJT Amplifiers: Classification of amplifiers, RC coupled amplifier (CE configuration) – need of various components and design, voltage gain and frequency response of RC Amplifier. Concept of AC load lines,

Small signal analysis of CE configuration using small signal hybrid-pi model for mid frequency and low frequency. (gain, input and output impedance).

MOSFET amplifiers: MOSFET circuits at DC, MOSFET as an amplifier, Biasing of discrete

MOSFET amplifier, small signal equivalent circuit. Small signal voltage and current gain, input and output impedance of CS configuration

Module 2

Feedback Amplifiers & Oscillators : Basic principles and types of feedback - Gain of an amplifier employing feedback - Effect of feedback (negative) on gain, stability, distortion and bandwidth of an amplifier. Use of positive feedback - Barkhausen criterion for oscillations - Different oscillator circuits - tuned collector, Hartley Colpitts, phase shift, Wien's bridge, and crystal oscillator (working principle and design equations of the circuits; analysis of Phase shift & Wien bridge oscillator only required).

Module 3

Multistage Amplifiers: Need for multistage amplifier - Gain of multistage amplifier - Different types of multistage amplifier - RC coupled, transformer coupled, direct coupled, and their frequency response and bandwidth. Cascode amplifiers

Power amplifiers: Classification, Transformer coupled class A power amplifier, push pull class B and class AB power amplifiers, complementary-symmetry class B and Class AB power amplifiers, efficiency and distortion (no analysis required)

Module 4

Operational amplifiers (Op Amps): The 741 Op Amp, Block diagram, Ideal op-amp parameters, typical parameter values for 741, Equivalent circuit, Voltage transfer curve, Frequency response curve. Virtual ground Concept.

Op-amp applications : summing and difference amplifiers-Differentiator and integrator –I-V and V-I converters, Instrumentation amplifier, Comparators, Schmitt Triggers, Log and antilog amplifiers.

Module 5

Linear ICs: Timer IC 555 – internal diagram – working - multivibrators with timer IC 555

Linear voltage regulators- protection mechanisms-LM 723 Functional-diagram-Design of voltage regulator using 723-Three terminal Voltage regulators-functional operation of 78xx series IC and design of fixed and adjustable regulators.

Phase locked loops- operation of first and second order PLLs-Lock and Capture rangeLM565PLL-Application of PLL as AM/FM/FSK/ detectors, frequency translators, signal synchronizer and frequency synthesizer

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Robert Boylestad & Louis Nashelsky	**Electronic Devices And Circuit**	Seventh Edition	Prentice Hall	**2015**

		Theory			
2	**Sedra A. S. and K. C. Smith**	**Microelectronic Circuits**	**Sixth Edition**	**Oxford University Press**	**2013**

REFERENCE BOOKS

S.No	**AUTHORS**	**TITLE**	**EDITION**	**PUBLISHERS**	**YEAR**
3	Neamen D.	**Electronic Circuits, Analysis and Design”**	Third Edition	McGraw Hill	**2007**
4	Razavi B	**Fundamentals of Microelectronics**	Third Edition	**Wiley**	**2015**

On line study materials:

1. https://youtu.be/Pz1ORs1ADi8
2. https://youtu.be/ZUvNTZVW5EI
3. https://youtu.be/Kbho2liydT0
4. https://youtu.be/zDOgcujHQUI

Course Contents and Lecture Schedule

Module No.	**Topic**	**No. of Hours**	**Course Outcome**
1.	**Amplifiers**		CO1
1.1	Classification of amplifiers, RC coupled amplifier (CE configuration) – need of various components and design	2	
1.2	Frequency response of RC Amplifier. Concept of AC load lines	2	
1.3.	Small signal analysis of CE configuration using small signal hybrid π model for mid frequency. (gain, input and output impedance).	2	
1.4	MOSFET circuits at DC, MOSFET as an amplifier, Biasing ofdiscrete MOSFET amplifier	2	
1.5	Small signal equivalent circuit. Small signal voltage and current gain, input and output impedances of CS configuration.	2	
2	**Feedback Amplifiers & Oscillators**		CO2
2.1	Basic principles and types of feedback - Gain of an amplifier employing feedback	2	
2.2	Effect of feedback (negative) on gain, stability, distortion and bandwidth of an amplifier	1	
2.3	Use of positive feedback - Barkhausen criterion for oscillations	1	
2.4	Different oscillator circuits - tuned collector, Hartley Colpitts and crystal oscillator	2	
2.5	Phase shift, Wien’s bridge Oscillators	2	
3	**Multistage Amplifiers:**		CO3

3.1	Need for multistage amplifier - Gain of multistage amplifier - Different types of multistage amplifier - RC coupled, transformer coupled, direct coupled, and their frequency response and bandwidth	3	
3.2	Cascode amplifiers	1	
	Power amplifiers		
3.3	Classification, Transformer coupled class A power amplifier, push pull class B and class AB power amplifiers	3	
3.4	complementary-symmetry class B and Class AB power amplifiers, efficiency and distortion (no analysis required)	1	
4.	**Operational amplifiers(Op Amps)**		CO4
4.1	The 741 Op Amp, Block diagram, Ideal op-amp parameters, typical parameter values for 741	1	
4.2	Equivalent circuit, Voltage transfer curve, Frequency response curve. Virtual ground Concept.	1	
4.3	summing and difference amplifiers-Differentiator and integrator	2	
4.4	I-V and V-I converters, Instrumentation amplifier	2	
4.5	Comparators ,Log and antilog amplifiers.	2	
5	**Linear ICs**		CO5
5.1	Timer IC 555 – internal diagram – working - multivibrators with timer IC 555	3	
5.2	Linear voltage regulators- protection mechanisms-LM 723 Functional-diagram-Design of voltage regulator using 723	2	
5.3	Three terminal Voltage regulators-functional operation of 78xx series IC and design of fixed and adjustable regulators.	2	
5.4	Phase locked loops- operation of first and second order PLLs-Lock and Capture rangeLM565PLL	2	
5.5	Application of PLL as AM/FM/FSK/ detectors, frequency translators, signal synchronizer and frequency synthesizer	3	
	TOTAL	45 hours	

COURSE DESIGNED BY	VERIFIED BY
Mr.Sanish V S Asst. Professor, ECE Dept, JCET E. Mail ID: sanishvs@jawaharlalcolleges.com	Ms.Jisha K V Asst. Professor, ECE Dept, JCET E. Mail ID: jishakv@jawaharlalcolleges.com

24ICIAIT304	INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND DATA SCIENCE	Category	L	T	P	Credit
		SEC	3	0	0	3

Preamble

Introduction to AI and Data Science, provides a comprehensive foundation in the essential concepts and techniques of these rapidly evolving fields. Spanning five modules, it covers data collection, management, and exploratory analysis, dives into artificial intelligence and machine learning, and explores advanced techniques such as reinforcement learning and model deployment. culminating in a capstone project that applies their knowledge to real-world problems. By the end of the course, students will be well-equipped to navigate and contribute to the dynamic landscape of AI and Data Science.

Prerequisite

24ICATPT104 Algorithmic Thinking with python

Course Outcomes

On the successful completion of the course students will be able to

COs	Course Outcome Statement	Weightage
CO1	Explain the fundamental features of Artificial Intelligence (Understanding)	20
CO2	Analyse various machine learning methods and apply them to develop basic intelligent agents. (Applying)	20
CO3	Utilize neural network architectures and data science foundations to design and implement simple neural network models. (Applying)	20
CO4	Organize and manage data effectively by applying data collection, pre-processing, and storage techniques. (Applying)	20
CO5	Employ data analysis and visualization tools to build predictive models and evaluate their performance. (Applying)	20

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	1	-	-	-	-	-	-	1	-	-	-
CO2	3	3	-	3	3	-	-	-	-	-	-	2	-	-	-
CO3	3	-	-	-	3	-	-	-	-	-	-	1	-	-	-
CO4	3	3	-	2	3	-	-	-	-	-	-	2	-	-	-
CO5	3	3	3	3	3	-	-	-	-	2	-	2	-	-	-
Avg	**3**	**3**	**3**	**2.67**	**2.6**	**-**	**-**	**-**	**-**	**2**	**-**	**2.67**	**-**	**-**	**-**

1-Low; 2-Medium; 3- Strong.

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment			Terminal Examination
	1	2	1	2	3	
Remember						
Understand	60	20	40	40	20	60
Apply	40	80	60	60	80	40
Analyse						
Evaluate						
Create						

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	Practical
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	60	40	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 9 marks
Continuous Assessment Test (2 numbers) : 24 marks
Assignment (Case study) / Practical (Activity) : 27 marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks;** **Duration =90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 40 Marks;** **Duration =150Minutes** Part A: 5 X 8 = 40 Marks

Sample Questions for Course Outcome Assessment

Course Outcome 1(CO1):

1. Define Artificial Intelligence and describe its key historical milestones.
2. Differentiate between Narrow AI and General AI with relevant examples.
3. Explain the Turing Test and its significance in the field of AI.
4. Describe the characteristics of Intelligent Agents and their environment properties.
5. Write a Python program that simulates a simple AI problem-solving agent.

Course Outcome 2(CO2):

1. 1. Compare and contrast supervised learning and unsupervised learning with examples.
2. Explain the concept of reinforcement learning and its application in game playing.
3. Discuss different search strategies used in AI problem-solving methods.
4. Analyse how knowledge representation influences AI reasoning processes.
5. Develop a basic intelligent agent in Python that uses supervised learning to solve a problem.

Course Outcome 3 (CO3):

1. Explain the architecture of Convolutional Neural Networks (CNNs) and their applications.
2. Describe the working of Recurrent Neural Networks (RNNs) and their importance in sequential data processing.
3. Discuss the role of data science in AI and its key concepts.
4. Use the Neural Network Toolbox to design a simple neural network for a classification task.
5. Evaluate the performance of a neural network model on a given dataset.

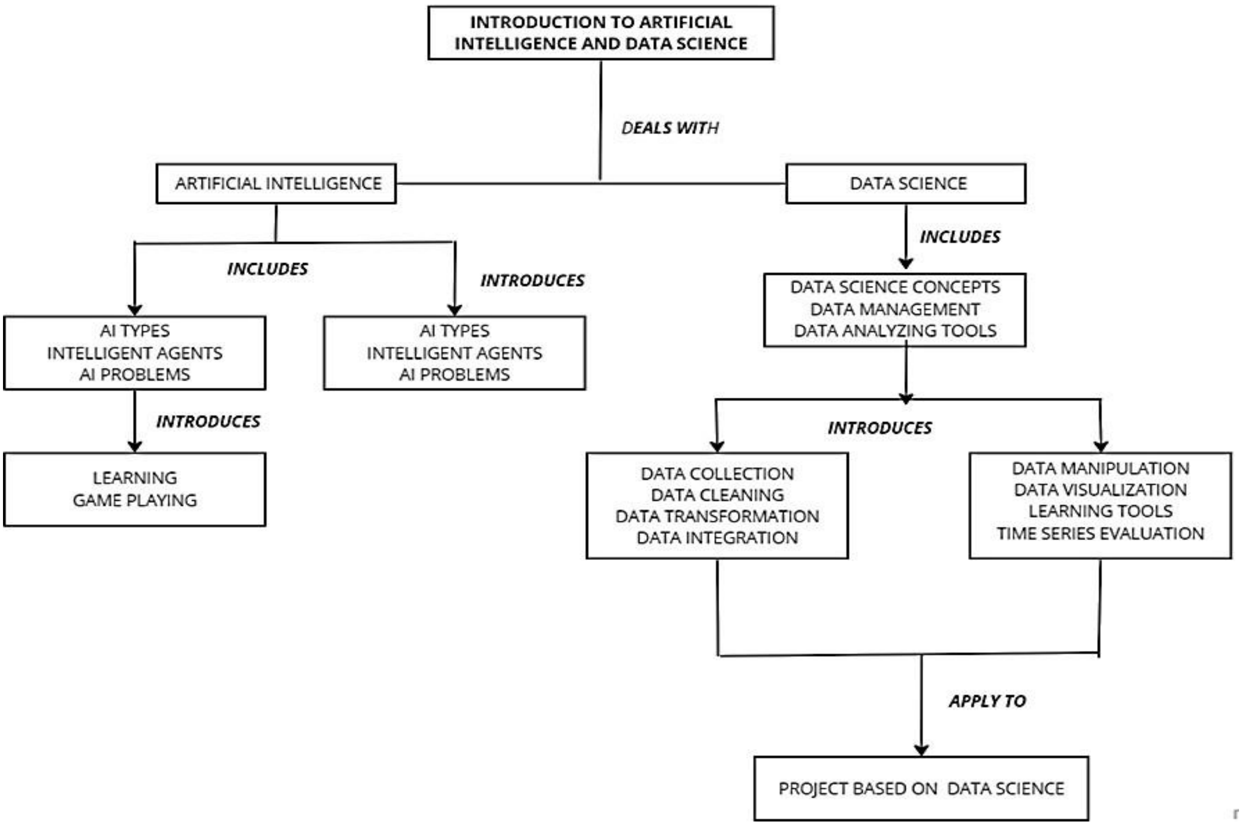
Course Outcome 4 (CO4):

1. Describe various data collection techniques and their importance in AI projects.
2. Explain the process of data cleaning and its significance in ensuring data quality.
3. Demonstrate how to use Pivot Tables to process and analyze a dataset.
4. Discuss different data storage methods, including databases and data warehouses.
5. Apply data transformation and normalization techniques to a raw dataset.

Course Outcome 5(CO5):.

1. Explain how Pandas and NumPy can be used for data manipulation in AI projects.
2. Describe the process of building a predictive model using Scikit-learn.
3. Demonstrate basic data visualization techniques using Matplotlib.
4. Discuss the importance of exploratory data analysis (EDA) in AI.
5. Evaluate the performance of a predictive model using model evaluation metrics.

Concept Map



Syllabus

Module 1

Overview of AI -Definition and History of AI Types of AI: Narrow vs. General AI Key AI Applications. Introduction: Turing Test – Intelligent Agents, Characteristics of Intelligent Agents –Environments properties – Future of AI – Typical AI problems – Problem-Solving Approach to Typical AI problems. Introduction to AI Tools and Platforms. Python Programming Basics practice. Simple AI Programs.

Module 2

Machine Learning- Deep learning –Natural Language processing (introduction only). Problem-Solving Methods Search Strategies– Game Playing – Optimal Decisions in Games. Knowledge Representation. Uncertain knowledge and Reasoning. Learning: Learning from Examples – Supervised Learning and Unsupervised Learning – Reinforcement Learning. Turing Test Simulation. Develop a basic intelligent agent using Python

Module 3

Neural networks - Familiarization of Neural network tool box - convolutional neural networks , recurrent neural networks and advanced architectures

Foundations of Data Science. Introduction to Data Science -Definition and Importance. Key Concepts and Terminology. Applications of Data Science.

Module 4

Data Collection and Management. Data Types and Sources. Data Collection Techniques. Data Storage and Management (Databases, Data Warehouses). Data Cleaning and Preprocessing. Handling Missing Data. Data Transformation and Normalization. Data Integration and Aggregation. Familiarization of processing of data using Pivot table.

Module 5

Tools and techniques for analyzing data and building predictive models. Data visualization tools. Libraries- Pandas and NumPy for data manipulation, and Matplotlib or ggplot2 for data visualization (Introduction Only). Basic statistical concepts and exploratory data analysis. Supervised and unsupervised learning tools- Scikit-learn or caret- covers basic time series analysis and model evaluation metrics- version control. Course project based on prediction Techniques.

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Stuart Russell and Peter Norvig.	Artificial Intelligence: A Modern Approach,	4th Edition	Prentice Hall	2020
2	Dr. Sushil Dohare , Dr. V Selva Kumar , Sachin Raval, Dr. Sumegh Shrikant Tharewal	INTRODUCTION TO DATA SCIENCE	First Edition	Xoffencer	2023

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1.	Dan W Patterson	Introduction to Artificial Intelligence & Expert Systems		PHI.	2010
2.	G. Luger	Artificial Intelligence: Structures and Strategies for complex problem solving	Fourth Edition	Pearson Education	2002.
3.	Laura Igual , Santi Seguí , Jordi Vitrià	Introduction to Data Science: A Python Approach to Concepts, Techniques and Applications	1st Edition	Kindle Edition	2017
4.	Wes McKinney	Python for Data Analysis: Data Wrangling with pandas, NumPy, and Jupyter	3rd Edition	Shroff/O'Reilly	2022

On line study materials:

1. nptel/courses/video/106102220/L01.html
2. nptel.ac.in/noc/courses/noc21/SEM1/noc21-cs42/
3. https://www.geeksforgeeks.org/data-science-fundamentals/

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**Introduction**	**12**	CO1
1.1	Definition and History of AI	1	
1.2	Types of AI: Narrow vs. General AI Key AI Applications	1	
1.3	Turing Test	1	
1.4	Intelligent Agents	1	
1.5	Characteristics of Intelligent Agents –Environments properties	1	
1.6	Typical AI problems - Problem Solving Approach to Typical AI problems- Future of AI	1	
1.7	Familiarize students with AI development environments like Anaconda Navigator and Jupyter Notebooks,	2	
1.8	Basic programming exercises and tutorials in Python	2	
1.9	Implement basic AI algorithms, such as search algorithms	2	
2.	**Problem-Solving Methods**	**12**	CO2
2.1	Machine Learning- Deep learning- Natural Language processing.	1	
2.2	Search Strategies – Informed Search	1	
2.3	Game Playing – Optimal Decisions in Games	1	
2.4	Knowledge Representation. Uncertain knowledge and Reasoning	1	
2.5	Learning from Examples	1	
2.6	Supervised Learning and Unsupervised Learning – Reinforcement Learning.	2	
2.7	Familiarization of Natural Language Processing basics.	1	
2.8	Turing Test Simulation: Create a simple chatbot using Python's NLTK library.	2	
2.9	Develop a basic intelligent agent using Python that can navigate a simple environment.	2	

3.	**Neural Networks and basics of Data Science**	**10**	
3.1	Familiarization of Neural network tool box	2	CO3
3.2	Familiarization of convolutional neural networks	2	
3.3	Familiarization of recurrent neural networks	2	
3.4	Foundations of Data Science -Introduction to Data Science -Definition and Importance.	1	
3.5	Key Concepts and Terminology	1	
3.6	Applications of Data Science Data Collection and Management.	1	
3.7	Data Types and Sources.	1	
4	**Data Management**	**13**	CO4
4.1	Data Collection Techniques.	1	
4.2	Data Storage and Management (Databases, Data Warehouses)	1	
4.3	Data Cleaning and Preprocessing.	1	
4.4	Handling Missing Data.	1	
4.5	Data Transformation and Normalization	1	
4.6	Data Integration and Aggregation	1	
4.7	Create a Pivot Table from a dataset and practice the process of selecting the data range, choosing the location for the Pivot Table, and creating it.	1	
4.8	Familiarization of Pivot Table Layout and Summarizing Data customize the Pivot and summarize data by different categories	2	
4.9	Perform different types of analysis by changing the summary function.	1	
4.10	Familiarize to apply filters to Pivot Tables and group data in Pivot Tables	1	
4.11	Perform Pivot Table Calculations and Formatting Pivot Tables for analyzing the datasets.	2	
5	**Tools and techniques for analyzing data**	**13**	CO5
5.1	Libraries- Pandas and NumPy for data manipulation, (Introduction Only).	1	
5.2	Matplotlib or ggplot2 for data visualization (Introduction Only).	1	
5.3	Basic statistical concepts.	1	

5.4	Exploratory data analysis	1	
5.5	Supervised and Unsupervised learning tools- Scikit-learn or caret	2	
5.6	basic time series analysis and model evaluation metrics-version control	2	
5.7	Design a course project based on prediction Techniques	5	
		60 hours	

COURSE DESIGNED BY	**VERIFIED BY**
Ms. Remya M Asst. Professor, CSE, JCET	Mr. Ambarish A Assistant Professor, CSE, JCET
Email: remya.mundarath@gmail.com	Email: ambruappat@gmail.com

24ICEEST305	ENGINEERING ETHICS AND SUSTAINABLE DEVELOPMENT	Category	L	T	P	Credit
		AEC	2	0	0	2

Preamble

In the contemporary world, engineers are tasked not only with the creation and optimization of systems and technologies but also with ensuring that their work adheres to the highest ethical standards and promotes sustainable development. This course, "Engineering Ethics and Sustainable Development," seeks to instill a profound understanding of the ethical obligations and responsibilities that come with the engineering profession. By examining the principles of professional conduct, the intricate balance between innovation and ethical considerations, and the importance of sustainable practices, students will be prepared to face the moral and ethical challenges in their careers.

Prerequisite

None

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Explain the fundamental principles of engineering ethics and demonstrate understanding of professional responsibilities and codes of conduct.	20
CO2	Evaluate the economic, environmental, and social dimensions of sustainable development and apply these principles to engineering practices.	20
CO3	Analyze the ethical challenges associated with emerging technologies and propose solutions that balance innovation with ethical considerations.	20
CO4	Assess the role of engineering in promoting social justice and equity, and develop strategies to engage communities and address inequality through engineering solutions.	20
CO5	Identify the characteristics of ethical leadership and apply ethical principles to corporate governance and sustainable business practices in engineering contexts.	20

Mapping with Programme Outcomes and Programme Specific Outcomes.

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	2	-	3	-	2	-	1	-	-
CO2	-	2	3	-	-	2	3	-	-	-	-	2	-	-
CO3	2	3	3	-	-	-	-	3	-	-	-	-	-	-
CO4	-	2	3	-	-	3	3	-	2	2	-	2	-	-
CO5	-	-	3	-	-	3	3	3	2	2	2	3	-	-
AVG	**1.5**	**2.33**	**3**	**0**	**0**	**2.5**	**3**	**3**	**2**	**2**	**2**	**2**	**0**	**0**

3- Strong; 2-Medium; 1-Low

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	**2**	**1**	**2**	
Remember	30	30	-	-	30
Understand	50	50	-	-	50
Apply	20	20	100	100	20
Analyze	-	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	100	-	-

Continuous Internal Evaluation Pattern:

Attendance : 15 marks
Continuous Assessment Test (2 numbers) : 50 marks
Assignment (Case study) / Practical (Activity) : 35 marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks** **Duration =90 Minutes** Part A: 5X 6 = 30 Marks Part B: 5 X 4 = 20 Marks

Sample Questions for Course Outcome Assessment

Course Outcome 1(CO1):

1. Explain the significance of engineering ethics and how it influences professional engineering practice.
2. Discuss the role of ethics in ensuring public safety and trust in engineering projects.
3. Analyze a case study involving an ethical dilemma faced by an engineer and describe how it was resolved using professional codes of ethics.
4. Use specific codes from IEEE, ASME, or another professional society.
5. Compare and contrast utilitarianism and deontology as ethical theories and explain their application in engineering decision-making.
6. Provide examples of engineering decisions guided by each theory.
7. Discuss the ethical implications of whistleblowing in an engineering context and the protections available to whistleblowers.
8. Include real-world examples and outcomes.
9. Examine the global and cultural considerations that engineers must take into account when working on international projects.
10. Explain how differing cultural values can impact ethical decision-making.

Course Outcome 2 (CO2):

1. Explain the significance of engineering ethics and how it influences professional engineering practice.
2. Discuss the role of ethics in ensuring public safety and trust in engineering projects.
3. Analyze a case study involving an ethical dilemma faced by an engineer and describe how it was resolved using professional codes of ethics.
4. Use specific codes from IEEE, ASME, or another professional society.
5. Compare and contrast utilitarianism and deontology as ethical theories and explain their application in engineering decision-making.
6. Provide examples of engineering decisions guided by each theory.
7. Discuss the ethical implications of whistleblowing in an engineering context and the protections available to whistleblowers.
8. Include real-world examples and outcomes.
9. Examine the global and cultural considerations that engineers must take into account when working on international projects.
10. Explain how differing cultural values can impact ethical decision-making.

Course Outcome 3(CO3):

1. Explain the significance of engineering ethics and how it influences professional engineering practice.
2. Discuss the role of ethics in ensuring public safety and trust in engineering projects.
3. Analyze a case study involving an ethical dilemma faced by an engineer and describe how it was resolved using professional codes of ethics.
4. Use specific codes from IEEE, ASME, or another professional society.
5. Compare and contrast utilitarianism and deontology as ethical theories and explain their application in engineering decision-making.
6. Provide examples of engineering decisions guided by each theory.
7. Discuss the ethical implications of whistleblowing in an engineering context and the protections available to whistleblowers.
8. Include real-world examples and outcomes.
9. Examine the global and cultural considerations that engineers must take into account when working on international projects.
10. Explain how differing cultural values can impact ethical decision-making.

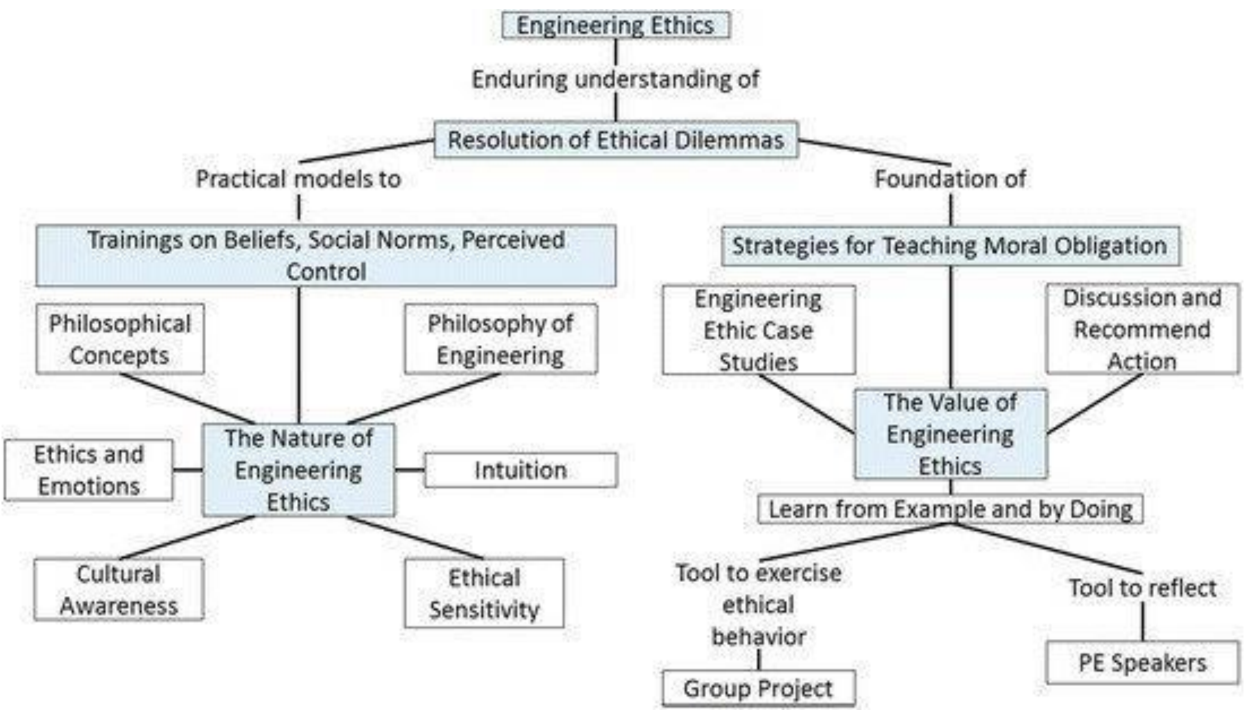
Course Outcome 4 (CO4):

1. Explain the significance of engineering ethics and how it influences professional engineering practice.
2. Discuss the role of ethics in ensuring public safety and trust in engineering projects.
3. Analyze a case study involving an ethical dilemma faced by an engineer and describe how it was resolved using professional codes of ethics.
4. Use specific codes from IEEE, ASME, or another professional society.
5. Compare and contrast utilitarianism and deontology as ethical theories and explain their application in engineering decision-making.
6. Provide examples of engineering decisions guided by each theory.
7. Discuss the ethical implications of whistleblowing in an engineering context and the protections available to whistleblowers.
8. Include real-world examples and outcomes.
9. Examine the global and cultural considerations that engineers must take into account when working on international projects.
10. Explain how differing cultural values can impact ethical decision-making.

Course Outcome 5(CO5):

1. Explain the significance of engineering ethics and how it influences professional engineering practice.
2. Discuss the role of ethics in ensuring public safety and trust in engineering projects.
3. Analyze a case study involving an ethical dilemma faced by an engineer and describe how it was resolved using professional codes of ethics.
4. Use specific codes from IEEE, ASME, or another professional society.
5. Compare and contrast utilitarianism and deontology as ethical theories and explain their application in engineering decision-making.
6. Provide examples of engineering decisions guided by each theory.
7. Discuss the ethical implications of whistleblowing in an engineering context and the protections available to whistleblowers.
8. Include real-world examples and outcomes.
9. Examine the global and cultural considerations that engineers must take into account when working on international projects.
10. Explain how differing cultural values can impact ethical decision-making.

CONCEPT MAP



SYLLABUS

Module 1

Introduction to Engineering Ethics Definition and importance of engineering ethics, Historical perspective and evolution of engineering ethics, Professional responsibility and codes of ethics (IEEE, ASME, etc.), Case studies on ethical dilemmas and professional conduct, Moral frameworks and ethical theories (utilitarianism, deontology, virtue ethics), Application of ethical theories to engineering decision-making, Conflict of interest and whistleblowing, bligations, risks, and protections of whistleblowing, Global and cultural considerations in engineering ethics, Ethical challenges in international engineering projects

Module 2

Principles of Sustainable Development: Definition and dimensions of sustainable development, Economic, environmental, and social dimensions, Interdependence of the dimensions of sustainable development, Overview of the United Nations Sustainable Development Goals (SDGs), Role of engineers in achieving the SDGs, Concepts of environmental ethics, Environmental stewardship and sustainability, Ethical issues related to environmental degradation and resource use, Basics of Life Cycle Analysis (LCA) methodology, Principles of sustainable design and green engineering, Understanding Corporate Social Responsibility (CSR), Case studies on CSR initiatives in engineering firms

Module 3

Ethical Issues in Technology and Innovation: Emerging technologies and ethical challenges, Ethical implications of AI, biotechnology, nanotechnology, etc. Balancing innovation with ethical considerations, Ethical issues in data collection, storage, and use, protecting privacy in the digital age, Ethical considerations in intellectual property rights, Balancing innovation and public good, Ethical responsibility for safety and risk management, Case studies on engineering failures and lessons learned, Principles of ethical entrepreneurship, Promoting sustainability in technological innovation

Module 4

Social Justice and Equity in Engineering: Role of engineers in promoting social justice, Addressing inequality through engineering solutions, Importance of engaging communities in engineering projects, Methods for effective public participation, Principles of inclusive design, Ensuring accessibility for all users in engineering solutions, Ethical considerations in disaster response, Case studies on humanitarian engineering projects, Understanding environmental justice issues, Addressing disproportionate environmental impacts on marginalized communities

Module 5

Ethical Leadership and Sustainable Practices: Characteristics of ethical leaders, Developing ethical leadership skills, Role of corporate governance in ensuring ethical practices, Case studies on ethical governance failures and successes, Ethical issues in engineering research, Responsible conduct of research, Integrating sustainability into business strategies, Case studies on successful sustainable business practices, Emerging trends and future challenges in engineering ethics, Preparing engineers for ethical and sustainable practice in the future

Learning Resources

Text Books

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Venkataratnam	Engineering Ethics	PHI Learning Pvt. Ltd.	1st	2012
2	Madan Mohan Agrawal, Sunita Agrawal	Ethics in Engineering	Prentice-Hall of India Pvt. Ltd.	1st	2009
3	Ravi Rajan	Sustainable Development and Environmental Ethics in India	Routledge India	1st	2016

Reference Books

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	D. R. Kiran	Engineering Ethics and Human Values	Tata McGraw-Hill Education Pvt. Ltd.	1st	2007
2	A. C. Fernando	Corporate Social Responsibility and Sustainable Development	Oxford University Press	1st	2014

Course Contents and Lecture Schedule

Lecture No:	Topic	No. of Hours	Course Outcome
	MODULE 1 - 6		
1.1	Foundations of Engineering Ethics	1	CO1
1.2	Ethical Theories in Engineering	1	
1.3	Case Studies in Engineering Ethics	1	
1.4	Global Perspectives in Engineering Ethics	1	
1.5	Professional Responsibilities and Codes of Ethics	1	
1.6	Ethics in Emerging Technologies	1	
	MODULE 2 - 6		
2.1	Concepts and Principles of Sustainable Development	1	CO2
2.2	Life Cycle Assessment (LCA)	1	
2.3	Sustainable Design and Green Engineering	1	
2.4	Corporate Social Responsibility (CSR)	1	
2.5	Ethics in Sustainable Business Practices	1	
2.6	Environmental Ethics and Policy	1	

MODULE 3 - 6			
3.1	Ethics in Engineering Research and Development	1	CO3
3.2	Data Privacy and Security	1	
3.3	Ethical Challenges in Artificial Intelligence (AI)	1	
3.4	Biotechnology and Genetic Engineering	1	
3.5	Risk Management and Engineering Ethics	1	
3.6	Humanitarian Engineering and Disaster Response	1	
MODULE 4 - 6			
4.1	Engineering and Social Justice	1	CO4
4.2	Community Engagement and Stakeholder Participation	1	
4.3	Inclusive Design and Accessibility	1	
4.4	Environmental Justice	1	
4.5	Ethics in Urban Planning and Infrastructure	1	
4.6	Engineering Ethics in Policy and Governance	1	
4.7			
MODULE 5 - 6			
5.1	Leadership and Ethics in Engineering	1	CO5
5.2	Corporate Governance and Ethical Practices	1	
5.3	Responsible Innovation and Entrepreneurship	1	
5.4	Professional Ethics and Personal Integrity	1	
5.5	Integrating Sustainability into Engineering Education	1	
5.6	Future Trends in Engineering Ethics and Sustainable Development	1	
	TOTAL	**30 hours**	

COURSE DESIGNED BY	**VERIFIED BY**
Dr. Sujesh G HOD, Aero, JCET	Dr. Shine K HOD, Mech, JCET
Email: dr.sujeshg@gmail.com	Email: shinekunnath@gmail.com

24ECSCIP306	SCIENTIFIC COMPUTING LABORATORY	Category	L	T	P	Credit
		PCL	0	0	3	2

Preamble

The following experiments are designed to translate the mathematical concepts into system design. The students shall use Python for the realization of experiments. Other software such as R/MATLAB/SCILAB/LabVIEW can also be used. The experiments will lay the foundation for future labs such as the DSP lab. The first two experiments are mandatory and any six of the rest should be done.

Prerequisite

24ICMATT101 Linear Algebra, Multivariable Calculus and Series
24ICMATT201 Vector Calculus, Ordinary Differential Equations and Transforms

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Describe the needs and requirements of scientific computing and to familiarize one programming language for scientific computing and data visualization	20
CO2	Approximate an array/matrix with matrix decomposition. Implement numerical integration and differentiation.	20
CO3	Solve ordinary differential equations for engineering applications	20
CO4	Compute with exported data from instruments.	20
CO5	Simulate random processes and understand their statistics.	20

Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	-	-	-	3	1	-	3	3	2	1
CO2	3	3	1	2	3	-	-	-	3	-	-	1	3	2	1
CO3	3	3	1	1	3	-	-	-	-	-	-	1	3	2	1
CO4	3	3	1	3	-	-	-	-	3	3	-	-	3	2	1
CO5	3	3	2	2	3	-	-	-	3	1	-	1	3	2	1
AVG	**3**	**3**	**1.6**	**2**	**2.4**	**-**	**-**	**-**	**2.4**	**1**	**-**	**1.2**	**3**	**2**	**1**

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	
Set	Practical Sessions
Guided Response	Practical Sessions
Mechanism	Practical Sessions
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution:

Total Mark	CIE	ESE	ESE Duration
100	60	40	2.5 hours

Continuous Internal Evaluation Pattern

Attendance : 9 marks
Continuous Assessment : 27 marks
Internal Test : 24 marks

End Semester Examination Pattern

The following guidelines should be adhered regarding the award of marks

a. Preliminary Work : 10 marks
b. Implementing the work/Conducting the experiment : 10 marks
c. Performance/Result/Inference (usage of equipment and troubleshooting) : 10 marks
d. Viva voce : 5 marks
e. Record : 5 marks

List of Experiments

Experiment 1. Familiarization of the Computing Tool

- Needs and requirements in scientific computing
- Familiarization of a programming language like Python/R/MATLAB/SCILAB /LabVIEW for scientific computing
- Familiarization of data types in the language used.
- Familiarization of the syntax of while, for, if statements.
- Basic syntax and execution of small scripts.

Experiment 2. Familiarization of Scientific Computing

- Functions with examples
- Basic arithmetic functions such as abs, sine, real, imag, complex, sinc, etc. using built-in modules.
- Vectorized computing without loops for fast scientific applications.

Experiment 3. Realization of Arrays and Matrices

- Realize a one-dimensional array of real and complex numbers
- stem and continuous plots of real arrays using matplotlib/GUIs/charts.
- Realization of two-dimensional arrays and matrices and their visualizations with imshow/matshow/charts
- Inverse of a square matrix and the solution of the matrix equation

$$[A]\,[X] = [b]$$

  where A is an N x N matrix and X and b are N x 1 vectors.

- Computation of the rank(ρ) and eigenvalues (λi) of A
- Approximate A for N = 1000 with the help of singular value decomposition of A as

$$\tilde{A} = \sum_{i=0}^{r} \lambda_i U_i V_i^T$$

- where Ui &Vi are the singular vectors and λ_i are the eigenvalues with $\lambda_i < \lambda_j$ for i > j. One may use the built-in functions for singular value decomposition.
- Plot the absolute error (ζ) between A and $\tilde{A}$ as

$$\zeta = \sum_{i=1}^{N} \sum_{j=i}^{N} |a_{ij} - \tilde{a}_{ij}|^2$$

  against r for r = 10, 50, 75, 100, 250, 500, 750 and appreciate the plot.

Experiment 4. Numerical Differentiation and Integration

- Realize the functions sint, cost, sinht and cosht for the vector t = [0, 10] with increment 0.01
- Compute the first and second derivatives of these functions using built-in tools such as grad.
- Plot the derivatives over the respective functions and appreciate.
- Familiarize the numerical integration tools in the language you use.
- Realize the function

$f(t) = 4t^2 + 3$

and plot it for the vector t = [—5, 5] with increment 0.01

- Use a general integration tool to compute

$$\int_{-2}^{2} f(t)dt$$

- Repeat the above steps with the trapezoidal and Simpson methods and compare the results.
- Compute

$$\frac{1}{\sqrt{2\pi}}\int_{0}^{\infty} e^{-x^2/2}dt$$

using the above three methods.

Experiment 5. Solution of Ordinary Differential Equations

- Solve the first-order differential equation

$$\frac{dx}{dt} + 2x = 0$$

with the initial condition x (0) = 1

- Solve for the current transient through an RC network (with RC = 3) that is driven by

5 VDC

the signal $5e^{-t}U(t)$ and plot the solutions.

- Solve the second order differential equation

$$\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + 2x = e^{-t}$$

- Solve the current transient through a series RLC circuit with R = 1Ω, L = 1mH and C = 1μF that is driven by

5 VDC

the signal $5e^{-t}U(t)$

Experiment 6. Simple Data Visualization

- Draw stem plots, line plots, box plots, bar plots and scatter plots with random data.
- Plot the histogram of a random data.
- Create legends in plots
- Realize a vector t = [-10, 10] with increment 0.01 as an array.

- Implement and plot the functions

  f (t) = cost

  f (t) = cost cos 5t + cos 5t

Experiment 7. Simple Data Analysis with Spreadsheets

- Display an electrical signal on DSO and export it as a .csv file.
- Read this .csv or .xls file as an array and plot it.
- Compute the mean and standard deviation of the signal. Plot its histogram with an appropriate bin size.

Experiment 8. Convergence of Fourier Series

- The experiment aims to understand the lack of convergence of Fourier series
- Realize the Fourier series

$$f(t) = \frac{4}{\pi}\ [\ 1 - \frac{1}{3} cos \frac{2\pi 3t}{T} + \frac{1}{5} cos \frac{2\pi 5t}{T} - \ \frac{1}{7} cos \frac{2\pi 7t}{T} + \cdots]$$

- Realize the vector t = [0, 100] with an increment of 0.01 and keep T = 20.
- Plot the first 3 or 4 terms on the same graphic window and understand how the smooth sinusoids add up to a discontinuous square function.
- Compute and plot the series for the first 10, 20, 50 and 100 terms of the and understand the lack of convergence at the points of discontinuity.
- With t made a zero vector, f (0) = 1, resulting in the Madhava series for as

$$\pi\ = 4\ [\ 1 - \frac{1}{3} + \frac{1}{5} - \ \frac{1}{7} + \cdots\ ]$$

- Use this to compute Tt for the first 10, 20, 50 and 100 terms.

Experiment 9: Coin Toss and the Level Crossing Problem

- Simulate a coin toss that maps a head as 1 and tail as 0.
- Toss the coin N = 100, 500,1000, 5000 and 500000 times and compute the probability (p) of head in each case.
- Compute the absolute error |0.5 — p| in each case and plot against N and understand the law of large numbers.
- Create a uniform random vector with a maximum magnitude of 10, plot, and observe.
- Set a threshold (VT = 2) and count how many times the random function has crossed V_T.

- Count how many times the function has gone above and below the threshold.

Experiment10: Virtual Instrumentation using SCILAB

1. Develop VI to convert Celsius to Fahrenheit

2. Develop a signal generator using SCILAB

Schedule of Experiments: Every experiment should be completed in three hours.

Learning Resources:

Text Books

Sl.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Abubeker K M, Shafeena Karim A	A Lab Manual on Scientific Computing Laboratory	1st Edition	Notion Press	2022
2	Martin C. Brown	Python: The Complete Reference	4th Edition	McGraw Hill Education	2018

COURSE DESIGNED BY	VERIFIED BY
Mr. Srikanth K Asst. Professor, ECE Dept, JCET E. Mail ID: srikanth4019.ece@jawaharlalcolleges.com	Dr. Sandeep C S Associate Professor & HoD IC, ECE Dept, JCET E. Mail ID: sandeepcs4080.ece@jawaharlalcolleges.com

24ECCASP307	CIRCUITS AND SIMULATION LAB	Category	L	T	P	Credit
		PCL	0	0	3	2

Preamble

This course aims to (i) Familiarize students with the Circuits Design through the implementation of basic Electronics Circuits using discrete components. (ii) Familiarize students with simulation of basic Electronics Circuits.

Prerequisite

Nil

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Design and demonstrate the functioning of basic RC circuits using discrete components	20
CO2	Design and demonstrate the functioning of Amplifier circuits	20
CO3	Design and demonstrate the functioning of Power Amplifier circuits	20
CO4	Design and demonstrate the functioning of Oscillator and Voltage Regulator circuits	20
CO5	Design and simulate the functioning of basic analog circuits using simulation tools.	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO3
CO1	3	3	3						2			2	1	3	2
CO2	3	3	3						3				1	3	2
CO3	3	3	3						3			3	1	3	2
CO4	3	3	3						2				1	3	2
CO5	3	3	3		3				2			2	1	3	2
AVG	**3**	**3**	**3**		**0.6**	**-**	**-**	**-**	**2.4**	**-**	**-**	**1.4**	**1**	**3**	**2**

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	
Set	Practical Sessions
Guided Response	Practical Sessions
Mechanism	Practical Sessions
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution:

Total Mark	CIE	ESE	ESE Duration
100	60	40	2.5 hours

Continuous Internal Evaluation Pattern

Attendance : 9 marks
Continuous Assessment : 27 marks
Internal Test : 24 marks

End Semester Examination Pattern

a) Preliminary Work : 10 marks

b) Implementing the work/Conducting the experiment : 10 marks

c) Performance/Result/Inference (usage of equipment and trouble shooting): 10 marks

d) Viva voce : 5 marks

e) Record : 5 marks

Duration: 2.5 Hours

List of Experiments/ Activities with CO Mapping

Module No.	Topic	Course Outcomes
	Part A: List of Experiments using discrete components [Any Six experiments mandatory]	
1.	RC integrating and differentiating circuits	CO1
2.	Clipping and clamping circuits (Transients and transfer characteristics)	CO1
3.	RC coupled CE amplifier - frequency response characteristics	CO2
4.	MOSFET amplifier (CS) - frequency response characteristics	CO2
5.	Cascade amplifier - gain and frequency response	CO2
6.	Cascode amplifier - frequency response	CO2
7.	Feedback amplifiers (current series, voltage series) - gain and frequency response	CO2
8.	Power amplifiers (transformer less) - Class B and Class AB	CO3
9	Low frequency oscillators – RC phase shift or Wien bridge	CO4
10	Transistor series voltage regulator (load and line regulation)	CO4
	PART B: Simulation experiments [Any Six experiments mandatory] The experiments shall be conducted using open tools such as QUCS, KiCad or variants of SPICE	

1	RC integrating and differentiating circuits (Transient analysis with different inputs and frequency response)	CO5
2	Clipping and clamping circuits (Transients and transfer characteristics)	CO5
3	RC coupled CE amplifier - frequency response characteristics	CO5
4	MOSFET amplifier (CS) - frequency response characteristics	CO5
5	Cascade amplifier – gain and frequency response	CO5
6	Cascode amplifier – frequency response	CO5
7	Feedback amplifiers (current series, voltage series) - gain and frequency response	CO5
8	Low frequency oscillators – RC phase shift or Wien bridge	CO5
9	Power amplifiers (transformer less) - Class B and Class AB	CO5
10	Transistor series voltage regulator (load and line regulation)	CO5

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Robert Boylestad and L Nashelsky	**Basic Electronics**	11th Edition	Pearson,	**2015**
2	Sedra A. S. and K. C. Smith	Microelectronic Circuits	6th Edition	Oxford University Press	**2013**

On line study materials:

1. ***https://www.analog.com/en/resources/media-center/videos/series/ltspice- getting-started-tutorial.html***
2. ***https://web.mit.edu/6.101/www/s2020/handouts/LTSpiceIntro.pdf***
3. *https://youspice.com/getting-started-with-ltspice*

COURSE DESIGNED BY	VERIFIED BY
Ms. Ajeena A Asst. Professor, ECE Dept, JCET E. Mail ID: ajeena4093.ece@jawaharlalcolleges.com	Mr. Srikanth K Asst. Professor, ECE Dept, JCET E. Mail ID: srikanth4019.ece@jawaharlalcolleges.com

24ECVACP308	COMPUTATIONAL TOOL FOR ENGINEERS	Category	L	T	P	Credit
		VAC	**0**	**0**	**2**	**2**

Preamble

This course introduces engineering students to MATLAB and Simulink, essential tools for numerical computation, data analysis, and simulation in engineering. It covers fundamental programming concepts in MATLAB, modeling and simulation techniques in Simulink, and their applications in solving real-world engineering problems..

Prerequisite

Basics of C programming

Course Outcomes

On the successful completion of the course students will be able to:

CO Number	Course Outcome Statement	Weightage in %
CO1	Understand the basics of MATLAB programming. (Understanding)	20
CO2	Analyze data and visualization in MATLAB.(Analyzing)	20
CO3	Develop mathematical models using Simulink. (Applying)	20
CO4	Apply MATLAB and Simulink in engineering problem-solving.. (Applying)	20
CO5	Create MATLAB and Simulink for dynamic system simulations. (Applying)	20

Mapping of Course Outcomes with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2													
CO2	2	2	2												
CO3			2	2											
CO4				3	3										
CO5					3	3	3								
AVG	**2**	**2**	**2**	**2.5**	**3**	**3**	**3**								

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	
Set	Hands-on Sessions
Guided Response	Exercises
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	100	-	-

Continuous Internal Assessmsnt Pattern:

Attendance : 15 marks
Practical : 50 marks
Assessment Test : 35 marks

Syllabus

MODULE 1

Introduction to MATLAB :Overview of MATLAB interface, navigating the command window, workspace, and file management, Basic Commands and Operations - Common commands in MATLAB, Basic operations (addition, subtraction, multiplication, division), Working with variables - creating and managing variables, understanding variable naming conventions and workspace variables, Data Types in MATLAB - Introduction to data types: numeric, logical, character, and arrays, Converting between data types, Basic Mathematical Operations -Performing mathematical operations on variables, Introduction to Scripts - Understanding script files vs. command window execution, Introduction to Functions - Input/output arguments and function handles, Control Flow Statements: If-Else, Control Flow Statements: Switch and Loops, Creating and manipulating arrays, Introduction to Cell Arrays and Structures, Basic File I/O and Data File Operations

Assignments: ● Problem set on basic MATLAB operations. ● Mini-project: Writing a simple function in MATLAB

MODULE 2

Data Analysis and Visualization: Introduction to Vectors, Understanding Matrices, Performing Matrix Operations, Techniques for Data Import/Export, Effective File Handling Practices, Working with Various Data Types, Fundamentals of Plotting and Visualization, Creating and Customizing 2D Plots, Exploring Advanced

Plotting Techniques, Generating and Manipulating 3D Plots, Customizing Plots for Enhanced Visualization, Conducting Statistical Analysis, Curve Fitting, and Interpolation

Assignments: ● Problem set on matrix operations. ● Mini-project: Data analysis and visualization project

MODULE 3

Introduction to Simulink: Introduction to Simulink and its key features for model-based design, Overview of the Simulink environment, including layout and user interface navigation, Step-by-step process for creating simple models in Simulink, Exploring block libraries and understanding different types of blocks available, Techniques for connecting blocks and establishing relationships between components, Running simulations and analyzing results in Simulink, Understanding subsystems and how to group blocks for better model organization, Masking subsystems and creating user-friendly interfaces for custom blocks, Developing custom blocks tailored to specific project requirements, Methods for importing and exporting data in Simulink, Efficient techniques for logging and managing data during simulations, Integrating Simulink models with MATLAB scripts and functions for enhanced functionality

Assignments: ● Problem set on creating Simulink models. ● Mini-project: Building and simulating a simple system in Simulink

MODULE 4

Modeling and Simulation of Dynamic Systems: Introduction to Modeling Discrete Systems, Overview of Solvers in Simulink, Configuring Simulation Settings, Analyzing and Interpreting Simulation Results, Case Study: Modeling an Electrical Circuit, Case Study: Simulating a Mechanical System, Case Study: Simulating a Control System, Comparison of Continuous and Discrete Systems, Advanced Techniques in System Simulation, Troubleshooting Common Simulation Issues, Best Practices for Dynamic System Modeling

Assignments:

● Problem set on dynamic system modeling.

● Major project: Simulating a real-world engineering system

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MODULE 5

Advanced Topics and Integration: Introduction to S-Functions and their role in Simulink, Integrating MATLAB code with Simulink models, Techniques for co-simulation with other software, Hardware interfacing and integration with Simulink, Overview of optimization techniques in Simulink, Methods for parameter tuning and improving model Performance, Advanced Simulink topics: Introduction to

Stateflow, Advanced Simulink topics: Introduction to Simscape, Best practices for effective Simulink modelling, Strategies for managing complex simulations and large models, Preparing and presenting final project presentations, Review and application of module concepts in a final project

Assignments:

● Problem set on advanced Simulink features.

● Final project: Comprehensive project integrating MATLAB and Simulink

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Holly Moore	MATLAB for Engineers	5th Edition	Pearson	2017
2	Amos Gilat	MATLAB: An Introduction with Applications	6th Edition	Wiley	2017

REFERENCE BOOKS

Sl.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Stormy Attaway	MATLAB: A Practical Introduction to Programming and Problem Solving	4th Edition	Butterworth-Heinemann	2016
2	Steven C. Chapra	Applied Numerical Methods with MATLAB for Engineers and Scientists, Marketers, And Entrepreneurs.	4th Edition	McGraw-Hill Education	2017

Online study materials:

- https://shorturl.at/nMzva
- https://matlabacademy.mathworks.com/
- https://shorturl.at/FlRbU

Course contents and Lecture Schedule

Module No.	Topic	No. of Hours	CO
1	**Module 1: Introduction to MATLAB**	12	CO1
1.1	Overview of MATLAB interface, navigating the command window, workspace, and file management window, workspace, and file management	1	
1.2	Basic Commands and Operations - Common commands in MATLAB, Basic operations (addition, subtraction, multiplication, division)	1	
1.3	Working with variables - creating and managing variables, understanding variable naming conventions and workspace variables	1	
1.4	Data Types in MATLAB - Introduction to data types: numeric,logical, character, and arrays, Converting between data types	1	
1.5	Basic Mathematical Operations –Performing mathematical operations on variables	1	
1.6	Introduction to Scripts - Understanding script files vs. command window execution	1	
1.7	Introduction to Functions - Input/output arguments and function handles	1	
1.8	Control Flow Statements: If-Else	1	
1.9	Control Flow Statements: Switch and Loops	1	
1.10	Creating and manipulating arrays	1	
1.11	Introduction to Cell Arrays and Structures	1	
1.12	Basic File I/O and Data File Operations	1	
	Assignments: ● Problem set on basic MATLAB operations. ● Mini-project: Writing a simple function in MATLAB	1	
2	**Module 2: Data Analysis and Visualization**	12	
2.1	Introduction to Vectors	1	
2.2	Understanding Matrices	1	

2.3	Performing Matrix Operations	1	CO2
2.4	Techniques for Data Import/Export	1	
2.5	Effective File Handling Practices	1	
2.6	Working with Various Data Types	1	
2.7	Fundamentals of Plotting and Visualization	1	
2.8	Creating and Customizing 2D Plots	1	
2.9	Exploring Advanced Plotting Techniques	1	
2.10	Generating and Manipulating 3D Plots	1	
2.11	Customizing Plots for Enhanced Visualization	1	
2.12	Conducting Statistical Analysis, Curve Fitting, and Interpolation	1	
	Assignments: ● Problem set on matrix operations. ● Mini-project: Data analysis and visualization project	1	
3	**Module 3: Introduction to Simulink**	12	CO3
3.1	Overview of the Simulink environment, including layout and user interface navigation.	1	
3.2	Step-by-step process for creating simple models in Simulink.	1	
3.3	Exploring block libraries and understanding different types of blocks available.	1	
3.4	Techniques for connecting blocks and establishing relationships between components	1	
3.5	Running simulations and analyzing results in Simulink.	1	
3.6	Understanding subsystems and how to group blocks for better model organization.	1	
3.7	Masking subsystems and creating user-friendly interfaces for custom blocks.	1 1	
3.8	Developing custom blocks tailored to specific project	1	

	requirements.		
3.9	Methods for importing and exporting data in Simulink.	1	
3.10	Efficient techniques for logging and managing data during simulations.	1	
3.11	Integrating Simulink models with MATLAB scripts and functions for enhanced functionality	2	
	Assignments: ● Problem set on creating Simulink models. ● Mini-project: Building and simulating a simple system in Simulink.		
4	**Creating Links (Hyperlinks)**	12	CO4
4.1	Introduction to Modeling Continuous Systems	1	
4.2	Introduction to Modeling Discrete Systems	1	
4.3	Overview of Solvers in Simulink	1	
4.4	Configuring Simulation Settings	1	
4.5	Analyzing and Interpreting Simulation Results	1	
4.6	Case Study: Modeling an Electrical Circuit	1	
4.7	Case Study: Simulating a Mechanical System	1	
4.8	Case Study: Simulating a Control System	1	
4.9	Comparison of Continuous and Discrete Systems	1	
4.10	Advanced Techniques in System Simulation	1	
4.11	Troubleshooting Common Simulation Issues	1	
4.12	Best Practices for Dynamic System Modeling	1	
	Assignments: ● Problem set on dynamic system modeling. ● Major project: Simulating a real-world engineering system		
5	**Module 5: Advanced Topics and Integration**	12	

5.1	Introduction to S-Functions and their role in Simulink	1	CO5
5.2	Integrating MATLAB code with Simulink models	1	
5.3	Techniques for co-simulation with other software	1	
5.4	Hardware interfacing and integration with Simulink	1	
5.5	Overview of optimization techniques in Simulink	1	
5.6	Methods for parameter tuning and improving model performance	1	
5.7	Advanced Simulink topics: Introduction to Stateflow	1	
5.8	Advanced Simulink topics: Introduction to Simscape	1	
5.9	Best practices for effective Simulink modeling	1	
5.10	Strategies for managing complex simulations and large models	1	
5.11	Preparing and presenting final project presentations	1	
5.12	Review and application of module concepts in a final project	1	
	Assignments: ● Problem set on advanced Simulink features. ● Final project: Comprehensive project integrating MATLAB and Simulink		
	Total Hours	**60**	

COURSE DESIGNED BY	VERIFIED BY
Mr. Jayesh T P Asst. Professor, ECE Dept, JCET E. Mail ID: jayesh4205.ece@jawaharlalcolleges.com	Ms Ajeena A Asst. Professor, ECE Dept, JCET E. Mail ID :ajeena4093.ece@jawaharlalcolleges.com

SEMESTER-IV

24ICMATT421	PROBABILITY RANDOMPROCESS AND NUMERICAL METHODS	Category	L	T	P	Credit
		BSC	3	0	0	3

Preamble

This course introduces students to the modern theory of probability and statistics, covering important models of random variables. A brief course in numerical methods familiarizes students with some basic numerical techniques for finding roots of equations, evaluating definite integrals solving systems of linear equations, and solving ordinary differential equations which are especially useful when analytical solutions are hard to find.

Prerequisite

A basic course in one-variable and multi-variable calculus**.**

Course Outcomes

After the completion of the course the student will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Understand the concept, properties and important models of discrete random variables(univariate and bivariate) and, using them, analyses suitable random phenomena.	20
CO2	Understand the concept, properties and important models of continuous random variables(univariate and bivariate) and, using them, analyses suitable continuous random phenomena.	20
CO3	Analyze random process using autocorrelation, Power spectrum and Poisson process model as appropriate.	20
CO4	Compute roots of equations, evaluate definite integral and perform interpolation and apply numerical techniques for solving system of equations.	20
CO5	Apply numerical techniques for curve fitting on a given bivariate data and solving ordinary differential equations.	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	-	-	-	-	2	-	1	1	-	-
CO2	3	2	2	2	2	-	-	-	-	2	-	1	1	-	-
CO3	3	2	2	2	2	-	-	-	-	2	-	1	1	-	-
CO4	3	2	2	2	2	-	-	-	-	2	-	1	1	-	-
CO5	3	2	2	2	2	-	-	-	-	2	-	1	1	-	-
Avg	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**1**	**1**	**-**	**-**

1-Low; 2-Medium; 3- Strong

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests			Assignment		Terminal Examination
	1	**2**	**3**	1	2	
Remembering	20	20	20	-	-	20
Understanding	30	30	30	-	-	30
Applying	50	50	50	100	100	50
Analyzing						
Evaluating						
Creating						

Assessment Pattern: Psychomotor

Psychomotor Skill	**Mini project /Assignment/Practical Component**
Perception	
Set	
Guided Response	
Mechanism	Assignment/ spoken tutorials.
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution:

Total Mark	**CIE**	**ESE**	**ESE Duration**
100	40	60	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance : 6 marks
Continuous Assessment Test (2 numbers) : 20 marks
Assignment/Quiz/Course project : 14 marks

Question Paper Pattern:

Type of Test	**Pattern**
Internal Series Test I & II	**Total = 50 Marks;** **Duration =90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 6 Marks;** **Duration =150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment

Course Outcome 1 (CO1):

1. Let X denote the number that shows up when an unfair die is tossed. Faces 1 to 5 of the die are equally likely, while face 6 is twice as likely as any other. Find the probability distribution, mean and variance of X.

2. An equipment consists of 5 components each of which may fail independently with probability 0.15. If the equipment is able to function properly when at least 3 of the components are operational, what is the probability that it functions properly?

3. X is a binomial random variable (n, p) with $n = 100$and $p = 0.1$. How would you approximate it by a Poisson random variable?

4. Three balls are drawn at random without replacement from a box containing 2 white and 3 red and 4 black balls. X denote the number of white balls drawn and Y denote the number of red balls drawn find the joint probability distribution of (X,Y).

Course Outcome 2(CO2):

1. What can you say about $P\,(X = a)$ for any real number $a$when X is a (i) discrete random variable? (ii) continuous random variable?

2. A string, 1 meter long, is cut into two pieces at a random point between its ends. What is the probability that the length of one piece is at least twice the length of the other?

3. A random variable has a normal distribution with standard deviation 10. If the probability that it will take on a value less than 82.5 is 0.82, what is the probability that it will take on a value more than 58.3?

4. X and Y are independent random variables with X following an exponential distribution with parameter μ and Y following and exponential distribution with parameter λ. Find $P(X + Y \leqslant 1)$

Course Outcome 3 (CO3):

1. A random process X(t) defined by Acos(ωt+θ) where A and ω are constants and **θ** is uniformly distributed over [0,2π] . Show that X(t) is WSS.

2. How are autocorrelation function and power spectral density of a WSS process are related to each other.
3. Find Power spectral density of WSS random process X(t), given the autocorrelation function $R(\tau)=25e^{-|\tau|}$

4. Cell-phone calls processed by certain wireless base stations arrive according to a Poisson process with an average of 12 per minute, what is the Probability that more than 3 calls arrive in an interval of 20 seconds.

Course Outcome 4 (CO4):

1. Use Newton- Raphson method to find the real root of the equation

   $f(x) = e^{2x} - x - 6$ correct four decimal places.

2. Evaluate $\int_0^1 e^{-x^2} dx$ using Simpson's one-third rule, dividing the interval [0,1] into 8 sub intervals.

3. Find a polynomial P(x) of degree 3 or less the graph of which passes through the points

   (-1,3), (0, -4), (1,5) and (2, -6). And also find P (3).

4. Solve the following system of equations by Gauss-Siedel method:
   x + y + z = 2, x + 2y + 3z = 5, 2x + 3y + 4z = 1

Course Outcome 5(CO5):

1. Using the method of least squares fit a straight line of the form $y = ax + b$ to the following set of ordered pairs (x, y):
   (2,4), (3,5), (5,7), (7,10), (9,15)

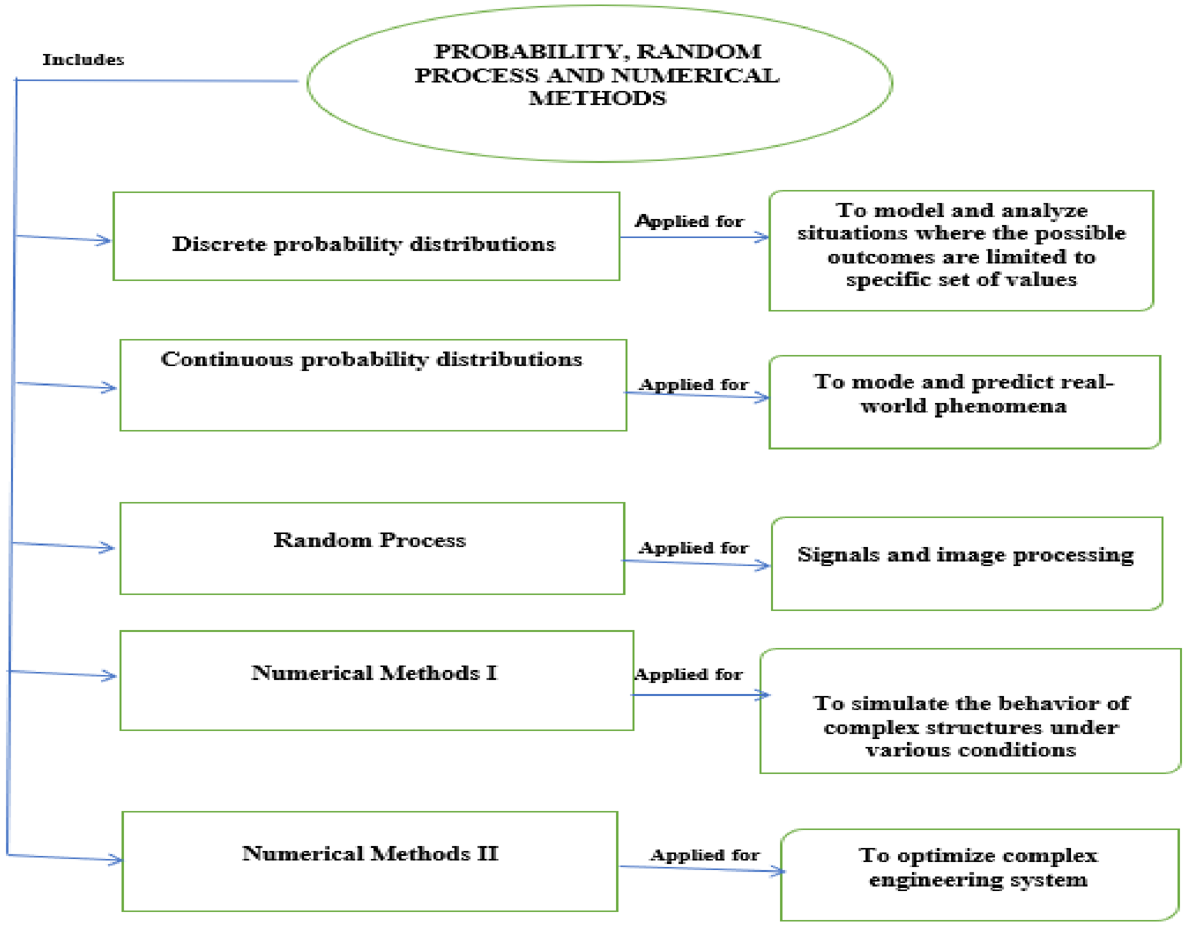
2. What are regression lines and explain why we always fit two regression lines for a given bivariate data.

3. Use Runge-Kutta method of fourth order to find (0.2) given the initial value problem $\frac{dy}{dx} = \frac{xy}{1+x^2}, y(0) = 1$. Take step-size, h=0.1

4. Solve the initial value problem using Euler method $\frac{dy}{dx} = x + y, y(0) = 0$

   Find y (0.2) using step-size h=0.1

Concept Map



Syllabus

MODULE I (Discrete probability distributions)
Discrete random variables and their probability distributions, Expectation, mean and variance, Binomial distribution, Poisson distribution, Poisson approximation to the binomial distribution, Bivariate distribution, Marginal distribution,

MODULE II (Continuous probability distributions)

Continuous random variables and their probability distributions, Expectation, mean and variance, Uniform, exponential and normal distributions, Continuous Bivariate distribution Marginal distribution, Independence of random variables, Central limit theorem (without proof)

MODULE III (Random process)
Random process, Mean and autocorrelation, Wide sense stationary (WSS) process, autocorrelation and power spectral density of WSS process and their properties,Poisson process.

MODULE IV (Numerical methods -I)

Solution of equations - Newton-Raphson method, Interpolation- finite difference, Newton's forward and backward difference, Lagrange's interpolation, Numerical integration- Simpson's one-third rule (proof or derivation of the formulae are not required for any of the methods in this module), Solution of linear system by Gausssiedal method

MODULE V (Numerical methods -II)
Curve fitting-method of least squares, fitting straight lines, Regression lines, Solution of ordinary differential equations-Euler and Classical Runge-Kutta method of fourth order only (Proof or derivation of the formulae not required for any of the methods in this module)

Learning Resources

TEXT BOOKS

Sl.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Dougles C Montgomery and George C Runger	Applied Statisticsand Probability for Engineers	7th Edition	John Wiley and Sons, Inc	2018
2	Gerald C F and Wheatley P O	Applied Numerical Analysis	7thEdition	Pearson Edition,New Delhi	2015

REFERENCE BOOKS

Sl.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Devore J L	Probability and Statistics for Engineering and the Sciences	9th Edition	Cengage Learning	2016
2	Sheldon M. Ross	Introduction to probability and statistics for engineers and scientists	5th Edition	Elsevier	2014
3	Chapra S.C and Canale R.p	Numerical Methods for Engineers	7thEdition	Tata McGraw-Hill,New Delhi	2017
4	B.S. Grewal	Higher Engineering Mathematics	36th Edition	Khanna Publishers	2010

Online study materials:

1. https://youtu.be/Kpb4YTRWgrA?si=fMEajnyeiAR1N0sk
2. https://youtu.be/o2LB3KQME3U?si=bL4P_inypXdyH0-5
3. https://youtu.be/WlQclObEAiA?si=VQBeBfAtx-SgadyD
4. https://youtu.be/yPNSIhE_FZM?si=3nLOuiiWm6jzEI_Z
5. https://youtu.be/6A44kxVrnIU?si=cCwIlgqYWhYWDhfQ

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1	**Discrete probability distributions**	**9**	CO1
1.1	Discrete random variables	1	
1.2	Expectation, mean and variance	2	
1.3	Discrete probability distributions Binomial distribution	3	
1.4	Poisson distribution	2	
1.5	Poisson approximation to the binomial distribution	1	
2	**Continuous probability distributions**	**9**	
2.1	Continuous random variables, Probability distribution	1	CO2
2.2	Expectation, mean and variance	2	
2.3	Standard distribution-Uniform distribution	2	
2.4	Exponential distribution	1	
2.5	Normal distribution	1	
2.6	Continuous bivariate distribution-Marginal distribution, Independence of random variables, Central limit theorem	2	
3	**Random process**	**9**	
3.1	Random process-Definition, Mean, autocorrelation	1	CO3
3.2	WSS process, Autocorrelation function and properties	3	
3.3	Power spectral density	3	
3.4	Poisson process	2	
4	**Numerical methods -I**	**9**	
4.1	Roots of equation Newton Raphson Method	2	CO4
4.2	Interpolation-Finite difference, Newton's forward and backward formula and Lagrange's method	3	
4.3	Numerical integration- Simpson’s 1/3rd rule	2	
4.4	Solution of linear system -Gauss siedal method	2	
5	**Numerical methods -II**	**9**	
5.1	Curve fitting by method of least squares- Fitting straight lines	2	CO5
5.2	Regression lines for bivariate data	2	
5.3	Solution of ordinary differential equations: Euler method	2	
5.4	2.Classical Runge-Kutta method of fourth order	3	
	Total	**45 Hours**	

COURSE DESIGNED BY	**VERIFIED BY**
Prof. K R Vijayakumaran Pillai Professor and Head, BS & H, JCET E Mail ID: krvijay@jawaharlalcolleges.com	Ms.Dayana K Asst. Professor, BS & H, JCET E Mail ID:dayanak@jawaharlalcolleges.com

24ECSAST402	SIGNALS AND SYSTEMS	Category	L	T	P	Credit
		PCC	3	1	0	4

Preamble

This course aims to lay the foundational aspects of signals and systems in both continuous time and discrete time, in preparation for more advanced subjects in digital signal processing, image processing, and communication theory and control systems.

Prerequisite

MAT101 Linear algebra and calculus
MAT102 Vector Calculus, Differential Equations and Transforms (Laplace Transform)

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Apply properties of signals and systems; and their classification	20
CO2	Represent signals with the help of series and transforms	20
CO3	Describe the analysis of the LTI system using Laplace transform and sampling theorem.	20
CO4	Apply the transfer function to compute the LTI response to input signals.	20
CO5	Solve differential and difference equations with initial conditions using Laplace and Z transforms.	20

*** Weightage depends on Bloom‟s Level, number of contact hours,

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3											2	2	
CO2	3	3	3										2	2	
CO3	3	3	3										2	2	
CO4	3	3											2	2	
CO5	3	3	3										2	2	
Avg	3	3	3										2	2	

1-Low; 2-Medium; 3- Strong

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	15	15	-	-	15
Understanding	35	35	-	-	35
Applying	50	50	100	100	50

Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution:

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Assessment Pattern:

Attendance : 6 Marks

Continuous Assessment Test (2 numbers) : 20 Marks

Assignment/ Quiz/ Course project : 14 Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks;** **Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1(CO1):

1. Check whether the following systems are stable, causal, linear, and time-invariant (a) $y[n] = x[2n]$ (b) $y(t) = x^2(t) + 3$ (c) $y[n] = nx[n]$

2. Plot (a) u(t-1) + u(1-t) (b) u(t-1) – u(t+1) (c) sinc(t/T) (d) r(t) – r(t-2) – 2u(t-2)

Course Outcome 2(CO2):

1. Compute the Fourier transform of (a) x(t) = 1, -T/2 < t < T/2, and 0 elsewhere (b) x(t) = 1 - (|t|/T), -T < t < T, and 0 elsewhere
2. Show that a square wave has only odd harmonics.
3. State and prove Perceval's theorem

Course Outcome 3 (CO3):

1. Show that δ(t-a) and δ(t-b), a ≠ b are orthogonal
2. Define convolution of x(t) and h(t)

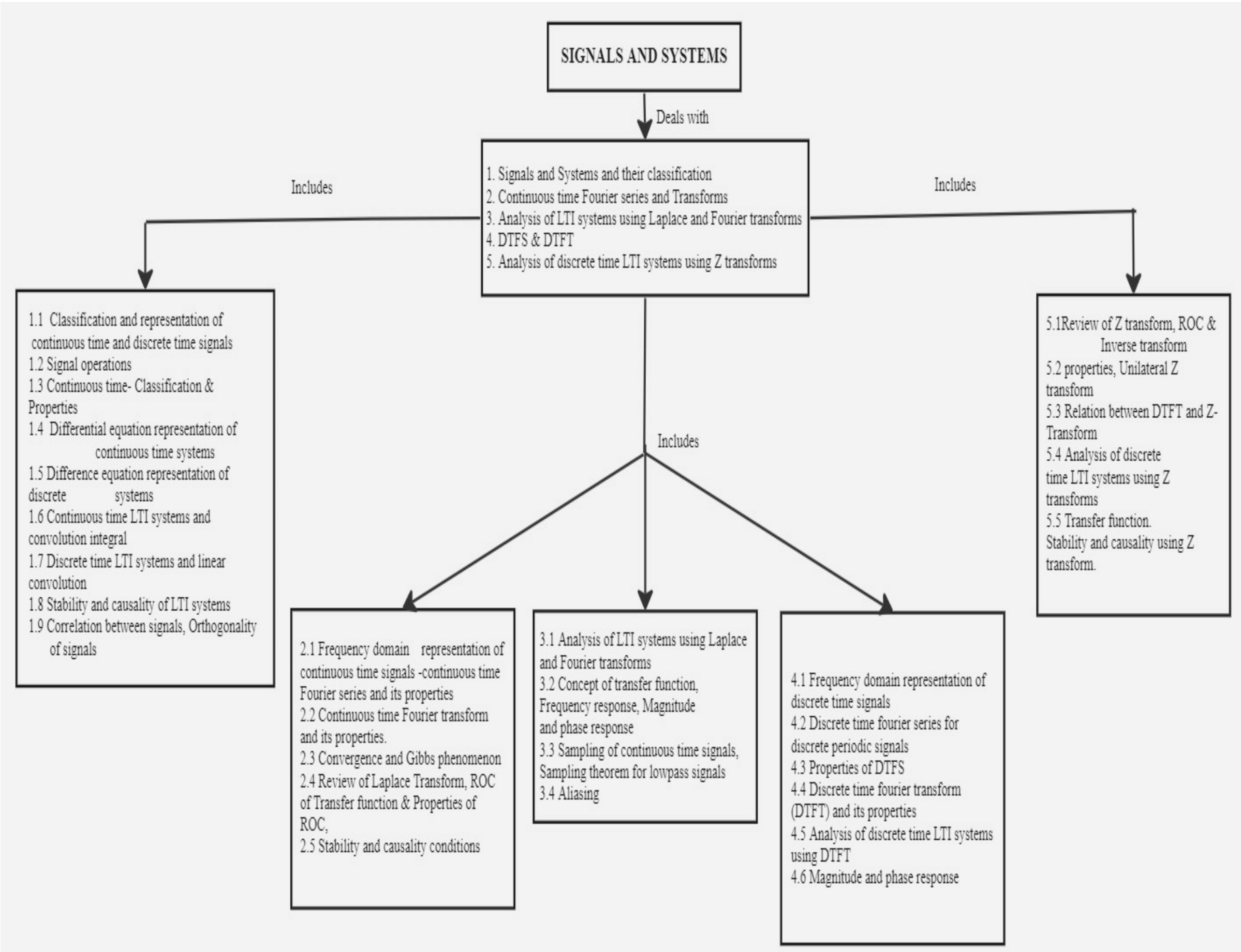
Course Outcome 4 (CO4):

1. Give the frequency response of a first-order low pass filter. What is the 3-dB cut offfrequency?
2. What is the significance of linear phase response?

Course Outcome 5(CO5):

Derive the interpolation formula for finite-energy band-limited signals from its samples.

Concept Map



Syllabus

Module 1:

Elementary Signals, Classification and representation of continuous time and discrete time signals, Signal operations Continuous time and discrete time systems – Classification, Properties. Representation of systems: Differential equation representation of continuous time systems. Difference equation representation of discrete systems, Continuous time LTI systems and convolution integral, Discrete time LTI systems and linear convolution. Stability and causality of LTI systems. Correlation between signals, Orthogonality of signals.

Module 2:

Frequency domain representation of continuous time signals - continuous time Fourier series and its properties. Continuous time Fourier transform and its properties. Convergence and Gibbs phenomenon, Review of Laplace Transform, ROC of Transfer function, Properties of ROC, Stability and causality conditions. Relation between Fourier and Laplace transforms.

Module 3:

Analysis of LTI systems using Laplace and Fourier transforms. Concept of transfer function, Frequency response, Magnitude and phase response. Sampling of continuous time signals, Sampling theorem for lowpass signals, aliasing..

Module 4:

Frequency domain representation of discrete time signals, Discrete time fourier series for discrete periodic signals. Properties of DTFS. Discrete time fourier transform (DTFT) and its properties. Analysis of discrete time LTI systems using DTFT. Magnitude and phase response.

Module 5:

Z transform, ROC , Inverse transform, properties, Unilateral Z transform. Relation between DTFT and Z-Transform, Analysis of discrete time LTI systems using Z transforms, Transfer function. Stability and causality using Z transform.

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Anand Kumar	Signals and Systems	3	PHI	2013
2	Ziemer,Rodger.E, Tranter William.H, and Fannin,D.Ronald	Signals and Systems	4	Pearson	2013

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Roberts, Michael	Fundamentals of Signals And Systems	1	McGraw Hill	2007
2	Nagoor Kani A	Signals and Systems	2	McGraw Hill	2010

Online study materials:

1. https://archive.nptel.ac.in/courses/108/104/108104100/
2. https://www.youtube.com/watch?v=WDyhAe5vwZ8

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**Module 1**		CO1
1.1	Elementary Signals, Classification and representation of continuous time and discrete time signals, Signal operations	4	
1.2	Continuous time and discrete time systems – Classification, Properties.	3	
1.3	Representation of systems: Differential equation representation of continuous time systems. Difference equation representation of discrete systems,	2	
1.4	Continuous time LTI systems and convolution integral,	2	
1.5	Discrete time LTI systems and linear convolution.		
1.6	Stability and causality of LTI systems	2	
1.7	.Correlation between signals, Orthogonality of signals.	2	
2	**Module 2**		CO2
2.1	Frequency domain representation of continuous time signals - continuous time Fourier series and its properties.	4	
2.2	Continuous time Fourier transform and its properties. Convergence and Gibbs phenomenon	4	
2.3	Review of Laplace Transform, ROC of Transfer function, Properties of ROC,	3	
2.4	Stability and causality conditions.	2	
2.5	Relation between Fourier and Laplace transforms.	2	
3	**Module 3**		CO3
3.1	Analysis of LTI systems using Laplace and Fourier transforms.	4	
3.2	Concept of transfer function,	2	
3.3	Frequency response, Magnitude and phase response.	2	
3.4	Sampling of continuous time signals,	4	
3.5	Sampling theorem for lowpass signals, aliasing.	3	

4	**Module 4**		CO4
4.1	Frequency domain representation of discrete time signals	3	
4.2	Discrete time fourier series for discrete periodic signals. Properties of DTFS.	3	
4.3	Discrete time fourier transform (DTFT) and its properties.	4	
4.4	Analysis of discrete time LTI systems using DTFT	3	
4.5	Magnitude and phase response.	2	
5	**Module 5**		CO5
5.1	Z transform, ROC	3	
5.2	Inverse transform, properties, Unilateral Z transform.	3	
5.3	Relation between DTFT and Z-Transform	2	
5.4	Analysis of discrete time LTI systems using Z transforms, Transfer function	4	
5.5	Stability and causality using Z transform	3	
	TOTAL	**60 hours**	

COURSE DESIGNED BY	**VERIFIED BY**
Ms. Sayana M Asst. Professor, ECE Dept, JCET E. Mail ID: sayanam@jawaharlalcolleges.com	Dr Sandeep C S Asso. Professor/HoD IC, ECE Dept, JCET E. Mail ID:sandeepcs4080.ece@jawaharlalcolleges.com

24ECPCET403	PRINCIPLES OF COMMUNICATION ENGINEERING	Category	L	T	P	Credit
		PCC	3	0	0	3

Preamble

Introduction to Communication Theory encompasses the mathematical ground work of analog and digital communication systems. The viewpoints represent a useful approach to analog communication and digital communication with continuous wave and pulse modulation techniques. It is required to analyse the performance of various modulation techniques. The course will introduce the participants to the signal representation in both time and frequency domain, basic analog communication techniques like modulation theory, system design for analog modulator and De-modulator, random process and noise analysis. This course covers the fundamental principles underlying the analysis, design, and optimization of analog and digital communication systems.

Prerequisite

Engineering Mathematics,

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Understand the basics of analog communication systems and to the understand generation, detection of various analog modulation techniques and also perform the mathematical analysis associated with these techniques.	20
CO2	To develop ability to analyze system requirements of analog communication systems	20
CO3	To understand the basics of Digital communication system and the study various modulation techniques,	20
CO4	To construct a mathematical model of digital communication system for bit error rate analysis of different digital modulation systems	20
CO5	To understand the concept of information and to design the encoding and decoding circuits.	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO12	PSO1	PSO2	PSO3
CO1	3											2			
CO2	3	3			3							2			
CO3	3	3	3									2			
CO4	3	3	3		3							2			
CO5	3	3	3		3							2			
Avg	**3**	**3**	**3**		**3**							**2**			

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	30	30	20	40	20
Understanding	30	30	40	20	30
Applying	40	40	40	40	50
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	

Origination	

Mark Distribution:

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Assessment Pattern:

Attendance : 6 Marks

Continuous Assessment Test (2 numbers) : 20 Marks

Assignment/ Quiz/ Course project : 14 Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks;** **Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1(CO1):

1. List the need for modulation.

2. With neat diagram explain the generation and detection of AM wave.

3.Explain the working of super hetrodyne receivers with neat block diagram

Course Outcome 2(CO2):

1.Analyse the effects of various noise in analog communication systems.

2 .Derive the expression of noise figure of communication systems.

3.Explain the various analog pulse modulation techniques.

Course Outcome 3 (CO3):

1.State and explain source coding theorem I and theorem II.

2.Derieve Wiener Hopf equation.

3.Compare the features of DM and DPCM.

Course Outcome 4 (CO4):

1. Differentiate coherent and non coherent modulation techniques.

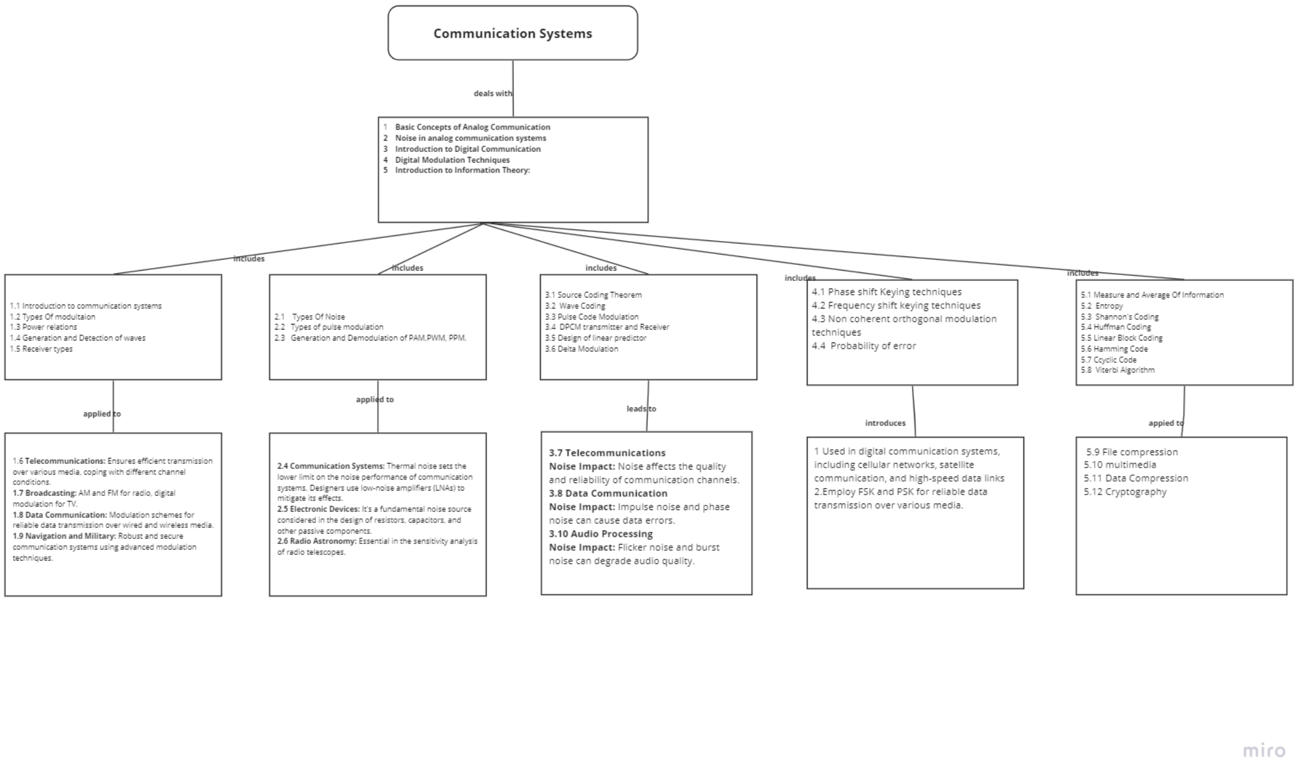
2. Draw the constellation diagram of QPSK systems .

3. Derive the probability of error of BPSK systems.

Course Outcome 5(CO5):

1. Encode the binary symbols using Huffmann coding.
2. Draw a (2, 1, 3) encoder, if the generator sequences are (1 0 0 0) and (1 1 0 1) respectively. Also find the code vector for the input u = 1101 using transform domain approach.
3. Explain Viterbi decoding and decode the sequence 11011000011100.

Concept Map



Syllabus

Module I

Basic Concepts of Analog Communication

Introduction to communication system, Need for modulation, Amplitude modulation, Frequency Modulation, Angle Modulation, Spectrum Analysis of Modulated Waves, Power relations in AM wave ,Narrow band FM, Wide band FM, , DSB-SC modulation, Detection of AM and FM waves, Pre-emphasis and De-emphasis.

Generation and detection of AM and FM waves, DSB-FC,DSB-SC waves, SSB-SC, Receiver types- Tuned Radio Frequency receivers, Super heterodyne receiver

Module II

Noise in analog communication systems

Types of noise: Resistive noise, shot noise, white noise, narrow band noise in phase and Quadrature phase components and its properties. modeling of noise sources, Average noise bandwidth, effective noise temperature, average noise figure, average noise figure of cascaded networks.

Types of pulse modulation -PAM, PWM, PPM, Generation and Demodulation of PAM,PWM, PPM.

Module III

Introduction to Digital Communication

Block diagram of digital communication systems, Source coding theorems I and II (Statements only). Waveform coding. Sampling and Quantization. Pulse code modulation, Transmitter and receiver. Companding. Practical 15 level A and mu-law companders. DPCM transmitter and receiver.

Design of linear predictor. Wiener-Hopf equation. Delta modulation. Slope overload. Design of band limited signals for zero lSI-The Nyquist Criterion (statement only)

Module IV

Digital Modulation Techniques:

Phase shift Keying techniques using coherent detection: generation, detection and error probabilities of BPSK and QPSK, M–ary PSK, M–ary QAM. Frequency shift keying techniques using Coherent detection: BFSK generation, detection and error probability. Non coherent orthogonal modulation techniques: BFSK, DPSK Symbol representation, Block diagrams treatment of Transmitter and Receiver, Probability of error (with derivation of probability of error equation)

Module V

Introduction to Information Theory:

Measure of information, Average information content of symbols in long independent sequences,Entropy, Encoding of the Source Output, Shannon's Encoding Algorithm, Shannon-Fano Encoding Algorithm, Huffman coding.

Linear Block Codes: Matrix description of Linear Block Codes, Error Detection & Correction capabilities of Linear Block Codes, Single error correction Hamming code, Cyclic codes-Encoding and decoding, Convolution Encoder, Time domain approach, Transform domain approach, Code Tree, Trellis and State Diagram , Viterbi Algorithm.

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Simon Haykin	Digital Communication Systems	First Edition	John Wiley & sons	2014
2	K Sam Shanmugam	Digital and analog		John Wiley India Pvt. Ltd	

		communication systems			
3	H. Taub, D L Schilling, Gautam Saha,	Principles of Communication	4th Edition,	McGraw-Hill Publishing Company	2012

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	B.P.Lathi	“Modern Digital and Analog Communication Systems	3rd Edition	Oxford University Press	2007
2	B.Sklar	Digital Communications Fundamentals and Applications	2nd Edition	Pearson Education.	2007
3	J.G.Proakis, M.Salehi	“Fundamentals of Communication Systems”		Pearson Education	2014

On line study materials:

1. https://onlinecourses.nptel.ac.in/noc21_ee74/preview
2. https://www.udemy.com/course/analog-communication-e/?couponCode=LEADERSALE24A

(Use of Standard and approved Steam Table, Mollier Chart is permitted)

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**Basic Concepts of Analog Communication**		CO1
1.1	Introduction to communication system, Need for modulation, Amplitude modulation, Power relations in AM wave.	2	
1.2	Frequency Modulation, Angle Modulation, Spectrum Analysis of Modulated Waves, Narrow band FM, Wide band FM,	2	
1.3	DSB-SC modulation, Detection of AM and FM waves, Pre-emphasis and De-emphasis.	2	
1.4	Generation and detection of AM and FM waves, DSB-FC,DSB-SC waves, SSB-SC, Receiver types- Tuned Radio Frequency receivers, Super heterodyne receiver.	3	
2	**Noise in analog communication systems**		CO2
2.1	Types of noise: Resistive noise, shot noise, white noise,.	2	
2.2	narrow band noise in phase and Quadrature phase components and its properties	2	
2.3	modeling of noise sources, Average noise bandwidth, effective noise temperature, average noise figure, average noise figure of cascaded networks.	2	
2.4	Types of pulse modulation -PAM, PWM, PPM	2	
2.5	Generation and Demodulation of PAM,PWM, PPM.	1	
3.	**Introduction to Digital Communication**		CO3
3.1	Block diagram of digital communication systems, Source coding theorems I and II (Statements only)	1	
3.2	Sampling and Quantization. Pulse code modulation, Transmitter and receiver.	2	
3.3	Companding. Practical 15 level A and mu-law companders	2	
3.4	DPCM transmitter and receiver., Delta modulation. Slope overload	2	
3.5	Design of linear predictor. Wiener-Hopf equation, design of band limited signals for zero lSI-The Nyquist Criterion	2	

	(statement only)		
4.	**Digital Modulation Techniques**		CO4
4.1	Phase shift Keying techniques using coherent detection: generation, detection and error probabilities of BPSK and QPSK, M–ary PSK, M–ary QAM	2	
4.2	Frequency shift keying techniques using Coherent detection: BFSK generation, detection and error probability	2	
4.3	Non coherent orthogonal modulation techniques: BFSK, DPSK Symbol representation, Block diagrams treatment of Transmitter and Receiver.	3	
4.4	Probability of error (with derivation of probability of error equation)	2	
5.	**Introduction to Information Theory**		CO5
5.1	Measure of information, Average information content of symbols in long independent sequences-entropy	2	
5.2	Encoding of the Source Output, Shannon's Encoding Algorithm, Shannon-Fano Encoding Algorithm, Huffman coding	2	
5.3	**Linear Block Codes:** Matrix description of Linear Block Codes, Error Detection & Correction capabilities of Linear Block Codes, Single error correction Hamming code	2	
5.4	Cyclic codes-Encoding and decoding	1	
5.5	Convolution Encoder, Time domain approach, Transform domain approach, Code Tree, Trellis and State Diagram , Viterbi Algorithm	2	
	TOTAL	**45**	

COURSE DESIGNED BY	**VERIFIED BY**
Ms.Ajeena A Asst. Professor, ECE Dept, JCET E. Mail ID: ajeena4093.ece@jawaharlalcolleges.com	Ms.Vijitha G Asst. Professor, ECE Dept, JCET E. Mail ID: vijithag@jawaharlalcolleges.com

24ECMEST405	MICROCONTROLLER AND EMBEDDED SYSTEMS	Category	L	T	P	Credit
		PCC-PBL	3	0	0	3

Preamble

The Purpose of this course is to provide students with the knowledge of PIC Microcontroller & ARM. The study of microprocessor architecture is to focus on the structure and behavior of the computer. The course on microprocessor includes elements such as instruction sets, formats, operation codes, data types, the number and types of registers, addressing modes, main memory access methods, and various I/O mechanisms of microprocessor. Microcontrollers based embedded systems are involved in almost every facet of modern life. Consumer gadgets, entertainments gadgets, medical devices and automobiles all contain embedded Microcontroller. The tremendous number of applications for embedded computing has given rise to high demand for engineers with experience in designing and implementing embedded systems with microcontroller. This course is designed to provide an introduction to microcontroller architecture, internal and external peripherals and assembly language programming. The tremendous number of applications for embedded computing has given rise to high demand for engineers with experience in designing and implementing embedded systems with microcontroller.

Prerequisite

Introduction to Analog and Digital Electronics

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Understand the basics of microprocessors and microcontrollers their architectures and its functionalities..	20
CO2	Understand the architecture of microprocessor and to understand the importance of peripheral devices for data communication and transfer.	20
CO3	To analyse 8051 microcontroller and to write assembly language programs using 8051 microcontrollers.	20
CO4	Acquire the knowledge of functional blocks of ARM and to understand the pipelining concept and the coprocessor interface of ARM.	20
CO5	To design small circuits using Aurdino and Rasperry Pi and to program the IDE boards.	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO2	PSO 3
CO1	3											2			
CO2	3	3										2			
CO3	3	3	3		3							2			
CO4	3	3	3		3							2			
CO5	3	3	3									2			
Avg	**3**	**3**	**3**		**3**							**2**			

1-Low; 2-Medium; 3- Strong;;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	30	30	-	-	20
Understanding	30	30	-	-	30
Applying	40	40	100	100	50
Analyzing	-	-	-	-	-
Evaluating	-	-	-	-	-
Creating	-	-	-	-	-

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Continuous Internal Assessment Pattern:

Attendance : 9 marks
Continuous Assessment Test (2 numbers) : 24 marks
Project : 27 marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks;** **Duration =90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 40 Marks;** **Duration =150 Minutes** Part A: 10 X 4 = 40 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1(CO1):

1. Compare the features of microprocessors and microcontrollers

2. With neat diagram explain the architecture of 8085.

3.Discuss why interfacing is used in microprocessor systems,

Course Outcome 2(CO2):

1. Draw the timing diagram of minimum mode operation of 8086.

2.Write a program to find the largest number of an array.

Course Outcome 3 (CO3):

1.Explain the architecture of 8051 microcontroller.

2.Write a 8051 program to sort an array in ascending order.

3.Interface 8051 program with seven segment display,

Course Outcome 4 (CO4):

1. Explain the registers of ARM processor.

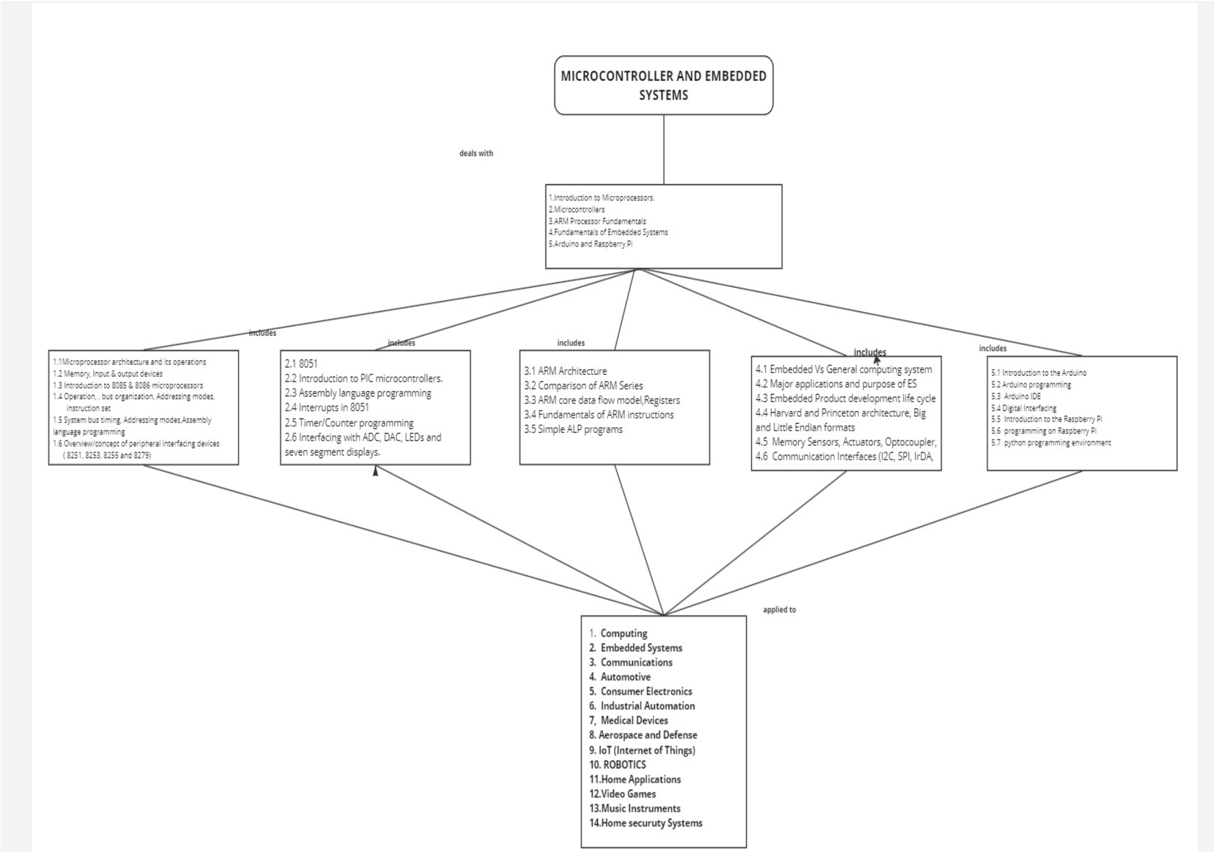
2. Write an ARM program to find the factorial of a number.

3. Explain the classification of ARM instruction set.

Course Outcome 5(CO5):

1. Compare the features of various IDEs.
2. Design a circuit using Raspberry Pi to measure the temperature of a furnace and display it on monitor.

Concept Map



Syllabus

Module I

Introduction to Microprocessors - Microprocessor architecture and its operations, basic components of a microprocessor, Memory, Input & output devices, Introduction to 8085 microprocessor, operation,bus organization, Addressing modes, Introduction to 8086 – Microprocessor architecture – 8086 signals — Basic configurations — System bus timing, Addressing modes, Assembly language programming.

Overview/concept of peripheral interfacing devices-8251, 8253, 8255 and 8279(Block diagram and working only)

Module II

Microcontrollers:

8051-architecture, operation, pin configuration and functions, memory organization, register, I/O ports, addressing modes, instruction sets, instruction classification. Introduction to PIC microcontrollers.

Assembly language programming, Interrupts in 8051. Timer/Counter programming for time delay generation and waveform generation. Interfacing with ADC, DAC, LEDs and seven segment displays.

Module III

ARM Processor Fundamentals:

Introduction to ARM, ARM Architecture, Register Set and Modes, ARM Processor Core, Data Path and Instruction Decoding, Comparison of ARM Series (ARM 10, ARM 11, Cortex), ARM core data flow model, Registers, CPSR-Processor modes, Banked registers. Pipeline-Characteristics.

Fundamentals of ARM instructions, Barrel shifter, Classification and explanation of instructions with examples-Data processing, Branch, Load-store, SWI and Program Status Register instruction. Simple ALP programs on Arithmetic & logical operations, Factorial, string operation, sorting, searching, and Scan.

Module IV

Fundamentals of Embedded Systems

Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. Elements of an Embedded System (Block diagram and explanation), Embedded Product development life cycle, Harvard and Princeton architecture, Big and Little Endian formats, Memory (ROM and RAM types), Sensors, Actuators, Optocoupler, Communication Interfaces (I^2C, SPI, IrDA, Bluetooth, Wi-Fi, Zigbee only)

Module V

Arduino and Raspberry Pi: Introduction to the Arduino, creating an Arduino programming Environment, Arduino IDE, creating an Arduino program, Arduino Libraries, Analog and Digital Interfacing,. Introduction to the Raspberry Pi, basic functionality of the Raspberry Pi board and its processor, setting and configuring the board, programming on Raspberry Pi, python programming environment, python expressions, general purpose IO pins, Protocol pins, RPi, GPIO library, communicating with devices and sensors.

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Ramesh S. Goankar,	“8085 Microprocessors Architecture Application and Programming”,	5th Edition	Penram International,	
2	A K RAY, K M BHURCHANDI	Advanced Microprocessors And Peripherals	2nd Edition	mcgraw hill education	2018
3	Kenneth J. Ayala,	The 8051 Microcontroller	3rd Edition	Cangage learning	
4	Andrew N. SLOSS	ARM System Developer’s guide		ELSEVIER Publications	2016
5	John Baichtal	“Arduino for beginners: Essential Skills Every Maker Needs	1st Edition	Person Education	
6	Eben Upton and Gareth Halfacree	“Raspberry Pi User Guide”,	4th Edition	John Wiley & Sons	August 2016
7	Rajkamal (TMH)	**Embedded Systems-** Architecture,	3rd Edition	TMH	July 2017

		Programming and Design			

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Douglas Hall and S S S P Rao	"Microprocessors and Its Interfacing"	2nd Edition	Mcgraw Hill Higher Education	2005
2	Barry B Brey	"The Intel Microprocessors: 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium pro Processor"	8th Edition	Pearson Education India	2008
3	Michael Margolis, O'Reilly Media,	Arduino Cookbook	1st Edition		
4	Frank Vahid	Embedded Systems		Wiley India	2022

On line study materials:

1. https://onlinecourses.nptel.ac.in/noc22_ee12/preview
2. https://onlinecourses.nptel.ac.in/noc24_cs24
3. https://nptel.ac.in/courses/108105102

(Use of Standard and approved Steam Table, Mollier Chart is permitted)

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**Basic Concepts**		
1.1	Microprocessor architecture and its operations, basic	2	

	components of a microprocessor, Memory, Input & output devices,		CO1
1.2	Introduction to 8085 microprocessor, Architecture. operation,and bus organization	2	
1.3	Addressing modes, instruction set	2	
1.4	Overview/concept of peripheral interfacing devices-8251, 8253, 8255 and 8279,	3	
2	**Introduction to 8086**		CO2
2.1	Microprocessor architecture – 8086 signals — Basic configurations — System bus timing,	2	
2.2	Instruction set and assembler directives	2	
2.3	Assembly language programming –Interrupts and interrupt service routines	2	
2.4	Memory interfacing with 8086, address decoding, Introduction to basic I/O interface, I/O port address decoding.	2	
2.5	Introduction to 8088, 80286, 80386 and Pentium Processors-Features and applications.	1	
3.	**Microcontrollers:**		CO3
3.1	8051-architecture, operation, pin configuration and functions, memory organization, register, I/O ports,	1	
3.2	addressing modes, instruction sets, instruction classification.	2	
3.3	Introduction to PIC microcontrollers, PIC18 and its features	2	
3.4	Assembly language programming, Interrupts in 8051. Timer/Counter programming for time delay generation and waveform generation.	2	
3.5	Interfacing with ADC, DAC, LEDs and seven segment displays.	2	
4.	**ARM Processor Fundamentals**		

4.1	Introduction to ARM, ARM Architecture, Register Set and Modes, ARM Processor Core, Data Path and Instruction Decoding, Comparison of ARM Series (ARM 10, ARM 11, Cortex)	2	CO4
4.2	ARM core data flow model, Registers, CPSR-Processor modes, Banked registers. Pipeline- Characteristics	2	
4.3	Fundamentals of ARM instructions, Barrel shifter, Classification and explanation of instructions with examples-Data processing, Branch, Load-store, SWI and Program Status Register instruction.	3	
4.4	Simple ALP programs on Arithmetic & logical operations, Factorial, string operation, sorting, searching, and Scan.	2	
5.	**Arduino and Raspberry Pi**		CO5
5.1	Introduction to the Arduino, creating an Arduino programming Environment, Arduino IDE,	2	
5.2	creating an Arduino program, Arduino Libraries, Analog and Digital Interfacing	2	
5.3	Python programming environment, python expressions,.	2	
5.4	General purpose IO pins, Protocol pins, RPi,	1	
5.5	GPIO library, communicating with devices and sensors	2	
	TOTAL	45	

COURSE DESIGNED BY	**VERIFIED BY**
Ms.Vijitha G Assistant Professor, ECE, JCET Email: vijithag@jawaharlalcolleges.com	Ms.Jisha K V Assistant Professor, ECE, JCET Email: jishakv.ece@gmail.com

24ECDSDT404	DIGITAL SYSTEM DESIGN	Category	L	T	P	Credit
		PCC	3	0	0	3

Preamble

Digital system design course focuses on design digital system from scratch. The course focuses on designing combinational and sequential building blocks, using these building blocks to design bigger digital systems. During this course we also learn how to use VHDL to design/model a digital system.

Prerequisite

Nil

Course Outcomes

On the successful completion of the course students will be able to

COs	Course Outcome Statement	Weightage in %
CO1	Use VHDL for digital system design	20
CO2	Design and analyze combinational logic circuits through VHDL models.	20
CO3	Design and analyze sequential logic circuits through VHDL models	20
CO4	Analyze the Hazards in Sequential Circuits	20
CO5	Explain the memory devices and Digital Integrated circuits	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3				**3**						1			
CO2	3	3										1			
CO3	3	3										1			
CO4	3	3										1			
CO5	3	3										1			
Avg		**3**										**1**			

1-Low; 2-Medium; 3- Strong;;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	**2**	1	2	
Remembering	**20**	**20**	-	-	**20**
Understanding	30	30	-	-	30
Applying	50	50	100	100	50
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution:

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Assessment Pattern:

Attendance : 6 Marks

Continuous Assessment Test (2 numbers) : 20 Marks

Assignment/ Quiz/ Course project : 14 Marks

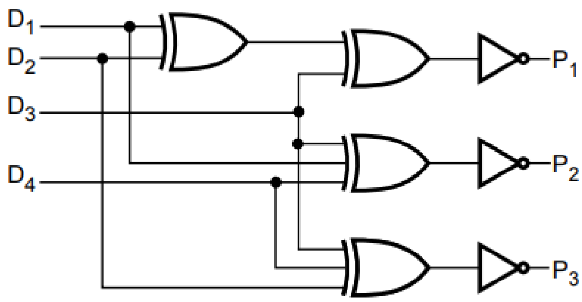
Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks;** **Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1(CO1):

1. Write a VHDL program for full adder using structural modelling.
2. Explain functions and subprograms with suitable examples
3. Write the VHDL code for the given state diagram, using behavioral modeling.



Course Outcome 2(CO2):

1. What you mean by Full adder. Implement full adder using Gates. Also implement Full adder using Two half adders & an OR Gate.
2. Implement the following Boolean functions using 8: 1 Multiplexer.
   (a). $F(A, B, C, D) = \sum m(0,1,2,4,6,9,12,14)$(b) $F(A, B, C, D) = \prod M(0,3,5,6,8,9,10,12,14)$

Course Outcome 3 (CO3):

1. Design a Synchronous BCD counter Using JK Flip Flops
2. Design a Synchronous BCD counter Using JK Flip Flops

Course Outcome 4 (CO4):

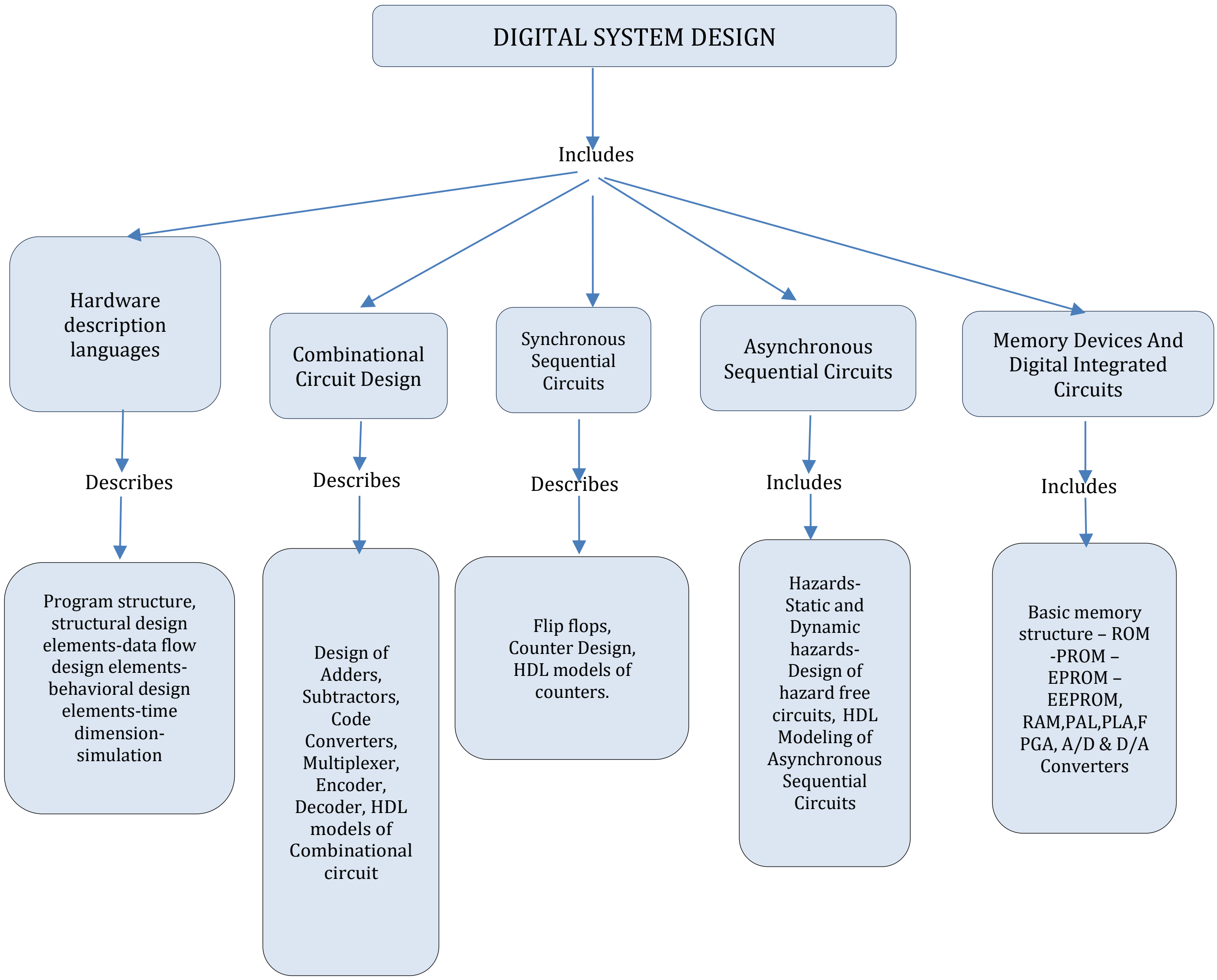
1. What is critical and non-critical races in asynchronous circuits? How to avoid races? Illustrate with one example

2. What is static 0 and 1 hazard?

Course Outcome 5(CO5):

1. Write the differences between PAL and PLA.
2. Compare Static RAM and Dynamic RAM

Concept Map


DIGITAL SYSTEM DESIGN
Includes
Hardware description languages
Combinational Circuit Design
Synchronous Sequential Circuits
Asynchronous Sequential Circuits
Memory Devices And Digital Integrated Circuits
Describes
Describes
Describes
Includes
Includes
Program structure, structural design elements-data flow design elements-behavioral design elements-time dimension-simulation
Design of Adders, Subtractors, Code Converters, Multiplexer, Encoder, Decoder, HDL models of Combinational circuit
Flip flops, Counter Design, HDL models of counters.
Hazards-Static and Dynamic hazards-Design of hazard free circuits, HDL Modeling of Asynchronous Sequential Circuits
Basic memory structure – ROM -PROM – EPROM – EEPROM, RAM,PAL,PLA,FPGA, A/D & D/A Converters

Syllabus

Module 1(INTRODUCTION TO HARDWARE DESCRIPTION LANGUAGE)

Hardware description languages-HDL based digital design-VHDL hardware description language- Program structure-Types, constants and arrays-Functions and procedures libraries and packages-structural design elements-data flow design elements- behavioral design elements-time dimension-simulation –test benches-VHDL features for sequential logic design

Module 2 (COMBINATIONAL CIRCUIT DESIGN)

Design of Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder – Carry look ahead Adder, BCD Adder, Code Converters, Multiplexer, Demultiplexer, Magnitude Comparator, Decoder, Encoder, Priority Encoder, Parity Generator and Checker, HDL models of Combinational circuit.

Design and Verification combinational circuit: Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder – Carry look ahead Adder, BCD Adder, conversion of Binary to BCD code, Binary to Excess-3, Excess-3 to Binary, Binary to Gray and Gray code to Binary

Module 3 (SYNCHRONOUS SEQUENTIAL CIRCUITS)

Flip flops – SR, JK, T, D, Master/Slave FF – operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design – Moore/Mealy models, state minimization, state assignment, circuit implementation – Design of Counters ,Ripple Counters, Ring Counters, Shift registers, Universal Shift Register, HDL models of counters.

Verification of Flipflops: SR, JK, T, D using digital ICs, Design and verification of synchronous sequential circuit: Counters- Ripple Counters, Ring Counters. Simulation of Synchronous Sequential circuit: Mod -10 Counter, up/down counter

Module 4 (ASYNCHRONOUS SEQUENTIAL CIRCUITS)

Introduction - Analysis procedure –Transition table – Flow table – Races – Design procedure – Reduction of state and flow table – Hazards- Static and Dynamic hazards- Design of hazard free circuits. Elementary ideas of Clock skew, synchronizer failure and metastability. HDL Modeling of Asynchronous Sequential Circuits

Module 5 (MEMORY DEVICES AND DIGITAL INTEGRATED CIRCUITS)

Introduction - Basic memory structure – ROM -PROM – EPROM – EEPROM, RAM – Static and dynamic RAM – Programmable Logic Devices – Programmable Logic Array (PLA) – Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) – Implementation of combinational logic circuits using PLA, PAL

A/D and D/A Converters: Digital to analog converters: weighted resistor/converter,R-2R Ladder D/A converter, specifications for D/A converters, Analog to digital converters: Parrel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, specifications of A/D converters.

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	J. Bhasker	A VHDL Primer	III	Pearson Education	2015
2	John F Wakerly	Digital Design Principles and Practices	IV	Pearson Education	2008

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
3	Thomas L.Floyd	Digital Fundamentals	XI	Pearson Education Inc	2017
4	Soumitra Kumar Mandal	Digital Electronics	II	Mc Graw Hill Education Private	2018

On line study materials:

1. https://nptel.ac.in/courses/117105080
2. https://nptel.ac.in/courses/106102181

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**Hardware description languages**		CO1
1.1	Program structure-Types, constants and arrays	1	
1.2	-Functions and procedures libraries and packages	2	
1.3.	Structural design elements-data flow design elements	2	
1.4	behavioral design elements-time dimension	2	
1.5	Test benches-VHDL features for sequential logic design	3	
2	**Combinational Circuit Design**		CO2
2.1	Design of Half and Full Adders, Half and Full Subtractors	2	
2.2	Binary Parallel Adder – Carry look ahead Adder, BCD Adder	2	
2.3	Code Converters	2	
2.4	Multiplexer, Demultiplexer, Magnitude Comparator,	2	
2.5	Decoder, Encoder, Priority Encoder, Parity Generator and Checker	2	
2.6	HDL models of Combinational circuit.	2	
3	**Synchronous Sequential Circuits**		CO3

3.1	Flip flops – SR, JK, T, D, Master/Slave FF – operation and excitation tables	3	
3.2	Triggering of FF, Analysis and design of clocked sequential circuits	3	
3.3	Moore/Mealy models, state minimization, state assignment	2	
3.4	Design of Counters , Ripple Counters, Ring Counters, Shift registers, Universal Shift Register,	2	
3.5	HDL models of counters.	1	
4.	**Asynchronous Sequential Circuits**		CO4
4.1	Introduction - Analysis procedure –Transition table – Flow table – Races	3	
4.2	Design procedure – Reduction of state and flow table	2	
4.3	Hazards- Static and Dynamic hazards- Design of hazard free circuits.	1	
4.4	Elementary ideas of Clock skew, synchronizer failure and metastability	1	
4.5	HDL Modeling of Asynchronous Sequential Circuits	1	
5	**Memory Devices And Digital Integrated Circuits**		CO5
5.1	Basic memory structure – ROM -PROM – EPROM – EEPROM, RAM, Static and dynamic RAM	2	
5.2	Programmable Logic Array (PLA) – Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA)	2	
5.3	Implementation of combinational logic circuits using PLA, PAL	1	
5.4	Digital to analog converters: weighted resistor/converter,R-2R Ladder D/A converter, specifications for D/A converters	2	
5.5	Analog to digital converters: Parrel comparator A/D converter, successive approximation A/D converter	2	
5.6	counting A/D converter, dual slope A/D converter, specifications of A/D converters.	2	
	TOTAL	52 hours	

COURSE DESIGNED BY	VERIFIED BY
Mr.Sanish V S Asst. Professor, ECE Dept, JCET E. Mail ID: sanishvs@jawaharlalcolleges.com	Ms.Vijitha G Asst. Professor, ECE Dept, JCET E. Mail ID: vijithag@jawaharlalcolleges.com

24ICIEFT406	INDUSTRIAL ECONOMICS AND FOREIGN TRADE	Category	L	T	P	Credit
		AEC	**2**	**0**	**0**	**2**

Preamble

To equip the students to take industrial decisions and to create awareness of economic environment.

Prerequisite

None.

Course Outcomes

After completion of the course, the student will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Explain the problem of scarcity of resources and consumer behavior, and to tell the impact of government policies on the general economic welfare.	20
CO2	Cite appropriate decisions regarding volume of output and to calculate the social cost of production	20
CO3	Define the functional requirement of a firm under various competitive conditions.	20
CO4	Examine the overall performance of the economy, and the regulation of economic fluctuations and its impact on various sections in the society.	20
CO5	Interpret the impact of changes in global economic policies on the business opportunities of a firm	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	3	-	-	-
CO2	2	2	-	-	2	2	2	-	-	-	3	-	-	-
CO3	2	2	1	-	-	-	-	-	-	-	3	-	-	-
CO4	2	2	1	-	-	1	-	-	-	-	3	-	-	-
CO5	2		-	-	-	-	-	2	-	-	3	-	-	-
AVG	**2**	**2**	**1**	**-**	**2**	**1.5**	**2**	**2**	**-**	**-**	**3**	**-**	**-**	**-**

3- Strong; 2-Medium; 1-Low

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remember	30	30	40	40	30
Understand	40	40	40	40	40
Apply	30	30	20	20	30
Analyse					
Evaluate					
Create					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Observation
Set	Goal setting
Guided Response	
Mechanism	Demonstrations, Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	100	-	-

Continuous Internal Assessment Pattern:

Attendance : 15 marks
Continuous Assessment Test (2 numbers) : 50 marks
Assignment (Case study) / Practical (Activity) : 35 marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks** **Duration =90 Minutes** Part A: 5X 6 = 30 Marks Part B: 5 X 4 = 20 Marks

Sample Questions for Course Outcome Assessment

Course Outcome 1 (CO1):

1. Why does the problem of choice arise?
2. What are the central problems?
3. How do we solve the basic economic problems?
4. What is the relation between price and demand?
5. Explain deadweight loss due to the imposition of a tax.

Course Outcome 2 (CO2):

1. What is shutdown point?
2. What do you mean by producer equilibrium?
3. Explain break-even point;
4. Suppose a chemical factory is functioning in a residential area. What are the external costs?

Course Outcome 3 (CO3):

1. Explain the equilibrium of a firm under monopolistic competition.
2. Why is a monopolist called price maker?
3. What are the methods of non-price competition under oligopoly?
4. What is collusive oligopoly?

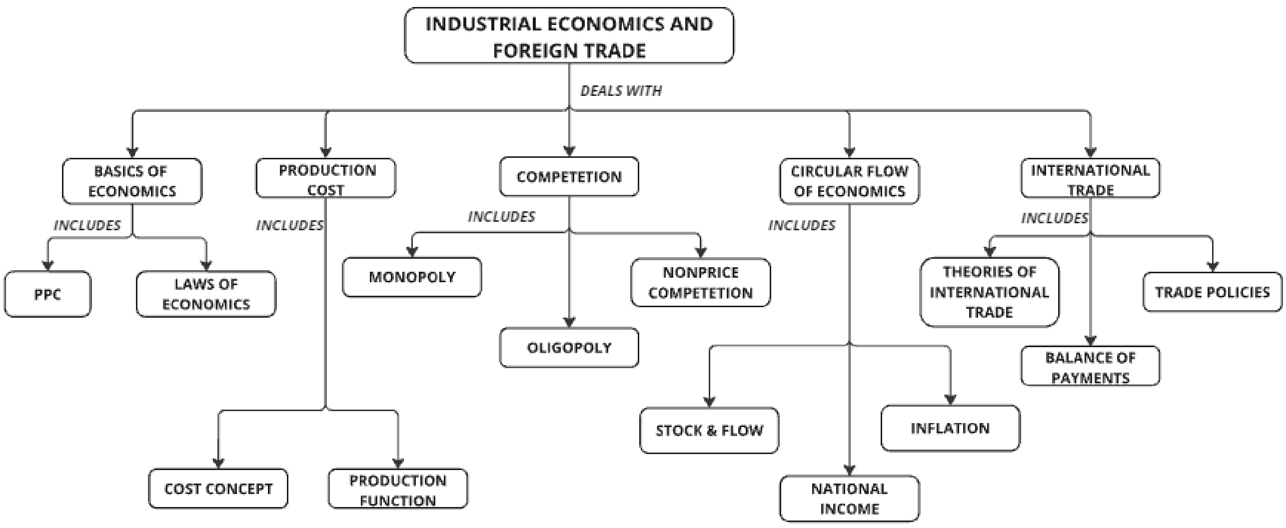
Course Outcome 4 (CO4):

1. What is the significance of national income estimation?
2. How is GDP estimated?
3. What are the measures to control inflation?
4. How does inflation affect fixed income group and wage earners?

Course Outcome 5 (CO5):

1. What is devaluation?
2. Suppose a foreign country imposes a tariff on Indian goods. How does it affect India's exports?
3. What is free trade?
4. What are the arguments in favour of protection?

Concept Map



Syllabus

Module-1

Scarcity and choice - Basic economic problems- PPC – Utility – Law of diminishing marginal utility – Demand and its determinants – law of demand – elasticity of demand – measurement of elasticity and its applications – Supply, law of supply and determinants of supply – Equilibrium – Changes in demand and supply and its effects – Consumer surplus and producer surplus (Concepts) – Taxation and deadweight loss

Module-2

Production function – law of variable proportion – economies of scale – internal and external economies – Isoquants, isocost line and producer's equilibrium – Expansion path – Technical progress and its implications – Cobb-Douglas production function - Cost concepts – Social cost: private cost and external cost – Explicit and implicit cost – sunk cost - Short run cost curves - long run cost curves – Revenue (concepts) – Shutdown point – Break-even point.

Module-3

Perfect and imperfect competition – monopoly, regulation of monopoly, monopolistic competition (features and equilibrium of a firm) – oligopoly – Kinked demand curve – Collusive oligopoly (meaning) – Non-price competition – Product pricing – Cost plus pricing – Target return pricing – Penetration pricing – Predatory pricing – Going rate pricing – Price skimming.

Module-4

Circular flow of economic activities – Stock and flow – Final goods and intermediate goods - Gross Domestic Product - National Income – Three sectors of an economy- Methods of measuring national income – Inflation- causes and effects – Measures to control inflation Monetary and fiscal policies – Business financing- Bonds and shares -Money market and Capital market – Stock market – Demat account and Trading account - SENSEX and NIFTY

Module-5

Advantages and disadvantages of international trade - Absolute and Comparative advantage theory - Heckscher - Ohlin theory - Balance of payments – Components – Balance of Payments deficit and devaluation – Trade policy – Free trade versus protection – Tariff and non-tariff barriers.

Text Books

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Gregory N Mankiw	Principles of Macro Economics	4th Edition	Cengage Publications	2010
2	Mithani D M	International Economics	1st Edition	Himalaya Publishing House	2005

References Books

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Mithani D M	Managerial Economics	7th Edition	Himalaya Publishing House	2015
2	D Salvatore	International Economics	4th Edition	McGraw-Hill	1996

On line study materials:

1. https://www.india.gov.in/topics/industries
2. https://www.nseindia.com/
3. https://commerce.gov.in/
4. https://msme.gov.in/

Course Contents and Lecture Schedule

Module	TOPIC	No. of hours	Course Outcomes
1.1	Scarcity and choice – Basic economic problems - PPC	1	CO1
1.2	Utility – Law of diminishing marginal utility – Demand – law of demand	1	
1.3	Measurement of elasticity and its applications	1	
1.4	Supply, law of supply and determinants of supply	1	
1.5	Equilibrium – changes in demand and supply and its effects	1	
1.6	Consumer surplus and producer surplus (Concepts) – Taxation and deadweight loss.	1	
2.1	Productions function – law of variable proportion	1	CO2
2.2	Economies of scale – internal and external economies – Producers equilibrium – Expansion path	1	
2.3	Technical progress and its implications – cob Douglas Production function	1	
2.4	Cost concepts – social cost: private cost and external cost – Explicit and implicit cost – sunk cost	1	
2.5	Short run cost curves & Long run cost curves	1	
2.6	Revenue (concepts) – shutdown point – Break-even point.	1	
3.1	Equilibrium of a firm, MC – MR approach and TC – TR approach	1	CO3
3.2	Perfect competition & Imperfect competition	1	
3.3	Monopoly – Regulation of monopoly – Monopolistic competition	1	
3.4	Oligopoly – kinked demand curve	1	
3.5	Collusive oligopoly (meaning) – Non price competition	1	
3.6	Cost plus pricing – Target return pricing – Penetration, Predatory pricing – Going rate pricing – price skimming	1	
4.1	Circular flow of economic activities – Stock and flow – Final goods and intermediate goods	1	CO4
4.2	Gross Domestic Product - National income – Three sectors of an economy – Methods of measuring national income	1	
4.3	Inflation – Demand pull and cost push – Causes and effects	1	
4.4	Measures to control inflation – Monetary and fiscal policies	1	
4.5	Business financing – Bonds and shares – Money market and capital market	1	
4.6	Stock market – Demat account and Trading account – SENSEX and NIFTY	1	
5.1	Advantages and disadvantages of international trade	1	CO5

5.2	Absolute and comparative advantage theory	1	
5.3	Heckscher – Ohlin theory	1	
5.4	Balance of payments - components	1	
5.5	Balance of payments deficit and devaluation	1	
5.6	Trade policy – Free trade versus protection – Tariff and non-tariff barriers.	1	
	Total	30 Hours	

COURSE DESIGNED BY	**VERIFIED BY**
Dr. Sujesh G HOD, Aero, JCET	Dr. Shine K HOD, Mech, JCET
Email: dr.sujeshg@gmail.com	Email: shinekunnath@gmail.com

24ECDIGP407	DIGITAL ELECTRONICS LAB	Category	L	T	P	Credit
		PCL	0	0	3	2

Preamble

To familiarize students with the Digital Logic Design through the implementation of Logic Circuits using ICs of basic logic gates and to familiarize students with the HDL based Digital Design Flow.

Prerequisite

Basics of Digital Electronics

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Design and demonstrate the functioning of various combinational and sequential circuits using ICs	20
CO2	Apply an industry compatible hardware description language to implement digital circuits	20
CO3	Implement digital circuits on FPGA boards and connect external hardware to the boards	20
CO4	Apply concept of universal logic gates for digital circuit designing	20
CO5	Function effectively as an individual and in a team to accomplish the given task	20

Mapping of Course Outcomes with Programme Outcomes

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	3	3						3			3			
CO2	3	1	1	3	3				3			3	1		
CO3	3	1	1	3	3				3	1		3			1
CO4	3	1	3	3	3				3			3			
CO5	3	3	3		3				3			3		1	
Avg	**3**	**1.8**	**2.2**	**3**	**3**				**3**	**1**		**3**	**1**	**1**	**1**

1-Low; 2-Medium; 3- Strong;

Mark Distribution:

Total Mark	CIE	ESE	ESE Duration
100	60	40	2.5 hours

Continuous Internal Evaluation Pattern

Attendance : 9 marks
Continuous Assessment Test (2 numbers) : 24 marks
Assignment/Quiz/Course project : 27 marks

End Semester Examination Pattern

a) Preliminary Work : 10 marks
b) Implementing the work/Conducting the experiment : 10 marks
c) Performance/Result/Inference (usage of equipment and troubleshooting): 10 marks
d) Viva voce : 5 marks
e) Record : 5 marks

Duration: 2.5 Hours

List of Experiments

Part A (Any 5)

The following experiments can be conducted on breadboard or trainer kits.

1. Realization of functions using basic and universal gates (SOP and POS forms).

2. Design and Realization of half /full adder and subtractor using basic gates and universal gates.

3. 4 bit adder/subtractor and BCD adder using 7483.

4. Study of Flip Flops: S-R, D, T, JK and Master Slave JK FF using NAND gates.

5. Asynchronous Counter:3 bit up/down counter

6. Asynchronous Counter:Realization of Mod N counter

7. Synchronous Counter: Realization of 4-bit up/down counter.

8. Synchronous Counter: Realization of Mod-N counters.

9. Ring counter and Johnson Counter. (using FF & 7495).

10. Realization of counters using IC's (7490, 7492, 7493).

11. Multiplexers and De-multiplexers using gates and ICs. (74150, 74154)

12. Realization of combinational circuits using MUX & DEMUX.

13. Random Sequence generator using LFSR.

PART B (Any 5)

The following experiments aim at training the students in digital circuit design with verilog and implementation in small FPGAs. Small, low cost FPGAs, that can be driven by open tools for simulation, synthesis and place and route, such as TinyFPGA or Lattice iCEstick can be used.

Open software tools such as yosis (for simulation and synthesis) and arachne (for place and route) may be used. The experiments will lay the foundation for digital design with FPGA with the objective of increased employability.

Experiment 1. Realization of Logic Gates and Familiarization of FPGAs

(a) Familiarization of a small FPGA board and its ports and interface.

(b) Create the .pcf files for your FPGA board.

(c) Familiarization of the basic syntax of verilog

(d) Development of verilog modules for basic gates, synthesis and implementation in the above FPGA to verify the truth tables.

(e) Verify the universality and non associativity of NAND and NOR gates by uploading the corresponding verilog files to the FPGA boards.

Experiment 2: Adders in Verilog

(a) Development of verilog modules for half adder in 3 modeling styles (dataflow/structural/ behavioral).

(b) Development of verilog modules for full adder in structural modeling using half adder.

Experiment 3: Mux and Demux in Verilog

(a) Development of verilog modules for a 4x1 MUX.

(b) Development of verilog modules for a 1x4 DEMUX.

Experiment 4: Flip Flops and counters

(a) Development of verilog modules for SR, JK and D flip flops.

(b) Development of verilog modules for a binary decade/Johnson/Ring counters

Experiment 5. Multiplexer and Logic Implementation in FPGA

(a) Make a gate level design of an 8 : 1 multiplexer, write to an FPGA and test its functionality.

(b) Use the above module to realize the logic function f (A, B, C) = Σm(0, 1, 3, 7) and test it.

(c) Use the same 8 : 1 multiplexer to realize the logic function f (A, B, C, D) = Σm(0, 1, 3, 7, 10, 12) by partitioning the truth table properly and test it.

Experiment 6. Flip-Flops and their Conversion in FPGA

(a) Make gate level designs of J-K, J-K master-slave, T and D flip-flops, implement and test them on the FPGA board.

(b) Implement and test the conversions such as T to D, D to T, J-K to T and J-K to D

Experiment 7: Asynchronous and Synchronous Counters in FPGA

(a) Make a design of a 4-bit up down ripple counter using T-flip-lops in the previous

experiment, implement and test them on the FPGA board.

(b) Make a design of a 4-bit up-down synchronous counter using T-flip-lops in the previous experiment, implement and test them on the FPGAboard.

Experiment 8: Universal Shift Register in FPGA

(a) Make a design of a 4-bit universal shift register using D-flip-flops in the previous

experiment, implement and test them on the FPGA board.

(b) Implement a ring and Johnson counters with it.

Experiment 9. BCD to Seven Segment Decoder in FPGA

(a) Make a gate level design of a seven segment decoder, write to FPGA and test its

functionality.

(b) Test it with switches and a seven segment display. Use output ports for connection to the display.

Learning Resources

TEXT BOOKS

Sl.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	M. Morris Mano, Michael D. Cilett	Digital Design: With an Introduction to the Verilog HDL	6th Edition	Pearson	2022
2	Stephen Brown, Zvonko Vranesic	Fundamentals of Digital Logic with Verilog Design	3rd Edition	McGraw-Hill Education	2022

Online study materials:

1. https://onlinecourses.nptel.ac.in/noc20_ee32
2. https://archive.nptel.ac.in/courses/108/105/108105132/

COURSE DESIGNED BY	VERIFIED BY
Mr. Jayesh T P Asst. Professor, ECE Dept, JCET E. Mail ID: jayesh4205.ece@jawaharlalcolleges.com	Dr. Sandeep C S Associate Professor & Head IC ECE Dept, JCET E. Mail ID: sandeepcs4080.ece@jawaharlalcolleges.com

24ECCOMP408	COMMUNICATION LAB	Category	L	T	P	Credit
		PCC	0	0	3	2

Preamble

The course “Communication Lab” is offered in the fourth semester concurrent with the course on “Communication Theory”. The purpose of this course is to give hands on training to the students in understanding the theory of communications and practicing sessions used in analog and digital communication systems. This will improve the understanding capability of the communication systems

Prerequisite

Nil

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Construct and test Analog modulation and demodulation circuits	20
CO2	Construct and test circuits for pulse amplitude and pulse position modulation circuits	20
CO3	Simulation of Analog modulation and Demodulation schemes	20
CO4	Simulation of performance analysis of Digital modulation schemes	20
CO5	Familiarization with Software Defined Radio (Hardware and Control Software)	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	-	-	-	-	-	-	1	2	3	2
CO2	3	3	3	2	3	-	-	-	-	-	-	1	2	3	2
CO3	3	3	3	2	3	-	-	-	-	-	-	1	2	3	2
CO4	3	3	3	2	3	-	-	-	-	-	-	1	2	3	2
CO5	3	3	3	2	3	-	-	-	-	-	-	1	0	3	3
AVG	**3**	**3**	**3**	**2**	**3**	-	-	-	-	-	-	**1**	**1.6**	**3**	**2.2**
1-Low; 2-Medium; 3- Strong															

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	
Set	Practical Sessions
Guided Response	Practical Sessions
Mechanism	Practical Sessions
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	60	40	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 9 Marks

Continuous Assessment : 27 Marks

Internal Test : 24 Marks

End Semester Examination Pattern:

The following guidelines should be adhered regarding the award of marks

a) Diagram & Design : 12 Marks
b) Procedure : 8 Marks
c) Output : 8 Marks
d) Viva : 8 Marks
e) Record : 4 Marks

List of Experiments/ Activities with CO Mapping

Module No.	Topic	Course Outcomes
1.	Generation of Amplitude Modulation and Demodulation	CO1
2.	Double Side Band Suppressed Carrier Modulation (DSBSC) and Demodulation	CO1
3.	Frequency Modulation and Demodulation	CO1
4.	Pulse Amplitude Modulation, Pulse Position Modulation	CO2

5.	Generation of ASK,FSK and PSK and QPSK	CO2
6.	Generation of PN Sequences and Direct sequence spread spectrum	CO2
7.	Simulation of Analog Modulation schemes in MATLAB	CO3
8.	Simulation of BER analysis of Digital Modulation schemes in AWGN using MATLAB	CO4
9	Familiarize with an SDR/ADALM hardware for reception and transmission of RF signal.	CO5
10	Familiarize available blocks in GNU Radio. Study how signals can be generated and spectrum (or power spectral density) of signals can be analyzed. Study how filtering can be performed	CO5

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Simon Haykin	Digital Communication Systems	First Edition	John Wiley & sons	2014
2	H. Taub, D L Schilling, Gautam Saha,	Principles of Communication	4th Edition,	McGraw-Hill Publishing Company	2012

On line study materials:

1. https://onlinecourses.nptel.ac.in/noc21_ee74/preview
2. https://www.udemy.com/course/analog-communication-e/?couponCode=LEADERSALE24A

COURSE DESIGNED BY	VERIFIED BY
Mr.Sanish V S Assistant professor ,ECE E mail: sanishvs@jawaharlalcolleges.com	Ms.Ajeena A Assistant professor ,ECE E mail: ajeena4093.ece@jawaharlalcolleges.com

24ECEATT501	ELECTROMAGNETICS & ANTENNA THEORY	Category	L	T	P	Credit
		PCC	3	1	0	4

Preamble

This course aims to impart knowledge on the basic concepts of electric and magnetic fields and its applications along with the basic parameters of antennae, the design and working of various broadband antennas, arrays, and their radiation patterns. Also gives a brief explanation of Microwave hybrid circuits and sources.

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Prerequisite

24ICMATT201 Vector Calculus, Ordinary Differential Equations and Transforms

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	To summarize the basic mathematical concepts related to electromagnetic vector fields	20
CO2	Analyze Maxwell's equation in different forms and apply them to diverse engineering problems.	20
CO3	Understand the basic concept of antennas and parameters.	20
CO4	Design and Analyze various antenna arrays	20
CO5	Explain the principle of operation of various microwave Hybrid Circuits and sources	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	2	3	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	2	3	3	-
CO3	3	3	3	2	2	-	-	-	-	-	-	2	3	3	-
CO4	3	3	3	2	2	-	-	-	-	-	-	2	3	3	-
CO5	3	3	3	2	2	-	-	-	-	-	-	2	3	3	-
Avg	**3**	**3**	**1.8**	1.2	**1.2**	-	-	-	-	-	-	**2**	**3**	**3**	-

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30
Applying	50	50	50	50	50
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) 20 Marks
Assignment/Quiz/Course project 14 Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1(CO1):

1. State and explain divergence theorem. Give a geometrical explanation.
2. Find the curl of the vector A =2rcosϕ aρ +r aϕ in cylindrical coordinates.
3. Show that curl grad F and div curl F are identically zero.

Course Outcome 2(CO2):

1. State and explain Maxwell's equations in the integral and differential forms
2. Derive the solution of uniform plane wave in lossy dielectric medium.

Course Outcome 3 (CO3):

1. Explain the terms
   i) Antenna temperature ii) Antenna efficiency iii) Beam efficiency
   iv) Radiation pattern v) Antenna Polarization.
2. State and Prove Reciprocity Theorem..
3. Design an RMPA for 5.2GHz wireless application. Assume h=1.6mm and use FR4 Substrate.

Course Outcome 4 (CO4):

1. Derive the relation for normalized electrical field in the case of 'n' isotropic array sources En= (AF) n
2. Differentiate between broadside array & end fire array
3. Calculate the direction of nulls for 8 element end-fire array having element spacing equal to 0.375λ

Course Outcome 5(CO5):

1. Explain S-parameters and its properties.
2. With a schematic describe the operation of a four port circulator. Obtain the simplified S matrix
   of a perfectly matched, lossless four-port circulator.
3. With the help of figures explain the bunching process of an 8-cavity cylindrical magnetron

Syllabus

Module 1

Introduction to Electromagnetic Theory. Review of vector calculus- curl, divergence gradient. Rectangular, cylindrical, and spherical coordinate systems. Expression of curl divergence and Laplacian in cartesian, cylindrical, and spherical coordinate systems. Electric field and magnetic field, Review of Coulomb's law, Gauss law, and Amperes current law. Poisson and Laplace equations.

Module 2

Derivation of capacitance and inductance of two-wire transmission line and coaxial cable.

Energy stored in Electric and Magnetic field. Magnetic vector potential. Relation between scalar potential and vector potential. Maxwell's equation from fundamental laws.

Propagation of plane EM wave in perfect dielectric, lossy medium, good conductor, media-attenuation, phase velocity, group velocity, skin depth

Module 3

Basic antenna parameters: gain, directivity, beam width and effective aperture calculations, effective height, wave polarization, radiation resistance, radiation efficiency, antenna field zones. duality and Principles of reciprocity.

Principle of Log periodic antenna array, Helical antenna, Design Microstrip Rectangular Patch antennas and feeding methods, Principles of Horn, Parabolic dish antenna (expression for E, H and Gain without derivation), Mobile phone antenna – Inverted F antenna

Module 4

Arrays of point sources, field of two isotropic point sources, the principle of pattern multiplication, linear arrays of 'n' isotropic point sources. Array factor, Grating lobes. Design of Broadside, End-fire and Dolph-Chebyshev arrays

Module 5

Microwaves: Introduction, advantages, Scattering parameters, Waveguide Tees- Magic tees, Hybrid rings. Formulation of S-matrix. Directional couplers: Two-hole directional couplers, S-matrix. Circulators and Isolators.

Single cavity klystron- Reflex Klystron Oscillator: Derivation of Power output, efficiency and admittance.

Magnetron oscillators: Cylindrical magnetron, π-Mode Operation, Hull-Cutoff magnetic field, and Hull-Cutoff Voltage derivation.

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Mathew N O Sadiku	Elements of Electromagnetics	6^{th} Edition	Oxford University Press	2014
2	K D Prasad	Antenna and Wave Propagation	1^{st} Edition	Satyaprakash Publications	2009

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Jordan and Balmain	Electromagnetic waves and Radiating Systems	**2nd**	**PHI**	**2013**
2	Umran S. Inan and Aziz S. Inan	Engineering Electromagnetics	2nd	Pearson	2010
3	Constantine A. Balanis	Antenna Theory and Applications	4th	Wiley	2021

Online study materials:
https://archive.nptel.ac.in/courses/108/101/108101092/

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**MODULE 1**	12	CO1
1.1	Review of vector calculus- curl, divergence gradient.	2	
1.2	Rectangular, cylindrical, and spherical coordinate systems	1	
1.3	Expression of curl divergence and Laplacian in cartesian, cylindrical, and spherical coordinate systems	3	
1.4	Electric field and magnetic field, Review of Coulomb's law, Gauss law, and Amperes current law	4	
1.5	Poisson and Laplace equations		
2	**MODULE 2**	12	CO2
2.1	Derivation of capacitance and inductance of two-wire transmission line and coaxial cable.	2	
2.2	Energy stored in Electric and Magnetic field. Magnetic vector potential	2	
2.3	Relation between scalar potential and vector potential.	1	
2.4	Maxwell's equation from fundamental laws	2	
2.5	Propagation of plane EM wave in perfect dielectric, lossy medium, good conductor,	3	
2.6	Media-attenuation, phase velocity, group velocity, skin depth	2	
3.	**MODULE 3**	12	CO3
3.1	Basic antenna parameters: gain, directivity, beam width and effective aperture calculations, effective height, wave polarization	3	

3.2	Radiation resistance, radiation efficiency, antenna field zones. duality and Principles of reciprocity.	2	
3.3	Principle of Log periodic antenna array, Helical antenna	2	
3.4	Microstrip Rectangular Patch antennas and feeding methods	2	
3.5	Principles of Horn, Parabolic dish antenna (expression for E, H and Gain without derivation), Mobile phone antenna – Inverted F antenna	3	
4.	**MODULE 4**	12	CO4
4.1	Arrays of point sources, field of two isotropic point sources	3	
4.2	The principle of pattern multiplication	1	
4.3	linear arrays of ‘n’ isotropic point sources. Array factor	3	
4.4	Grating lobes. Design of Broadside, End-fire arrays	3	
4.5	Design of Dolph-Chebyshev arrays	2	
5.	**MODULE 5**	12	CO5
5.1	Microwaves: Introduction, advantages, Scattering parameters	3	
5.2	Waveguide Tees- Magic tees, Hybrid rings. Formulation of S-matrix	3	
5.3	Directional couplers: Two-hole directional couplers, S-matrix. Circulators and Isolators.	2	
5.4	Single cavity klystron- Reflex Klystron Oscillator: Derivation of Power output, efficiency and admittance.	2	
5.5	Magnetron oscillators: Cylindrical magnetron, π-Mode Operation, Hull-Cutoff magnetic field, and Hull-Cutoff Voltage derivation.	2	
	TOTAL	**60 Hours**	

Course Designers:

COURSE DESIGNED BY	VERIFIED BY
Mr.Sanish V S Asst. Professor, ECE, JCET E Mail ID: sanishvs@jawaharlalcolleges.com	Mr.Srikanth K Asst. Professor, ECE, JCET E Mail ID:srikanth4019.ece@jawaharlalcolleges.com

24ECVDET502	VLSI DESIGN	Category	L	T	P	Credit
		PCC	3	1	0	4

Preamble

This course aims to impart knowledge of VLSI design methodologies and Digital VLSI circuit design.

Prerequisite

24ECBADT205 -Basics of Analog and Digital Electronics

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Explain the various methodologies in ASIC and FPGA design.	20
CO2	Design VLSI Logic circuits with various MOSFET logic families.	20
CO3	Compare different types of memory elements.	20
CO4	Design and analyse data path elements such as Adders and multipliers.	20
CO5	Explain MOSFET fabrication techniques and layout design rules.	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		3									2	2	2	
CO2	3	2	3									2	2	3	
CO3	3	2	3									2	2	3	
CO4	3	2	3									2	3	2	
CO5	3		2		2							2	3	2	
Avg	3.00	2.00	2.67	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	2.50	2.50	0.00

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30
Applying	50	50	50	50	50
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) 20 Marks
Assignment/Quiz/Course project 14 Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1(CO1):

1. Differentiate between full custom and semi-custom ASIC.
2. With a neat flow chart, explain ASIC design flow.
3. Describe Gate array based ASIC with neat diagram.
4. What are the processes involved in Soc design.

Course Outcome 2(CO2):

1. With a neat diagram explain static and transient analysis of CMOS inverter
2. Realize the given logic function using static CMOS logic and transmission gate logic.
3. Compare the advantages and disadvantages of static and dynamic circuits.

Course Outcome 3 (CO3):

1. Compare different ROM structures.
2. Compare static and dynamic RAM structures.
3. Compare the advantages of three transistor and one transistor DRAM cell.

Course Outcome 4 (CO4):

1. Design a full adder with static CMOS logic
2. Compare the delay of Carry-Bypass adder, Linear Carry- Select adder, Square- root carry-select adder.

Course Outcome 5(CO5):

1. Explain how electronic grade silicon (EGS) is developed.
2. Explain the necessity of single crystalline silicon in VLSI fabrication and how single crystal silicon is made.
3. Explain diffusion and ion implantation techniques.
4. Explain the advantages of SiO_2 and the oxidation techniques.

Syllabus

Module 1: VLSI Design Methodologies.

Introduction: Moore's law .ASIC design, Full custom ASICs, Standard cell based ASICs, Gate array based ASICs, SoCs, FPGA devices, ASIC and FPGA Design flows, Top-Down and Bottom-Up design methodologies. Logical and Physical design. Speed power and area considerations in VLSI design

Module 2: Static CMOS Logic Design

MOSFET Logic Design - NMOS Inverter (Static analysis only), basic logic gates,CMOS logic, Static and transient analysis of CMOS inverter, Switching power dissipation and delays. Realization of logic functions with static CMOS logic, Pass transistor logic, and transmission gate logic

Module 3: Dynamic logic Design and Storage Cells

Dynamic Logic Design-Pre charge- Evaluate logic, Domino Logic, NP domino logic. Read Only Memory-4x4 MOS ROM Cell Arrays(OR,NOR,NAND, Random Access Memory –SRAM-Six transistor CMOS SRAM cell, DRAM –Three transistor and One transistor Dynamic Memory Cell.

Module 4: Arithmetic circuits

Adders: Static adder, Carry-Bypass adder, Linear Carry- Select adder, Square- root carry- select adder. Multipliers: Array multiplier, Verilog and VHDL coding

Module 5: Fabrication techniques and MOSFET physical Design

Material Preparation Purification and Crystal growth (CZ process), wafer preparation, Thermal Oxidation- Growth mechanisms, Dry and Wet oxidation, Diffusion and ion implantation techniques.

Epitaxy : molecular beam epitaxy. Lithography- Photo lithographic sequence, Electron Beam Lithography, Etching and metal deposition techniques.MOSFET Fabrication techniques Twin-Tub fabrication sequence, Fabrication process flow.Layout Design and Design rules, Stick Diagram and Design rules-micron rules and Lambda rules. (definitions only). layout of CMOS Inverter, two input NAND and NOR gates.

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Dr. K V K Prasad	VLSI Design Black Book	2nd	Dreamtech Press	2012
2	PUCKNELL DOUGLAS A., ESHRAGHIAN, KAMRAN	BASIC VLSI DESIGN	3rd	PHI	2005

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Jan M. Rabaey,	Digital Integrated Circuits- A Design	2nd	Prentice Hall	2010

		Perspective			
2	Neil H.E. Weste, Kamran Eshraghian,	Principles of CMOS VLSI Design- A Systems Perspective	2nd	Pearson Publication	2005

Online study materials:
https://nptel.ac.in/courses
Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**MODULE 1**	12	CO1
1.1	Introduction: Moores law. ASIC design, Full custom ASICs,Standard cell based ASICs, Gate array based ASICs,.	3	
1.2	SoCs, FPGA devices	3	
1.3	ASIC and FPGA Design flows Top-Down and Bottom-Up design methodologies.	3	
1.4	Logical and Physical design. Speed power and area considerations in VLSI design	3	
2	**MODULE 2**	11	CO2
2.1	MOSFET Logic Design - NMOS logic (Static analysis of Basic gates only).	3	
2.2	CMOS logic, Static and transient analysis of CMOS inverter Switching power dissipation and delays	3	
2.3	Realization logic functions in static CMOS logic, Pass transistor logic,	3	
2.4	transmission gate logic (Static analysis only)	2	
3.	**MODULE 3**	11	CO3
3.1	Dynamic Logic Design-Pre charge- Evaluate logic, Domino Logic,NP domino logic.	3	
3.2	Read Only Memory-4x4 MOS ROM Cell Arrays(OR,NOR,NAND)	3	
3.3	Random Access Memory –SRAM-Six transistor CMOS SRAM cell,	3	
3.4	DRAM –Three transistor and One transistor Dynamic Memory Cell.	2	
4.	**MODULE 4**	9	CO4

4.1	Adders- Static adder, Carry-Bypass adder,	3	
4.2	Linear Carry- Select adder, Square- root carry- select adder.	3	
4.3	Multipliers-Array multiplier.	3	
5.	**MODULE 5**	17	CO5
5.1	Material Preparation (qualitative analysis only) Purification and Crystal growth (CZ process), wafer preparation.	3	
5.2	Thermal Oxidation- Growth mechanisms, Dry and Wet oxidation. Diffusion and ion implantation techniques.	3	
5.3	Epitaxy: Molecular beam epitaxy. Lithography- Photo lithographic sequence, Electron Beam Lithography, Etching and metal deposition techniques	3	
5.4	MOSFET Fabrication techniques (qualitative analysis only) Twin-Tub fabrication sequence, Fabrication process flow.	3	
5.5	Layout Design and Design rules, Stick Diagram and Design rules-micron rules and Lambda rules.	3	
5.6	Layout of CMOS Inverter, two input NAND and NOR gates,	2	
	TOTAL	**60 Hours**	

Course Designers:

COURSE DESIGNED BY	VERIFIED BY
Ms. Remya K P Asst. Professor, ECE, JCET E Mail ID: remyakp@jawaharlalcolleges.com	Mr.Sanish V S Asst. Professor, ECE, JCET E Mail ID: sanishvs@jawaharlalcolleges.com

24ECDSPT503	DIGITAL SIGNAL PROCESSING	Category	L	T	P	Credit
		PCC	3	0	0	3

Preamble

This course aims to provide an understanding of the principles, algorithms and applications of DSP.

Prerequisite

Signals and systems

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	State and prove the fundamental properties and relations relevant to DFT and solve basic problems involving DFT based filtering methods	20
CO2	Compute DFT and IDFT using DIT and DIF radix-2 FFT algorithms	20
CO3	Design linear phase FIR filters and IIR filters for a given specification	20
CO4	Illustrate the various FIR and IIR filter structures for the realization of the given system function and Explain the basic multi-rate DSP operations decimation and interpolation in both time and frequency domains using supported mathematical equations	20
CO5	Explain the architecture of DSP processor (TMS320C67xx) and the finite word length effects	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	2	-	-	-	-	-	-	2	-	-	-
CO2	3	3	3	-	3	-	-	-	-	-	-	2	-	-	-
CO3	3	3	3	-	3	-	-	-	-	-	-	2	-	-	-
CO4	3	3	2	-	3	-	-	-	-	-	-	2	-	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-	2	-	-	-
Avg	**2.5**	**2.5**	**2.5**	**-**	**2.75**	-	-	-	-	-	-	**2**	**-**	-	-

1-Low; 2-Medium; 3- Strong

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	10	10			10
Understanding	20	20			30

Applying	20	20			60
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) : 20 Marks
Assignment/Quiz/Course project : 14 Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1(CO1):

1. Determine the N-point DFT X(k) of the N point sequences given by (i)$x1(n)=\sin(2\pi n/N)n/N$ (ii) $x2(n)=\cos^2(2\pi n/N)\, n/N$)
2. Show that if x(n) is a real valued sequence, then its DFT X(k) is also real and even.

Course Outcome 2(CO2):

1. Find the 8 point DFT of a real sequence x(n) = {1,2,2,2,1,0,0,0,0} using Decimation in frequency algorithm?
2. Find out the number of complex multiplications require to perform a 1024 point DFT using (i) direct computation and (ii) using radix 2 FFT algorithm?

Course Outcome 3 (CO3):

1. Design a linear phase FIR filter with order M=15 and cut-off frequency πn/N) /6. Use a Hanning Window.
2. Design a low pass digital butter-worth filter using bilinear transformation for the given specifications. Passband ripple ≤1dB, Passband edge:4kHz, Stopband Attenuation: ≥40 dB, Stopband edge:6kHz, Sampling requency:24 kHz

Course Outcome 4 (CO4):

1. Realize an FIR system with the given difference equation y(n)=x(n)-0.5x(n-1) +0.25x (n 2) +0.5x(n-3)-0.4x(n-4) +0.2x(n-5)
2. Derive the frequency domain expression of the factor of 2 up-sampler whose input is
3. given by x(n) and transform by X (k).

Course Outcome 5(CO5):

1. Derive the variance of quantization noise in an ADC with step size Δ, assuming uniformly distributed quantization noise with zero mean.
2. Bring out the architectural features of TMS320C67xx digital signal processor?

Syllabus

Module 1

Signal Processing Fundamentals

Basic Elements of a DSP system, Typical DSP applications, Finite-length discrete transforms, Orthogonal transforms – The Discrete Fourier Transform: DFT as a linear transformation (Matrix relations), Relationship of the DFT to other transforms, IDFT, Properties of DFT and examples. Circular convolution, Linear Filtering methods based on the DFT, linear convolution using circular convolution, Filtering of long data sequences, overlap save and overlap add methods, Frequency Analysis of Signals using the DFT (concept only required)

Module 2

Discrete Fourier Transform – Properties and Application

Efficient Computation of DFT: Fast Fourier Transform Algorithms-Radix-2 Decimation in Time and Decimation in Frequency FFT Algorithms, IDFT computation using Radix-2 FFT Algorithms, Application of FFT Algorithms, Efficient computation of DFT of Two Real Sequences and a 2N-Point Real Sequence

Module 3
Design of FIR and IIR Filters

Design of FIR Filters - Symmetric and Anti-symmetric FIR Filters, Design of linear phase FIR filters using Window methods, (rectangular, Hamming and Hanning) and frequency sampling method, Comparison of design methods for Linear Phase FIR Filters. Design of IIR Digital Filters from Analog Filters (Butterworth), IIR Filter Design by Impulse Invariance, and Bilinear Transformation, Frequency Transformations in the Analog and Digital Domain.

Module 4
Filter Realization

Structures for the realization of Discrete Time Systems - Block diagram and signal flow graph representations of filters, FIR Filter Structures: Linear structures, Direct Form, Cascade Form, IIR Filter Structures: Direct Form, Transposed Form, Cascade Form and Parallel Form, Computational Complexity of Digital filter structures. Multi-rate Digital Signal Processing: Decimation and Interpolation (Time domain and Frequency Domain Interpretation), Anti-aliasing and anti-imaging filter.

Module 5
Introduction to General and Specific Purpose Hardware for DSP

Computer architecture for signal processing: Harvard Architecture, pipelining, MAC, Introduction to latest digital signal processor, Functional Block Diagram. Finite word length effects in DSP systems: Introduction (analysis not required), fixed-point and floating-point DSP arithmetic, ADC quantization noise, Finite word length effects in IIR digital filters: coefficient quantization errors. Finite word length effects in FFT algorithms: Round off errors

Learning Resources
TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Proakis, J.G. & Manolakis, D.G.	Digital Signal Processing: Principles, Algorithms, & Applications	3rd Edition	Prentice Hall of India	1996
2	Ifeachor, E.C., & Jervis, B.W.	Digital Signal Processing: A Practical Approach	2nd Edition	Pearson Education Asia	2002

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Chen, C.T.	Digital Signal Processing: Spectral Computation & Filter Design	1^{st} Edition	Oxford University Press	2001
2	Mitra, S.K.	Digital Signal Processing: A Computer-Based Approach	1st Edition	McGraw Hill	1988
3	Monson H Hayes	Schaums outline: Digital Signal Processing	2^{nd} Edition	McGraw Hill	2011

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**Signal Processing Fundamentals**	9	CO1
1.1	Basic Elements of a DSP system, Typical DSP applications, Finite length Discrete transforms, Orthogonal transforms	2	
1.2	The Discrete Fourier Transform: DFT as a linear transformation(Matrix relations),	1	
1.3	Relationship of the DFT to other transforms, IDFT	1	
1.4	Properties of DFT and examples ,Circular convolution	2	
1.5	Linear Filtering methods based on the DFT- linear convolution using circular convolution, Filtering of long data sequences, overlap save and overlap add methods	2	
1.6	Frequency Analysis of Signals using the DFT(concept only required)	1	
2	**DFT**	9	CO2
2.1	Efficient Computation of DFT: Fast Fourier Transform Algorithms	2	
2.2	Radix-2 Decimation in Time and Decimation in Frequency FFT Algorithms	3	
2.3	IDFT computation using Radix-2 FFT Algorithms	2	
2.4	Application of FFT Algorithms-Efficient computation of DFT of Two Real Sequences and a 2N-Point Real Sequence	2	
3.	**Design of FIR and IIR Filters**	9	

3.1	Design of FIR Filters- Symmetric and Anti-symmetric FIR Filters, Design of linear phase FIR filters using Window methods, (rectangular, Hamming and Hanning)	3	CO3
3.2	Design of linear phase FIR filters using frequency sampling Method, Comparison of Design Methods for Linear Phase FIR Filters	2	
3.3	Design of IIR Digital Filters from Analog Filters, (Butterworth), IIR Filter Design by Impulse Invariance	2	
3.4	IIR Filter Design by Bilinear Transformation	1	
3.5	Frequency Transformations in the Analog and Digital Domain.	1	
4.	**Filter Realization**	9	CO4
4.1	Structures for the realization of Discrete Time Systems- Block diagram and signal flow graph representations of filters	2	
4.2	FIR Filter Structures: (Linear structures), Direct Form Cascade Form	2	
4.3	IIR Filter Structures: Direct Form, Cascade Form and Parallel Form	2	
4.4	Computational Complexity of Digital filter structures.	1	
4.5	Multi-rate Digital Signal Processing: Decimation and Interpolation (Time domain and Frequency Domain Interpretation), Anti-aliasing and anti-imaging filter.	2	
5.	**Introduction to General and Specific Purpose Hardware for DSP**	9	CO5
5.1	Computer architecture for signal processing : Harvard Architecture, pipelining, MAC, Introduction to TMS320C67xx digital signal processor ,Functional Block Diagram	2	
5.2	Finite word length effects in DSP systems: Introduction (analysis not required), fixed-point and floating-point DSP arithmetic, ADC quantization noise,	2	
5.3	Finite word length effects in IIR digital filters: coefficient quantization errors.	2	
5.4	Finite word length effects in FFT algorithms: Round off errors	3	
	TOTAL	**45 Hours**	

Course Designers:

COURSE DESIGNED BY	VERIFIED BY
Mr. Srikanth K Asst. Professor, ECE, JCET E Mail ID: sanishvs@jawaharlalcolleges.com	Dr. Sandeep C S Asso. Professor and HoD, ECE, JCET E Mail ID:hodece@jawaharlalcolleges.com

24ECIOTT504	IoT DEVICES	Category	L	T	R	Credit
		PCC PBL	3	0	1	4

Preamble

Internet of Things (IoT) is one of the most sought technologies worldwide. Different aspects of research, business, and real-time implementation with IoT are being carried out by Governments, academia, and industry. Application of IoT is wide and spread across agriculture, space, healthcare, manufacturing, construction, water etc. IoT systems help to achieve deeper automation, analysis, and integration within a system. IoT utilizes existing and emerging technology for sensing, networking, and robotics.

Prerequisite

Fundamentals of computer network, internet technology

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Understand the IoT fundamentals and architecture modeling (Understanding)	20
CO2	Understand the smart things in IoT and functional blocks (Understanding)	20
CO3	Understand the communication networks and protocols used in IoT. (Understanding)	20
CO4	Understand the cloud resources, data analysis and applications (Understanding)	20
CO5	Apply the IoT processes in embedded applications (Applying)	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	3	3	3		1				2		2		3	
CO2	1		2									2		3	
CO3	3	1										2	2	3	2
CO4	3	3	1	2								2	2	3	2
CO5	3	1	1	2	2	1	3	3	3	3	3	2	2	3	
Avg	2.6	2	2.3	2.3	2	1	3	3	3	2.5	3	2	2	3	2

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	**Continuous Assessment Tests**		**Assignment**		**Terminal Examination**
	1	**2**	**1**	**2**	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30
Applying	50	50	50	50	50
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	**Mini project /Assignment/Practical Component**
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	60	40	2.5 Hours

Continuous Internal Assessment Pattern:

Attendance : 9 Marks
Continuous Assessment Test (2 numbers) : 24 Marks
Assignment/Quiz/Course project : 27 Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 10 X 4 = 40 Marks

Course Level Assessment Questions

Course Outcome 1 (CO1): Understand the IoT fundamentals and architecture modelling
1. What is the definition of IoT and different characteristics of IoT
2. Define the architectural view of IoT and functional blocks
3. What are the different levels of IoT

Course Outcome 2 (CO2): Understand the smart things in IoT and functional blocks
1. What are the different smart things in IoT
2. How the communication is established among nodes and nodes and cloud.
3. What are the protocols that are used in IoT

Course Outcome 3 (CO3): To understand the communication networks and protocols used in IoT.
1. Differentiate between IEEE standard protocols
2. Explain the advantages of next generation IP based protocols used in IoT
3. Define different layers used in embedded protocols

Course Outcome 4 (CO4): To understand the cloud resources, data analysis and applications.
1. Explain how data is stored in IoT environment and processed
2. How to use cloud resources and different options available
3. How end devices can be used to control input and output devices

Course Outcome 5 (CO5): To apply the IoT processes in embedded applications.
1. What are the security and privacy concerns of IoT
2. Explain the typical applications of IoT.
3. Describe the processes involved in implementing a smart city.

Syllabus

Module 1
Introduction to IoT technology: Definitions and Characteristics of IoT, IoT Architectural View, Physical Design of IOT, Logical Design of IoT- IoT Functional blocks, IoT communication models, IoT Enabling Technologies, IoT Levels & Deployment Templates.use of Arduino
Module 2
IoT and M2M- M2M, Difference between IoT and M2M, SDN and NFV for IoT, Smart Objects: The "Things" in IoT: Sensors, Actuators, and Smart Objects, Sensor Networks- Wireless Sensor Networks (WSNs), Communication Protocols for Wireless Sensor Networks- Connecting Smart Objects- Communication Criteria.
Module 3
Unified Data Standards –Protocols –IEEE 802.15.4 -The Physical Layer, The Media-Access Control Layer, Uses of 802.15.4 , The Future of 802.15.4: 802.15.4e and 802.15.4g–Modbus–ZigBee-Zigbee Architecture- LoRaWAN -Standardization and Alliances, Physical Layer, MAC Layer, Topology, LTE-M, NB-IoT-Network layer –The next generation: IP-based protocols - 6LoWPAN and RPL, Overview of the 6LoWPAN Adaptation Layer.
Module 4
Data Collection, storage and computing Using a Cloud Platform-Introduction, Cloud Computing Paradigm for Data Collection, Storage and Computing-Cloud Computing Paradigm, Cloud Deployment Models-Everything as a Service and Cloud Service Models-SaaS, PaaS, IaaS, DaaS. Cloud based platforms-XIVELY, NIMBITS.
IoT Physical Devices & Endpoints-IoT Device-Building blocks –Raspberry-Pi -Board-Linux on Raspberry-Pi-Raspberry-Pi Interfaces (serial, SPI, I2C). Raspberry Pi interfacing and programming examples using python (LED, switch, sensor, serial, SPI, I2C devices). Controlling GPIO outputs and displaying sensor readings using web interface/cloud.
Module 5
IoT privacy, security and vulnerabilities solutions, vulnerabilities, security requirements, threat analysis, security tomography, layered attacker model, Identity management, access control, secure message communication.
Smart and Connected Cities-An IoT Strategy for Smarter Cities-Vertical IoT Needs for Smarter Cities, Global vs. Siloed Strategies-Smart City IoT Architecture-Street Layer, City Layer, Data Center Layer, Services Layer- Smart City Security Architecture - Smart City Use-Case Examples – Street lighting, smart parking, smart traffic and air pollution monitoring

Learning Resources
TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Samuel Greengard	The Internet of Things	2nd Edition	MIT Press	2021
2	Colin Dow	Internet of Things Programming Projects	2nd Edition	Packt Publishing	2024

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Giacomo Veneri, Antonio Capasso	Hands-On Industrial Internet of Things	2nd Edition	Packt Publishing	2024
2	Agus Kurniawan	IoT Projects with NVIDIA Jetson Nano	1st Edition	Packt Publishing	2020
3	Raj Kamal	Internet of Things: Architecture and Design Principles	2nd Edition	Tata McGraw Hill	2021

Online study materials:

https://onlinecourses.nptel.ac.in/noc22_cs53/preview

Course Contents and Lecture Schedule

No	Topic	No. of Lectures	Course Outcome
1	**Introduction to Internet of Things-12 hrs**		
1.1	Introduction, definition and characteristics	3	CO1
1.2	IoT architectural view, functional blocks	3	
1.3	IoT Communication models, enabling technologies	3	
1.4	IoT deployment levels	3	
2	**Essential components of IoT- 12Hrs**		CO2
2.1	IoT and M2M	4	
2.2	Smart objects	4	
2.3	Wireless sensor networks	4	
3	**IoT protocols-12 Hrs**		
3.1	IEEE 802.15.4 protocols	3	CO3
3.2	Zigbee	3	
3.3	6LoWPAN and RPL	3	
3.4	LoraWAN, LTE-M and NB-IoT	3	
4	**Cloud storage and Programming the end device- 12Hrs**		
4.1	Data storage and computation	4	CO4

4.2	Physical devices and end points	4	
4.3	Raspberry pi programming	4	
5	**Security and Applications- 12 Hrs**		
5.1	Security and Privacy	4	CO5
5.2	Smart city application	4	
5.3	Use case examples	4	

Course Designers:

COURSE DESIGNED BY	VERIFIED BY
Mr.Jayesh T P Asst. Professor, ECE, JCET E Mail ID: jayesh4205.ece@jawaharlalcolleges.com	D. Aswani K Asst. Professor , ECE, JCET E Mail ID: draswani4316.ece@jawaharlalcolleges.com

24ECDSPP507	DIGITAL SIGNAL PROCESSING LAB	Category	L	T	P	Credit
		PCL	0	0	3	2

Preamble

- The following experiments are designed to make the student do real time DSP computing.
- Dedicated DSP hardware (such as TI or Analog Devices development/evaluation boards) will be used for realization.

Prerequisite

- Digital Signal Processing
- Programming in C

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Simulate digital signals and verify the properties of DFT computationally	20
CO2	Familiarize the DSP hardware and interface with computer.	20
CO3	Implement LTI systems with linear convolution and also implement FFT and IFFT and use it on real time signals.	20
CO4	Implement FIR low pass filter.	20
CO5	Implement real time LTI systems with block convolution and FFT.	20

Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	2	3	-	-	-	3	-	-	1	-	-	-
CO2	3	3	3	2	3	-	-	-	3	1	-	1	-	-	-
CO3	3	3	1	2	3	-	-	-	3	-	-	1	-	-	-
CO4	3	3	1	1	3	-	-	-	-	-	-	1	-	-	-
CO5	3	3	1	3	3	-	-	-	3	3	-	-	-	-	-
AVG	**3**	**3**	**1.4**	**2**	**3**	**-**	**-**	**-**	**3**	**2**	**-**	**1**	**-**	**-**	**-**

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	
Set	Practical Sessions
Guided Response	Practical Sessions
Mechanism	Practical Sessions
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution:

Total Mark	CIA	ESE	ESE Duration
100	60	40	2.5 hours

Continuous Internal Assessment Pattern

Attendance : 9 marks
Continuous Assessment : 27 marks
Internal Test : 24 marks

End Semester Examination Pattern

The following guidelines should be adhered regarding the award of marks

a. Preliminary Work : 10 marks
b. Implementing the work/Conducting the experiment : 10 marks
c. Performance/Result/Inference (usage of equipment and troubleshooting) : 10 marks
d. Viva voce : 5 marks
e. Record : 5 marks

Course Level Assessment Questions

CO1-Simulation of Signals and Verification of the Properties of DFT

1. Write a Python/MATLAB/SCILAB function to generate a rectangular pulse.
2. Write a Python/MATLAB/SCILAB function to verify Parseval's theorem for N = 1024.

CO2-Simulation of Signals and Verification of the Properties of DFT

1. Write a C function to control the output LEDs with input switches.
2. Write a C function to connect the analog input port to the output port and test with a microphone.

CO3- LTI System with Linear Convolution and FFT Computation

1. Write a function to compute the linear convolution and download to the hardware target and test with some signals.
2. Write and download a function to compute N point FFT to the DSP hardware target and test it on real time signal.

CO4- Implementation of FIR Filter

1. Design and implement an FIR low pass filter for a cut off frequency of 0.1π and test it with an AF signal generator.

CO5- LTI Systems by Block Convolution

1. Implement an overlap add block convolution for speech signals on DSP target.

List of Experiments (All experiments are mandatory)

Experiment 1. Simulation of Signals Simulate the following signals using Python/ Scilab/MATLAB.

1. Unit impulse signal
2. Unit pulse signal
3. Unit ramp signal
4. Bipolar pulse
5. Triangular signal

Experiment 2. Verification of the Properties of DFT

Generate and appreciate a DFT matrix.

1. Write a function that returns the N point DFT matrix V_N for a given N.
2. Plot its real and imaginary parts of V_N as images using matshow orimshow commands (in Python) for N = 16, N = 64 and N = 1024
3. Compute the DFTs of 16 point, 64 point and 1024 point random sequences using the above matrices.
4. Observe the time of computations for N = 2γ for 2 γ 18 (You may use the time module in

Python).

5. Use some iterations to plot the times of computation against γ. Plot and understand this curve. Plot the times of computation for the fft function over this curve and appreciate the computational saving with FFT.

- Circular Convolution.
    1. Write a python function circcon.py that returns the circular convolution of an N_1 point sequence and an N_2 point sequence given at the input. The easiest way is to convert a linear convolution into circular convolution with N = max (N_1, N_2).

- Parseval's Theorem

    For the complex random sequences $x_1[n]$ and $x_2[n]$,

$$\sum_{n=0}^{N-1} x_1(n)x_2^*(n) = \frac{1}{N}\sum_{k=0}^{N-1} x_1(k)x_2^*(k)$$

    1. Generate two random complex sequences of say 5000 values.
    2. Prove the theorem for these signals.

Experiment 3. Familiarization of DSP Hardware

1. Familiarization of the code composer studio (in the case of TI hard- ware) or Visual DSP (in the case of Analog Devices hardware) or any equivalent cross compiler for DSP programming.
2. Familiarization of the analog and digital input and output ports of the DSP board.
3. Generation and cross compilation and execution of the C code to connect the input digital switches to the output LEDs.
4. Generation and cross compilation and execution of the C code to connect the input analog port to the output. Connect a microphone, speak into it and observe the output electrical signal on a DSO and store it.
5. Document the work.

Experiment 4. Linear Convolution

1. Write a C function for the linear convolution of two arrays.

2. The arrays may be kept in different files and downloaded to the DSP hardware.
3. Store the result as a file and observe the output.
4. Document the work.

Experiment 5. FFT of Signals

1. Write a C function for N - point FFT.
2. Connect a precision signal generator and apply 1 mV, 1 kHz sinusoid at the analog port.
3. Apply the FFT on the input signal with appropriate window size and observe the result.
4. Connect microphone to the analog port and read in real time speech.
5. Observe and store the FFT values.
6. Document the work.

Experiment 6. IFFT with FFT

1. Use the FFT function in the previous experiment to compute the IFFT of the input signal.
2. Apply IFFT on the stored FFT values from the previous experiments and observe the reconstruction.
3. Document the work.

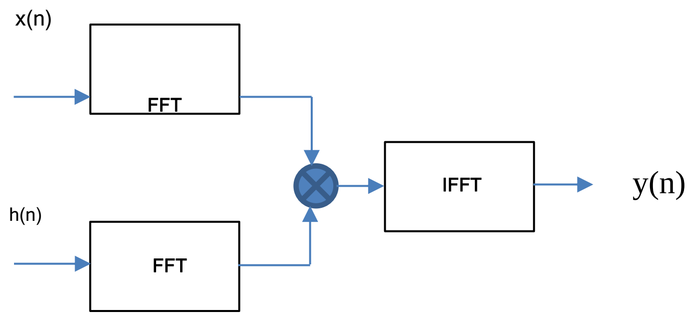
Experiment 7. FIR Low Pass Filter

1. Use Python/scilab to implement the FIR filter response $h[n] = \frac{\sin(w_c n)}{\pi n}$ for a filter size N = 50, $\omega_c = 0.1\pi$ and $\omega_c = 0.3\pi$.
2. Realize the hamming ($w_H[n]$) and kaiser ($w_K[n]$) windows.
3. Compute h[n]w[n] in both cases and store as file.
4. Observe the low pass response in the simulator.
5. Download the filter on to the DSP target board and test with 1 mV sinusoid from a signal generator connected to the analog port.
6. Test the operation of the filters with speech signals.
7. Document the work.

Experiment 8. Overlap Save Block Convolution

1. Use the file of filter coefficients from the previous experiment.

2. Realize the system shown below for the input speech signal x[n].



3. Segment the signal values into blocks of length N = 2000. Pad the last block with zeros, if necessary.

4. Implement the overlap save block convolution method

5. Document the work.

Experiment 9: Overlap Add Block Convolution

1. Use the file of filter coefficients from the previous experiment.
2. Realize the system shown in the previous experiment for the input speech signal $x[n]$.
3. Segment the signal values into blocks of length $N = 2000$. Pad the last block with zeros, if necessary.
4. Implement the *overlap add* block convolution method
5. Document the work.

Schedule of Experiments: Every experiment should be completed in three hours.

Learning Resources:

Text Books

Sl.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Vinay K. Ingle, John G. Proakis	Digital Signal Processing Using MATLAB	4th Edition	Cengage India Private Limited	2017
2	Allen B. Downey	Think DSP: Digital Signal Processing using Python.	1st Edition	O'Reilly Media	2016

COURSE DESIGNED BY	VERIFIED BY
Mr. Srikanth K Asst. Professor, ECE Dept, JCET E. Mail ID: srikanth4019.ece@jawaharlalcolleges.com	Mr.Sanish V S Asst. Professor, ECE, JCET E Mail ID: sanishvs@jawaharlalcolleges.com

24ECESVP508	Embedded System and VLSI Lab	Category	L	T	P	Credit
		PCC	0	0	3	2

Preamble

This course aims to
(i) Familiarize the students with Assembly Language Programming of modern microcontrollers.
(ii) Impart the skills for interfacing the microcontroller with the help of Embedded C/Assembly Language Programming

Prerequisite

Nil

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Write an Assembly language program/Embedded C program for performing data manipulation.	20
CO2	Develop ALP/Embedded C Programs to interface microcontroller with peripherals	20
CO3	Perform programming/interfacing experiments with IDE for modern microcontrollers.	20
CO4		20
CO5		20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO12	PSO 1	PSO2	PSO 3
CO1	3		3		3				3			3			
CO2	3		3	2	3				3			3			
CO3	3		3	3	3	3			3		3	3			
CO4	3		3		3				3			3			
CO5	3		3		3				3			3			
AVG	**3**		**3**		**3**				**3**			**3**			
1-Low; 2-Medium; 3- Strong															

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	
Set	Practical Sessions
Guided Response	Practical Sessions
Mechanism	Practical Sessions
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	60	40	2.5 Hours

Continuous Internal Assessment Pattern:

Attendance : 9 Marks

Continuous Assessment : 27 Marks

Internal Test : 24 Marks

End Semester Examination Pattern:

The following guidelines should be adhered regarding the award of marks

a) Algorithm & Program : 12 Marks
b) Procedure : 8 Marks
c) Output : 8 Marks
d) Viva : 8 Marks
e) Record : 4 Marks

List of Experiments/ Activities with CO Mapping

Module No.	Topic	Course Outcomes
1.	Data transfer/exchange between specified memory locations	CO1
2.	Largest/smallest from a series.	CO1
3.	Sorting (Ascending/Descending) of data	CO1
4.	Addition / subtraction / multiplication / division of 8/16 bit data.	CO1
5.	Sum of a series of 8 bit data.	CO2

6.	Multiplication by shift and add method.	CO2
7.	Square / cube / square root of 8 bit data.	CO2
8.	Matrix addition.	CO3
9	LCM and HCF of two 8 bit numbers.	CO3
10	Code conversion – Hex to Decimal/ASCII to Decimal and vice versa.	CO3
11	Time delay generation and relay interface.	CO4
12	Display (LED/Seven segments/LCD) and keyboard interface.	CO4
13	ADC interface	CO4
14	DAC interface with wave form generation.	CO5
15	Stepper motor and DC motor interface.	CO5
16	Realization of Boolean expression through port	CO5

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1					
2					

On line study materials:

https://swayam.gov.in/nd1_noc20_ee98/preview

COURSE DESIGNED BY	VERIFIED BY
Mr. Jisha K V Assistant professor ,ECE E mail:jishakv.ece@gmail.com	Mr. Srikanth K Assistant professor, ECE E mail: srikanth4019.ece@jawaharlalcolleges.com

24ECMEIT515	MEDICAL INSTRUMENTATION	Category	L	T	P	Credit
		PEC	3	0	0	3

Preamble

This course aims to develop the skills for methods of various transformation and analysis of image enhancement, image reconstruction, image compression, image segmentation and image representation

Prerequisite

Nil

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Explain the human anatomy and physiological signal Measurements.	20
CO2	Illustrate various techniques used for measurement of Blood flow, blood pressure, and respiration rate and body temperature.	20
CO3	Analyze the recording of ECG, EEG, EMG and ERG signals.	20
CO4	Summarizethe concept of assisting and therapeutic devices.	20
CO5	Describe the advances in medical imaging techniques.	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	2	2	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	2	2	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	2	2	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	2	2	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	2	2	-
Avg	**3**	**3**	-	-	-	-	-	-	-	-	-	-	2	2	-

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	30	30	-	-	20
Understanding	30	30	-	-	30
Applying	40	40	100	100	50
Analyzing	-	-	-	-	-
Evaluating	-	-	-	-	-
Creating	-	-	-	-	-

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Continuous Internal Assessment Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) : 20 Marks
Project : 14 Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1 (CO1):Introduction to human physiological system

1. Describe in detail the formation of resting potential and action potential in human body.
2. Briefly explain the physiological functions of human circulatory system
3. Briefly explain the physiological functions of human respiratory system

Course Outcome 2 (CO2):Bio potential electrodes and ECG

1. Describe different bio-potential electrode used to measure bioelectric events.
2. Explain in details the electro conduction system of a human heart. Illustrate the same with PQRS waveform of the ECG.

Course Outcome 3 (CO3):Measurement of blood pressure, blood flow and heart sound

1. With help of neat diagram explain how the oscilloetric method helps to measure blood pressure.
2. Write a short note on phonocardiography.

Course Outcome 4 (CO4):Measurement of EEG, EMG and Respiratory Parameters and therapeutic aid

1. Write a short note on tidal volume and vital capacity in breathing mechanism with neat diagram.
2. Explain heart lung machine with the help of neat diagram.
3. Explain spirometer for measurement of respiratory parameters
4. Explain standard 10-20 electrode placement system for EEG measurement.

Course Outcome 5 (CO5):Advances in Radiological Imaging andElectrical safety

1. Draw the block diagram and explain the principle of ultrasound imaging.
2. What are the biological effects of NMR imaging over CT?
3. What is the basic principle of CT? How image reconstruction is done in CT

Syllabus

Module 1

Introduction to human physiological system

Physiological systems of the body (brief discussion on Heart and cardio vascularsystem, Anatomy of nervous system, Physiology of respiratorysystems) problems encountered in biomedical measurements.Sources of bioelectric potentials – resting and action potentials -propagation of action potentials – bio electric potentials example(ECG, EEG, EMG, ERG, EOG, EGG etc.)

Module 2

Bio potential electrodes and ECG

Bio potential electrodes – theory – microelectrodes – skin surfaceelectrodes – needle electrodes – biochemical transducers –transducers for biomedical applications. Electro conduction system of the heart. Electro cardiograph –electrodes and leads – Einthoven triangle, ECG read out devices,ECG machine – block diagram.

Module 3

Measurement of blood pressure, blood flow and heart sound

Measurement of blood pressure – direct and indirect measurement– oscillometric measurement – ultrasonic method, measurement of blood flow and cardiac output, plethysmography –photo electricand impedance plethysmographs.Measurement of heart sounds –phonocardiography

Module 4

Measurement of EEG, EMG and Respiratory Parameters

Electro encephalogram –neuronal communication – EEGmeasurement, recording and analysis. Muscle response– Electromyogram (EMG) – NerveConduction velocity measurements- Electromyogram Measurements. Respiratory parameters – Spiro meter,pneumograph

Therapeutic Aid

Cardiac pacemakers – internal and external pacemakers,defibrillators.Ventilators, heart lung machine, hemodialysis, lithotripsy, infantincubators, introduction o biomechanics.

Module 5

Advances in Radiological Imaging

X-rays- principles of generation, uses of X-rays- diagnostic stillpicture, fluoroscopy, angiography, endoscopy, and diathermy.Basic principle of computed tomography, magnetic resonanceimaging system and nuclear medicine system – radiation therapy.Ultrasonic imaging system - int roduction and basic principle.

Electrical safety

Electrical safety– physiological effects of electric current –shock hazards from electrical equipment –method of accident prevention, introduction to tele-medicine

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	J. G. Webster	Medical Instrumentation, Application and Design	5th Edition	John Wiley and Sons	2020
2	R. S. Khandpur	Handbook of Biomedical Instrumentation	3rd Edition	Tata Mc Graw Hill	2014

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	John Enderele , Susan Blanchard, Joseph Bronzino	Introduction to Biomedical Engg	3rd Edition	Academic Press	2012
2	Welkovitz	Biomedical Instruments, Theory and Design	2nd edition	Elselvier	2012

Online study materials:
https://onlinecourses.swayam2.ac.in/nou23_bt05/preview

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction to human physiological system**	
1.1	Physiologicalsystems of the body (brief discussion on Heart and cardio vascularsystem, Anatomy of nervous system, Physiology of respiratorysystems) problems encountered in biomedical measurements.	4
1.2	Sources of bioelectric potentials – resting and action potentials	2
1.3	Propagation of action potentials – bio electric potentials example(ECG, EEG, EMG, ERG, EOG, EGG etc.)	3
2	**Bio potential electrodes and ECG**	
2.1	Bio potential electrodes –basic theory – microelectrodes – skin surface electrodes – needle electrodes	2
2.2	Biochemical transducers –transducers for biomedical applications	2
2.3	Instrumentation for clinical laboratory: Bio Potential amplifiers-instrumentation amplifiers, isolation amplifiers, chopper amplifier	3

2.4	Electro conduction system of the heart, Electro cardiograph –electrodes and leads – Einthoven triangle,	1
2.5	ECG read out devices,ECG machine – block diagram.	1
3	**Measurement of blood pressure, blood flow and heart sound**	
3.1	Measurement of blood pressure – direct and indirect measurement– oscillometric measurement –ultrasonic method	3
3.2	Measurement of blood flow and cardiac output, plethysmography –photo electricand impedance plethysmographs	3
3.3	Measurement of heart sounds –phonocardiography	3
4	**Measurement of EEG,EMG and Respiratory Parameters, Therapeutic Aid**	
4.1	Electro encephalogram –neuronal communication – EEG measurement, recording and analysis	2
4.2	Muscle response– Electromyogram (EMG) – Nerve Conduction velocity measurements- Electromyogram Measurements.	2
4.3	Respiratory parameters – Spiro meter,pneumograph	1
4.4	Cardiac pacemakers – internal and external pacemakers,defibrillators.	1
4.5	Ventilators, heart lung machine, hemodialysis, lithotripsy, infantincubators	3
5	**Advances in Radiological Imaging and Electrical Safety**	
5.1	X-rays- principles of generation, uses of X-rays- diagnostic stillpicture, fluoroscopy, angiography, endoscopy, diathermy	2
5.2	Basic principle of computed tomography, magnetic resonanceimaging system and nuclear medicine system	3
5.3	Ultrasonic imaging system - introduction and basic principle	2
5.4	Electrical safety– physiological effects of electric current –shock hazards from electrical equipment –method of accident prevention, introduction to tele- medicine	2

Course Designers:

COURSE DESIGNED BY	VERIFIED BY
Dr.Sandeep C S Asso. Professor and HoD, ECE, JCET E Mail ID:hodece@jawaharlalcolleges.com	Mr.Sanish V S Asst. Professor, ECE, JCET E Mail ID: sanishvs@jawaharlalcolleges.com

24ECFORT525	FUNDAMENTALS OF ROBOTICS	Category	L	T	P	Credit
		PCC	3	0	0	3

Preamble

This course on Robotics provides a comprehensive introduction to the field, focusing on the fundamental principles, technologies, and applications that shape the rapidly evolving robotics industry. The syllabus is designed to equip students with both theoretical and practical knowledge of robotic systems, covering essential topics such as robot anatomy, motion analysis, drive systems, and path planning.

Prerequisite

Introduction to Basic Electronics

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Understand the importance, societal impact, and future potential of robotics and automation across diverse engineering fields.	20
CO2	Identify and explain the key components and structural elements of robotic systems.	20
CO3	Explore various path planning techniques and evaluate different motion strategies for robotic systems.	20
CO4	Select and implement appropriate drives and end-effectors based on specific robotic application requirements.	20
CO5	Apply robotics concepts to automate repetitive and hazardous tasks, and classify different types of robots based on their design and real-world applications.	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	3	-	-	-	-	-	-	2	2	3	-
CO2	3	3	3	-	3	-	-	-	-	-	-	2	2	3	-
CO3	3	3	3	-	3	-	-	-	-	-	-	2	2	3	-
CO4	3	3	3	-	3	-	-	-	-	-	-	2	2	3	-
CO5	3	3	3	-	3	-	-	-	-	-	-	2	2	3	-
Avg	**3**	**3**	**3**	-	**3**	-	-	-	-	-	-	**2**	**2**	**3**	-

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30
Applying	50	50	50	50	50
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) : 20 Marks
Assignment/Quiz/Course project : 14 Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1(CO1):

1. Apply: Imagine you are tasked with designing a robotic system for a manufacturing line. Based on the classification of robots, choose an appropriate type of robot and explain why it is suitable for the specific tasks, such as pick-and-place or assembly.
2. Describe the laws of robotics and how they could be applied to ensure safety in a collaborative environment where humans and robots work side by side.
3. Considering the future prospects of robotics, analyze how advancements in robotics could affect the healthcare industry. Provide specific examples of how robots could enhance medical procedures or patient care.

Course Outcome 2(CO2):

1. Given a robotic arm with a cylindrical configuration, explain how you would design its movement to reach a point within its workspace. Include the concept of degrees of freedom and kinematic transformations in your answer.
2. How does the concept of "degrees of freedom" relate to the movement of a robot? Provide an example of a robotic system with different degrees of freedom and explain how this affects its capabilities in performing tasks.
3. A robot is tasked with moving from one point to another in a 3D space. Using the concept of direct and inverse kinematics, explain how you would calculate the robot's joint angles to reach the target position.

Course Outcome 3 (CO3):

1. Compare the advantages and disadvantages of using pneumatic, hydraulic, and electric drive systems for this task. Which system would you choose and why?
2. Describe how a mechanical gripper works as an end effector in robotics. How does the design of the gripper influence the robot's ability to handle different objects in various environments?
3. Given a scenario where a robot is required to manipulate delicate objects, propose a suitable end effector type (e.g., vacuum gripper, magnetic gripper, etc.). Justify your choice based on the characteristics of the objects being handled.

Course Outcome 4 (CO4):

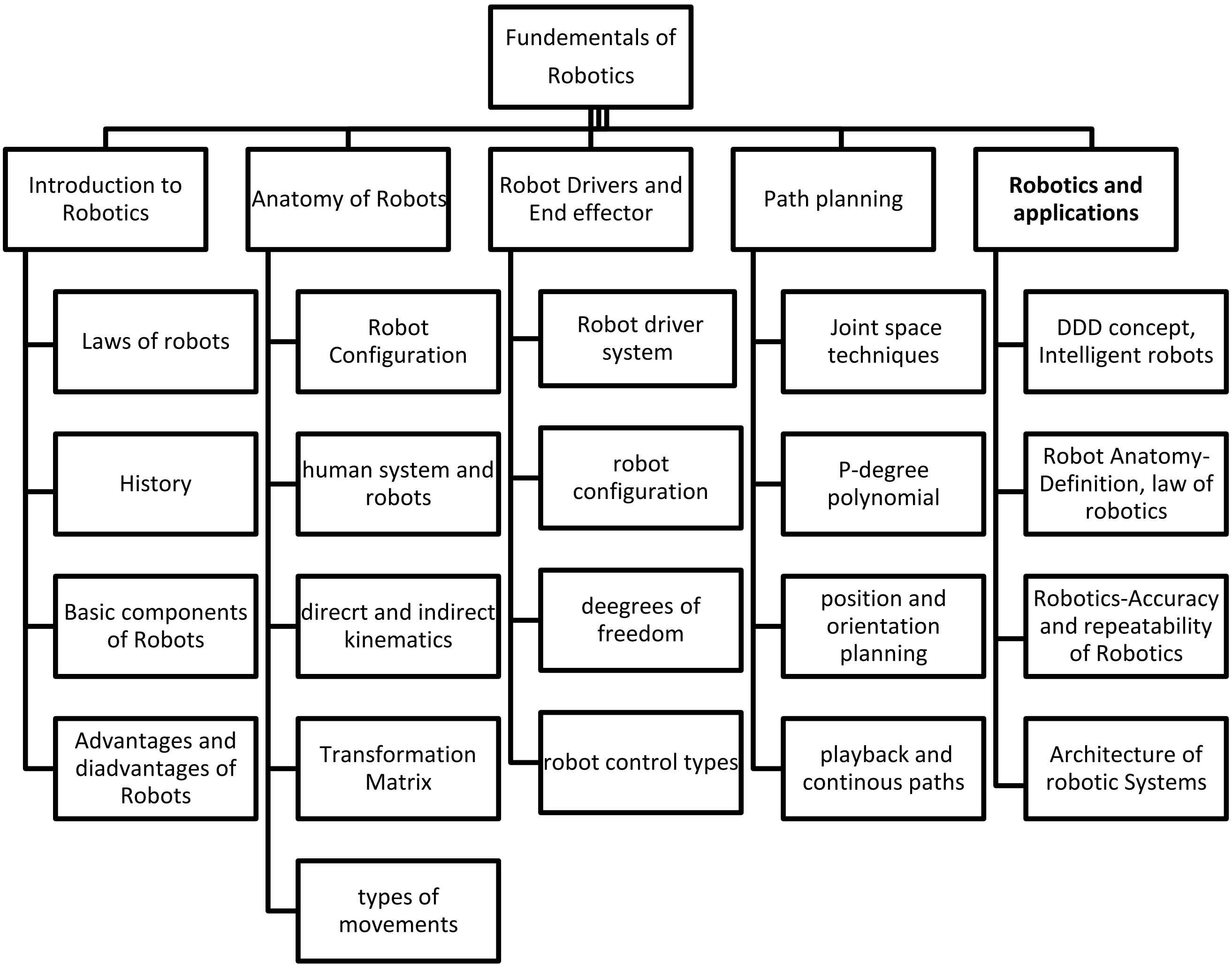
1. In a manufacturing environment, a robot must move along a path from one point to another while avoiding obstacles. Using joint space techniques, explain how you would plan the robot's trajectory to ensure smooth and efficient movement.
2. What is the difference between Cartesian space and joint space path planning? Provide examples of situations where each would be preferred.
3. Given a scenario where a robot must perform both linear and circular motions, demonstrate how you would use cubic polynomial and Cartesian space techniques to plan the path efficiently.

Course Outcome 5(CO5):

1. You are designing a robotic system for space exploration that must perform multiple tasks, such as sample collection and surface analysis. Based on the types of robots covered, suggest the most suitable robot type for this mission and justify your choice.
2. Explain the concept of unmanned vehicles (ground, aerial, and underwater) in robotics. How do these different robots handle their respective environments, and what are the key challenges in their design?

3. A robot is required to automate the process of welding and assembly in a manufacturing plant. Describe the specific applications of robotic systems in this scenario and explain how the robot's design and control systems would be adapted to the task.

Concept Map



Syllabus

Module-1 Introduction to Robotics

Introduction to Robotics and Automation, laws of robot, brief history of robotics, basic components of robot, robot specifications, classification of robots, human system and robotics, safety measures in robotics, social impact, Robotics market and the future prospects, advantages and disadvantages of robots

Module-2 Robot Anatomy and Motion Analysis

Anatomy of a Robot, Robot configurations: polar, cylindrical, Cartesian, and jointed arm configurations, Robot links and joints, Degrees of freedom: types of movements, vertical, radial and rotational traverse, roll, pitch and yaw, Wok volume/envelope, Robot kinematics: Introduction to direct and inverse kinematics, transformations and rotation matrix.

Module-3 Robot Drives and End Effector

Robot drive systems: Hydraulic, Pneumatic and Electric drive systems, classification of end effectors, mechanical grippers, vacuum grippers, magnetic grippers, adhesive gripper, gripper force analysis and gripper design, 1 DoF, 2 DoF, multiple degrees of freedom robot hand, tools as end effectors, Robot control types: limited sequence control, point-to-point control, playback with continuous path control, and intelligent control.

Module-4 Path Planning

Definition-Joint space technique, Use of P-degree Polynomial-Cubic, polynomial- Cartesian space technique, parametric descriptions, straight line and circular paths, position and orientation planning.

Module-5 Robotics Applications

Material Handling: pick and place, palletizing and depalletizing, machining loading and unloading, welding & assembly, Medical, agricultural and space applications, unmanned vehicles: ground, Ariel and underwater applications, robotic for computer integrated manufacturing. Types of robots: Manipulator, Legged robot, wheeled robot, aerial robots, Industrial robots, Humanoids, Robots, Autonomous robots, and Swarm robots

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	S.R. Deb	Robotics Technology and flexible automation	11th Edition	Tata McGraw-Hill Education	2009
2	Ganesh S Hegde,	A textbook on Industrial Robotics	3rd Edition	University science press	2017

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Richard D Klafter, Thomas A	"Robotics Engineering – An Integrated	4th Edition	Eastern Economy Edition,	2006

	Chmielewski, Michael Negin	Approach"		Prentice Hall of India Pvt. Ltd	

Online study materials:

1. https://roboticscasual.com/ros-tutorial-pick-and-place-task-with-the-moveit-c-interface/
2. https://roboticscasual.com/ros-tutorial-simulate-ur5-robot-in-gazebo-urdf-explained/
3. https://roboticscasual.com/the-best-degrees-to-work-in-robotics/
4. https://roboticscasual.com/robotics-tutorials/
5. https://www.ieee-ras.org/educational-resources-outreach/educational-material-in-robotics-andautomation
6. https://www.academia.edu/20361073/Web_Based_Control_and_Robotics_Education_pdf
7. https://github.com/Developer-Y/cs-video-courses
8. https://www.isa.org/

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**Module-1 Introduction to Robotics**	9	CO1
1.1	Introduction to Robotics and Automation, laws of robot, brief history of robotics,	2	
1.2	basic components of robot, robot specifications	2	
1.3	classification of robots, human system and robotics	2	
1.4	safety measures in robotics, social impact, Robotics market and the future prospects	2	
1.5	advantages and disadvantages of robots	1	
2	**Module-2 Robot Anatomy and Motion Analysis**	9	CO2
2.1	Anatomy of a Robot, Robot configurations: polar, cylindrical, Cartesian, and jointed arm configurations,	2	
2.2	Robot links and joints, Degrees of freedom	2	
2.3	types of movements, vertical, radial and rotational traverse	2	
2.4	roll, pitch and yaw, Wok volume/envelope,	1	
2.5	Robot kinematics: Introduction to direct and inverse kinematics	1	
2.6	transformations and rotation matrix.	1	
3.	**Module-3 Robot Drives and End Effector**	9	

3.1	Robot drive systems: Hydraulic, Pneumatic and Electric drive systems, classification of end effectors	2	CO3
3.2	mechanical grippers, vacuum grippers, magnetic grippers, adhesive gripper	2	
3.3	gripper force analysis and gripper design, 1 DoF, 2 DoF	1	
3.4	multiple degrees of freedom robot hand, tools as end effectors	2	
3.5	Robot control types: limited sequence control, point-to-point control, playback with continuous path control, and intelligent control.	2	
4.	**Module-4 Path Planning**	9	CO4
4.1	Definition-Joint space technique	2	
4.2	Use of P-degree Polynomial-Cubic	2	
4.3	polynomial- Cartesian space technique,	2	
4.4	parametric descriptions, straight line and circular paths	2	
4.5	position and orientation planning.	1	
5.	**Module-5 Robotics Applications**	9	CO5
5.1	Material Handling: pick and place, palletizing and depalletizing	2	
5.2	machining loading and unloading,	1	
5.3	welding & assembly, Medical, agricultural and space applications	2	
5.4	unmanned vehicles: ground, Ariel and underwater applications,	1	
5.5	robotic for computer integrated manufacturing. Types of robots: Manipulator, Legged robot, wheeled robot, aerial robots, Industrial robots, Humanoids, Robots,	2	
5.6	Autonomous robots, and Swarm robots	1	
	TOTAL	**45 hours**	

Course Designers:

COURSE DESIGNED BY	**VERIFIED BY**
Mr.Sree Sankar. J Asst. Professor, ECE, JCET E Mail ID: sreesankar4228.ece@jawaharlalcolleges.com	Dr.Sandeep C S Asso. Professor and HoD, ECE, JCET E Mail ID:hodece@jawaharlalcolleges.com

24ECMIST535	MEASUREMENTS AND INSTRUMENTATION SYSTEMS	Category	L	T	P	Credit
		PEC	3	0	0	3

Preamble

This course introduces the principle of operation and construction of basic instruments for measurement of electronic quantities. Measurement of basic circuit parameters, magnetic quantities, and passive parameters by using bridge circuits, sensors and transducers will be discussed.Familiarization of modern digital measurement systems are also included.

Prerequisite

Nil

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Understand the factors affecting performance of measuring system and appropriate instruments for the measurement of voltage, current in ac and dc measurements(Understanding)	20
CO2	Understand the operating principle of power and energy measurement(Understanding)	20
CO3	Understand the principles of operation of Magnetic measurement systems (Understanding)	20
CO4	Understand the operating principle of DC and AC bridges, transducers based systems.(Understanding)	20
CO5	Understand the operating principles of basic building blocks of digital systems, recording and display units.(Understanding)	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1											1	1	-
CO2	3	1											1	1	-
CO3	3												1		-
CO4	3				1								1		-
CO5	3				1							2	1		-
Avg	**3**	**1**			**1**							**2**	**1**	**1**	-

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	30	30	30	30	30
Understanding	70	70	70	70	70
Applying					
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) : 20 Marks
Assignment/Quiz/Course project : 14 Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1 (CO1)

1. Explain static characteristics of measuring systems.
2. Problems related to measurement errors.
3. Concept of calibration of measuring instruments
4. Explain the construction and working indicating Instruments.
5. Problems related to extension of range of meters

Course Outcome 2(CO2):

1. Describe the principle of operation and construction of energy meter
2. Describe the principle of operation and construction of wattmeter
3. Problems related to two and three wattmeter method of power measurement.

Course Outcome 3 (CO3):

1. Explain the principle of operation of ballistic galvanometer.
2. Describe the procedure for plotting the B-H curve of a magnetic specimen.

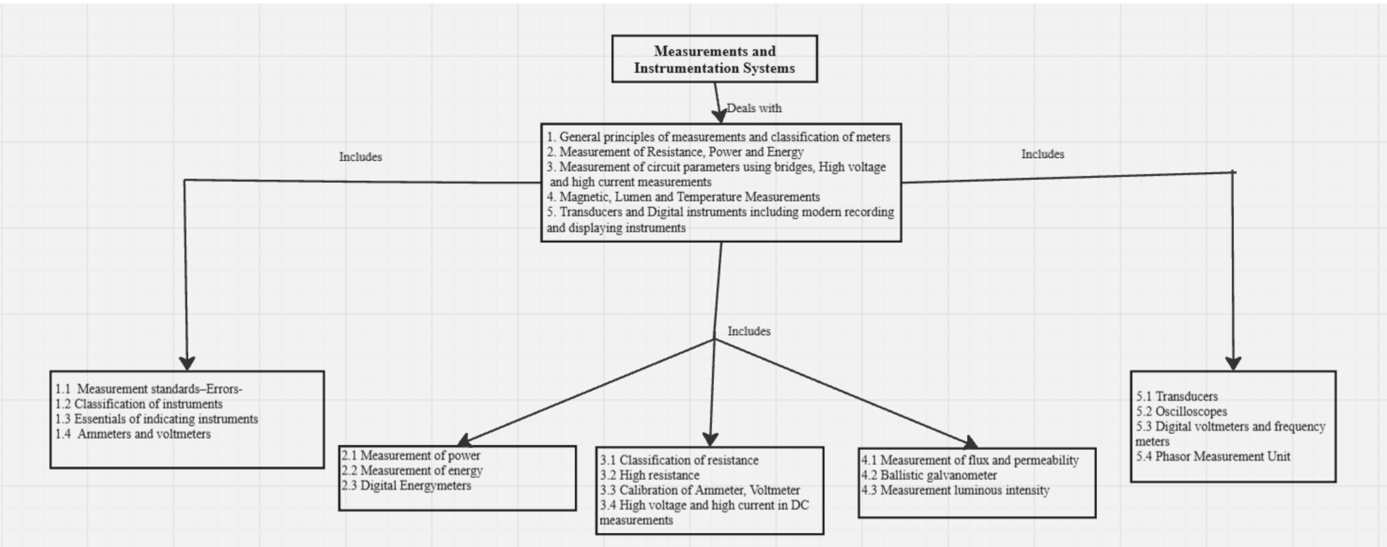
Course Outcome 4 (CO4):

1. Explain classification of Transducers
2. Measurement of frequency using Wien bridge.
3. Explain the operation of basic ac/dc bridges
4. Illustrate the principle of temperature measurement using thermocouple.

Course Outcome 5 (CO5):

1. Block diagram of DMM, CRO, DSO, PMU
2. Basic ideas on simulation softwares and virtual instrumentation.
3. Explain the operation of basic ac/dc bridges

Concept Map



SYLLABUS

Module 1:

Measurement standards–Errors-Types of Errors- Statistics of errors, Need for calibration. Classification of instruments, secondary instruments–indicating, integrating and recording-operating forces - essentials of indicating instruments - deflecting, damping, controlling torques. Ammeters and voltmeters - moving coil, moving iron, constructional details and operation, principles, shunts and multipliers – extension of range.

Module 2:

Measurement of power: Dynamometer type wattmeter –Construction and working. Measurement of energy: Induction type watt-hour meters- Single phase energy meter –construction and working, two element three phase energy meters, Digital Energy Meters -Time of Day(TOD) and Smart metering (description only).

Module 3:

Classification, measurement of low, medium and high resistance- Ammeter voltmeter method(for low and medium resistance measurements)-Kelvin’s double bridge-Wheatstones bridge- loss of charge method, measurement of earth resistance. Measurement of self inductance-Maxwell’s Inductance bridge, Measurement of capacitance –Schering’s, Measurement of frequency-Wien’s bridge. Calibration of Ammeter, Voltmeter and Wattmeter using DC potentiometers. High voltage and high current in DC measurements- voltmeters, Sphere gaps, DC Hall effect sensors.

Module 4:

Magnetic Measurements: Measurement of flux and permeability - flux meter, BH curve and permeability measurement - hysteresis measurement- ballistic galvanometer – principle- determination of BH curve - hysteresis loop. Lloyd Fisher square —measurement of iron losses. Measurement luminous intensity-Photoconductive Transducers-Photovoltaic cells Temperature sensors-Resistance temperature detectors-negative temperature coefficient Thermistors-thermocouples-silicon temperature sensors.

Module 5:

Transducers - Definition and classification. LVDT, Electromagnetic and Ultrasonic flow meters, Piezoelectric transducers-modes of operation-force transducer, Load cell, Strain gauge. Oscilloscopes- Principal of operation of general purpose CRO-basics of vertical and horizontal deflection system, sweep generator etc. DSO-Characteristics-Probes and Probing techniques. Digital voltmeters and frequency meters using electronic counters, DMM, Clamp on meters. Phasor Measurement Unit (PMU) (description only). Introduction to Virtual Instrumentation systems- Simulation software’s (description only)

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Sawhney A.K.,	A course in Electrical and Electronic Measurements & instrumentation,	4th Edition	DhanpatRai.	2021
2	J. B. Gupta	A course in Electrical & Electronic Measurement & Instrumentation.	3rd Edition	SK Kataria& Sons	2013

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Golding E.W.	Electrical Measurements & Measuring Instruments,	4th Edition	Wheeler Pub.	2011

Online study materials:
https://www.youtube.com/watch?v=3eYmFjHnQjY

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**General principles of measurements and classification of meters**		CO1
1.1	Measurement standards–Errors-Types of Errors- Statistics of errors, Need for calibration.	3	
1.2	Classification of instruments, secondary instruments– indicating, integrating and recording- operating forces	2	
1.3	Essentials of indicating instruments - deflecting, damping, controlling torques.	2	
1.4	Ammeters and voltmeters - moving coil, moving iron, constructional details and operation, principles shunts and multipliers – extension of range.	2	
2	**Measurement of Resistance, Power and Energy**		
2.1	Measurement of power: Dynamometer type wattmeter – Construction and working	3	

2.2	Measurement of energy: Induction type watt-hour meters-Single phase energy meter – construction and working,two element three phase energy meters,	4	CO2
2.3	Digital Energymeters - Time of Day (TOD) and Smart metering(description only).	2	
3.	**Measurement of circuit parameters using bridges, High voltage and high current measurements**		CO3
3.1	Classification of resistance, low resistance, Ammeter voltmeter method, Kelvin's double bridge Medium resistance- Ammeter voltmeter method - Wheatstones bridge	3	
3.2	High resistance- loss of charge method- measurement of earth resistance. Measurement of self inductance-Maxwell's Inductance bridgeMeasurement of capacitance–Schering's bridge Measurement of frequency-Wien's bridge.	2	
3.3	Calibration of Ammeter, Voltmeter and Wattmeter using DC potentiometers.	2	
3.4	High voltage and high current in DC measurements-voltmeters, Sphere gaps, DC Hall effect sensors.	2	
4.	**Magnetic, Lumen and Temperature Measurements**		CO4
4.1	Measurement of flux and permeability - flux meter, BH curve and permeability measurement - hysteresis measurement	2	
4.2	Ballistic galvanometer – principle- determination of BH curve - hysteresis loop. Lloyd Fisher square - measurement of iron losses.	2	
4.3	Measurement luminous intensity-Photoconductive Transducers-Photovoltaic cells	2	
4.4	Temperature sensors-Resistance temperature detectors-negative temperature coefficient Thermistors-thermocouples-silicon temperature sensors.	3	
5.	**Transducers and Digital instruments including modern recording and displaying instruments**		CO5
5.1	Transducers - Definition and classification. LVDT, Electromagnetic and Ultrasonic flow meters, Piezoelectric transducers-modes of operation-force transducer, Load cell, Strain gauge.	2	
5.2	Oscilloscopes- Principal of operation of general purpose CRO-basics of vertical and horizontal deflection system, sweep generator etc. DSO-Characteristics-Probes and Probing techniques.	3	
5.3	Digital voltmeters and frequency meters using electronic counters, DMM, Clamp on meters.	2	

5.4	Phasor Measurement Unit (PMU) (description only). Introduction to Virtual Instrumentation systems-Simulation software's (description only)	2	
	TOTAL	**45 Hours**	

Course Designers:

COURSE DESIGNED BY	VERIFIED BY
Ms. Sayana M Asst. Professor, ECE, JCET E Mail ID: sayanam@jawaharlalcolleges.com	Mr.Sanish V S Asst. Professor, ECE, JCET E Mail ID: sanishvs@jawaharlalcolleges.com

24ECSDMT545	SEMICONDUCTOR DEVICE AND MODELLING	Category	L	T	P	Credit
		PCC	3	0	0	3

Preamble

This course aims to introduce the operating principles of electronic circuits. To give the student an idea about Semiconductor devices, BJT and its second order effects, FET and its second order effects. Students will get an introduction to different circuits simulation.

Prerequisite

1. 24ECBADT205- Basics of Analog and Digital Electronics

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Understand the Compound semiconductors	20
CO2	Analyze the basics of semiconductor devices and their second order effects	20
CO3	Understand and analyze various models for BJT	20
CO4	Understand second order effects of MOS devices	20
CO5	Understand various types of circuits models for MOSFET.	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2										2	1	1	
CO2	3	2										2	1	2	
CO3	3	2	3									2	2	2	2
CO4	3	2	3	3								2	2	2	
CO5	3											2	2	2	2
Avg	3.00	2.00	3.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	1.60	1.80	2.00

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30
Applying	50	50	50	50	50
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) : 20
Marks Assignment/Quiz/Course project : 14
Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1(CO1):

1. Explain the significance of the lattice structure in compound semiconductors.
2. Explain the concept of the "lattice constant" in compound semiconductors and its impact on the fabrication of heterostructures.
3. Describe factors affect the drift velocity of carriers in compound semiconductors
4. How do temperature and material composition influence the scattering rates in compound semiconductors

Course Outcome 2(CO2):

1. Discuss the main factors that affect the width of the depletion region in a PN junction
2. How does the diffusion current differ from the drift current in a PN junction
3 Explain how the BJT's current gain (β) affect the amplification of signals.

Course Outcome 3 (CO3):

1 What is the Eber-Moll model for BJTs, and how does it describe the behavior of the transistor.
2. Explain key components of the Hybrid Pi model.
3.Compare Gummel-Poon model and SPICE model.

Course Outcome 4 (CO4):

1. Discuss the significance of the threshold voltage (Vth) for N-channel and P-channel MOSFETs, and how is it influenced by the type of substrate
2. Explain the body effect in MOSFETs, and how does it influence the threshold voltage of a MOSFET.
3. How can latch-up be prevented or mitigated in CMOS designs
4. Explain differences in the behaviour of a MOSFET in analog applications versus digital logic circuits

Course Outcome 5(CO5):

1. Explain mall-signal model of a MOSFET, and how is it derived from the large-signal characteristics
2. Explain limitations of the SPICE model for MOSFETs in terms of accuracy and computational complexity.
3. Compare BSIM models with other MOSFET models.
4. Discuss timing simulations, and how are they used to verify the timing characteristics of MOSFET

circuits such as delays and rise/fall times

Syllabus

Module 1: Compound semiconductors.

Compound semiconductors, Lattice structures, Carrier drift, Direct and indirect semiconductors Scattering, Recombination, Mean life time, Continuity equation

Module 2: PN junction, BJT characteristics

PN junction characteristics, Current components in diode, Equivalent circuits of diode, BJT characteristics, second order effects in BJT: Thermal runaway, Base width modulation, Kirk effect, Band gap narrowing, small signal analysis.

Module 3: Circuits models for BJT

Eber's moll model, Hybrid pi model, Figure of merit, approximate model and complete equivalent model of BJT, Charge control model, Gummel poon model, SPICE model of BJT, Simulation of BJT

Module 4: Second Order Effects of MOS

N-channel, P-channel MOS characteristics and features, Enhancement and depletion mode: second order effects of MOS: Body effect, Channel length modulation, Subthreshold conduction, DIBL, Hot carrier effect, Mobility degradation, Velocity saturation, CMOS latch up, MOS parasitic capacitances and resistances.

Module 5: Circuits models for MOSFET

Circuits models for MOSFET: small signal, SPICE models, BSIM model, Simulation and Layout design DC, AC and Transient analysis of linear and nonlinear circuits, logic and timing simulations.FinFET and nanometre technology .

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Baker, Boyce	Cmos: Circuit Design, Layout, and Simulation	4th	McGraw-Hill Professional	2012
2	Jacob Millman	Millman's Electronic Devices and Circuits	4th	McGraw-Hill	2015

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Jan M. Rabaey,	Digital Integrated Circuits- A Design Perspective	2nd	Prentice Hall	2010

2	Kanna Kano	Semiconductor Devices	2nd	Prentice Hall	2005

Online study materials:
https://onlinecourses.nptel.ac.in/noc21_ee80/preview
https://digimat.in/nptel/courses/video/117106033/L35.html

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**MODULE 1**	9	CO1
1.1	Compound semiconductors	2	
1.2	Lattice structures, Carrier drift	2	
1.3	Direct and indirect semiconductors Scattering.	2	
1.4	Recombination, Mean life time, Continuity equation	3	
2	**MODULE 2**	9	CO2
2.1	PN junction characteristics	2	
2.2	Current components in diode, Equivalent circuits of diode	2	
2.3	BJT characteristics, second order effects in BJT: Thermal runaway, Base width modulation	2	
2.4	Kirk effect, Band gap narrowing, small signal analysis.	3	
3.	**MODULE 3**	9	CO3
3.1	Eber’s moll model, Hybrid pi model	2	
3.2	Figure of merit, approximate model and complete equivalent	2	
3.3	Model of BJT, Charge control model, Gummel poon model	2	
3.4	SPICE model of BJT, Simulation of BJT	3	
4.	**MODULE 4**	9	CO4
4.1	N-channel, P-channel MOS characteristics and features, Enhancement and depletion mode,	2	
4.2	second order effects of MOS: Body effect, Channel length modulation	2	
4.3	Subthreshold conduction, DIBL, Hot carrier effect	2	
4.4	Mobility degradation, Velocity saturation, CMOS latch up, MOS parasitic capacitances and resistances	3	
5.	**MODULE 5**	9	CO5
5.1	Circuits models for MOSFET: small signal	2	

5.2	SPICE models, BSIM model	2	
5.3	Simulation and Layout design DC, AC and Transient analysis of linear and nonlinear circuits	2	
5.4	logic and timing simulations.	3	
	TOTAL	**45 Hours**	

Course Designers:

COURSE DESIGNED BY	**VERIFIED BY**
Ms. Remya K P Asst. Professor, ECE, JCET E Mail ID: sanishvs@jawaharlalcolleges.com	Mr.Sanish V S Asst. Professor, ECE, JCET E Mail ID: sanishvs@jawaharlalcolleges.com

24ECCOAT545	COMPUTER ARCHITECTURE	Category	L	T	P	Credit
		PEC	3	0	0	3

Preamble

This course aims to impart knowledge of basic computer architecture and modern microcontrollers.

Prerequisite

Logic Circuit Design

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Explain the functional units, I/O and memory management w.r.t a typical computer architecture.. (Understanding)	20
CO2	Distinguish between microprocessor and microcontroller.. (Understanding)	20
CO3	Develop simple programs using assembly language programming.(Applying)	20
CO4	Interface 8051 microcontroller with peripheral devices using ALP/Embedded C (Applying)	20
CO5	Familiarize system software and Advanced RISC Machine Architecture. (Understanding)	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3											3	1	3	-
CO2	3											3	-	3	-
CO3	3		3		3							3	1	1	1
CO4	3	3	3		3							3	2	2	-
CO5	3				3							3	-		-
Avg	**3**	**3**	**3**		**3**							**3**	**2**	**3**	-

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30
Applying	50	50	50	50	50
Analyzing					

Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) : 20
Marks Assignment/Quiz/Course project : 14
Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1 (CO1) : Explain the functional units, I/O and memory management w.r.t a typical computer architecture.. (K1).

1. Understand Computer Arithmetic and Number Representation Perform binary multiplication and division, and work with fixed and floating-point number representations.
2. Comprehend Processor Architectures: Differentiate between Von Neumann and Harvard architectures, and understand CISC vs. RISC designs.

3. Analyze Processor Operation and Components: Describe the function of processor registers, buses, and the instruction cycle, including fetch, decode, and execute phases.

Course Outcome 2 (CO2): Distinguish between microprocessor and microcontroller.(K1)

1. Understand 8051 Microcontroller Architecture: Comprehend the block diagram, pin configuration, registers, internal memory, timers, ports, and interrupts of the 8051 microcontroller.
2. Master 8051 Assembly Language: Gain proficiency in 8051 assembly language programming, including addressing modes and a detailed study of the 8051 instruction set.
3. Interface with External Devices: Develop the ability to interface the 8051 microcontroller with external devices, using assembly language for programming and control.

Course Outcome 3 (CO3): Develop simple programs using assembly language programming.(K3)

1. Develop 8051 Assembly Language Programs: Write and debug simple assembly language programs for the 8051 microcontroller, including tasks like LED control and seven-segment display programming.
2. Program in C for 8051: Implement basic C programs for the 8051, covering variable declaration, delay generation, port programming, and code conversion.
3. Interface 8051 with External Devices: Interface the 8051 microcontroller with devices like LCD displays, keyboards, stepper motors, DAC, and ADC, and develop corresponding programs for these interfacing tasks.

Course Outcome 4 (CO4): Interface 8051 microcontroller with peripheral devices using ALP/Embedded C. (K3)

1. Understand 8051 Timers and Counters: Learn the operation and applications of 8051 timers and counters, including different modes of operation.
2. Program Serial Data Transfer: Program the 8051 microcontroller for serial data transfer using the special function registers (SFRs) of the serial port.
3. Gain Knowledge of ARM Architecture: Understand the ARM family, particularly ARM7 architecture, and learn about the ARM programmer's model and its applications in embedded systems.

Course Outcome 5 (CO5): Familiarize system software and Advanced RISC Machine Architecture. (K2)

1. Understand Memory Types and Hierarchy: Comprehend the characteristics and organization of different memory types (RAM, ROM) and the concept of memory hierarchy.
2. Analyze Cache Memory: Understand the basics of cache memory, including mapping techniques and strategies to improve cache performance.
3. Explore I/O Organization and Virtual Memory: Learn about input/output organization (synchronous vs. asynchronous I/O, programmed I/O, interrupt-driven I/O, and DMA) and the concepts of virtual memory, memory management, and address translation.

Syllabus

SYLLABUS

Module 1: Computer Arithmetic and Processor Basics

Algorithms for binary multiplication and division. Fixed and floating-point number representation. Functional units of a computer, Von Neumann and Harvard computer architectures, CISC and RISC architectures. Processor Architecture – General internal architecture, Address bus, Data bus, control bus. Register set – status register, accumulator,program counter, stack pointer, general purpose registers. Processor operation – instruction cycle, instruction fetch, instruction decode, instruction execute, timing response, instruction sequencing and execution (basic concepts, datapath.

Module 2: 8051 Architecture

Microcontrollers and Embedded Processors. Architecture – Block diagram of 8051, Pin configuration, Registers, Internal Memory, Timers, Port Structures, Interrupts. Assembly Language Programming - Addressing Modes, Instruction set (Detailed study of 8051 instruction set is required).

Module 3: Programming and Interfacing of 8051

Simple programming examples in assembly language. Interfacing with 8051 using Assembly language programming: LED, Seven segment LED display. Programming in C – Declaring variables, Simple examples – delay generation, port programming, code conversion. Interfacing of – LCD display, Keyboard, Stepper Motor, DAC and ADC -- with 8051 and its programming.

Module 4: Advanced Concepts

8051 Timers/Counters - Modes and Applications. Serial Data Transfer – SFRs of serial port, working, Programming the 8051 to transfer data serially. Introduction to ARM – ARM family, ARM 7 register architecture. ARM programmer’s model. System software -Assembler, Interpreter, Compiler, Linker, Loader, Debugger.

Module 5: The Memory System

Types of memory - RAM, ROM. Memory Characteristics and Hierarchy. Cache memory –The basics of Caches, Mapping techniques, Improving Cache performance. Virtual memory – Overlay, Memory management, Address translation. Input/Output Organization –Introduction, Synchronous vs. asynchronous I/O, Programmed I/O, Interrupt driven I/O,Direct Memory Access.

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Muhammed Ali Mazidi & Janice Gilli Mazidi, R.D. Kinley,	“The 8051 microcontroller and Embedded System,	2nd Edition	Pearson Education,	2018
2	Subrata Ghoshal,	Computer Architecture and Organization: From 8085 to Core2Duo	2nd Edition	Pearson Education,	2016

		and beyond,			

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	John P Hayes,	Computer Architecture and Organization,"	4th Edition	McGraw Hill.	2018
2	Ramesh S Goankar,	8085 Microprocessor Architecture, Applications and Programming,"	5th Edition	Penram International,	2016
3	Stallings W.,	5th Edition	5th Edition	Pearson Education.	2018

Online study materials:
https://www.youtube.com/watch?app=desktop&v=9nuAjYRbITQ&t=0s
https://www.youtube.com/watch?v=ot-ufo2AJ_c

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**Computer Arithmetic and Processor Basics**	9	CO1
1.1	Algorithms for binary multiplication and division	2	
1.2	Fixed- and floating-point number representation in computers	1	
1.3	Functional units of a computer, Von Neumann and Harvard computer architectures, CISC and RISC architectures	2	
1.4	Processor Architecture – General internal architecture, Address bus, Data bus,control bus. Register set – status register, accumulator, program counter, stack pointer, general purpose registers.	2	
1.5	Processor operation – instruction cycle, instruction fetch, instruction decode,instruction execute, timing response, instruction sequencing and execution (basic concepts), data path	2	
2	**8051 Architecture**	9	CO2
2.1	Microcontrollers and Embedded Processors and Applications	2	
2.2	Architecture – Block diagram of 8051, Pin configuration, Registers, Internal Memory, Timers, Port Structures, and Interrupts.	2	

2.3	Addressing Modes of 8051	2	
2.4	Instruction sets (Detailed study of 8051 instructions)	3	
3.	**Programming and Interfacing of 8051**	9	CO3
3.1	Simple programming examples in assembly language.	1	
3.2	Interfacing programming in Assembly language	1	
3.3	Programming in C - Declaring variables, Simple examples – delay generation, port programming, code conversion	2	
3.4	Interfacing of 7 segment LCD display 1	1	
3.5	Interfacing of Keyboard and stepper motor 2	2	
3.6	Interfacing of DAC and ADC	2	
4.	**Advanced Concepts**	9	CO4
4.1	8051 Timers/Counters - Modes and Applications	2	
4.2	Serial Data Transfer – SFRs of serial port, working, Programming the 8051 to transfer data serially	3	
4.3	Introduction to ARM - ARM family, ARM 7 register architecture. ARM programmer’s model	2	
4.4	System software - Assembler, Interpreter, Compiler, Linker, Loader, Debugger.	2	
5.	**Memory System**	9	CO5
5.1	Types of memory - RAM, ROM. Memory Characteristics and Hierarchy	2	
5.2	Cache memory – The basics of Caches, Mapping techniques, Improving Cache performance	2	
5.3	Virtual memory – Overlay, Memory management, Address translation	2	
5.4	Input/Output Organization – Introduction, Synchronous vs. asynchronous I/O,Programmed I/O, Interrupt driven I/O, Direct Memory Access.	2	
	TOTAL	**45 Hours**	

Course Designers:

COURSE DESIGNED BY	VERIFIED BY
Ms Ajeena A Asst. Professor, ECE, JCET E Mail ID:ajeena4093.ece@jawaharlalcolleges.com	Ms. Remya K P Asst. Professor, ECE, JCET E Mail ID: sanishvs@jawaharlalcolleges.com

24ECCSET601	CONTROL SYSTEMS ENGINEERING	Category	L	T	P	Credit
		PCC	2	1	0	3

Preamble

This course aims to develop the skills for mathematical modelling of various control systems and stability analysis using time domain and frequency domain approaches.

Prerequisite

EC202 Signals & Systems

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Apply electromechanical systems by mathematical modelling and derive their transfer functions(Applying)	20
CO2	Determine Transient and Steady State behaviour of systems using standard test signals(Understanding)	20
CO3	Determine absolute stability and relative stability of a system(Understanding)	20
CO4	Apply frequency domain techniques to assess the system performance and to design a control system with suitable compensation techniques (Applying)	20
CO5	Apply the system Controllability and Observability using state space representation. (Applying)	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2		1							2	1	2	-
CO2	3	3	2		1							2	1	2	-
CO3	3	3	3		1							2	1	2	-
CO4	3	3	3		1							2	1	2	-
CO5	3	3	3		1							2	1	2	-
Avg	**3**	**3**	**2.6**		**1**							**2**	**1**	**2**	**-**

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	10	10	10	10	20
Understanding	20	20	20	20	30
Applying	70	70	70	70	50
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) : 20
Marks Assignment/Quiz/Course project : 14
Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1 (CO1): Apply electromechanical systems by mathematical modelling and derive their transfer functions

1. For the given electrical/ mechanical systems determine transfer function.
2. Using block diagram reduction techniques, find the transfer function of the given system.
3. Find the overall gain for the given signal flow graph using Mason's gain equation.

Course Outcome 2 (CO2): Determine Transient and Steady State behaviour of systems using standard test signals

1. Derive an expression for time response of a given first/ second order system to step/ ramp input.
2. Determine step, ramp and parabolic error constants for the given unity feedback control system.
3. Obtain the steady state error of a given system when subjected to an input.

Course Outcome 3 (CO3): Determine absolute stability and relative stability of a system

1. Using Ruth Hurwitz criterion, for the given control system determine the location of roots on S-plane and comment on the stability of the system.
2. Sketch the Root Locus for the given control system.
3. Compare P, PI and PID controllers.

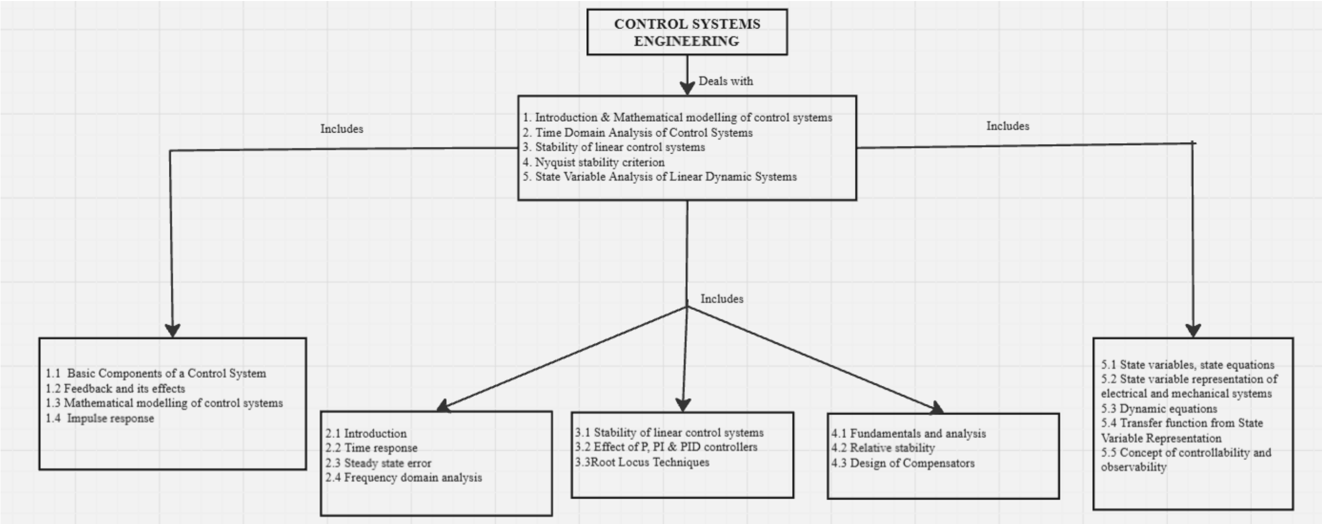
Course Outcome 4 (CO4): Apply frequency domain techniques to assess the system performance and to design a control system with suitable compensation techniques

1. Explain frequency domain specifications.
2. Draw the Nyquist plot for the given control system and determine the range of K for which the system is stable.
3. Plot the bode plot for the given transfer function and find the gain margin and phase margin.
4. Describe the design procedure of a lag/ lead compensator.

Course Outcome 5 (CO5): Apply the system Controllability and Observability using state space representation.

1. Obtain the state space representation of the given electrical/ mechanical system.
2. For the given control system, obtain the state equations and output equations:-
3. Plot the bode plot for the given transfer function and find the gain margin and phase margin.
4. Determine the controllability and observability of the given system.

Concept Map



SYLLABUS

Module 1:

Introduction: Basic Components of a Control System, Open-Loop Control Systems and Closed-Loop Control Systems, Examples of control system, digital control system

Feedback and its effects: Types of Feedback Control Systems, Linear versus Nonlinear Control Systems, Time-Invariant versus Time-Varying Systems**.**

Mathematical modelling of control systems: Electrical Systems and Mechanical systems. Transfer Function from Block Diagrams and Signal Flow Graphs: impulse response and its relation with the transfer function of linear systems. Block diagram representation and reduction methods, Signal flow graph and Mason's gain formula.

Module 2:

Time Domain Analysis of Control Systems: Introduction- Standard Test signals, Time response specifications.

Time response of first and second order systems to unit step input and ramp inputs, time domain specifications.

Steady state error and static error coefficients.

Frequency domain analysis: Frequency domain specifications, correlation between time and frequency responses.

Module 3:

Stability of linear control systems: Concept of BIBO stability, absolute stability, Routh Hurwitz Criterion, Effect of P, PI & PID controllers.

Root Locus Techniques: Introduction, properties and its construction, Application to system stability studies. Illustration of the effect of addition of a zero and a pole.

Module 4:

Nyquist stability criterion: Fundamentals and analysis.
Relative stability: gain margin and phase margin. Stability analysis with Bode plot.
Design of Compensators: Need of compensators, design of lag and lead compensators using Bode plots.

Module 5:

State Variable Analysis of Linear Dynamic Systems: State variables, state equations, state variable representation of electrical and mechanical systems, dynamic equations, merits for higher order differential equations and solutions.
Transfer function from State Variable Representation, Solutions of the state equations, state transition matrix
Concept of controllability and observability and techniques to test them - Kalman's Test.

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Ogata K	Discrete-time Control Systems	2nd Edition	2/e, Pearson Education.	2015
2	Farid Golnaraghi, Benjamin C. Kuo,	Automatic Control Systems	9th Edition	9/e, Wiley India.	2014
3	I.J. Nagarath, M.Gopal	Control Systems Engineering	5th Edition	New Age International Pub. Co.	2009

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	M. Gopal,	Digital Control and State Variable Method	4th Edition	4/e, McGraw Hill Education India.	2012

Online study materials:

https://archive.nptel.ac.in/courses/107/106/107106081/

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**INTRODUCTION**		CO1
1.1	Basic Components of a Control System, Open-Loop Control Systems and Closed-Loop Control Systems, Examples of control system	2	
1.2	Feedback and its effects: Types of Feedback Control Systems, Linear versus Nonlinear Control Systems, Time- Invariant versus Time-Varying Systems	3	

1.3	Mathematical modelling of control systems: Electrical Systems and Mechanical systems Transfer Function from Block Diagrams and Signal Flow Graphs	2	
1.4	Impulse response and its relation with transfer function of linear systems. Block diagram representation and reduction methods, Signal flow graph and Mason's gain formula	2	
2	**Time Domain Analysis of Control Systems**		CO2
2.1	Introduction- Standard Test signals, Time response specifications	3	
2.2	Time response of first and second order systems to unit step input and ramp inputs, time domain specifications	3	
2.3	Steady state error and static error coefficients	3	
2.4	Frequency domain analysis: Frequency domain specifications, correlation between time and frequency responses.	3	
3.	**Stability of linear control systems**		CO3
3.1	Stability of linear control systems: concept of BIBO stability, absolute stability, Routh's Hurwitz Criterion	3	
3.2	Effect of P, PI & PID controllers	3	
3.3	Root Locus Techniques - Introduction, properties and its construction, Application to system stability studies. Illustration of the effect of addition of a zero and a pole	3	
4.	**Nyquist stability criterion**		CO4
4.1	Fundamentals and analysis	2	
4.2	Relative stability: gain margin and phase margin. Stability analysis with Bode plot	4	
4.3	Design of Compensators: Need of compensators, design of lag and lead compensators using Bode plots	3	
5.	**State Variable Analysis of Linear Dynamic Systems**		CO5
5.1	State variables, state equations	1	
5.2	State variable representation of electrical and mechanical systems	2	
5.3	Dynamic equations, merits for higher order differential equations and solution	2	
5.4	Transfer function from State Variable Representation, Solutions of the state equations, state transition matrix	2	
5.5	Concept of controllability and observability and techniques to test them - Kalman's Test	2	
	TOTAL	**45 Hours**	

Course Designers:

COURSE DESIGNED BY	VERIFIED BY
Ms SAYANA M Asst. Professor, ECE, JCET E Mail ID:sayanam@jawaharlalcolleges.com	Dr. Sandeep C S Asso. Professor and HoD, ECE, JCET E Mail ID:hodece@jawaharlalcolleges.com

24ECSOCT602	SATELLITE AND OPTICAL COMMUNICATION	Category	L	T	P	Credit
		PCC	2	1	0	3

Preamble

This course aims to impart the basic knowledge of satellite and Optical communication systems.

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Prerequisite

24ECPCET403 Principles of Communication Engineering

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Define satellite communications& possible satellite orbits.	20
CO2	Describe satellite communication subsystems& launching mechanisms of satellites	20
CO3	Calculate link budgets. Provide an in-depth treatment of satellite communication systems operation and planning	20
CO4	Understand the optical fibers and their types	20
CO5	Describe optical sources, detectors and amplifiers	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	2	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	2	-	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	2	2	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	2	-	3	-
CO5	3	3	-	-	-	-	-	-	-	-	-	2	-	3	-
Avg	**3**	**3**	**0.6**	**-**	**-**	-	-	-	-	-	-	**2**	**0.4**	**3**	-

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30
Applying	50	50	50	50	50
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) : 20
Marks Assignment/Quiz/Course project : 14
Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks

End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1(CO1):

1. Explain the different types of satellite orbits?
2. Describe various orbital elements
3. Describe the effect of orbits on satellite performance?

Course Outcome 2(CO2):

1. Describe the major subsystems of a communication satellite .
2. Describe the significance of antenna subsystem why uplink and downlink frequency different in satellite communication are different

Course Outcome 3 (CO3):

1. Calculation of total link loss for various sky condition
2. Calculation of Effective Isotropic Radiated Power required for various Sky Conditions.

Course Outcome 4 (CO4):

1. Discuss the Dispersion mechanisms in fibers in detail
2. Calculate the core radius and cladding refractive index of step-index silicon fiber having NA= 0.3,V=75,n_1 =1.5 and it is to be operated in 850nm.

Course Outcome 5(CO5):

1. Explain the operation of PIN with necessary diagrams.
2. Discuss about the different amplifier configurations used in Optical receiver with relevant sketches.

Syllabus

Module 1

Introduction to Satellite Communication: - Historical background, Basic concepts of Satellite Communications, Kepler's laws of planetary motion, types of satellite orbits, orbit determination. Definitions of terms for Earth-Orbiting Satellites, Orbital Elements, Apogee and Perigee Heights, satellite stabilization, and orbital effects on satellites' performance. Antenna Look Angles, The Polar Mount Antenna, Limits of Visibility, launch systems for geostationary satellites.

Module 2

The Space Segment: -Introduction, Power Supply, Attitude & Orbit Control, Satellite stabilization, Station Keeping, Thermal Control, TT&C Subsystem, Transponders, Antenna Subsystem

The Earth Segment Types of Earth station, architecture & design considerations. Transmit-Receive Earth Station, Wideband receiver, the input demultiplexer, the power amplifier, Satellite tracking.

Module 3

The Satellite Link design: -Introduction, Transmission Theory, System Noise Temperature and G/T Ratio, Design of Downlinks Ku-Band GEO Satellite Systems, Uplink Design , Design for Specified CNR: Combining CNR and C/I Values in Satellite Links ,System Design for Specific Performance. Regional &global satellite systems INSAT, INTELSAT& INMARSAT**.**

Module 4

Optical Fibres:- types and refractive index profiles, mode theory of fibres: modes in SI and GI fibres, linear and non linear effects in fibres, dispersion, Group Velocity Dispersion, modal, wave guide and Polarization, Modes, Dispersion, attenuation- absorption, bending and scattering losses

Fibre materials, fabrication of fibres, photonic crystal fibre, index guiding PCF, photonic bandgap fibre, fibre cables.

Module 5

Optical sources:- LEDs and LDs, structures, characteristics, modulators using LEDs and LDs

Optical detectors:- types and characteristics, structure and working of PIN and AP

Optical Amplifiers:-,basic concept, applications, types, doped fibre amplifiers, EDFA, basic theory, structure and working, Semiconductor laser amplifier, Raman amplifiers, TDFA, amplifier configurations, performance comparison.

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Timothy Pratt,Jeremy E,Allnutt	Satellite Communications	3rd Edition	Wiley	2019
2	Gerd Keiser	Optical Fiber Communications	5th Edition	McGraw Hill	2013

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Dennis Roddy	Satellite Communications	**4th**	McGraw- Hill International edition	**2006**
2	Gerard Maral,Michel Bousquet,Zhili Sun	Satellite Communications Systems: Systems, Techniques and Technology,	6th	Wiley	2020
3	Chakrabarthi	Optical Fibre Communication	4th	McGraw Hill	2015

Online study materials:
https://archive.nptel.ac.in/courses/117/105/117105131/

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**MODULE 1: Introduction to Satellite Communication**	**9**	CO1
1.1	Historical background, Basic concepts of Satellite Communications, Kepler's laws of planetary motion, types of satellite orbits, orbit determination	2	
1.2	Definitions of terms for Earth-Orbiting Satellites, Orbital Elements, Apogee and Perigee Heights, satellite stabilization, and orbital effects on satellites' performance.	3	
1.3	Antenna Look Angles, The Polar Mount Antenna	2	
1.4	launch systems for geostationary satellites.	2	
2	**MODULE 2: Satellite System**	**9**	CO2
2.1	**The Space Segment**: -Introduction, Power Supply, Attitude & Orbit Control, Satellite stabilization	3	
2.2	Station Keeping, Thermal Control, TT&C Subsystem, Transponders, Antenna Subsystem	2	
2.3	**The Earth Segment** Types of Earth station, architecture & design considerations. Transmit-Receive Earth Station,	2	
2.4	Wideband receiver, the input demultiplexer, the power amplifier, Satellite tracking.	2	
3.	**MODULE 3: The Satellite Link design**	**9**	CO3
3.1	Introduction, Transmission Theory, System Noise Temperature and G/T Ratio	2	

3.2	Design of Downlinks Ku-Band GEO Satellite Systems,	2	
3.3	Uplink Design , Design for Specified CNR: Combining CNR and C/I Values in Satellite Links	2	
3.4	System Design for Specific Performance. Regional &global satellite systems	2	
3.5	INSAT, INTELSAT& INMARSAT	1	
4.	**MODULE 4 : Optical Fibres**	**9**	CO4
4.1	Types and refractive index profiles, mode theory of fibres: modes in SI and GI fibres,	2	
4.2	linear and non linear effects in fibres, dispersion, Group Velocity Dispersion, modal, wave guide	2	
4.3	attenuation- absorption, bending and scattering losses	2	
4.4	Fibre materials, fabrication of fibres, photonic crysta fibre, index guiding PCF	2	
4.5	photonic bandgap fibre, fibre cables.	1	
5.	**MODULE 5: Optical sources,Detectors & Amplifiers**	**9**	CO5
5.1	LEDs and LDs, structures, characteristics, modulators using LEDs and LDs	2	
5.2	Optical detectors:- types and characteristics, structure and working of PIN and AP	2	
5.3	Optical Amplifiers:-,basic concept, applications, types, doped fibre amplifiers	2	
5.4	, EDFA, basic theory, structure and working, Semiconductor laser amplifier	2	
5.5	Raman amplifiers, TDFA, amplifier configurations, performance comparison.	1	
	TOTAL	**45 Hours**	

Course Designers:

COURSE DESIGNED BY	**VERIFIED BY**
Mr.Sanish V S Asst. Professor, ECE, JCET E Mail ID: sanishvs@jawaharlalcolleges.com	Ms.Jisha K V Asst. Professor, ECE, JCET E Mail ID:srikanth4019.ece@jawaharlalcolleges.com

24ECDIPT603	DIGITAL IMAGE PROCESSING	Category	L	T	R	Credit
		PCC-PBL	3	0	1	4

Preamble

This course aims to develop the skills for methods of various transformation and analysis of image enhancement, image reconstruction, image compression, image segmentation and image representation.

Prerequisite

Probability, Random Processes and Numerical Methods, Digital Signal Processing

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Understand The fundamentals of digital image and its processing.	20
CO2	Perform image enhancement techniques in spatial and frequency domain	20
CO3	Apply the mathematical modelling of image restoration and compression	20
CO4	Apply the concept of image segmentation	20
CO5	Understand the concept of classification and develop small projects of 1-D and 2-D Digital Signal Processing	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3											2			
CO2	3	3			3							2			
CO3	3	3	3									2			
CO4	3	3	3		3							2			
CO5	3	3	3		3							2			
Avg	**3**	**3**	**3**		**3**							**2**			

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30
Applying	50	50	50	50	50
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	60	40	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 9 Marks
Continuous Assessment Test (2 numbers) : 24 Marks
Assignment/Quiz/Course project : 27 Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 40 Marks** **Duration = 150 Minutes** Part A: 10 X 4 = 40 Marks

Course Level Assessment Questions

Course Outcome 1 (CO1): Understand The fundamentals of digital image and its processing

1. List out the examples of image processing applications as per electromagnetic spectrum
2. Discuss the fundamental digital image processing steps
3. Explain the components of digital image processing
4. Define and explain pixel, sampling, quantization, grey levels, relation between pixels
5. Describe human eye and image formation

Course Outcome 2 (CO2): Perform image enhancement techniques in spatial and frequency domain

1. What is Image Transform? What is the need for transform? Write applications of transform
2. Explain 2D Unitary DFT and state the various properties.
3. What are image sharpening filters? Write the application of sharpening filters
4. Discuss image smoothing filter with its model I the spatial domain
5. What is histogram? Explain the role of histogram equalization in image enhancement.
6. Explain the concept of histogram matching, development of the method and the corresponding implementation with suitable example

Course Outcome 3 (CO3): Apply the mathematical modelling of image restoration and compression

1. What is meant by image restoration? Give the difference between enhancement and restoration
2. 2 Define the process of restoration. Explain the order statistics filter for restoring images in the presence of noise.
3. How the estimation of noise parameters are done? Give the expression for exponential noise.

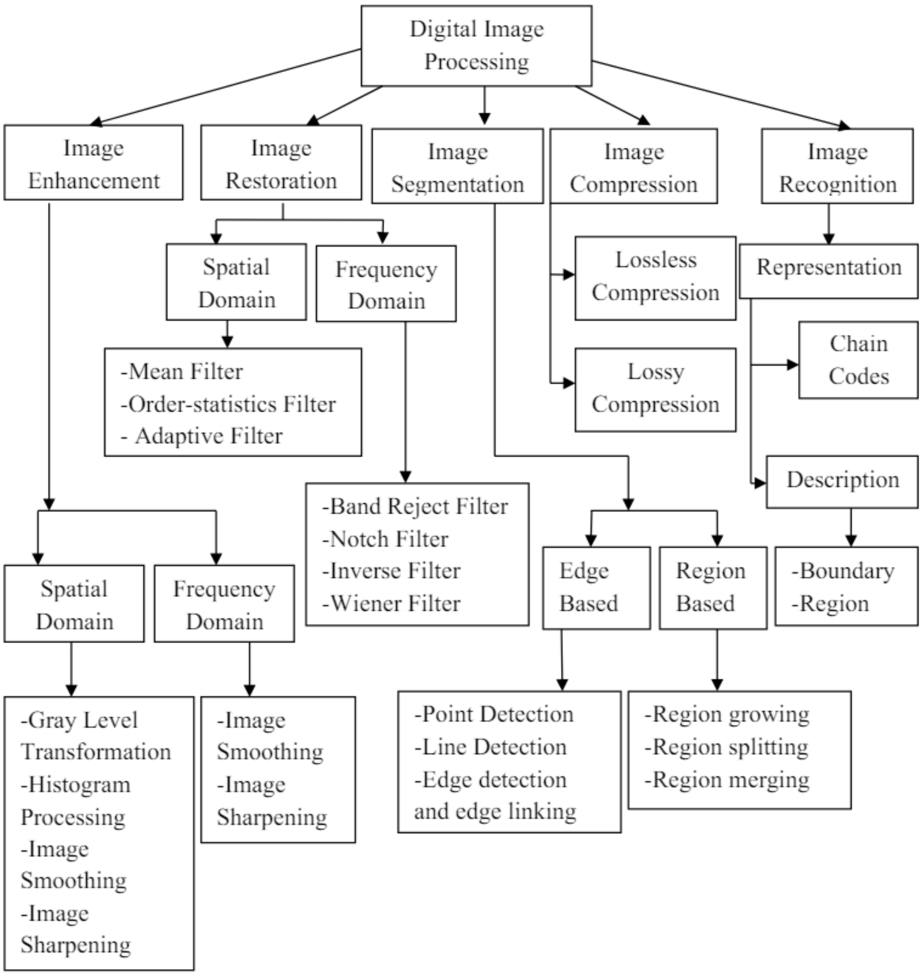
Course Outcome 4 (CO4): Apply the concept of image segmentation

1. Name two basic approaches of image segmentation and mention their differences.
2. How can you decide optimal thresholds when the image contains a background and several foreground objects? Write down a corresponding algorithm.
3. Write down the region growing algorithm. What are its advantages and disadvantages?

Course Outcome 5 (CO5): Understand the concept of classification and develop small projects of 1-D and 2-D Digital Signal Processing

1. Encode the binary symbols using Huffmann coding.
2. Draw a (2, 1, 3) encoder, if the generator sequences are (1 0 0 0) and (1 1 0 1) respectively. Also find the code vector for the input u = 1101 using transform domain approach.
3. Explain Viterbi decoding and decode the sequence 11011000011100

Concept Map



Syllabus

Module 1: Digital Image Fundamentals

Introduction to Digital Image Processing and its applications; Elements of Digital Image Processing Systems, Image Representation; Digital Image Properties; Steps in Digital Image Processing; Elements of Visual perception; Image Sensing and Acquisition; Image Sampling and Quantization; Relationship between Pixels; Color Image Processing: Color Fundamentals, Color Models, Color Representation Pseudo Color Image Processing

Module 2: Image Enhancement

Image Transform: Fourier transform, SHFT, DFT, FFT, DCT, Hadamard Transform, Wavelets transform (CWT, DWT), KLT, SVD, Applications.
Spatial Domain: Gray level transformations –Histogram, Enhancement using arithmetic and logic operators , Basics of Spatial Filtering–Smoothing and Sharpening Spatial Filtering , Frequency Domain: 2D Fourier Transform,– Smoothing and Sharpening frequency domain filters.

Module 3: Image Restoration and Segmentation

Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters, Notch Filters, Optimum Notch Filtering, Inverse Filtering – Wiener filtering. Segmentation, Edge detection Edge Linking and Boundary detection, Region based segmentation, Morphological processing-erosion and dilation, Segmentation by Morphological Watersheds.

Module 4 Open Source Embedded Development Boards

Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transforms, Some Basic Morphological Algorithms. Compression – Fundamentals; Image Compression models; Error-Free Compression; Variable Length Coding, LZW coding, Bit-Plane Coding, Lossless Predictive Coding; Lossy Compression: Lossy Predictive Coding, Transform Coding, wavelet Coding; Image Compression Standards.

Module 5 Image Classification

Pattern recognition concepts-Baye's classifier, supervised and unsupervised classifier, Support vector machine, texture based segmentation, fuzzy set classification, Hebbian learning, Neuro fuzzy classifiers, Texture-based classification -Segmentation (Spatial, Spectral)-regions Fuzzy set classification – Object-based classifiers – Deep Learning – Artificial Neural nets: Hebbian leaning – Adaline, Madaline, BPN – hybrid classifiers – Neuro – Fuzzy models- Expert system – Knowledge based systems, Deep learning, artificial neural networks.

Learning Resources
TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Rafael C. Gonzales, Richard E. Woods	Digital Image Processing	4th Edition	Pearson Education	2018
2	Anil Jain K	Fundamentals of Digital Image Processing	2nd Edition	PHI Learning Pvt. Ltd	2015
3	S Jayaraman, S Esakkirajan, T Veerakumar,	Digital image processing	2nd Edition	Tata Mc Graw Hill,	2020

4	Mark Nixon, Alberto S Acquado	Feature Extraction and Image Processing for computer Vision	3rd Edition	Academic Press	2012

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins	"Digital Image Processing Using MATLAB",	**3rd Edition**	Oxford University Press	2007
2	S. Sridhar	Digital Image Processing	2nd Edition	Oxford University Press	2016
3	Kenneth R Castleman	Digital image processing	1st edition	Pearson	2007

Online study materials:

https://onlinecourses.nptel.ac.in/noc19_ee55/preview
https://matlabacademy.mathworks.com/details/image-processing-with-matlab/mlip
https://www.udemy.com/course/image-processing-and-computer-vision-with-python-opencv

Course Contents and Lecture Schedule

No.	Topic	No. of Lectures	Course Outcome
1	**Digital Image Fundamentals**	12	CO1
1.1	Introduction to Digital Image Processing and its applications; Elements of Digital Image Processing Systems	3	
1.2	Image Representation ; Digital Image Properties; Steps in Digital Image Processing	3	
1.3	Elements of Visual perception;, Image Sensing and Acquisition; Image Sampling and Quantization, Relationship between Pixels	3	
1.4	Color Image Processing: Color Fundamentals, Color Models, Color Representation Pseudo color Image Processing	3	
2	**Image Enhancement**	12	CO2
2.1	Image Transform: Fourier transform, SHFT, DFT, FFT, DCT, Hadamard Transform	3	
2.2	Spatial Domain: Gray level transformations –Histogram, Enhancement using arithmetic and logic operators	3	
2.3	Basics of Spatial Filtering–Smoothing and Sharpening Spatial Filtering	3	
2.4	Frequency Domain:,– Smoothing and Sharpening frequency domain filters.	2	
2.5	2D Fourier Transform	1	
3	**Image Registration and Segmentation**	12	
3.1	Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters , Notch Filters	3	

3.2	Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters , Notch Filters, Optimum	3	CO3
3.3	Segmentation, Edge detection Edge Linking and Boundary detection	3	
3.4	Region based segmentation	1	
3.5	Morphological processing- erosion and dilation , Segmentation by Morphological Watersheds	2	
4	**Morphological Image Processing**	12	
4.1	Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transforms, Some Basic Morphological Algorithms	3	CO4
4.2	Compression – Fundamentals ; Image Compression models; Error-Free Compression; Variable Length Coding, LZW coding, Bit-Plane Coding	3	
4.3	Lossless Predictive Coding; Lossy Compression: Lossy Predictive Coding, Transform Coding, wavelet Coding; Image Compression Standards.	3	
4.4	Feature Selection and extraction: Extracting Interest Points and Their Descriptors (with Harris, SIFT and SURF) in Image Pairs, Principal Component Analysis (PCA) and Linear Discriminant Analysis for Image Recognition- Image Classification using SVM-ANN-Feedforward and Back propagation-Object Detection using CNN-RCNN	3	
5	**Image Classification**	12	
5.1	Pattern recognition concepts-Baye's classifier, supervised and unsupervised classifier, Support vector machine	3	CO5
5.2	fuzzy set classification, Hebbian learning, Neuro fuzzy classifiers, Texture-based classification -Segmentation (Spatial, Spectral)-regions Fuzzy set classification – Object-based classifiers	3	
5.3	Deep Learning – Artificial Neural nets: Hebbian leaning – Adaline, Madaline, BPN – hybrid classifiers	3	
5.4	Neuro – Fuzzy models- Expert system – Knowledge based systems, Deep learning, artificial neural networks	3	
	TOTAL	**60**	

Course Designers:

COURSE DESIGNED BY	**VERIFIED BY**
Mr .Jisha K V Asst. Professor, ECE, JCET E Mail ID:jishakv.ece@gmail.com	Dr. Sandeep C S Asso. Professor and HoD, ECE, JCET E Mail ID:hodece@jawaharlalcolleges.com

24ECEMTL607	Electromagnetics Lab

Category	T	P	Credit
PCL	-	3	2

Preamble

1. Provide practical experience in design and analysis of few electronic devices and circuits used for Microwave and Optical communication engineering
2. Familiarize students with simulation of basic Antenna experiments with simulation tools..

Prerequisite

Nil

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement
CO1	Familiarize the basic Microwave components and to analyze the parameters using Klystron oscillator
CO2	Analyze Microwave solid-state device or Hybrid Circuits
CO3	Understand the principles of fiber-optic communications and analyze the parameters of Optical fiber
CO4	analyze optical sources.
CO5	Design and simulate basic antenna experiments with simulation tools.

*** Weightage depends on Bloom's Level, number of contact hours,

Mapping of Course Outcomes with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3									3		2	3
CO2	3	3	3									3		2	3
CO6	3	3	3									3		2	3
CO4	3	3	3									3		2	3
CO5	3	3	3	2	3							3		2	3
AVG	**3**	**3**	**3**	**0.4**	**0.6**							**3**		**2**	**3**

1-Low; 2-Medium; 3- Strong;

Assessment Pattern:

Total Mark	CIA	ESE	ESE Duration
100	60	40	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 9 Marks

Continuous Assessment : 27 Marks

Internal Test : 24 Marks

End Semester Examination Pattern:

The following guidelines should be adhered regarding the award of marks

a) Diagram & Design : 12 Marks
b) Procedure : 8 Marks
c) Output : 8 Marks
d) Viva : 8 Marks
e) Record : 4 Marks

List of Experiments

Part A: MICROWAVE EXPERIMENTS (Minimum Four Experiments are mandatory)

1. Reflex Klystron Mode Characteristics.
2. GUNN diode characteristics.
3. VSWR and Frequency measurement.
4. Verify the relation between Guide wave length, free space wave length and cut off wave length for rectangular wave guide.
5. Unknown load impedance measurement using smith chart and verification using transmission line equation.
6. Measurement of Magic Tee characteristics.
7. Crystal Index Measurement.

PART B: OPTICAL EXPERIMENTS (Minimum Three Experiments are mandatory)

1. Setting up of Fiber optic Digital link.
2. Measurement of Numerical Aperture of a fiber.
3. Study of losses in Optical fiber.
4. Voltage vs. Current (V-I) characteristics of Laser Diode.
5. Voltage vs. Current (V-I) characteristics of LED.
6. Characteristics of Photodiode

ANTENNA EXPERIMENTS (Minimum Three Experiments are mandatory)

1. Familiarization of any antenna simulation software.
2. Simulation of Dipole Antenna.
3. Simulation of Patch Antenna.
4. Simulation of Antenna Array.
5. Study of Vector Network Analyzer.
6. Antenna Radiation Pattern Measurement

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Samuel Y. Liao,	Microwave Devices and Circuits	III	Pearson Education,	2003.
2	Gred Keiser	Optical Fiber Communication	V	Mc Graw Hill,	2013
3	Balanis	Antenna Theory and Design	III	Wiley Publications.	

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	John D. Krauss	Antennas for all Applications,	III	Mc Graw Hill	
2	Thomas A. Milligan	Modern Antenna Design,	II	Wiley Inter science.	

On line study materials:

1. https://youtu.be/qzIUJZ39Zro?si=vrYtC3222EE8jUTl
2. https://archive.nptel.ac.in/courses/108/101/108101092/

COURSE DESIGNED BY	VERIFIED BY
Mr.Sanish V S Asst. Professor, ECE Dept, JCET E. Mail ID: sanishvs@jawaharlalcolleges.com	Ms. Ajeena A Asst. Professor, ECE Dept, JCET E. Mail ID: ajeena4093.ece@jawaharlalcolleges.com

24ECIMPP608	IMAGE PROCESSING LAB	Category	L	T	P	Credit
		PCL	0	0	3	2

Preamble

This course is divided into two sections, Introductory Cycle to familiarize the working environment and Digital Image Processing foundation techniques. It provides an in hand experience related to digital image processing, image transforms and enhancement. It equips the learners with skills to design and implement image restoration and de noising. This also helps the learners to analyze the existing binary image processing algorithms as well as to propose new ones.

Prerequisite

- Digital Signal Processing
- Digital Image Processing

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Implement Digital Signal Processing basic algorithms.	20
CO2	Perform image transforms.	20
CO3	Perform image enhancement.	20
CO4	Implement image restoration and denoising.	20
CO5	Implement binary image processing.	20

Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	3	-	-	-	3	-	-	2	-	-	-
CO2	3	3	2	2	3	-	-	-	3	-	-	2	-	-	-
CO3	3	3	2	2	3	-	-	-	3	-	-	2	-	-	-
CO4	3	3	2	2	3	-	-	-	3	-	-	2	-	-	-
CO5	3	3	2	2	3	-	-	-	3	-	-	2	-	-	-
AVG	**3**	**3**	**2**	**2**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**2**	**-**	**-**	**-**

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	
Set	Practical Sessions
Guided Response	Practical Sessions
Mechanism	Practical Sessions
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution:

Total Mark	CIE	ESE	ESE Duration
100	60	40	2.5 hours

Continuous Internal Evaluation Pattern

Attendance : 9 marks
Continuous Assessment : 27 marks
Internal Test : 24 marks

End Semester Examination Pattern

The following guidelines should be adhered regarding the award of marks

a. Preliminary Work : 10 marks
b. Implementing the work/Conducting the experiment : 10 marks
c. Performance/Result/Inference (usage of equipment and troubleshooting) : 10 marks
d. Viva voce : 5 marks
e. Record : 5 marks

Course Level Assessment Questions

CO1

1. Convert colour image to grayscale image, generate negative, mirror and flipped image, perform brightness adjustment, implement oil paint effect

CO2

1. Perform Convolution, DFT, DCT, KLT, Walsh Transform.

CO3

1. Perform Image Enhancement using Histogram equalization, Bartlett filter, Median filter, Average filter.

CO4

1. Perform bit plane slicing, zooming of a grayscale image, Gaussian blur, smoothen and sharpen.

CO5

1. Perform erosion, dialation, opening, closing, hit and miss transform.

List of Experiments (All experiments are mandatory)

Experiment 1. Digital Signal Processing Basics

Experiment 2. Image Transforms

Experiment 3. Image Enhancement

Experiment 4. Image Restoration and Denoising

Experiment 5. Binary Image Processing

Experiment 6. Video Processing

Experiment 7. classification of images based on AI using Python and Open CV

Laboratory Softwares to be used

- GNU Octave 3.8 or higher
- Scilab 5.5 or higher
- Choice of any open-source tool with the prior permission obtained from the department.

Schedule of Experiments: Every experiment should be completed in three hours.

Learning Resources:

Text Books

Sl.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	R C Gonzalez, R E Woods, S L Eddins	Digital Image Processing using Matlab	2nd Edition	Gatesmark Publishing	2009
2	Jayaraman S, Veerakumar T, Esakkirajan S	Digital Image Processing	1st Edition	Mc Graw Hill Education	2009

Reference Books

Sl.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Anil K Jain	Fundamentals of Digital Image Processing	1st Edition	Prentice Hall	1989
2	Chris Soloman, Toby Breckon	Fundamentals of Digital Image Processing: A Practical Approach with Examples in Matlab	1st Edition	Wiley-Blackwell	2010

COURSE DESIGNED BY	VERIFIED BY
Mr. Srikanth K Asst. Professor, ECE Dept, JCET E. Mail ID: srikanth4019.ece@jawaharlalcolleges.com	Ms. Ajeena A Asst. Professor, ECE Dept, JCET E. Mail ID: ajeena4093.ece@jawaharlalcolleges.com

24ECVACP609	ELECTRONIC SYSTEM DESIGN & AUTOMATION	Category	L	T	P	Credit
		VAC	0	0	3	2

Preamble

This course provides a comprehensive understanding of electronic system design and automation, focusing on the integration of modern tools and technologies in engineering. Students will gain hands-on experience in designing and optimizing automated systems for real-world industrial applications.

Prerequisite

Basics of Electronics and Mechanical engineering.

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Understand and apply the principles of electronic systems design, including analog and digital circuits, using modern design and simulation tools.	20
CO2	Design, implement, and troubleshoot control systems such as PLC-based automation, robotic systems, and industrial control systems for real-world applications.	20
CO3	Program and develop embedded systems using microcontrollers and real-time operating systems (RTOS) to automate tasks and integrate communication protocols in industrial settings.	20
CO4	Identify, design, and integrate automation technologies like IoT, robotics, and AI to optimize industrial processes and enhance system efficiency.	20
CO5	Utilize modeling and simulation tools to analyze and optimize automated systems, ensuring they meet the required performance, safety, and operational standards.	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	1	-	3	-	-	1	-	-	-	2	-	-	3
CO2	3	-	-	-	3	-	-	1	-	-	-	2	-	-	3
CO3	3	-	2	-	3	-	-	1	-	-	-	2	-	-	3
CO4	3	-	2	-	3	-	-	1	-	-	-	2	-	-	3
CO5	3	-	-	-	3	-	-	1	-	-	-	2	-	-	3
Avg	**3**	-	**1.6**	-	**3**	-	-	1	-	-	-	**2**	**-**	-	**3**

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	
Set	Hands –on Sessions
Guided Response	Exercises
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	100	-	-

Continuous Internal Evaluation Pattern:

Attendance : 15 Marks
Practical : 50
Test : 35

Syllabus

Module 1

Introduction to Electronic Systems and Automation:
Overview of Electronic Systems - Automation Concepts and Evolution - Basic Components of an Electronic System (Sensors, Actuators, Controllers) - Introduction to Microcontrollers and Embedded Systems - Applications of Automation in Engineering

Module 2

Electronic Circuit Design and Simulation: Basic Electronic Circuits (Resistors, Capacitors, Diodes, Transistors) - Operational Amplifiers and Signal Processing - Digital Logic Circuits (Gates, Flip-Flops, Multiplexers) - Simulation Tools for Electronic Circuit Design (SPICE, LTspice) - Signal Integrity and Circuit Optimization

Module 3

Control Systems and Automation Hardware: Principles of Control Systems (Feedback, Open Loop, Closed Loop) - Sensors and Actuators for Automation - Microcontroller-based Automation Hardware Design - PLC (Programmable Logic Controllers) and SCADA Systems
Industrial Automation Hardware: Robots, Conveyors, and CNC Machines

Module 4

Embedded Systems and Real-time Operating Systems: Introduction to Embedded Systems and their role in Automation - Embedded Software Development (C, Python, Assembly) - Real-Time Operating Systems (RTOS) for Embedded Systems - Communication Protocols (I2C, SPI, UART) - Embedded System Debugging and Testing Techniques

Module 5

Advanced Topics in Automation and System Integration: Internet of Things (IoT) and Industry 4.0 Machine Vision and Artificial Intelligence in Automation - Robotics and Automation Systems Integration - Modeling and Simulation of Complex Automated Systems - Case Studies in Industrial Automation

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	K. Lal Kishore	Electronic System Design	1st	McGraw-Hill Education	2019
2	M. K. Gupta	Introduction to Automation	2nd	PHI Learning	2018

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Ajay V. Deshmukh	Microcontroller and Embedded Systems	1st	Tata McGraw-Hill Education	2016
2	Amit Kumar	Fundamentals of Industrial Automation	1st	Pearson Education	2017

Online study materials:

https://nptel.ac.in/courses/108102481

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	Introduction to Electronic Systems and Automation	12	CO1
1.1	Overview of Electronic Systems	2	
1.2	Automation Concepts and Evolution	2	
1.3	Basic Components of an Electronic System	3	
1.4	Sensors, Actuators, Controllers	1	
1.5	Introduction to Microcontrollers and Embedded Systems -	1	
1.6	Applications of Automation in Engineering	3	
2	Electronic Circuit Design and Simulation	12	
2.1	Basic Electronic Circuits (Resistors, Capacitors, Diodes, Transistors)	3	
2.2	Operational Amplifiers and Signal Processing	3	

2.3	Digital Logic Circuits (Gates, Flip-Flops, Multiplexers) Simulation Tools for Electronic Circuit Design (SPICE, LTspice)	3	CO2
2.4	Signal Integrity and Circuit Optimization	3	
3.	Control Systems and Automation Hardware	12	CO3
3.1	Principles of Control Systems (Feedback, Open Loop, Closed Loop)	2	
3.2	Sensors and Actuators for Automation	2	
3.3	Microcontroller-based Automation Hardware Design	2	
3.4	PLC (Programmable Logic Controllers) and SCADA Systems	2	
3.5	Industrial Automation Hardware: Robots, Conveyors, and CNC Machines	4	
4.	**Embedded Systems and Real-time Operating Systems**	12	CO4
4.1	**Introduction to Embedded Systems and their role in Automation**	3	
4.2	**Embedded Software Development (C, Python, Assembly)**	3	
4.3	**Real-Time Operating Systems (RTOS) for Embedded Systems - Communication Protocols (I2C, SPI, UART)**	3	
4.4	**Embedded System Debugging and Testing Techniques**	3	
5.	**Advanced Topics in Automation and System Integration**	12	CO5
5.1	**Internet of Things (IoT) and Industry 4.0 Machine Vision and Artificial Intelligence in Automation**	3	
5.2	**Robotics and Automation Systems Integration**	4	
5.3	**Modeling and Simulation of Complex Automated Systems**	2	
5.4	**Case Studies in Industrial Automation**	3	
	TOTAL	**60 Hours**	

Course Designers:

COURSE DESIGNED BY	**VERIFIED BY**
Dr Aswani K Asst. Professor, ECE, JCET E Mail ID: draswani4316.ece@jawaharlalcolleges.com	Mr.Sanish V S Asst. Professor, ECE, JCET E Mail ID: sanishvs@jawaharlalcolleges.com

24ECESMT515	**EMBEDDED SYSTEMS IN MEDICINE**	Category	L	T	P	Credit
		PEC	3	0	0	3

Preamble

This course provides a comprehensive overview of the application of embedded systems in the medical field, focusing on the design, development, and implementation of medical devices. Students will learn about key medical technologies, the integration of embedded systems in these devices, as well as the regulatory standards and ethical concerns in the medical industry

Prerequisite

Medical Instrumentation

Course Outcomes

On the successful completion of the course students will be able to

CO Number	**Course Outcome Statement**	**Weightage in %**
CO1	understanding of the fundamentals of embedded systems and their critical role in healthcare applications	20
CO2	Explain embedded systems for medical applications, including selecting appropriate sensors and actuators,	20
CO3	Explain various wireless communication systems and IoT solutions for medical devices	20
CO4	Understanding the embedded software for medical devices to meet regulatory standards	20
CO5	Describe the awareness of the ethical, legal, and regulatory considerations in medical device development	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	2	2	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	2	2	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	2	2	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	2	2	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	2	2	-
Avg	**3**	**3**	-	-	-	-	-	-	-	-	-	-	2	2	-

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	30	30	-	-	20
Understanding	30	30	-	-	30
Applying	40	40	100	100	50
Analyzing	-	-	-	-	-
Evaluating	-	-	-	-	-
Creating	-	-	-	-	-

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Continuous Internal Assessment Pattern:

Attendance : 6 Marks

Continuous Assessment Test (2 numbers) : 20 Marks

Project : 14 Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1 (CO1):

1. What are the key components of an embedded system, and how do they contribute to the functionality of medical devices?
2. Describe the role of embedded systems in modern healthcare applications. Provide examples of medical devices that rely on embedded systems.

Course Outcome 2 (CO2):

1. Explain how sensors and actuators are selected for medical applications, such as heart rate monitoring or insulin pumps. What factors influence this selection?
2. How do embedded systems interface with sensors and actuators in medical devices, and what challenges may arise in their integration?

Course Outcome 3 (CO3):

1. Describe the role of wireless communication protocols like Bluetooth, ZigBee, and Wi-Fi in remote patient monitoring systems. What are the advantages and limitations of each?
2. How does the Internet of Things (IoT) enhance healthcare delivery, and what are some key IoT-based applications in medical devices?

Course Outcome 4 (CO4):

1. Describe the process of software validation and verification in medical devices. Why are these steps critical for patient safety?
2. How can embedded software be developed to meet both functional requirements and safety standards in medical devices? Provide examples.

Course Outcome 5 (CO5):

1. Explain the importance of patient privacy and data protection in the development of medical devices that use embedded systems.
2. What are the main regulatory requirements for the approval of medical devices, and how do they impact the development lifecycle of embedded healthcare systems?

Syllabus

Module 1: Fundamentals of Embedded Systems and Their Role in Medicine

Module 2: Sensors and Actuators for Medical Devices

Types of Sensors in Medicine (temperature, pressure, ECG, EEG, glucose, etc.), Sensors for Diagnostics and Monitoring, Actuators: Types, working principles, and their role in therapeutic devices, Interface of Sensors/Actuators with Embedded Systems: ADC/DAC, signal conditioning, Real-time Data Processing and Interpretation in Healthcare Applications

Module 3: Embedded Software Development for Medical Devices

Programming Embedded Systems for Medical Applications, Real-time Systems and Safety Considerations in Medical Devices, Development of Embedded Software for Health Monitoring and Diagnostics, User Interfaces and Human-Device Interaction (HMI) in Medical Devices, Power Management and Optimization for Medical Devices

Module 4: Wireless Communication and Data Security in Medical Devices

Wireless Technologies for Medical Devices (Bluetooth, ZigBee, Wi-Fi, NFC), IoT (Internet of Medical Things) in Healthcare: Remote monitoring, smart healthcare systems, Wireless Health Devices: Wearables, implants, and home-care devices, Security Challenges: Data privacy, encryption, and medical data protection, Regulatory Compliance for Medical Data Transmission

Module 5: Medical Device Certification and Ethical Considerations

Overview of Certification and Regulatory Requirements for Medical Devices, Medical Device Software Validation and Verification, Risk Management in Medical Device Development, Ethical Considerations in Medical Technology: Data privacy, patient consent, and decision-making, Impact of Embedded Systems on Medical Ethics: Autonomous devices, AI in diagnostics

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	**Jonathan W. Valvano**	Embedded Systems: Introduction to the MSP432 Microcontroller	5th Edition	CreateSpace Independent Publishing Platform	2021
2	John G. Webster	Medical Instrumentation: Application and Design	5th Edition	Wiley	2021

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Tim Wilmshurst	Designing Embedded Systems with PIC Microcontrollers: Principles and Applications	2nd Edition	Newnes	2020
2	Dinesh Samuel, Jyothi K. J.	Internet of Things for Healthcare Applications	1st Edition	Springer	2021

Online study materials:
https://onlinecourses.nptel.ac.in/noc21_ee74/preview
(Use of Standard and approved Steam Table, Mollier Chart is permitted)

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Module 1**	
1.1	Basics of Embedded Systems: Architecture, components, and characteristics,	2
1.2	Overview of Embedded Systems in Medicine: Applications, advantages, and challenges	2
1.3	Key Medical Devices Powered by Embedded Systems (e.g., pacemakers, insulin pumps)	3
1.4	Overview of Medical Device Development Lifecycle, Regulatory Framework for Medical Devices (FDA, CE, ISO, etc.)	2
2	**Module 2**	
2.1	Types of Sensors in Medicine (temperature, pressure, ECG, EEG, glucose, etc.),	2
2.2	Sensors for Diagnostics and Monitoring, Actuators: Types, working principles, and their role in therapeutic devices,	2
2.3	Interface of Sensors/Actuators with Embedded Systems: Applications	2
2.4	ADC/DAC, signal conditioning,	1
2.5	Real-time Data Processing and Interpretation in Healthcare	23
3	**Module 3**	
3.1	Programming Embedded Systems for Medical Applications,	3
3.2	Real-time Systems and Safety Considerations in Medical Devices,	2
3.3	Development of Embedded Software for Health Monitoring and Diagnostics,	2
3.4	User Interfaces and Human-Device Interaction (HMI) in Medical Devices,	2

	Power Management and Optimization for Medical Devices	
4	**Module 4**	
4.1	Wireless Technologies for Medical Devices (Bluetooth, ZigBee, Wi-Fi, NFC),	2
4.2	IoT (Internet of Medical Things) in Healthcare: Remote monitoring, smart healthcare systems,	2
4.3	Wireless Health Devices: Wearables, implants, and home-care devices,	2
4.4	Security Challenges: Data privacy, encryption, and medical data protection,	2
4.5	Regulatory Compliance for Medical Data Transmission	1
5	**Module 5**	
5.1	Overview of Certification and Regulatory Requirements for Medical Devices,	2
5.2	Medical Device Software Validation and Verification, Risk Management in Medical Device Development,	3
5.3	Ethical Considerations in Medical Technology: Data privacy, patient consent, and decision-making	2
5.4	Impact of Embedded Systems on Medical Ethics: Autonomous devices, AI in diagnostics	2

Course Designers:

COURSE DESIGNED BY	**VERIFIED BY**
Dr.Sandeep C S Asso. Professor and HoD, ECE, JCET E Mail ID:hodece@jawaharlalcolleges.com	Mr.Sanish V S Asst. Professor, ECE, JCET E Mail ID: sanishvs@jawaharlalcolleges.com

24ECAIRT624	AI IN ROBOTICS	Category	L	T	P	Credit
		PCC	3	1	0	4

Preamble

This course offers a comprehensive introduction to the fundamental concepts, techniques, and applications of AI in Robotics. Through a structured exploration of key topics, students will develop a deep understanding of both the theoretical underpinnings and practical implementations of AI technologies in Robotics.

Prerequisite

Knowledge of fundamentals in robotics

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Describe the concept of human intelligence and its relationship with artificial intelligence (AI).	20
CO2	Apply the fundamentals of fuzzy logic and neural networks in problem-solving.	20
CO3	Utilize knowledge representation techniques and understand the role of semantics in AI.	20
CO4	Develop an understanding of current research challenges and methodologies in the field of AI.	20
CO5	Demonstrate and explain the functionalities of robots and robotics systems.	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	3	-	-	-	-	-	-	2	2	3	-
CO2	3	3	3	-	3	-	-	-	-	-	-	2	2	3	-
CO3	3	3	3	-	3	-	-	-	-	-	-	2	2	3	-
CO4	3	3	3	-	3	-	-	-	-	-	-	2	2	3	-
CO5	3	3	3	-	3	-	-	-	-	-	-	2	2	3	-
Avg	**3**	**3**	**3**	-	**3**	-	-	-	-	-	-	**2**	**2**	**3**	-

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30
Applying	50	50	50	50	50
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) 20 Marks
Assignment/Quiz/Course project 14 Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1(CO1):

1. Given a scenario where a robot needs to navigate a maze, use state space representation to model the problem and describe how the robot would find its way out.
2. Apply the production system framework to solve a real-world problem such as planning a daily routine for a smart home system, explaining the system's state, rules, and control mechanisms.
3. Analyze a problem like the water jug problem and propose an efficient strategy for solving it using problem reduction techniques, justifying your choice of approach.

Course Outcome 2(CO2):

1. Given a maze with start and goal points, apply the A* algorithm to find the shortest path, explaining the role of heuristics and how they influence the search process.
2. You are tasked with developing a navigation system for a delivery drone. Apply the best-first search algorithm to plan an optimal route, comparing it with depth-first search and breadth-first search in terms of efficiency.
3. A local search algorithm is used to solve a puzzle like the 8-puzzle problem. Implement hill climbing and A* algorithms to solve it, and then evaluate the advantages and drawbacks of both approaches in this context.

Course Outcome 3 (CO3):

1. Using LISP, write a recursive function to solve a mathematical problem like calculating factorials, and explain the importance of recursion in AI problem-solving.
2. Given a set of logical propositions, implement First-Order Predicate Logic (FOPL) in a symbolic AI system to deduce new facts from the knowledge base.
3. In a given expert system for medical diagnosis, apply unification and resolution principles to identify symptoms from a set of patient data and provide a diagnosis recommendation.

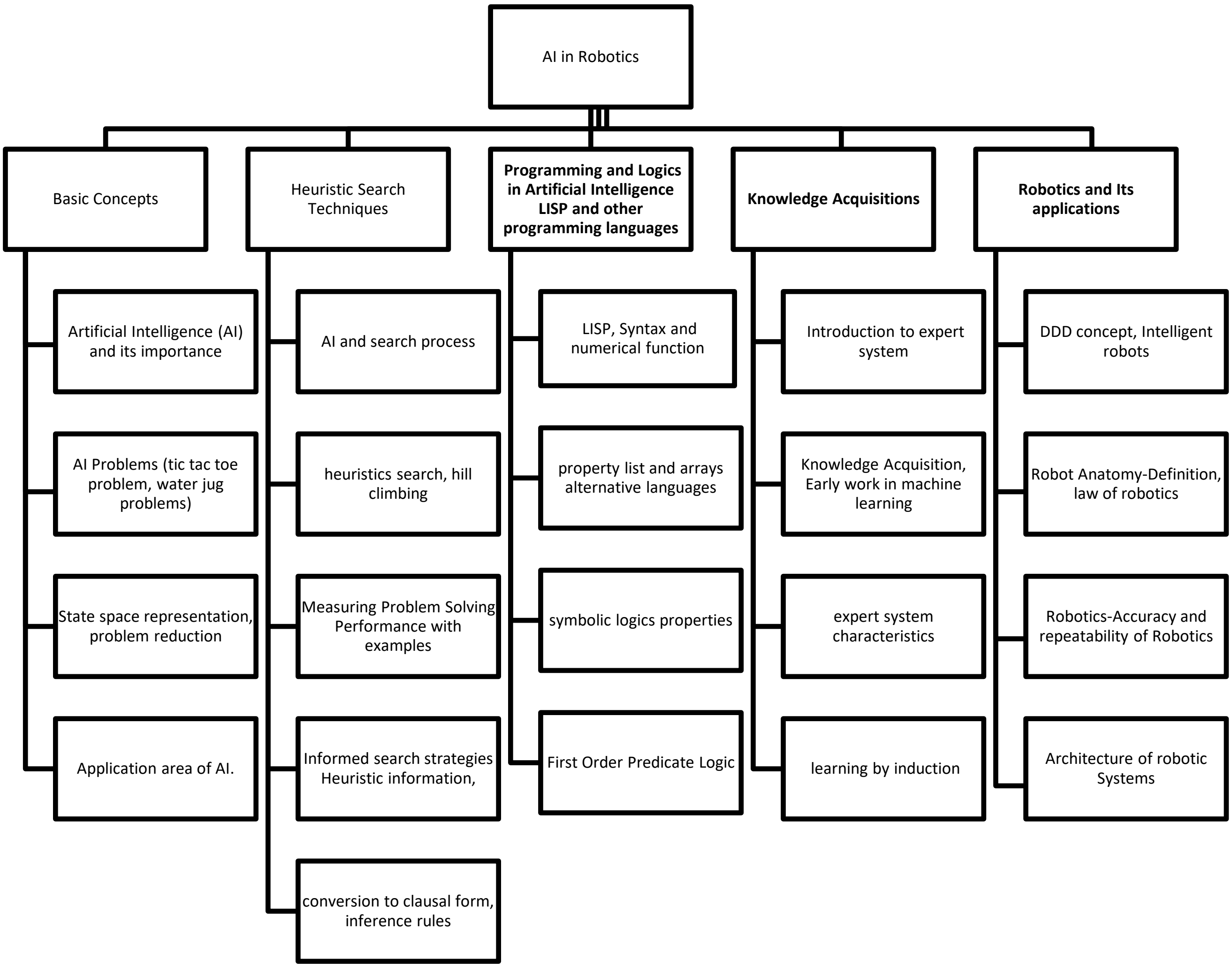
Course Outcome 4 (CO4):

1. Using LISP, write a recursive function to solve a mathematical problem like calculating factorials, and explain the importance of recursion in AI problem-solving.
2. Given a set of logical propositions, implement First-Order Predicate Logic (FOPL) in a symbolic AI system to deduce new facts from the knowledge base.
3. In a given expert system for medical diagnosis, apply unification and resolution principles to identify symptoms from a set of patient data and provide a diagnosis recommendation.

Course Outcome 5(CO5):

1. Design a robot system that can sort packages by size and shape, applying the principles of robotic anatomy and architecture. Justify the choice of actuators and sensors for this task.
2. Develop a scenario in which a robot must operate in a hazardous environment. Apply the laws of robotics to ensure that the robot behaves ethically and safely.
3. You are tasked with programming a robot arm to assemble products on a production line. Describe how you would use hydraulic, pneumatic, or electric systems in the robot's design, explaining the benefits and limitations of each.

Concept Map



Syllabus

Module-1 Introduction

Artificial Intelligence (AI) and its importance, AI Problems (tic tac toe problem, water jug problems), Application area of AI. Problem Representations: State space representation, problem reduction representation, production system, production system characteristics and types of production system.

Module-2 Heuristic Search Techniques

AI and search process, brute force search, depth-first search, breadth-first search, time and space complexities, heuristics search, hill climbing, best first search, A* algorithm and beam search, AO search, constraint satisfaction. Search Methods Problem Solving Agents: Problem Definitions, Formulating Problems, searching for solutions Measuring Problem Solving Performance with examples. comparing uniformed search strategies. Informed search strategies Heuristic information, Hill climbing methods, best first search, branch and bound search, optimal search, and A* and Iterative Deepening A*

Module-3 Programming and Logics in Artificial Intelligence LISP and other programming languages Introduction to LISP, Syntax and numerical function, LISP and PROLOG distinction, input, output and local variables, interaction and recursion, property list and arrays alternative languages, formalized symbolic logics properties of WERS, non-deductive inference methods. First Order Predicate Logic (FOPL): Syntax and semantics, conversion to clausal form, inference rules, unification, and the resolution principles

Module-4 Knowledge Acquisitions

Type of learning, Knowledge Acquisition, Early work in machine learning, learning by induction. Expert System: Introduction to expert system, Phases of expert system, characteristics of expert system and a case study; Introduction of Executive Support System and Decision Support System

Module-5 Robotics and Its applications

DDD concept, Intelligent robots, Robot Anatomy-Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics-Simple Problems Specifications of Robot-Speed of Robot joints and Links-Robot Classifications-Architecture of robotic Systems-Robot Drive Systems-Hydraulic, Pneumatic and Electric system

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Elaine Rich, Kevin Knight	Artificial Intelligence	11th Edition	TMH	2019
2	S.R. Deb	Robotics Technology and flexible automation	2nd Edition	Tata McGraw-Hill Education	2009

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	V S Janakiraman, K Sarukesi, P Gopalakrishan	Foundations of Artificial Intelligence and Expert Systems	4th Edition	Macmillan India Ltd.	2014
2	Dan W. Patterson	Introduction to AI and Expert System	2nd Edition	PHI	2007

Online study materials:

1. https://www.coursera.org/learn/ai-for-everyone
2. https://www.coursera.org/professional-certificates/applied-artifical-intelligence-ibm-watson-ai
3. https://www.youtube.com/watch?v=XCPZBD9lbVo&t=644
4. https://www.youtube.com/watch?v=XCPZBD9lbVo&t=1093
5. https://www.youtube.com/watch?v=xrwz9IxpMJg
6. http://kcl.digimat.in/nptel/courses/video/112103280/L01.html
7. https://nptel.ac.in/courses/106105077

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**Module-1 Introduction**	9	CO1
1.1	Artificial Intelligence (AI) and its importance, AI Problems (tic tac toe problem, water jug problems),	2	
1.2	Application area of AI.	1	
1.3	Problem Representations: State space representation	2	
1.4	problem reduction representation	2	
1.5	production system, production system characteristics	1	
1.6	types of production system.	1	
2	**Module-2 Heuristic Search Techniques**	9	CO2
2.1	AI and search process, brute force search, depth-first search, breadth-first search, time and space complexities,	2	
2.2	heuristics search, hill climbing, best first search	1	
2.3	A* algorithm and beam search, AO search, constraint satisfaction.	1	
2.4	Search Methods Problem Solving Agents: Problem Definitions, Formulating Problems, searching for solutions Measuring Problem Solving Performance with examples.	1	
2.5	comparing uniformed search strategies. Informed search strategies Heuristic information	2	
2.6	Hill climbing methods, best first search, branch and bound search, optimal search, and A* and Iterative Deepening A*	2	
3.	**Module-3 Programming and Logics in Artificial Intelligence LISP and other programming languages**	9	CO3
3.1	Introduction to LISP, Syntax and numerical function, LISP and PROLOG distinction	2	
3.2	input, output and local variables, interaction and recursion	2	
3.3	property list and arrays alternative languages, formalized symbolic logics properties of WERS	2	

3.4	non-deductive inference methods. First Order Predicate Logic (FOPL): Syntax and semantics,	2	
3.5	conversion to clausal form, inference rules, unification, and the resolution principles	1	
4.	**Module-4 Knowledge Acquisitions**	9	CO4
4.1	Type of learning, Knowledge Acquisition, Early work in machine learning	2	
4.2	learning by induction. Expert System: Introduction to expert system	2	
4.3	Phases of expert system, characteristics of expert system	3	
4.4	a case study; Introduction of Executive Support System and Decision Support System	2	
5.	**Module-5 Robotics and Its applications**	9	CO5
5.1	DDD concept, Intelligent robots, Robot Anatomy	2	
5.2	Definition, law of robotics, History and Terminology of Robotics	2	
5.3	Accuracy and repeatability of Robotics-Simple Problems	1	
5.4	Specifications of Robot-Speed of Robot joints and Links-Robot	1	
5.5	Classifications-Architecture of robotic Systems	1	
5.6	Robot Drive Systems-Hydraulic, Pneumatic and Electric system	2	
	TOTAL	**45 Hours**	

Course Designers:

COURSE DESIGNED BY	VERIFIED BY
Mr.Sree Sankar. J Asst. Professor, ECE, JCET E Mail ID: sreesankar4228.ece@jawaharlalcolleges.com	Mr. Sanish V S Asst. Professor, ECE, JCET E Mail ID: sanishvs@jawaharlalcolleges.com

24ECPRCT634	PROCESS CONTROL	Category	L	T	P	Credit
		PEC	3	0	0	3

Preamble This course aims to understand the principles of process dynamics and to analyze the various types of process control systems.

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Prerequisite :

Fundamentals of differential equations and Laplace transform

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Explain the characteristics and elements of process dynamics CO 2 CO 3	20
CO2	Analyze a process control loop	20
CO3	Model and tune a feedback controller	20
CO4	Analyze multi-loop and multi variable controllers	20
CO5		20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	2	-	3	-
CO2	3	3	-	-	2	-	-	-	-	-	-	2	-	3	-
CO3	3	3	-	-	2	-	-	-	-	-	-	2	-	3	-
CO4	3	3	-	-	2	-	-	-	-	-	-	2	2	3	-
CO5			-	-		-	-	-	-	-	-	-	-	3	-
Avg	**3**	**3**	**-**	-	**2**	-	-	-	-	-	-	**2**	**2**	**3**	-

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30
Applying	50	50	50	50	50
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) : 20
Marks Assignment/Quiz/Course project : 14
Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks

	Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1(CO1): : Explain the characteristic principles and different elements involved in process dynamics

1. For a given physical system with resistive or capacitive characteristics, find the period of oscillation and damping.
2. Distinguish between the following processes - (i) Regulating and non-regulating, (ii) Interacting and non-interacting and (iii) Linear and non linear
3. What are the criteria used for selecting the process variables?

Course Outcome 2(CO2): Analyze control loops.

1. For a given control loop, derive the expression for steady state gain and process gain.
2. Find the expression for the transfer function of a temperature control system.
3. Compare SLPC and MLPC.

Course Outcome 3 (CO3): Model and tune various control systems such as feedback control systems, multi loop as well as nonlinear systems

1. Design aspects for a feedback -feedforward control system?
2. How can we model a liquid level control system?
3. What can you infer from dead band velocity limiting?

Course Outcome 4 (CO4): : Analyze multi variable control systems and model-based controllers 1. Derive the transfer function of a multi variable control system.
2. What is the importance of relative Gain Array?

Course Outcome 5(CO5):

Syllabus

Module 1

Process characteristics: Incentives for process control, Process Variables types and selection criteria, Process degree of freedom, The period of Oscillation and Damping, Characteristics of physical System: Resistance, Capacitive and Combination of both. Elements of Process Dynamics, Types of processes- Dead time, Single /multi capacity, self-Regulating /non self-regulating, Interacting /non interacting, Linear/non-linear, and Selection of control action for them. Study of Liquid Processes, Gas Processes, Flow Processes, Thermal Processes in respect to above concepts

Module 2

Elements of Process Control Loop: Pneumatic and electric actuators, control valves - characteristics of control valves, valve positioner - I/P and P/I converters- Electronic Controllers. Analysis of Control Loop: Steady state gain, Process gain, Valve gain, Process time constant, Variable time Constant, Transmitter gain, linearizing an equal percentage valve, Variable pressure drop. Analysis of Liquid level Control, Temperature control. SLPC and MLPC features, faceplate, functions, SLPC and MLPC comparison. Scaling: types of scaling, examples of scaling

Module 3

Feedback Control: Basic principles, Elements of the feedback Loop, Block Diagram, Control Performance Measures for Common Input Changes, Selection of Variables for Control Approach to Process Control. Controller modes (P, PI, PD and PID) and tuning parameters. Tuning of feedback controllers: Process step testing, tuning for - Quarter Decay ratio response, minimal error integral criteria, sampled data controllers. Controller tuning for integrating processes – model of liquid level control system.

Module 4

Multi Loop & Nonlinear Systems: Cascade control, Feed forward control, feedback-feed forward control, Ratio control, Selective Control, Split range control- Basic principles, Design Criteria, Performance, Implementation issues, Examples and any special features of the individual loop and industrial applications. Nonlinear Elements in Loop: Limiters, Dead Zones, Backlash, Dead Band Velocity Limiting, Negative Resistance

Module 5

Multivariable Control: Concept of Multivariable Control: Interactions and its effects, Modelling and transfer functions, Influence of Interaction on the possibility of feedback control, important effects on Multivariable system behaviour Relative Gain Array, effect of Interaction on stability and tuning of Multi Loop Control system. Model Based controllers: Internal Model control, Model Predictive controller, Dynamic matrix controller (DMC), Self-Tuning Controller**.**

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	B.Wayne Bequette	Process Control: Modeling, Design and Simulation		PHI.	
2	Donald Eckman	Automatic Process Control		Wiley Eastern Limited.	

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Carlos A. Smith, Armando B. Corripio	Principles and practice of Automatic Process Control	2nd	John Wiley & Sons	
2	B.G.Liptak	Handbook of Instrumentation - Process control		Chilton.	
3	Curtis D Johnson,	Process Control Instrumentation Technology	Eighth Edition.		

Online study materials:

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	Process characteristics:	9	CO1
1.1	1.1 Incentives for process control, Process Variables types and selection criteria.	1	
1.2	Process degree of freedom, The period of Oscillation and Damping	1	
1.3	Characteristics of physical System: Resistance, Capacitive and Combination of both. 1.4 3 1.5 Study of Liquid Processes, Gas Processes, Flow Processes, Thermal Processes in respect to above concepts.	1	
1.4	Elements of Process Dynamics, Types of processes- Dead time, Single /multi capacity, self-Regulating /non self-regulating, Interacting /non interacting, Linear/non-linear, and Selection of control action for them.	3	
1.5	Study of Liquid Processes, Gas Processes, Flow Processes, Thermal Processes in respect to above concepts.	3	
2	**Elements of Process Control Loop**	12	CO2
2.1	Pneumatic and electric actuators	1	
2.2	Control valves - characteristics of control valves, Valve Positioner	2	
2.3	I/P and P/I converters, Electronic Controllers	1	
	Analysis of Control Loop		
2.4	Steady state gain, Process gain, Valve gain, Process time constant, Variable time Constant, Transmitter gain.	2	
2.5	Linearizing an equal percentage valve, Variable pressure drop	2	
2.6	Analysis of Liquid level Control, Temperature control.	2	
2.7	SLPC and MLPC features, faceplate, functions, SLPC and MLPC comparison.	1	
2.8	Scaling: types of scaling, examples of scaling.	1	
3.	**Feedback Control:**	7	CO3
3.1	Basic principles, Elements of the feedback Loop, Block Diagram,	1	
3.2	Control Performance Measures for Common Input Changes, Selection of Variables for Control Approach to Process Control.	1	
3.3	Controller modes and tuning parameters.	2	
	Tuning of feedback controllers:		
3.4	Process step testing, tuning for - Quarter Decay ratio	2	

	response, minimal error integral criteria, sampled data controllers.		
3.5	Controller tuning for integrating processes – model of liquid level control system.	1	CO4
4	**Multi Loop & Nonlinear Systems:**	9	
	Basic principles, Design Criteria and Implementation issues of		
4.1	Cascade control	1	
4.2	Feed forward control	1	
4.3	Feedback-feed forward control	1	
4.4	Ratio control	1	
4.5	Selective Control	1	
4.6	Split range control	1	
4.7	Examples and any special features of the individual loop and industrial applications	1	
4.8	Nonlinear Elements in Loop: Limiters, Dead Zones, Backlash, Dead Band Velocity Limiting, Negative Resistance	2	
5	**Multivariable Control:**	8	C05
5.1	Concept of Multivariable Control: Interactions and its effects, Modelling and transfer functions, Influence of Interaction on the possibility of feedback control	2	
5.2	Important effects on Multivariable system behaviour Relative Gain Array, effect of Interaction on stability and tuning of Multi Loop Control system.	2	
5.3	Model Based controllers: Internal Model control	1	
5.4	Model Predictive controller	1	
5.5	Dynamic matrix controller (DMC)	1	
5.6	Self-Tuning Controller	1	
	TOTAL	**45Hours**	

Course Designers:

COURSE DESIGNED BY	VERIFIED BY
Ms Aswathy J Asst. Professor, ECE, JCET E Mail ID: aswathy4088.ece@jawaharlalcolleges.com	Ms Jisha K V Asst. Professor, ECE, JCET E Mail ID: jishakv@jawaharlalcolleges.com

24ECASDT644	ASIC Design	Category	L	T	P	Credit
		PEC	3	0	0	3

Preamble

To prepare the student to be an entry-level industrial standard ASIC or FPGA designer and give them an understanding of issues and tools related to ASIC/FPGA design and implementation. To give the student an understanding of basics of System on Chip and platform-based design

Prerequisite

24ECVDET502 – VLSI Design

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Demonstrate VLSI tool-flow and appreciate FPGA architecture.	20
CO2	Understand the issues involved in ASIC design	20
CO3	Understand the ASIC design flow	20
CO4	Understand the basics of System on Chip, on chip communication architectures.	20
CO5	Understand high performance algorithms available for ASICsIC.	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		3									2	2	2	1
CO2	3	2										2	2	3	
CO3	3	2			2							2	2	3	
CO4	3	2										2	2	1	
CO5	3	2	2		2							2	3	2	1
Avg	3.00	2.00	2.50	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	2.20	2.20	1.00

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30
Applying	50	50	50	50	50
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) : 20
Marks Assignment/Quiz/Course project : 14
Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks

	Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1(CO1):

1. Explain the VLSI Design Flow.
2. With a neat flow chart, explain ASIC design flow.
3. Discuss the role of synthesis in the VLSI design flow.
4. What are the key components of an FPGA architecture

Course Outcome 2(CO2):

1. What are the key challenges in the ASIC design process
2. Explain how does power consumption impact the design of an ASIC.
3. Explain the importance of Design for Testability (DFT) in ASIC design

Course Outcome 3 (CO3):

1. Explain the significance of placement algorithms in ASIC design.
2. Explain the importance of technology mapping algorithms in ASIC design.
3. Describe the concept of incremental and iterative optimization in ASIC design algorithms.

Course Outcome 4 (CO4):

1. Explain the concept of a Network-on-Chip (NoC) and how it improves communication in SoCs.
2. What is an interconnect fabric in an SoC, and how does it contribute to the overall design of an SoC?

Course Outcome 5(CO5):

1. Explain the concept of optimization in ASIC design and describe some common optimization algorithms.
2. Explain how high-performance algorithms are used for the verification of ASICs during the post-synthesis phase.
3. How do algorithms for design rule checking (DRC) and layout versus schematic (LVS) verification contribute to high-performance ASIC design?

Syllabus

Module 1: Types of ASIC and VLSI Design

Types of ASICs, VLSI Design flow, Programmable ASICs - Antifuse, SRAM, EPROM, EEPROM based ASICs. Programmable ASIC logic cells and I/O cells. Programmable interconnects. Latest Version - FPGAs and CPLDs and Soft-core processors

Module 2: Issues involved in ASIC design

Trade off issues at System Level: Optimization with regard to speed, area and power, asynchronous and low power system design. ASIC physical design issues, System Partitioning, Power Dissipation, Partitioning Methods.

Module 3: ASIC Design Flow

Logic Design and Synthesis- RTL to Gate-level conversion, Logic synthesis tools and their usage. Optimization Techniques. Physical Design- Floorplanning-Block-level floorplanning and chip area estimation Placement algorithms: force-directed placement, simulated annealing Partitioning techniques and balanced designs. Routing-Routing algorithms: global and detailed routing

Module 4: System on Chip

System-On-Chip Design - SoC Design Flow, Platform-based and IP based SoC Designs, Basic Concepts of Bus-Based Communication Architectures, On-Chip Communication Architecture Standards, Low-Power SoC Design.

Module 5: Algorithms for ASIC IC

High performance algorithms for ASICS/ SoCs– Canonic Signed Digit Arithmetic, KCM, Distributed Arithmetic, High performance digital filters for sigma-delta ADC, USB controllers, OMAP.

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Michael Smith	Application-Specific Integrated Circuits	4th	Addison Wesley	2012
2	SH Gerez	Algorithms for VLSI Design Automation	3rd	John Wiley & Sons Inc	2005

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Jan M. Rabaey,	Digital Integrated Circuits- A Design Perspective	2nd	Prentice Hall	2010

2	Vaibbhav Taraate	ASIC Design and Synthesis: RTL Design Using Verilog	1st	Pearson Publication	2021

Online study materials:

https://archive.nptel.ac.in/courses/106/103/106103116/

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**MODULE 1**	12	CO1
1.1	Types of ASICs, VLSI Design flow	3	
1.2	Programmable ASICs - Antifuse, SRAM, EPROM, EEPROM based ASICs.	3	
1.3	Programmable ASIC logic cells and I/O cells. Programmable interconnects.	3	
1.4	Latest Version - FPGAs and CPLDs and Soft-core processors	3	
2	**MODULE 2**	12	CO2
2.1	Trade off issues at System	3	
2.2	Optimization with regard to speed, area and power	3	
2.3	Level asynchronous and low power system design.	3	
2.4	ASIC physical design issues, System Partitioning, Power Dissipation, Partitioning Methods	3	
3.	**MODULE 3**	12	CO3
3.1	Logic Design and Synthesis- RTL to Gate-level conversion,	3	
3.2	Logic synthesis tools and their usage. Optimization Techniques. Physical Design- Floorplanning-Block-level floorplanning and chip area estimation	3	
3.3	Placement algorithms: force-directed placement, simulated annealing Partitioning techniques and balanced designs.	3	
3.4	Routing-Routing algorithms: global and detailed routing	3	
4.	**MODULE 4**	12	CO4
4.1	System-On-Chip Design - SoC Design Flow	3	
4.2	Platform-based and IP based SoC Designs,	3	
4.3	Basic Concepts of Bus-Based Communication Architectures,	3	
4.4	On-Chip Communication Architecture Standards, Low-Power SoC Design.	3	

5.	**MODULE 5**	12	CO5
5.1	High performance algorithms for ASICS/ SoCs	3	
5.2	Canonic Signed Digit Arithmetic	3	
5.3	KCM, Distributed Arithmetic	3	
5.4	High performance digital filters for sigma-delta ADC, USB controllers, OMAP.	3	
	TOTAL	**60 Hours**	

Course Designers:

COURSE DESIGNED BY	VERIFIED BY
Ms. Remya K P Asst. Professor, ECE, JCET E Mail ID: sanishvs@jawaharlalcolleges.com	Ms. Ajeena A Asst. Professor, ECE, JCET E Mail ID: ajeena4093.ece@jawaharlalcolleges.com

24ECCONT654	COMPUTER NETWORKS	Category	L	T	P	Credit
		PEC	3	0	0	3

Preamble

The course aims to expose students to computer networks taking a top-down approach of viewing from the layer of user applications and zooming into link layer protocols. The principles of various protocols used in every layer are studied in detail. A brief introduction to mathematical modelling of queues with an application to a single example is included.

Prerequisite

Probability, Random Process and Numerical Methods

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Describe the protocols used in web and email applications. (Understanding)	20
CO2	Analyse problems pertaining to reliable data transfer, flow control and congestion over a TCP network. 4	20
CO3	Apply Dijkstra's algorithm and distance-vector algorithm in the context of routing over computer networks.3	20
CO4	Analyze the performance of collision avoidance algorithms in random access protocols such as ALOHA.4	20
CO5	Analyze the delay performance of an ARQ system using standard queueing models.4	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		3											2	3	-
CO2	2	3										2	2	3	2
CO3	2	3					2					2	2	1	2
CO4	2	2					2					2	2	2	2
CO5	2	3	2				3				2	2	-		-
Avg	**2**	**2.8**	**2**				**2.3**				**2**	**2**	**2**	**2.25**	2

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30

Applying	50	50	50	50	50
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) : 20Marks
Assignment/Quiz/Course project : 14 Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1 (CO1): Describe the protocols used in web and email applications.

1. Describe the HTTP message format
2. Compare and contrast two application layer protocols SMTP and HTTP Course Outcome

Course Outcome 2 (CO2)

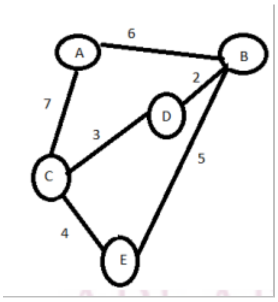
1.Analyse problems pertaining to reliale data transfer, flow control and congestion over a TCP network.

2. Why is it that voice and video traffic is often sent over TCP rather than UDP in today's Internet?

3. Suppose two TCP connections are present over some bottleneck link of rate R bps. Both connections have a huge file to send (in the same direction over the bottleneck link). The transmissions of the files start at the same time. What transmission rate would TCP like to give to each of the connections?

Course Outcome 3 (CO3): Apply Dijkstra's algorithm and distance-vector algorithm in the context of routing over computer networks.

1. Consider the following network. Compute the shortest-path from the node D to all other nodes using Dijkstra's shortest path algorithm. (Numbers indicated shows the link costs).



2. Consider a router that interconnects three subnets: Subnet 1, Subnet 2, and Subnet 3. Suppose all of the interfaces in each of these three subnets are required to have the prefix 223.1.17/24. Also suppose that Subnet 1 is required to support at least 60 interfaces, Subnet 2 is to support at least 90 interfaces, and Subnet 3 is to support at least 12 interfaces. Provide three network addresses (of the form a.b.c.d/x) that satisfy these constraints.

Course Outcome 4 (CO4): Analyze the performance of link-layer protocols in general, random access protocols in particular in terms of efficiency and collision avoidance capability.

1. Describe how slotted ALOHA achieves multiple access. 2. Distinguish between TDM, FDM and random access.

Course Outcome 5 (CO5): Analyze the delay performance of an ARQ system using standard queueing models.

1. Consider a network where packets arrive via N different nodes with different arrivate rates. Illustrate the use of Littles law in this scenario to calcualte the average packet delay inside the network.

2. Customers arrive in a restaurant at a rate of 5 per minute, and wait to receive their order for an average of 5 minutes. Customers eat in the restaurant with a probability of 0.5, and carry their order out without eating with probability 0.5. What is the average number of customers in the restaurant?

Syllabus

Module 1:

Components of computer networks Components of computer network, Applications of computer network – the Internet, Definition of protocol. Protocal standardization. Network edges, Network core and Network links Client and server hosts, connectionless and connection-oriented services provided to hosts, circuit-switched versus packet-swtiched network cores, FDM, TDM versus statistical multiplexing, Datagram versus Virtual-circuit networks. Access and physical media. Delay and loss in packet-swtiched networks Types of delay, Packet loss. Layered Architecture: Protocol layering, Internet protocol stack, Message encapsulation. Application Layer

Communication between processes, Web application: HTTP, Mssage format, Email application: SMTP, Message format, MIME, POP3, IMAP and Web-based email. Domain Name System (DNS

Module 2:

Transport Layer Multiplexing and demultiplexing: connectionless and connection-oriented. UDP. Procols for reliable data transfer: ARQ protocols, stop-and-wait protocol, alternating-bit protocol, Go-backN, Selective Repeat. TCP Connection, segment structure, RTT estimate, Flow control. Congestion Control General approaches. TCP congestion control.

Module 3:

Network Layer Datagram versus virtual-circuit network service, Router architecture, IPv4: datagram format, addressing, address assignement – manual and DHCP, NAT. ICMP. IPv6. Routing Algorithms Link-State (Dijkstra's) Algorithm, Distancevector algorithm. Routing in Internet – RIP, OSPF, BGP. Broadcast and Multicast.

Module 4:

Link Layer Services of link layer, Error detection and corretion – checksum, CRC. Multiple access protocols – Channel partitioning, random access, taking-turns. ALOHA – pure and slotted, efficiency, CSMA, CSMA/CA, CSMA/CD. Link layer addressing: MAC address, ARP, DHCP. Ethernet. Link virtualization: ATM, MPLS.

Module 5:

Wireless Networks IEEE 802.11 wireless LAN Queueing models in computer networks Littles theorem and examples. Review of Poisson process. M/G/1 Queue. Delay analysis of Go-Back-N ARQ system**.**

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	A.S. Tanenbaum, D.Wetherall	Computer Networking:A Top-Down Approach Featuring the Internet,	3rd edition	Pearson Education,	2018
2	N. Abramson, F. Kuo	ComputerCommunication Networks	Prentice Hall	Pearson Education,	2016

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	John P Hayes,	Computer Architecture and Organization,"	4th Edition	McGraw Hill.	2018
2	Ramesh S Goankar,	Data Networks,	5^{th} Edition	Prentice Hal	2016
3	.A Kumar, D. Manjunath, J. Kuri,	Communication Networking – An Analytical Approach	5^{th} Edition	Pearson Education.	2018

		Morgan Kauffman Series.			

Online study materials:
https://www.slideshare.net/slideshow/computer-arithmetic-and-processor-basics/262058207
https://www.slideshare.net/slideshow/8051-assembly-language-programming/49586134

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**Computer networks**	9	CO1
1.1	Components of computer networks, Applications, Protocol, Protocol standrdization	1	
1.2	Hosts, connectionless and connection-oriented, circuitswitching versus packet-swtiching in network core design, FDM, TDM versus statistical multiplexing	1	
1.3	Datagram versus Virtual-circuit networks. Examples of access networks, and examples of physical media.	1	
1.4	Types of delay, Packet loss.	2	
1.5	Layered Architecture, Protocol layering, Internet protocol stack, Message encapsulation.	1	
1.6	Communication between processes, HTTP, Mssage format	1	
1.7	Email application: SMTP, Message format, MIME, POP3, IMAP and Web-based email.	1	
1.8	Domain Name System (DNS)	1	
2	**Module 2**	9	CO2
2.1	Services of transport layer, Multiplexing and demultiplexing. Connectionless and connection-oriented transport. UDP. s	2	
2.2	Procols for reliable data transfer: ARQ protocols, stop-andwait protocol, alternating-bit protocol, Go-back-N, Selective Repeat.	2	
2.3	TCP Connection, TCP segment, RTT, Flow control.	2	
2.4	Congestion, Congestion control. TCP congestion control	3	
3.	**Module 3**	9	CO3
3.1	Services of Network Layer,Recap of Datagram versus virtualcircuit network service, Router.	2	
3.2	IPv4 addressing, Address assignement – manual and DHCP, NAT. ICMP. IPv6.	2	
3.3	Link-State (Dijkstra's) Algorithm, Distance-vector algorithm	2	
3.4	Routing in Internet – RIP, OSPF, BGP. Distinction between Broadcast and Multicast routing	3	
4.	**Module 4**	9	

4.1	Services of link layer, Parity checks, checksum, CRC	1	CO4
4.2	Multiple access protocols – Channel partitioning, random access, taking-turns.	2	
4.3	ALOHA – pure and slotted, efficiency, CSMA, CSMA/CA, CSMA/CD	2	
4.4	Link layer addressing: MAC address, ARP, DHCP..	2	
4.5	Ethernet	1	
4.6	Link virtualization: ATM, MPLS	1	
5.	**Module 5**	9	CO5
5.1	IEEE 802.11 wireless LAN	2	
5.2	Mathematical modeling of queues/buffers.	2	
5.3	Littles theorem and examples.	2	
5.4	Review of Poisson process. M/G/1 Queue	2	
5.5	Delay analysis of Go-Back-N ARQ system.	1	
	TOTAL	**45 Hours**	

Course Designers:

COURSE DESIGNED BY	VERIFIED BY
Ms Ajeena A Asst. Professor, ECE, JCET E Mail ID:ajeena4093.ece@jawaharlalcolleges.com	Ms Remya K P Asst. Professor, ECE, JCET E Mail ID:remyakp@jawaharlalcolleges.com

24OEMONT616	MOBILE NETWORKS	Category	L	T	P	Credit
		OEC	3	0	0	3

Preamble

Preamble: The course is designed with the view of preparing the engineering students capable of understanding the communication protocols, various architectures and security features used in mobile computing. This course covers basics of mobile computing, architecture of wireless transmission systems and next generation networks. This course enables the learners to acquire advanced concepts on wireless communication systems and mobile ad-hoc networks.

Prerequisite

A sound knowledge of computer networks.

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Explain the various mobile computing applications, services, design considerations and architectures (**Cognitive knowledge: Understand**)	20
CO2	Describe the various technology trends for next generation cellular wireless networks and use the spreading concept on data transmission **(Cognitive knowledge: Apply)**	20
CO3	Summarize the architecture of various wireless LAN technologies **(Cognitive knowledge: Understand)**	20
CO4	Identify the functionalities of mobile network layer and transport layer **(Cognitive knowledge: Understand)**	20
CO5	Explain the features of Wireless Application Protocol **(Cognitive knowledge: Understand)**	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2										2	-	-	-
CO2	2	2										2	-	-	-
CO3	2	2	1	1								2	-	-	-
CO4	2	2	1									2	-	-	-
CO5	3	3	1									2	-	-	-
Avg	2.2	**2.2**	1	1	-	-	-	-	-	-	-	2	-	-	-

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	30	30	-	-	20
Understanding	30	30	-	-	30
Applying	40	40	100	100	50
Analyzing	-	-	-	-	-
Evaluating	-	-	-	-	-
Creating	-	-	-	-	-

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Continuous Internal Assessment Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) : 20 Marks
Project : 14 Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1 (CO1):

1. Give examples for five mobile computing applications.
2. Identify any three differences between middleware and gateways.

Course Outcome 2 (CO2):

1. There are four stations sending data 1,1,1,0 respectively. Station 3 receives station 1's data. Show the encoding, decoding and channel sharing mechanisms using CDMA.
2. Compare the influence of near/far effect and its countermeasures in TDMA and CDMA systems.

Course Outcome 3 (CO3):

1. Compare IEEE 802.11 and Bluetooth with respect to their ad-hoc capabilities.
2. Describe with neat sketch the major baseband states of a Bluetooth device.

Course Outcome 4 (CO4):

1. With the help of an example, show how routing process is handled by Dynamic Source Routing protocol.
2. Describe the major differences between AODV and the standard Distance Vector Routing algorithm. Why are extensions needed?
3. Simulate routing protocols using NS2.

Course Outcome 5 (CO5):

1. How does WAP push operation differ from pull operation?
2. With the help of a neat sketch explain the secure session establishment using WTLS.

Course Outcome 6 (CO6):

1. Explain the 3GPP security framework for mobile security.
2. Explain the features of policy-based security model.

Syllabus

Module - 1 (Mobile Computing Basics)

Introduction to mobile computing – Functions, Middleware and Gateways, Application and services. Mobile computing architecture – Internet: The Ubiquitous network, Three-tier architecture for Mobile Computing, Design considerations for mobile computing.

Module – 2 (Wireless Transmission and Communication Systems)

Spread spectrum – Direct sequence, Frequency hopping. Medium Access Control – Space Division Multiple Access (SDMA), Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Code Division Multiple Access (CDMA). Satellite Systems – Basics, Applications, Geostationary Earth Orbit (GEO), Low Earth Orbit (LEO), Medium Earth Orbit (MEO), Routing, Localization, Handover. Telecommunication Systems - Global System for Mobile Communication (GSM) services, Architecture, Handover, Security.

Module – 3 (Wireless LANs)

Wireless LAN - Advantages, Design goals, Applications, Infrastructure Vs Ad-hoc mode, IEEE 802.11 System Architecture, Protocol Architecture, Physical layer, Medium Access Control layer, HIPERLAN-1, Bluetooth.

Module – 4 (Mobile Network and Transport Layer)

Mobile network layer – Mobile Internet Protocol (IP), Dynamic Host Configuration Protocol (DHCP), Mobile ad-hoc networks – Routing, Dynamic Source Routing (DSR), Destination Sequence Distance Vector (DSDV), Ad-hoc routing protocols. Mobile transport layer – Traditional Transmission Control Protocol (TCP), Improvements in Classical TCP. Wireless Application Protocol (WAP) - Architecture, Wireless Datagram Protocol (WDP), Wireless Transport Layer Security (WTLS), Wireless Transaction Protocol (WTP), Wireless Session Protocol (WSP).

Module – 5 (Mobile Security and Next Generation Networks)

Security issues in mobile computing - Information security, Security techniques and algorithms, Security models. Next generation networks - Orthogonal Frequency Division Multiplexing (OFDM), Wireless Asynchronous Transfer Mode (WATM), Multi Protocol Label Switching (MPLS), 10 pillars of 5G, Security for 5G communication.

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Asoke K. Talukder, Hasan Ahmad, Roopa R Yavagal,	Mobile Computing Technology-	2nd Edition	McGraw Hill Education	2010

		Application and Service Creation			
2	Jochen Schiller	Mobile Communications	2nd Edition	Pearson Education Asia	2008

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Raj Kamal	Mobile Computing	2nd Edition	Oxford University Press.	2011
2	Andrew S. Tanenbaum,	Computer Networks	3rd Edition	PHI	2003

Online study materials:
https://onlinecourses.nptel.ac.in/noc22_ch27/preview
(Use of Standard and approved Steam Table, Mollier Chart is permitted)

Course Contents and Lecture Schedule

No	Contents	No.of Lecture Hrs
	Module – 1 (Mobile Computing Basics)	
1.1	Introduction to mobile computing – Functions	1
1.2	Middleware and Gateways	1
1.3	Application and services	1
1.4	Internet: The Ubiquitous network	2
1.5	Three-tier architecture for Mobile Computing	2
1.6	Design considerations for mobile computing	2
	Module – 2 (Wireless Transmission and Communication Systems)	
2.1	Direct sequence spread spectrum, Frequency hopping spread spectrum	1
2.2	Space Division Multiple Access (SDMA), Frequency Division Multiple Access (FDMA)	1
2.3	Time Division Multiple Access (TDMA)	1
2.4	Code Division Multiple Access (CDMA)	1

2.5	Satellite Systems Basics, Applications, Geostationary Earth Orbit (GEO), Low Earth Orbit (LEO), Medium Earth Orbit (MEO)	1
2.6	Routing, Localization, Handover	1
2.7	Global System for Mobile Communication (GSM) services, Architecture	2
2.8	Handover, Security	1
Module - 3 (Wireless LANs)		
3.1	Wireless LAN - Advantages, Design goals, Applications, Infrastructure Vs Ad-hoc mode	2
3.2	IEEE 802.11 System Architecture	1
3.3	Protocol Architecture	1
3.4	Physical layer	1
3.5	Medium Access Control layer	2
3.6	HIPERLAN-1	1
3.7	Bluetooth	1
Module - 4 (Mobile Network and Transport Layer)		
4.1	Mobile Internet Protocol (IP), Dynamic Host Configuration Protocol (DHCP)	1
4.2	Mobile ad-hoc networks – Routing, Dynamic Source Routing (DSR)	1
4.3	Destination Sequence Distance Vector (DSDV)	1
4.4	Ad-hoc routing protocols	1
4.5	Traditional Transmission Control Protocol (TCP), Improvements in Classical TCP	2
4.6	Wireless Application Protocol (WAP) – Architecture, Wireless Datagram Protocol (WDP)	1
4.7	Wireless Transport Layer Security (WTLS)	1
4.8	Wireless Transaction Protocol (WTP), Wireless Session Protocol (WSP)	1
Module - 5 (Mobile Security and Next Generation Networks)		
5.1	Information security, Security techniques	1

5.2	Security algorithms, Security models	1
5.3	Introduction to Next generation networks, Orthogonal Frequency Division Multiplexing (OFDM)	2
5.4	Wireless Asynchronous Transfer Mode (WATM)	2
5.5	Multi Protocol Label Switching (MPLS)	1
5.6	10 pillars of 5G, Security for 5G communication	2

Course Designers:

COURSE DESIGNED BY	VERIFIED BY
Dr.Sandeep C S Asso. Professor and HoD, ECE, JCET E Mail ID:hodece@jawaharlalcolleges.com	Mr.Sanish V S Asst. Professor, ECE, JCET E Mail ID: sanishvs@jawaharlalcolleges.com

24OEMEMT626	MEMS TECHNOLOGY	Category	L	T	P	Credit
		OEC	3	0	0	3

Preamble

This course aims

- To understand the operation of major classes of MEMS devices/systems
- To give the fundamentals of standard micro fabrication techniques and processes
- To understand the unique demands, environments and applications of MEMS devices

Prerequisite

24ECVDET502 VLSI Design

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Understand the multidisciplinary nature of MEMS and different types of micro sensors and micro actuators.	20
CO2	Apply mechanical concepts such as stress, strain, and modulus of elasticity into designing MEMS structures.	20
CO3	Gain knowledge on the various actuation and sensing techniques in MEMS technology.	20
CO4	Understand the principles of miniaturization and the scaling laws applicable in the field.	20
CO5	Develop skills for micro manufacturing and the process of bonding techniques for MEMS.	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	-	2	-	3	-
CO2	3	3	3	-	-	-	-	-	-	-	-	2	-	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	2	-	3	-
CO4	3	3	3	-	-	-	-	-	-	-	-	2	-	3	-
CO5	3	3	3	-	-	-	-	-	-	-	-	2	-	3	-
Avg	**3**	**3**	**3**	-	**-**	-	-	-	-	-	-	**2**	**-**	**3**	-

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	**2**	**1**	**2**	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30
Applying	50	50	50	50	50

Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) : 20 Marks
Assignment/Quiz/Course project : 14 Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1(CO1):

1. Explain the principle of operation of thermal sensors and actuators with neat Diagrams
2. Describe the principle of micro-accelerometer with a neat schematic
3. Explain the operating principle of two types of micro motors with suitable schematics

Course Outcome 2(CO2):

1. Determine the moment of inertia for a beam under longitudinal strain and also find the

flexural formula

2. Write notes on the following thermal sensors/actuators
   (i) Thermal Bimorph
   (ii) Thermal Couple and Thermopile

Course Outcome 3 (CO3):

1. Explain Trimmer force scaling vector. Use scaling laws to estimate the changes in acceleration and time to actuate a MEMS component if its weight is reduced by a factor of 10.
2. With reference to scaling of electrostatic forces explain why electrostatic actuation is preferred over electromagnetic actuation in micro motors.

Course Outcome 4 (CO4):

1. Explain with figures one method to produce single crystal silicon. Why is silicon used as a substrate material for MEMS
2. Write a note on the uses of PDMS, PMMA and SU-8

Course Outcome 5(CO5):

1. Describe steps of fabrication of a square tube using LIGA process.
2. Explain any two bonding techniques for MEMS

Syllabus

Module 1

MEMS and Microsystems: Applications – Multidisciplinary nature of MEMS – principles and examples of Micro sensors and micro actuators – micro accelerometer –comb drives - Micro grippers – micro motors, micro valves, micro pumps, Shape Memory Alloys.

Review of Mechanical concepts: Stress, Strain, Modulus of Elasticity, yield strength, ultimate strength – General stress strain relations – compliance matrix. Overview of commonly used mechanical structures in MEMS - Beams, Cantilevers, Plates, Diaphragms – Typical applications

Module 2

Flexural beams: Types of Beams, longitudinal strain under pure bending – Deflection of beams – Spring constant of cantilever – Intrinsic stresses

Actuation and Sensing techniques: Thermal sensors and actuators, Electrostatic sensors and actuators , Piezoelectric sensors and actuators, magnetic actuators

Module 3

Scaling laws in miniaturization - scaling in geometry, scaling in rigid body dynamics, Trimmer force scaling vector, scaling in electrostatic and electromagnetic forces, scaling in electricity and fluidic dynamics, scaling in heat conducting and heat convection.

Module 4

Materials for MEMS – Silicon – Silicon compounds – Silicon Nitride, Silicon Dioxide, Silicon carbide, Poly Silicon, GaAs , Silicon Piezo resistors, Polymers in MEMS – SU-8, PMMA, PDMS, Langmuir – Blodgett Films, Micro System fabrication – Photolithography – Ion implantation- Diffusion – Oxidation – Chemical vapour deposition – Etching

Module 5

Overview of Micro manufacturing – Bulk micro manufacturing, Surface micro machining , LIGA process –Micro stereo lithography. Micro system Packaging: general considerations in packaging design – Levels of Micro system packaging

Bonding techniques for MEMS : Surface bonding , Anodic bonding , Silicon - on - Insulator , wire bonding , Sealing – Assembly of micro systems

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Chang Liu	Foundations of MEMS	2nd	Pearson	2012
2	Tai-Ran Hsu	MEMS and Microsystems Design and Manufacture	1st	TMH	2017

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Chang C Y and Sze S. M	VLSI Technology	1st	McGraw-Hill, New York	2000
2	Stephen D. Senturia	Microsystem design	1st	Springer (India)	2006

Online study materials:
https://nptel.ac.in/courses/117105082

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**MEMS and Microsystems:**	**9**	CO1
1.1	MEMS and Microsystems: Applications – Multidisciplinary nature of MEMS – principles and examples of Micro sensors and micro actuators	2	
1.2	micro accelerometer –comb drives - Micro grippers – micro motors, micro valves, micro pumps, Shape Memory Alloys.	2	
1.3	Review of Mechanical concepts: Stress, Strain, Modulus of Elasticity, yield strength, ultimate strength	2	
1.4	General stress strain relations – compliance matrix.	1	
1.5	Overview of commonly used mechanical structures in MEMS - Beams, Cantilevers, Plates, Diaphragms – Typical applications	2	
2	**Flexural beams**	**9**	CO2
2.1	Flexural beams: Types of Beams, longitudinal strain under pure bending	2	
2.2	Deflection of beams – Spring constant of cantilever – Intrinsic stresses	2	
2.3	Actuation and Sensing techniques: Thermal sensors and actuators, Electrostatic sensors and actuators ,	3	
2.4	Piezoelectric sensors and actuators, magnetic actuators	2	
3.	**Scaling laws in miniaturization**	**9**	CO3
3.1	Scaling laws in miniaturization - scaling in geometry, scaling in rigid body dynamics,	2	
3.2	Trimmer force scaling vector,	1	
3.3	scaling in electrostatic and electromagnetic forces,	2	
3.4	scaling in electricity and fluidic dynamics	2	
3.5	scaling in heat conducting and heat convection.	4	
4.	**Materials for MEMS**	**9**	

4.1	Materials for MEMS – Silicon – Silicon compounds – Silicon Nitride,Silicon Dioxide, Silicon carbide, Poly Silicon, GaAs , Silicon Piezo resistors	3	CO4
4.2	Polymers in MEMS – SU-8, PMMA, PDMS	2	
4.3	Langmuir – Blodgett Films, Micro System fabrication	2	
4.4	Photolithography – Ion implantation- Diffusion – Oxidation – Chemical vapour deposition – Etching	2	
5.	**Micro manufacturing**	**9**	CO5
5.1	Overview of Micro manufacturing – Bulk micro manufacturing, Surface micro machining ,	2	
5.2	LIGA process –Micro stereo lithography. Micro system Packaging: general considerations in packaging design – Levels of Micro system packaging	3	
5.3	Bonding techniques for MEMS : Surface bonding , Anodic bonding , Silicon - on - Insulator ,	2	
5.4	wire bonding , Sealing – Assembly of micro systems	2	
	TOTAL	**45 Hours**	

Course Designers:

COURSE DESIGNED BY	VERIFIED BY
Mr.Sanish V S Asst. Professor, ECE, JCET E Mail ID: sanishvs@jawaharlalcolleges.com	Ms.Remya K P Asst. Professor, ECE, JCET remyakp@jawaharlalcolleges.com

24ECMWCT701	MOBILE AND WIRELESS COMMUNICATION	Category	L	T	P	Credit
		PCC	2	1	0	3

Preamble

This course aims

Mobile and wireless communication technologies have revolutionized the way we connect, interact, and share information in the modern world. The rapid advancements in mobile communication, including the rollout of 6G networks, have significantly enhanced data transfer speeds, network reliability, and overall connectivity. It covers radio propagation and fading models, fundamentals of cellular communications, multiple access technologies, and various wireless systems like GSM, CDMA etc., including past and future generation wireless networks. This course will enable students to develop skillsto handle wireless and mobile communication systems.

Prerequisite

Engineering Mathematics,

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	To understand the evolution and operation of mobile and wireless communication systems, including modern networks and wireless access technologies.	20
CO2	To understand the fundamental cellular concepts, system design, and multiple access techniques, including their applications and strategies for optimizing coverage and capacity in cellular networks.	20
CO3	To analyze mobile radio propagation models, encompassing small-scale fading, diversity techniques, large-scale path loss factors, and statistical models for multipath fading channels.	20
CO4	To understand the diversity and equalization techniques in wireless communication systems, including receiver diversity methods and various types of equalizers.	20
CO5	To have an in depth understanding of the design consideration of different wireless communication systems.	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3			-	-	-	-	-	-	-	-	3	-	3	-
CO2	3	3	3	-	-	-	-	-	-	-	-	3	-	3	-

CO3	3	3	3	-	-	-	-	-	-	-	-	3	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	3	-	3	-
CO5	3	3	-	-	-	-	-	-	-	-	-	3	-	3	-
Avg	**3**	**3**	**3**	-	-	-	-	-	-	-	-	**3**	-	**3**	-

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	**2**	**1**	**2**	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30
Applying	50	50	50	50	50
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) : 20
Marks Assignment/Quiz/Course project : 14
Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1(CO1):

1.List the features of various generation of mobiles.

2. Explain in detail about IEEE 802.11.

3.Explain the working of a paging system

Course Outcome 2(CO2):

1.Analyze the impact of both co-channel and adjacent chancel interference on system capacity in a cellular system.

2.Write down the procedure involved in the determination of Co-Channel Cell.

3. Explain with neat sketch, Handoff mechanism adopted in cellular communication detailing the condition for proper handoff

4.Compare the features of various multiple access methods

Course Outcome 3 (CO3):

1. Determine the Fraunhofer distance for an antenna with maximum dimension of 1 m and operating frequency of 900 MHz. If the antennas have unity gain calculate the path loss.

2. With neat sketch explain and derive the received power for a two ray ground reflection model.

3. Derive the received power in dBm for a free space Propagation model.

Course Outcome 4 (CO4):

1. Draw the Block diagram of simplified communication system using an adaptive equalizer at the

receiver.

2. Write short notes on zero forcing and LMS algorithm.

3. Discuss a 2 x 2 MIMO system and provide your understanding on Alamouti Code.

Course Outcome 5(CO5):

1. Explain GSM architecture with neat block diagram.
2. Draw the structure of Rake Receiver.
3. Calculate the number of users who can be assigned mutually orthogonal sequence in a CDMA systems with N=8.

Syllabus

Module 1

INTRODUCTION OF MODERN MOBILE COMMUNICATION

Evolution of mobile and radio communications- Basic operation of paging system, cordless telephone system, cellular telephone system. Modern wireless communication systems: 2G networks, 3G networks,4G networks,5G networks,6G Networks, Personal communication systems –Wireless local area networks – Wireless broadband access systems - Wireless wide area networks, IEEE802.11, Overview to Wireless ATM, HYPERLAN, IEEE802.15 **Wireless PAN, and Home RF**

Module 2

INTRODUCTION TO CELLULAR SYSTEMS:

Cellular concepts: Basic Cellular concepts,Block diagram ,operation of cellular systems, Spectrum allocation, Cellular system design fundamentals -Frequency reuse, channel assignment strategies, hand off strategies, interference and system capacity, improving coverage and capacity in cellular systems.

Multiple Access Techniques:

Introduction, Comparisons of multiple Access Strategies,TDMA,CDMA, FDMA, OFDM

Module 3

Mobile Radio Propagation Model

Small Scale Fading and diversity: Large scale path loss:-Free Space Propagation loss equation, Pathloss of NLOS and LOS systems, Reflection, Ray ground reflection model, Diffraction, Scattering, Max. Distance Coverage formula, Empirical formula for path loss, Indoor and outdoor propagation models, Small scale multipath propagation, Impulse model for multipath channel, Delay spread, Feher's delay spread, upper bound Small scale, Multipath Measurement parameters of multipath channels, Types of small scale Fading, Rayleigh and Raycian distribution, Statistical for models multipath fading channels.

Module 4

Diversity & Equalization: Diversity System Model, Receiver Diversity: selection diversity, feedback diversity, maximal ratio combining, equal gain combining, Alamouti scheme for 2x2 MIMO,Equalizers, Types of Equalizers: linear equalizers, non-linear equalizers.

Module 5

Wireless Systems:

GSM system architecture, Radio interface, Protocols, Localization and calling, Handover, Authentication and security in GSM, GSM speech coding, GPRS system architecture. Ultrawideband (UWB) ,Ad-hoc and wireless sensor networks, Cognitive radio and Software defined radio.

Introduction to spread spectrum system : Fundamental concepts of spread spectrum systems

Pseudo noise sequences, direct sequence spread spectrum, frequency hop spread spectrum, Hybrid direct sequence frequency hop spread spectrum, code division multiple ,Air interface, CDMA forward channels, CDMA reverse channels, Soft handoff, CDMA features, Power control in CDMA, Performance of CDMA System, RAKE Receiver, CDMA2000 cellular technology.

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Theodre S Rappaport	Wireless Communication Systems	First Edition	Prentice hall	2014
2	Andrea Goldsmith	Wireless Communications	First Edition	Cambridge University Press	2005

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Rodger Eziemer, Roger L. Peterson , David E Borth	Introduction to spread spectrum communication	First Edition	Pearson	1995
2	W.C.Y. Lee -	Mobile Cellular Communications	2nd Edition	MC Graw Hill,	1998

Online study materials:

1. https://archive.nptel.ac.in/courses/117/102/117102062/

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**Introduction of modern mobile communication**	9	CO1
1.1	Evolution of mobile and radio communications- Basic operation of paging system, cordless telephone system, cellular telephone system	3	
1.2	Modern wireless communication systems: 2G networks, 3G networks,4G networks,5G networks,6G Networks,	2	
1.3	Personal communication systems –Wireless local area networks – Wireless broadband access systems - Wireless wide area networks	2	
1.4	IEEE802.11, Overview to Wireless ATM, HYPERLAN, IEEE802.15 Wireless PAN, and Home RF	2	
2	**Introduction to Cellular Systems**	9	CO2
2.1	Cellular concepts: Basic Cellular concepts, Block diagram ,operation of cellular systems, Spectrum allocation	2	
2.2	Cellular system design fundamentals -Frequency reuse, channel assignment strategies, hand off strategies,	2	
2.3	interference and system capacity ,improving coverage and capacity in cellular systems	2	
2.4	Multiple Access Techniques: Introduction, Comparisons of multiple Access Strategies	1	
2.5	TDMA,CDMA, FDMA, OFDM	2	
3.	**Mobile Radio Propagation Model**	9	CO3
3.1	Small Scale Fading and diversity: Large scale path loss:-Free Space Propagation loss equation, Pathloss of NLOS and LOS systems	2	
3.2	Reflection, Ray ground reflection model, Diffraction, Scattering, Max. Distance Coverage formula, Empirical formula for path loss,	2	

	Indoor and outdoor propagation models		
3.3	Small scale multipath propagation, Impulse model for multipath channel, Delay spread, Feher's delay spread, upper bound Small scale.	2	
3.4	Multipath Measurement parameters of multipath channels	2	
3.5	Types of small scale Fading, Rayleigh and Raycian distribution, Statistical for models multipath fading channels	1	
4	**Diversity & Equalization**	9	CO4
4.1	Diversity System Modal: Receiver Diversity	2	
4.2	Selection diversity, feedback diversity, maximal ratio combining, equal gain combining	3	
4.3	Alamouti scheme for 2x2 MIMO	2	
4.4	Types of Equalizers: linear equalizers, non-linear equalizers	2	
5	**Wireless Systems**	9	CO5
5.1	GSM system architecture, Radio interface, Protocols, Localization and calling, Handover, Authentication and security in GSM, GSM speech coding	2	
5.2	GPRS system architecture. Ultrawideband (UWB) ,Ad-hoc and wireless sensor networks,	2	
5.3	Cognitive radio and Software defined radio.	1	
5.4	Fundamental concepts of spread spectrum systems, Pseudo noise sequences, direct sequence spread spectrum, frequency hop spread spectrum, Hybrid direct sequence frequency hop spread spectrum	2	
5.4	CDMA forward channels, CDMA reverse channels, Soft handoff, CDMA features	1	
5.5	Power control in CDMA, Performance of CDMA System, RAKE Receiver, CDMA2000 cellular technology	1	
	TOTAL	**45 hours**	

Course Designers:

COURSE DESIGNED BY	**VERIFIED BY**
Ms Aswathy J Asst. Professor, ECE, JCET E Mail ID: aswathy4088.ece@jawaharlalcolleges.com	Mr Srikanth K Asst. Professor, ECE, JCET E Mail ID: srikanth4019.ece@jawaharlalcolleges.com

24ECBSPT712	BIOMEDICAL SIGNAL PROCESSING	Category	L	T	P	Credit
		PCC	3	0	0	3

Preamble

This course will enable the students to learn about widely used signal processing techniques, emphasizing biomedical applications.

Prerequisite

Basics of Laplace Transform and Fourier Transform

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Demonstrate the fundamentals of discrete-time signals and systems.	20
CO2	Apply domain transformation techniques in discrete-time signals.	20
CO3	Design digital filters and apply the concepts in biomedical scenarios.	20
CO4	Apply different power spectrum estimation techniques.	20
CO5	Apply various noise cancellation techniques for biomedical applications.	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3		3	-	-	-	-	2	-	-	-	3	-
CO2	3	3	3	-	3	-	-	-	-	2	-	-	-	3	-
CO3	3	3	3	-	3	-	-	-	-	2	-	-	-	3	-
CO4	3	3	3	-	3	-	-	-	-	2	-	-	-	3	-
CO5	3	3	3	-	3	-	-	-	-	2	-	-	-	3	-
Avg	**3**	**3**	**3**	-	**3**	-	-	-	-	**2**	-	**-**	**-**	**3**	-

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	**2**	**1**	**2**	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30
Applying	50	50	50	50	50
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) : 20 Marks
Assignment/Quiz/Course project : 14 Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1(CO1):

1. Distinguish between a digital signal and a discrete signal.
2. Give examples of any three biomedical signals with their frequency ranges.
3. With the help of a block diagram explain an Analog-to-Digital Conversion system.

Course Outcome 2(CO2):

1. Enumerate two properties of the DTFT.
2. State the properties of z-Transform.
3. Determine the unit sample response of the system characterized by the difference equation $y(n) = 2.5y(n-1) - y(n-2) + x(n) - 5x(n-1) + 6x(n-2)$

Course Outcome 3 (CO3):

1.Explain the Design a lowpass Butterworth filter satisfying the following requirements: a passband

frequency of 200 Hz with a maximum passband attenuation of 0.5 dB, a stopband frequency of 400 Hz with a minimum stopband attenuation of 20 dB, and a sampling frequency of 2 kHz.
2. Design a lowpass FIR filter using the rectangular windows satisfying the following requirements: a passband frequency of 500 Hz with a maximum passband attenuation of 0.2 dB, a stopband frequency of 600 Hz with a minimum stopband attenuation of 40 dB, and a sampling rate of 4 kHz.
3. Illustrate Gibbs Phenomenon in causal FIR filters.

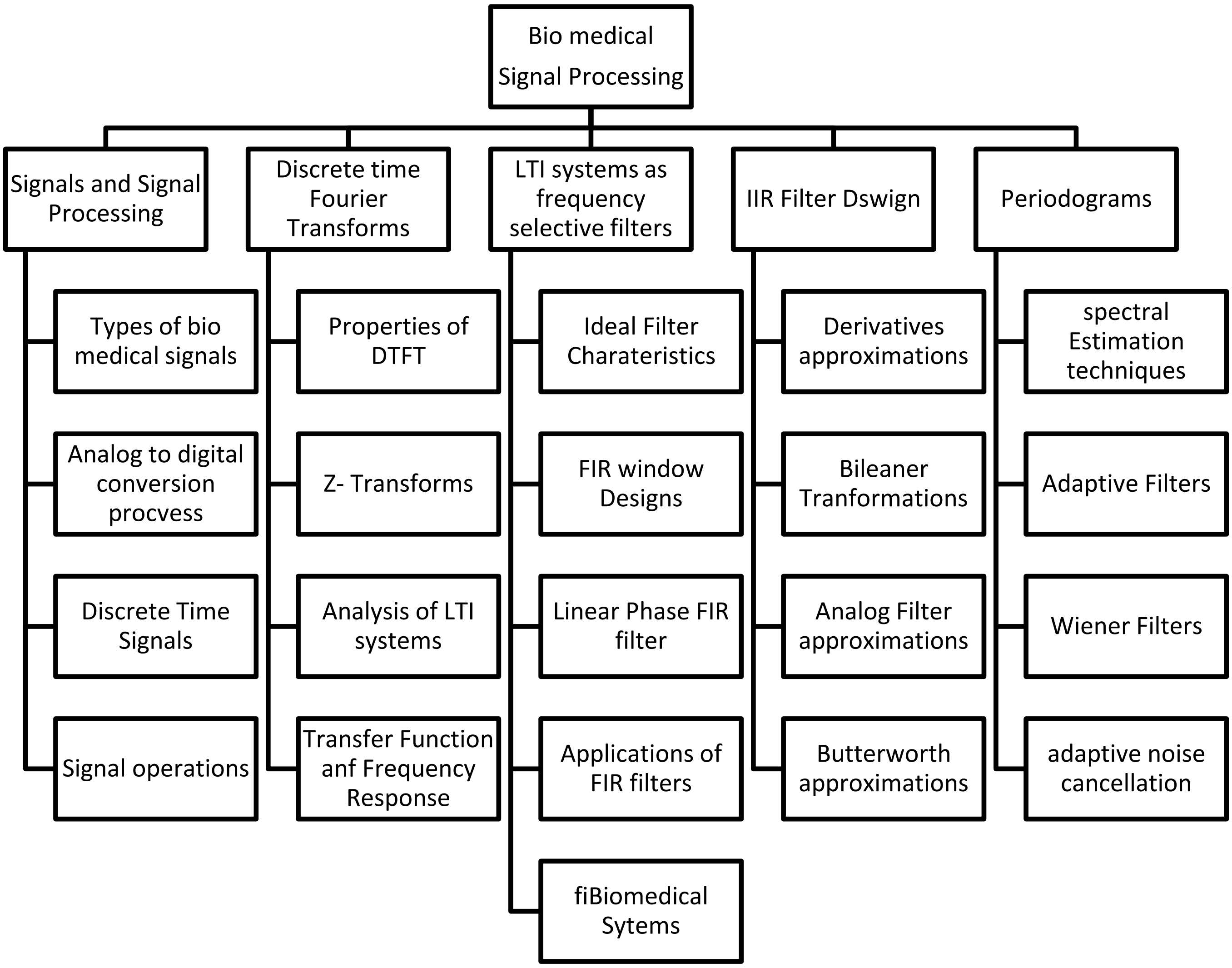
Course Outcome 4 (CO4):

1. Describe Blackman-Tukey spectral estimation.
2. Draw the block diagram of optimum noise canceler using Wiener Filter.
3. With the help of a block diagram, explain the adaptive noise cancelling method in ECG monitoring.

Course Outcome 5(CO5):

1. Analyse HRV using periodogram.
2. Draw the block diagram of optimum noise canceler using Wiener Filter.
3. With the help of a block diagram, explain 50 Hz noise cancelling method in ECG monitoring.

Concept Map



Syllabus

Module 1

Signals and Signal Processing-

Characterization and Classification of Signals, Typical signal Processing Operations, Examples of Biomedical Signals and Analog-to-Digital Conversion (block diagram only)Discrete-Time Signals -Typical Sequences and Sequence. Representation, Discrete-Time Systems-Classification of Discrete-Time Systems

Module 2

Discrete-Time Fourier Transform (DTFT)

Definition, Properties, Discrete Fourier Transform-Definition, Properties, FFT-Decimation-in-Time, Decimation-in-Frequency. The Z transform-Properties of the z-Transform, Poles and Zeros, Inversion of the z-Transform Using partial fraction expansion, Analysis of Linear Time-Invariant Systems in the z-Domain Transfer function, Frequency response

Module 3

LTI systems as frequency selective filters

Ideal filter characteristics-Simple Digital Filter Design-Preliminary Considerations, Design of linear-phase FIR Filter using windows (Bartlett, hamming, Hanning, Kaiser) and frequency sampling method-Applications of FIR filters in Biomedical systems - pre-processing of bio signals.

Module 4

IIR Filter Design

Approximation of Derivatives, Impulse invariance, Bilinear Transform Method, Analog filter approximation-Butterworth approximation, Frequency Transformations (Analog and Digital domain), IIR digital filters for ECG analysis

Module 5

Periodogram

Averaged periodogram, Blackman-Tukey Spectral estimation, QRS detection in ECG, Analysis of Heart Rate Variability using periodogram +,/Adaptive Filters-Principle of Wiener Filters, Principle of adaptive filtering, Principle of adaptive noise cancellation, Cancellation of 50-Hz interference in ECG

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Reddy, D. C	Biomedical signal processing: principles and techniques	1st edition	McGraw-Hill	2005
2	John G Proakis& Dimitris G Manolakis:	Digital Signal Processing Principles, Algorithms and Applications,	1st edition	Prentice Hall of India	2005

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Mitra, Sanjit Kumar, and YonghongKuo	Digital signal processing: a computer-based approach	2nd edition	New York: McGraw-Hill	2006
2	Rangaraj M Rangayyan	Biomedical Signal Analysis	1st edition	John Wiley	2002

Online study materials:

1. http://digimat.in/nptel/courses/video/108105101/L30.html
2. https://www.digimat.in/nptel/courses/video/108105101/L12.html
3. https://www.digimat.in/nptel/courses/video/108105101/L50.html
4. http://kcl.digimat.in/nptel/courses/video/108105101/L36.html

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**Module 1**	12	
1.1	Signals and Signal Processing	1	
1.2	Characterization and Classification of Signals, Typical Signal Processing Operations	2	CO1
1.3	Examples of Biomedical Signals and Analog-to-Digital Conversion	4	
1.4	Discrete-Time Signals-Typical Sequences and Sequence Representation	4	
1.5	Discrete-Time Systems	1	
2	**Module 2**	12	
2.1	The Discrete-Time Fourier Transform (DTFT)	3	
2.2	Discrete Fourier Transform (DFT)	3	
2.3	FFT	2	
2.4	Properties of the z-Transform	1	CO2
2.5	Inversion of the z-Transform	2	
2.6	Analysis of Linear Time-Invariant Systems in the z-Domain	1	
3.	**Module 3**	12	
3.1	LTI systems as frequency-selective filters	2	
3.2	Ideal filter characteristics	1	CO3
3.3	Simple Digital Filter Design-Preliminary Considerations	2	
3.4	Design of linear-phase FIR Filter using windows and	3	

	frequency sampling method		
3.5	Applications of FIR filters in Biomedical systems - pre-processing of bio signals	4	
4.	**Module 4**	12	CO4
4.1	IIR Filter Design-Approximation of Derivatives	3	
4.2	Impulse invariance	2	
4.3	Bilinear Transform Method	3	
4.4	Analog filter approximation-Butterworth approximation	1	
4.5	Frequency Transformations	1	
4.6	IIR digital filters for ECG analysis	2	
5.	**Module 5**	12	CO5
5.1	The Periodogram Blackman-Tukey Spectral estimation	3	
5.2	Analysis of Heart Rate Variability using Periodogram	3	
5.3	QRS detection in ECG	2	
5.4	Principle of Wiener Filters, Principle of adaptive filtering	2	
5.5	Principle of adaptive noise cancellation, Cancellation of 50-Hz interference in ECG	2	
	TOTAL	**60 Hours**	

Course Designers:

COURSE DESIGNED BY	**VERIFIED BY**
Mr.Sree Sankar. J Asst. Professor, ECE, JCET E Mail ID: sanishvs@jawaharlalcolleges.com	Dr.Sandeep C S Asso. Professor and HoD, ECE, JCET E Mail ID:hodece@jawaharlalcolleges.com

24ECIRAT722	INDUSTRIAL ROBOTICS AND AUTOMATION	Category	L	T	P	Credit
		PEC	3	0	0	3

Preamble

This course aims

- To learn the fundamental components and systems used in industrial automation and robotics.
- To study automated production lines, industrial robotics, spatial transformations, and hardware for process control.
- **To g**ain practical knowledge to implement automation solutions across various industries.

Prerequisite

Basics of electrical, Mechanical Engineering and Problem solving skills

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Translate and simulate a real time activity using modern tools and discuss the Benefits of automation.	20
CO2	Identify suitable automation hardware for the given application.	20
CO3	Recommend appropriate modelling and simulation tool for the given manufacturing Application.	20
CO4	Explain the basic principles of Robotic technology, configurations, control and Programming of Robots.	20
CO5	Explain the basic principles of programming and apply it for typical Pick & place, Loading & unloading and palletizing applications	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	-	2	-	3	-
CO2	3	3	3	-	-	-	-	-	-	-	-	2	-	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	2	-	3	-
CO4	3	3	3	-	-	-	-	-	-	-	-	2	-	3	-
CO5	3	3	3	-	-	-	-	-	-	-	-	2	-	3	-
Avg	**3**	**3**	**3**	-	-	-	-	-	-	-	-	**2**	-	**3**	-

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests	Assignment	Terminal Examination

	1	2	1	2	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30
Applying	50	50	50	50	50
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks

Continuous Assessment Test (2 numbers) : 20

Marks Assignment/Quiz/Course project : 14

Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1(CO1):

1. How can modern tools and technologies be utilized to translate and simulate a real-time industrial activity?
2. What are the key benefits of automation in industrial processes, and how does it impact productivity and efficiency?

Course Outcome 2(CO2):

1. What factors should be considered when selecting automation hardware for a specific manufacturing application?
2. How does the choice of automation hardware influence the overall performance and scalability of the system?

Course Outcome 3 (CO3):

1. What are the most widely used modeling and simulation tools for manufacturing applications, and how do they enhance design and production?
2. How can modeling and simulation tools improve the accuracy of predictive maintenance and process optimization in manufacturing?

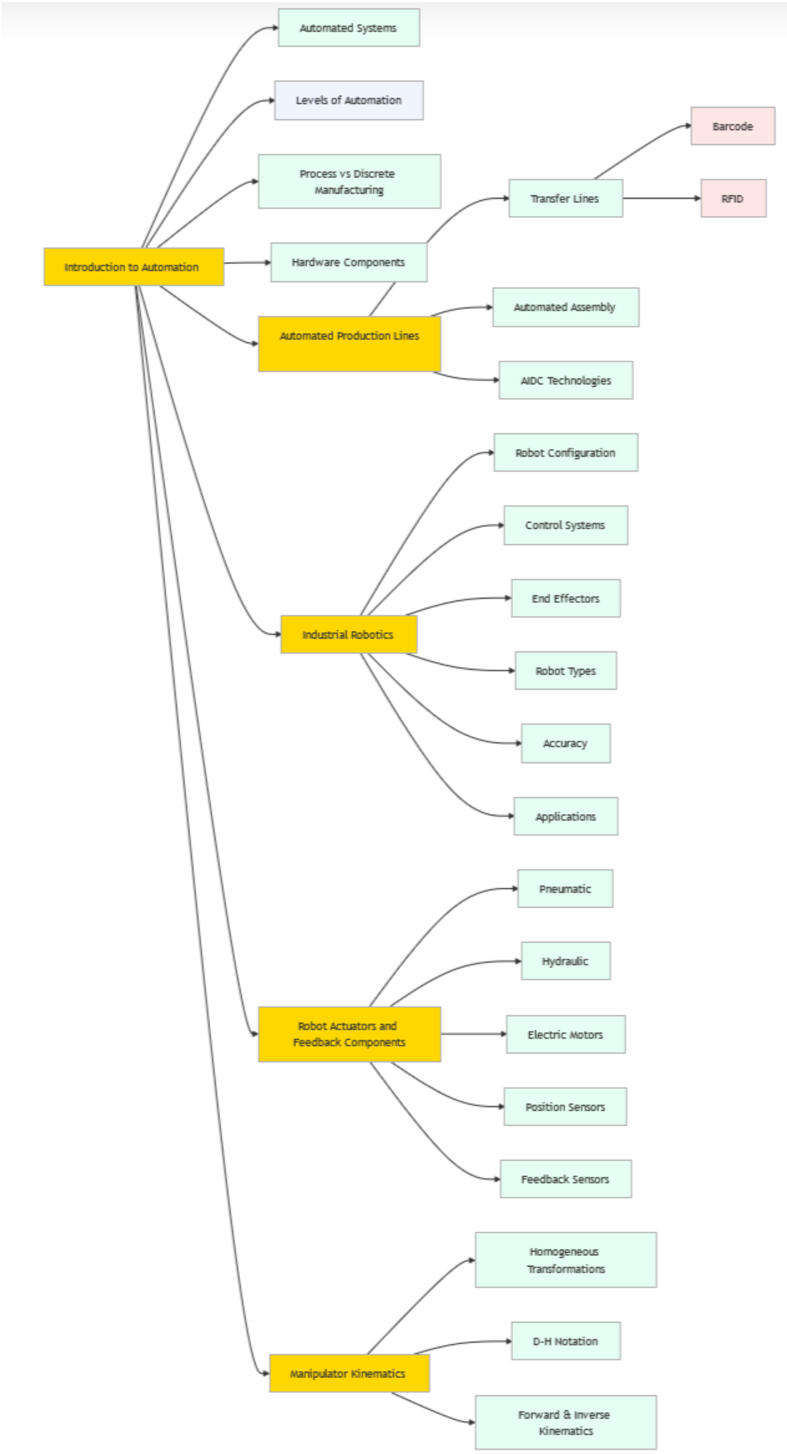
Course Outcome 4 (CO4):

1. What are the core principles of robotic technology, and how do different configurations of robots affect their capabilities in industrial settings?
2. How does robot control and programming vary across different types of robotic systems, and what are the challenges involved in each?

Course Outcome 5(CO5):

1. What are the key programming principles used in robotic systems for Pick & Place, Loading & Unloading, and Palletizing tasks?
2. How can programming techniques be applied to optimize the efficiency and precision of robots in Pick & Place, Loading & Unloading, and Palletizing operations?

Concept Map


Introduction to Automation
Automated Systems
Levels of Automation
Process vs Discrete Manufacturing
Hardware Components
Transfer Lines
Barcode
RFID
Automated Production Lines
Automated Assembly
AIDC Technologies
Industrial Robotics
Robot Configuration
Control Systems
End Effectors
Robot Types
Accuracy
Applications
Robot Actuators and Feedback Components
Pneumatic
Hydraulic
Electric Motors
Position Sensors
Feedback Sensors
Manipulator Kinematics
Homogeneous Transformations
D-H Notation
Forward & Inverse Kinematics

Syllabus

Module 1

Introduction to automation: Basic elements of an automated system, advanced automation functions, levels of automation, process industries versus discrete manufacturing industries, continuous versus discrete control, computer process control. Hardware components for automation and process control, sensors, actuators, analog to digital converters, digital to analog converters, input/output devices for discrete data

Module 2

Automated production lines: Fundamentals of automated production lines, application of automated production lines, analysis of transfer lines, automated assembly systems, fundamentals of automated assembly systems, quantitative analysis of assembly systems, automatic identification methods, barcode technology, radio frequency identification, other AIDC technologies

Module 3

Industrial Robotics: Robotic configuration, robot anatomy and related attributes, robot control systems, end effectors, sensors in robotics, industrial robot applications, robot accuracy and repeatability, different types of robots, various generations of robots, degrees of freedom – Asimov's laws of robotics, dynamic stabilization of robots.

Module 4

Spatial descriptions and transformations: Robot actuators and Feedback components: Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison. Position sensors – potentiometers, resolvers, encoders

Module 5

Velocity sensors, Tactile sensors, Proximity sensors. Manipulator Kinematics: Homogeneous transformations as applicable to rotation and translation -D-H notation, Forward and inverse kinematics.

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Mikell P. Groover	Computer Integrated Manufacturing	3rd	Pearson	2009
2	John J. Craig	Introduction to robotics mechanics and control	3rd	Pearson	2009

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Weiss, Nagel	Industrial Robotics Weiss	2nd	McGraw Hill International	2012
2	Klafter, Chmielewski	Robotic Engineering - An Integrated approach	1st	PHI	2009

Online study materials:
https://nptel.ac.in/courses/112105319

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	Introduction to automation	9	CO1
1.1	Basic elements of an automated system	2	
1.2	Advanced automation functions, levels of automation	2	
1.3	Process industries versus discrete manufacturing industries	2	
1.4	Continuous versus discrete control, computer process control.	1	
1.5	Hardware components for automation and process control, sensors, actuators,	1	
1.6	Analog to digital converters, digital to analog converters, input/output devices for discrete data	1	
2	Automated production lines:	9	CO2
2.1	Fundamentals of automated production lines, application of automated production lines	2	
2.2	Analysis of transfer lines, automated assembly systems, fundamentals of automated assembly systems	2	
2.3	Quantitative analysis of assembly systems, automatic identification methods	3	
2.4	Barcode technology	1	
2.5	Radio frequency identification, other AIDC technologies	1	
3.	Industrial Robotics	9	CO3
3.1	Robotic configuration, robot anatomy and related attributes, robot control systems	2	
3.2	Eeffectors, sensors in robotics, industrial robot applications, robot accuracy and repeatability	2	
3.3	Different types of robots, various generations of robots,	2	
3.4	Degrees of freedom – Asimov's laws of robotics	2	
3.5	Dynamic stabilization of robots.	1	

4.	Spatial descriptions and transformations	9	CO4
4.1	Robot actuators and Feedback components	2	
4.2	Actuators: Pneumatic, Hydraulic actuator	2	
4.3	Electric & stepper motors, comparison.	2	
4.4	Position sensors –potentiometers, resolvers, encoders	3	
5.	Velocity sensors, Tactile sensors	9	CO5
5.1	Proximity sensors	2	
5.2	Manipulator Kinematics: Homogeneous transformations as applicable to rotation and translation	2	
5.3	D-H notation	2	
5.4	Forward and inverse kinematics.	3	
	TOTAL	**45 Hours**	

Course Designers:

COURSE DESIGNED BY	**VERIFIED BY**
Dr Aswani K Asst. Professor, ECE, JCET E Mail ID: draswani4316.ece@jawaharlalcolleges.com	Dr.Sandeep C S Asso. Professor and HoD, ECE, JCET E Mail ID: hodece@jawaharlalcolleges.com

24ECINIT732	INDUSTRIAL INSTRUMENTATION	Category	L	T	P	Credit
		PEC	3	0	0	3

Preamble

This course aims to develop a strong understanding of the principle of operation of various temperature, pressure, flow and level measuring devices.

Prerequisite

Nil

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Understand the working of different types of temperature sensors (Understanding)	20
CO2	Familiarize with the various types of pressure measurement techniques(Understanding)	20
CO3	Understand the working of various flow measurement devices(Understanding)	20
CO4	Familiarize with the working of anemometers and viscometers (Understanding)	20
CO5	Understand the various level measurement techniques (Understanding)	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	2	1	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	2	1	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	2	1	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	2	1	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	2	1	-	-
Avg	**3**	**3**	**-**	-	**-**	-	-	-	-	-	-	**2**	**1**	-	-

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	30	30	30	30	30
Understanding	70	70	70	70	70
Applying					
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) :20Marks
Assignment/Quiz/Course project :14Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1(CO1):

1. Explain the working principle of Resistance Temperature detectors.
2. Explain the theory of operation of thermocouples.

Course Outcome 2 (CO2):

1. Explain the construction and principle of operation of Bourdon tubes.
2. Compare the performance of various types of electronic pressure sensors.

Course Outcome 3 (CO3):

1. Explain how venturi tubes are used in Flow Measurement?
2. Explain the working of Angular-momentum type flow meter.

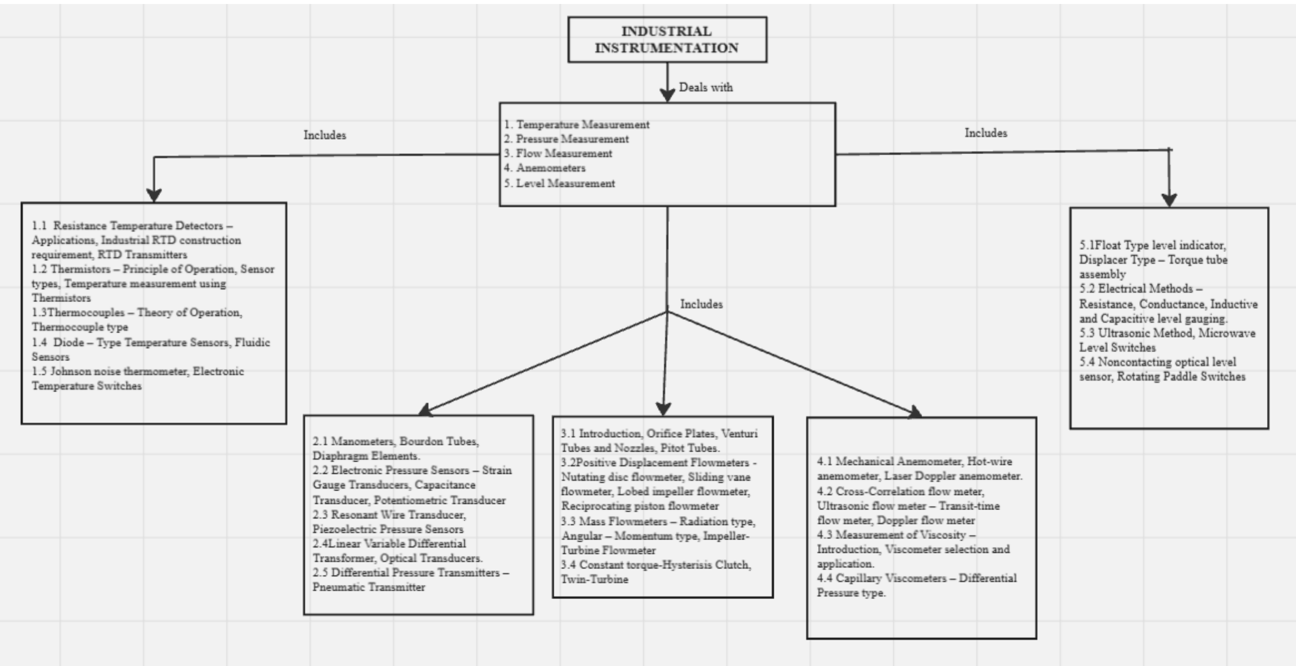
Course Outcome 4 (CO4):

1. What are anemometers used for? Explain the different categories of anemometers.
2. Explain the working of differential pressure type capillary viscometers

Course Outcome 5 (CO5):

1. What are the different types of float type designs for level measurement and control?
2. Compare the performance of various types of electrical level gauging methods

Concept Map



Syllabus

Module 1

Temperature Measurement: Resistance Temperature Detectors – Applications, Industrial RTD construction requirement, RTD Transmitters. Thermistors – Principle of Operation, Sensor types, Temperature measurement using Thermistors. Thermocouples – Theory of Operation, Thermocouple types. Diode – Type Temperature Sensors, Fluidic Sensors, Johnson noise thermometer, Electronic Temperature Switches.

Module 2

Pressure Measurement: Manometers, Bourdon Tubes, Diaphragm Elements. Electronic Pressure Sensors – Strain Gauge Transducers, Capacitance Transducer, Potentiometric Transducer, Resonant Wire Transducer, Piezoelectric Pressure Sensors, Linear Variable Differential Transformer, Optical Transducers. Differential Pressure Transmitters – Pneumatic transmitter.

Module 3

Flow Measurement: Introduction, Orifice Plates, Venturi Tubes and Nozzles, Pitot Tubes. Positive Displacement Flowmeters - Nutating disc flowmeter, Sliding vane flowmeter, Lobed impeller flowmeter, Reciprocating piston flowmeter Mass Flowmeters – Radiation type, Angular – Momentum type, Impeller-Turbine Flowmeter, Constant torque - Hysteresis Clutch, Twin-Turbine.

Module 4

Anemometers – Mechanical Anemometer, Hot-wire anemometer, Laser Doppler anemometer. Cross-Correlation flow meter, Ultrasonic flow meter – Transit-time flow meter, Doppler flow meter Measurement of Viscosity – Introduction, Viscometer selection and application. Capillary Viscometers– Differential Pressure type.

Module 5

Level Measurement – Float Type level indicator, Displacer Type – Torque tube assembly. Electrical Methods – Resistance, Conductance, Inductive and Capacitive level gauging. Ultrasonic Method, Microwave Level Switches, Noncontacting optical level sensor, Rotating Paddle Switches.

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Patranabis D	Principles of Industrial Instrumentation	3rd Edition	Tata McGraw Hill, New Delhi,	2010
2	Liptak B.G	Process Measurement and Analysis	4th Edition	Chilton Book Company, Radnor, Pennsylvania	2003

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Andrew W.G	Applied Instrumentation in Process Industries – A survey	Vol I & Vol II	Gulf Publishing Company, Houston,	2001

Online study materials:

1. http://www.digimat.in/nptel/courses/video/108105064/L29.html

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**Temperature Measurement**	9	CO1
1.1	Resistance Temperature Detectors – Applications, Industrial RTD construction requirement, RTD Transmitters	2	
1.2	Thermistors – Principle of Operation, Sensor types, Temperature measurement using Thermistors	2	
1.3	Thermocouples – Theory of Operation, Thermocouple types.	1	
1.4	Diode – Type Temperature Sensors, Fluidic Sensors	2	
1.5	Johnson noise thermometer, Electronic Temperature Switches	2	
2	**Pressure Measurement**	9	
2.1	Manometers, Bourdon Tubes, Diaphragm Elements.	2	
2.2	Electronic Pressure Sensors – Strain Gauge Transducers, Capacitance Transducer, Potentiometric	3	

	Transducer		CO2
2.3	Resonant Wire Transducer, Piezoelectric Pressure Sensors	1	
2.4	Linear Variable Differential Transformer, Optical Transducers.	2	
2.5	Differential Pressure Transmitters – Pneumatic Transmitter	1	
3.	**Flow Measurement**	9	CO3
3.1	Introduction, Orifice Plates, Venturi Tubes and Nozzles, Pitot Tubes.	2	
3.2	Positive Displacement Flowmeters - Nutating disc flowmeter, Sliding vane flowmeter, Lobed impeller flowmeter, Reciprocating piston flowmeter	3	
3.3	Mass Flowmeters – Radiation type, Angular – Momentum type, Impeller-Turbine Flowmeter	2	
3.4	Constant torque-Hysterisis Clutch, Twin-Turbine	2	
4	**Anemometers**	9	CO4
4.1	Mechanical Anemometer, Hot-wire anemometer, Laser Doppler anemometer.	3	
4.2	Cross-Correlation flow meter, Ultrasonic flow meter – Transit-time flow meter, Doppler flow meter	3	
4.3	Measurement of Viscosity – Introduction, Viscometer selection and application.	2	
4.4	Capillary Viscometers – Differential Pressure type.	1	
5	**Level Measurement**	9	CO5
5.1	Float Type level indicator, Displacer Type – Torque tube assembly.	2	
5.2	Electrical Methods – Resistance, Conductance, Inductive and Capacitive level gauging.	3	
5.3	Ultrasonic Method, Microwave Level Switches	2	
5.4	Noncontacting optical level sensor, Rotating Paddle Switches.	2	
	TOTAL	**45 hours**	

Course Designers:

COURSE DESIGNED BY	VERIFIED BY
Ms Sayana M Asst. Professor, ECE, JCET E Mail ID: sayanam@jawaharlalcolleges.com	Mr Sanish V S Asst. Professor, ECE, JCET E Mail ID: sanishvs@jawaharlalcolleges.com

24ECIOTT504	CMOS ANALOG IC DESIGN	Category	L	T	P	Credit
		PEC	3	0	0	3

Preamble

This course aims to impart the basic knowledge of CMOS analog circuits design and enable the students to design integrated circuits

Prerequisite

24ECCLIT303 Circuits & Linear ICs

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Analyze various single stage amplifiers with different types of loads (Analyzing)	20
CO2	Design and analyze differential amplifiers (Applying)	20
CO3	Design various types of current mirrors (Applying)	20
CO4	Plot the frequency response of single stage and differential amplifiers (Understanding)	20
CO5	Analyse the effect of noise in single stage amplifiers and implement PLL for various applications (Analyzing)	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3		1				2		2		3	
CO2	1		2									2		3	
CO3	3	1										2	2	3	2
CO4	3	3	1	2								2	2	3	2
CO5	3	1	1	2	2	1	3	3	3	3	3	2	2	3	
Avg	2.6	1.6	1.4	1.4	0.4	0.4	0.6	0.6	0.6	1	0.6	2	1.2	3	0.8

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering					
Understanding	20	20	10	10	20
Applying	30	30	40	40	30
Analyzing	50	50	50	50	50
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) : 20
Marks Assignment/Quiz/Course project : 14
Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Course Level Assessment Questions

CO1. Analyze various Single stage Amplifiers with different types of loads

1. Develop small signal model for various amplifier configurations
2. Calculate the small signal gain of various configurations
3. Analyze the effect of cascading of stages.

CO2. Design and Analyse Differential Amplifiers

1. Perform Qualitative Analysis of Differential Pair.
2. Calculate the small signal gain of differential pair if the bias voltages are equal.
3. Calculate the overdrive voltage of each transistor in differential pair.

CO3. Design various types of current mirrors

1. Explain the use of current mirrors to bias a differential pair
2. Explain the concept of an active current mirror.
3. Analysis of circuits having current mirror.

CO4:Plot the frequency response of single stage and differential amplifiers

1. Calculation of poles associated with the nodes in a circuit
2. Calculate the voltage transfer function of common source stageModelling the high frequency equivalent circuit of various configurations

CO5: Analyse the effect of noise in single stage amplifiers and Implement PLL for various applications

1. Modelling of noise in circuits.
2. Calculation of Input referred noise and output noise in various circuits.
3. Calculation of noise bandwidth
4. Describe the implementation of PLL for Frequency Multiplication, Frequency synthesizer and Skew reduction

Syllabus

Module I

Basic MOS Device physics- Review of MOS Characteristics and Second order effects (only basic theoretical concepts).

Single Stage Amplifiers. Common Source Stage with Different Load types, Source Follower, Common Gate and Cascode Stage

Module II

Differential Amplifiers - Single-ended and differential operation, Basic differential pair, Common-mode response, Differential pair with MOS load, Gilbert Cell.

Current Mirror: Simple, Cascode and Basic concepts of active current Mirror

Module III

Frequency Response of Amplifiers: Miller Effect, Poles and Zeros, Frequency Response Analysis of Common Source, Source Follower, Common Gate and Differential Pair.

Module IV

Noise in Amplifiers: Noise in Single Stage amplifier (CS,CG,Source Follower), Noise in Differential Pair, Noise Band Width.

Module V

Phase Locked Loops- Mathematical model of VCO, Phase Detector, Basic PLL Topology, Type I and Type II(Charge Pump) PLL, Stability Analysis of PLL, Non Ideal Effects in PLL, Application of PLL- Frequency Multiplication, Frequency synthesizer and Skew reduction. Block Diagram of Digital PLL.

Learning Resources
TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer	Analysis and Design of Analog Integrated Circuits	6th Edition	Wiley	2024

2	R. Jacob Baker	CMOS Circuit Design, Layout, and Simulation	4th Edition	Wiley-IEEE Press	2019

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Behzad Razavi	Design of Analog CMOS Integrated Circuits	2nd Edition	McGraw-Hill Education	2020
2	Phillip E. Allen, Douglas R. Holberg	CMOS Analog Circuit Design	3rd Edition	Oxford University Press	2020
3	Roland E. Best	Phase-Locked Loops: Design, Simulation, and Applications	6th Edition	Tata McGraw Hill	2021

Online study materials:

https://onlinecourses.nptel.ac.in/noc22_ee37/preview

Course Contents and Lecture Schedule

No.	Topic	No. of Hours	Course Outcome
1	**CMOS Amplifiers**		
1.1	Review of MOS Characteristics, Second order effects(Subtreshold conduction, DIBL,Velocity Saturation etc..)	2	CO1
1.3	Single Stage Amplifiers-Basic Concepts	1	
1.4	CS with resistive, Diode Connected and Current Source Load, CS with source Degeneration	3	
1.5	Source Follower and common Gate Stage	2	
1.6	Cascode Stage	1	
2	**Differential Amplifier**		CO2
2.1	Single Ended and Differential Operation	2	
2.2	Common Mode Response, Differential pair with MOS Load	2	
2.3	Concept of Gilbert Cell and Introduction to Basic Current Mirror	3	
2.4	Cascode current Mirrors and Basic Concepts of Active Current Mirrors	2	
3	**Frequency Response of Amplifiers**		
3.1	Miller Effect, Poles and Zeros	2	CO3

3.2	Calculation of poles and zeros of CS, CG and Source follower stage	3	
3.3	Stability Analysis of CS, CG and Source Follower	2	
3.4	Frequency Response of Differential Pair	2	
4	**Noise In Amplifiers**		CO4
4.1	Noise analysis in CS, CG and Source Follower	4	
4.2	Noise In differential Pair	2	
4.3	Noise Bandwidth	3	
5	**Phase Locked Loops**		CO5
5.1	Mathematical model of VCO, Phase Detector, Basic PLL Topology	2	
5.2	Type I and Type II(Charge Pump) PLL, Stability Analysis of PLL	2	
5.3	Non Ideal Effects in PLL	2	
5.4	Application of PLL- Frequency Multiplication, Frequency synthesizer and Skew reduction	1	
5.5	Block Diagram of Digital PLL	2	

Course Designers:

COURSE DESIGNED BY	VERIFIED BY
Mr.Jayesh T P Asst. Professor, ECE, JCET E Mail ID:jayesh4205.ece@jawaharlalcolleges.com	Mr. Sanish V S Asst. Professor, ECE, JCET E Mail ID: sanishvs@jawaharlalcolleges.com

24ECRTOT752	**REAL TIME OPERATING SYSTEMS**	**Category**	**L**	**T**	**P**	**Credit**
		PEC	**3**	**0**	**0**	**3**

Preamble

The course aims to expose students to identify the basics of general operating systems. ,Understand the structure and the scheduling operations performed by the operating system, Introduce Real Time Operating Systems, its basic structure, building blocks and various operations,Summarize the different scheduling algorithms used in RTOS and to Identify the different applications of real time operating systems

Prerequisite

24ECCOAT545 Computer Architecture

Course Outcomes

On the successful completion of the course students will be able to

CO Number	**Course Outcome Statement**	**Weightage in %**
CO1	Summarize the functions and structure of general-purpose operating systems.. (Understanding)	20
CO2	Use differe nt scheduling algorithms on processes and threads.(Applying)	20
CO3	Interpret a real time operating system along with its synchronization, communication and interrupt handling tools(Understanding)	20
CO4	Illustrate task constraints and analyze the different scheduling algorithms on tasks(Analysing)	20
CO5	Illustrate the applications of real time operating systems.(Applying)	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		3											1	3	-
CO2	2	3										2	-	3	-
CO3	2	3					2					2	1	1	1
CO4	2	3					2					2	2	2	-
CO5	2	3	2				3				2	2	-		-
Avg	**2**	**3**	**2**				**1.5**					**2**	**2**	**3**	1

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	**Continuous Assessment Tests**		**Assignment**		**Terminal Examination**
	1	**2**	**1**	**2**	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30

Applying	50	50	50	50	50
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) : 20 Marks
Assignment/Quiz/Course project : 14
Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1 (CO1):

1. List the functions of operating systems.
2. Describe the importance of Kernel in operating system functions.

3. Explain monolithic and layered architecture of operating systems.
4. Draw the process state diagram and explain.

Course Outcome 2(CO2)

1.Schedule the following processes with FCFS and Round Robin algorithm for a time Of 2mS. Assuming all the processes arrives at time zero. Also state the performance of the system.

Process	Burst time
P1	4
P2	5
P3	2
P4	3

2. Compare user level threads and Kernel level threads.
3. Discuss the different types of multiprocessor scheduling operations.
4. Explain the possible scheduling of user level threads with a 50mS process quantum and threads that run 5mS per CPU time.

Course Outcome 3 (CO3):

1. Explain the different types of semaphores used for process synchronization.
2. Explain how the priority inversion problem in RTOS is solved.
3. Draw the structure and explain the working of a message queue.
4. Differentiate between exceptions and interrupts.
5. What are the different classifications of exceptions?

Course Outcome 4 (CO4):

1. Explain the different timing constraints of a real time task.
2. Illustrate Jackson's algorithm with an example.
3. Explain EDF algorithm with precedence constraints.
4. Verify the schedulability under EDF and construct the schedule of the following task set

	Ci	Di	T1
r1	2	5	6
r2	2	4	8
r3	4	8	12

5. Draw the state transition diagram of a real time kernel.

Course Outcome 5 (CO5):

1. Illustrate the implementation of a real time system with an example,
2. With a block schematic explain the real time control system used in an adaptive cruise control.

Syllabus

Module 1
Operating system: Types, Objectives and functions , Kernel, Process - States, Process Control Block, Operations on processes
Module II
Process Scheduling: FCFS, SJF, Priority, Round-Robin, Multilevel Queue and Multilevel Feedback Queue Scheduling. Thread: Structure.User and kernel level threads, multi-threading models, multiprocessor scheduling**.**
Module III
Real Time Operating Systems: Structure and characteristics of Real Time Systems, Task: Task states, Task synchronization -Semaphores- types, Inter task communication mechanisms: message queues, pipes, event registers, signals, Exceptions and interrupt handling.
Module IV
Task constraints, Task scheduling: Aperiodic task scheduling: EDD. EDF,LDF, EDF with precedence constraints. Periodic task scheduling:Rate monotonic and Deadline monotonic, Real time Kernel- Structure, State transition diagram, Kernel primitives.
Module V
Features of FreeRTOS and Linux ,Commercial real time operating systems: PSOS, VRTX, RT Linux-Features and application only.Case study of (Kernel design, threads and task scheduling) RTOS:
MicroC/OS-II.RTOS control system used in real life applications - in adaptive cruise control..

Learning Resources

TEXT BOOKS

S.No	**AUTHORS**	**TITLE**	**EDITION**	**PUBLISHERS**	**YEAR**
1	Abraham Silberschatz-	‘Operating System Principles’:	7^{th} edition	Wiley India	2018
2	William Stallings	‘Operating systems Internals and design principles’,	7^{th} edition	Prentice Hall,	2016

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Tanenbaum,	-'Modern Operating Systems'	3rd Edition	,Pearson Edition,.	2018
2	Rajib Mall,	'Real-Time Systems: Theory and Practice,	5th Edition	Prentice Hal	2016
3	David E. Simon	'An Embedded Software Primer',.	5th Edition	Pearson Education.	2018

Online study materials:
https://www.youtube.com/watch?v=TEq3-p0GWGI
https://www.youtube.com/watch?v=F321087yYy4

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**Module 1**	9	CO1
1.1	Introduction to Operating system- Types, Objective and functions	2	
1.2	Kernel - Importance and functions 2	3	
1.3	Process - States, Process Control Block, Operations on processes	4	
2	**Module 2**	9	CO2
2.1	Process Scheduling: FCFS, SJF, Priority, Round-Robin	3	
2.2	Multilevel Queue and Multilevel Feedback Queue Scheduling	2	
2.3	Thread- Structure. User and kernel level threads, Multi-threading models	2	
2.4	Multiprocessor scheduling	2	
3.	**Module 3**	9	CO3
3.1	Real Time Operating Systems: Structure and characteristics of Real Time Systems	2	
3.2	Task: Task states	2	
3.3	Task synchronization -Semaphores- types	2	

3.4	Inter task communication mechanisms: message queues, pipes, event registers, signals	2	
3.5	Exceptions and interrupt handling	1	
4.	**Module 4**	9	CO4
4.1	Task constraints	2	
4.2	Task scheduling: Aperiodic task scheduling: EDD. EDF, LDF, EDF with precedence constraints	2	
4.3	Periodic task scheduling: Rate monotonic, Deadline monotonic	3	
4.4	Real time Kernel- Structure, State transition diagram, Kernel primitives	2	
5.	**Module 5**	9	CO5
5.1	Features of FreeRTOS and Linux 1	2	
5.2	Commercial real time operating systems: PSOS, VRTX, RT Linux-Features and application only.	3	
5.3	Case study of RTOS: MicroC/OS-II real time operating systems. -	2	
5.4	RTOS control system used in real life applications - in adaptive cruise control.	2	
	TOTAL	**45 Hours**	

Course Designers:

COURSE DESIGNED BY	VERIFIED BY
Ms Ajeena A Asst. Professor, ECE, JCET E Mail ID: ajeena4093.ece@jawaharlalcolleges.com	Dr.Sandeep C S Asso. Professor and HoD, ECE, JCET E Mail ID:hodece@jawaharlalcolleges.com

		Category	L	T	P	Credit
24ECMIET713	**MEDICAL INFORMATICS AND EXPERT SYSTEMS**	PEC	3	0	0	3

Preamble

This course aims to provide in-depth knowledge of medical informatics, expert systems, and their applications in healthcare, enabling students to design and develop intelligent systems for medical applications.

Prerequisite

Basic knowledge of Data Structures and Databases

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Understand data structures and relational database design concepts. (Understanding)	20
CO2	Apply indexing, normalization, and data security techniques to design databases. (Applying)	20
CO3	Develop expert systems and integrate them with medical information systems (Applying)	20
CO4	Understand multimedia concepts and design virtual reality applications in medicine. (Applying)	20
CO5	Analyze decision-making methods and AI techniques for applications in medicine (Analyzing)	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3		1				2		2		3	
CO2	1		2									2		3	
CO3	3	1										2	2	3	2
CO4	3	3	1	2								2	2	3	2
CO5	3	1	1	2	2	1	3	3	3	3	3	2	2	3	
Avg	2.6	1.6	1.4	1.4	0.4	0.4	0.6	0.6	0.6	1	0.6	2	1.2	3	0.8

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	**Continuous Assessment Tests**		**Assignment**		**Terminal Examination**
	1	**2**	**1**	**2**	
Remembering					
Understanding	20	20	10	10	20

Applying	50	50	50	50	50
Analyzing	30	30	40	40	30
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance	:	6 Marks
Continuous Assessment Test (2 numbers)	:	20
Marks Assignment/Quiz/Course project Marks	:	14

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Course Level Assessment Questions

Course Outcome 1 (CO1): Understand data structures and relational database design concepts

1. Explain the differences between singly and doubly linked lists with examples.
2. Describe the concept of data independence and its importance in relational databases.
3. Draw and explain an E-R diagram for a hospital management system.

Course Outcome 2 (CO2): Apply indexing, normalization, and data security techniques to design databases

1. Normalize a given database table to 3NF and explain the process.
2. Describe the purpose and working of indexing and hashing in relational databases.
3. Design a miniaturized data storage system for a patient record system using CD-ROM or magneto-optical discs.

Course Outcome 3 (CO3): Develop expert systems and integrate them with medical information systems

1. Explain the structure and types of expert systems with suitable examples.
2. Discuss the methods and challenges involved in knowledge acquisition for expert systems.
3. Develop a simple VB-based medical information system to store and retrieve patient records.

Course Outcome 4 (CO4): Understand multimedia concepts and design virtual reality applications in medicine.

1. Explain the basic components of multimedia and their role in designing medical information systems.
2. Discuss the applications of virtual reality in medical training and diagnosis.
3. Design an interactive multimedia package for teaching human anatomy using integrated design concepts.

Course Outcome 5 (CO5): Analyze decision-making methods and AI techniques for applications in medicine

1. Develop a Bayesian belief network to diagnose a disease based on symptoms and test results.
2. Analyze the role of Markov decision processes in hospital resource allocation.
3. Explain the application of neural networks and fuzzy logic in medical imaging for tumor detection.

Syllabus

Module 1: Introduction to Data Structures and Relational Databases

Elements: Arrays, records, sets, tables, singly and doubly linked data, stacks, queues, trees. Introduction to databases: Data models – relational, distributed, and other types. Data indexing and structuring techniques: Data independence, data definition language, and data manipulation language. E-R diagrams with examples. Relational model: Structure of relational databases, query language, views, and examples.

Module 2: Relational Database Design and Storage Systems

Relational database design: Normalization – 1NF, 2NF, and 3NF. Indexing and hashing. Security of databases. Design example using a popular RDBMS package. Miniaturized data storage and retrieval systems: CD-ROM, magneto-optical discs, optical jukeboxes, write-many read-many devices, and miniature magnetic tape devices. Interfacing and retrieval details.

Module 3: Expert Systems and Medical Databases

Introduction: Basic concepts, structure of expert systems, types of expert systems, knowledge engineering. Methods and challenges in knowledge acquisition. Search and real-time search, constraint satisfaction, and robot motion planning. Medical data acquisition and database systems. Visual programming concepts: Visual Basic environment, tools, controls, dynamic data exchange. VB-based medical information systems.

Module 4: Multimedia and Medical Informatics

Basic concepts of multimedia. Design of multimedia information systems. Components and applications of virtual reality in medicine. Medical informatics and its levels. Design and development of educational packages on medical sciences. Integrated design concepts, interactive multimedia, virtual and digital libraries. Internet and its applications.

Module 5: Decision-Making Methods and AI Applications in Medicine

Decision-making methods for biomedicine: Bayesian statistics, decision analysis, Bayesian belief networks. Markov models and Markov decision processes. Applications: Speech recognition and medical diagnosis. Hospital information systems: Design and functional characteristics. Principles and applications of AI: Pattern recognition, neural networks, and fuzzy logic in medicine.

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Stuart Russell, Peter Norvig	Artificial Intelligence: A Modern Approach	4th Edition	Pearson	2020
2	E.H. Shortliffe, J. J. Cimino	Biomedical Informatics: Computer Applications in Health Care and Biomedicine	4th Edition	Springer	2021

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	J.H. Davenport	Computer Algebra: Systems and Algorithms for Algebraic Computation	2nd Edition	Academic Press	2020
2	Mark J. Shelhamer,	Systems Medicine for Human Spaceflight	1st Edition	Springer	2024

	Erik Antonsen				
3	Arlen Meyers	Digital Health Entrepreneurship	1st Edition	Springer	2023

Online study materials:

https://onlinecourses.nptel.ac.in/noc20_bt09/preview

Course Contents and Lecture Schedule

No	Topic	No. of Lecture	Course Outcome
1	**Introduction to Data Structures and Relational Databases**		**CO1**
1.1	Elements: Arrays, records, sets, tables, singly and doubly linked data, stacks, queues, trees	2	
1.2	Introduction to databases: Data models – relational, distributed, and other types	2	
1.3	Data indexing and structuring techniques: Data independence, data definition language, and data manipulation language	2	
1.4	E-R diagrams with examples, relational model: Structure of relational databases, query language, views, and examples	3	
2	**Relational Database Design and Storage Systems**		**CO2**
2.1	Relational database design: Normalization – 1NF, 2NF, and 3NF	2	
2.2	Indexing and hashing	2	
2.3	Security of databases	2	
2.4	Miniaturized data storage systems: CD-ROM, magneto-optical discs, optical jukeboxes, write-many read-many devices, and miniature magnetic tape devices	2	
2.5	Interfacing and retrieval details	1	
3	**Expert Systems and Medical Databases**		
3.1	Introduction: Basic concepts, structure of expert systems, types of expert systems, knowledge engineering	2	

3.2	Methods and challenges in knowledge acquisition	1	**CO3**
3.3	Search and real-time search, constraint satisfaction, robot motion planning	2	
3.4	Visual programming concepts: Visual Basic environment, tools, controls, dynamic data exchange	2	
3.5	VB-based medical information systems	2	
4	**Multimedia and Medical Informatics**		**CO4**
4.1	Basic concepts of multimedia	1	
4.2	Design of multimedia information systems	2	
4.3	Components and applications of virtual reality in medicine	2	
4.4	Medical informatics and its levels	2	
4.5	Integrated design concepts, interactive multimedia, virtual and digital libraries	2	
5	**Decision-Making Methods and AI Applications in Medicine**		**CO5**
5.1	Decision-making methods for biomedicine: Bayesian statistics, decision analysis, Bayesian belief networks	2	
5.2	Markov models and Markov decision processes	2	
5.3	Applications: Speech recognition and medical diagnosis	2	
5.4	Hospital information systems: Design and functional characteristics	1	
5.5	Principles and applications of AI: Pattern recognition, neural networks, and fuzzy logic in medicine	2	

Course Designers:

COURSE DESIGNED BY	VERIFIED BY
Mr.Jayesh T P Asst. Professor, ECE, JCET E Mail ID:jayesh4205.ece@jawaharlalcolleges.com	Ms. Jisha K V Asst. Professor, ECE, JCET E Mail ID:jishakv@jawaharlalcolleges.com

24ECSADT723	SENSORS AND ACTUATOR DEVICES FOR ROBOTICS	Category	L	T	P	Credit
		PCC	3	1	0	4

Preamble

The course aims to give a reasonable understanding of the principles and operations of sensors and actuators for robotics. The course helps with the selection of sensors and actuators for the robot based on the application

Prerequisite

Introduction to Basic Electronics

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Understand the fundamental principles, classifications, and characteristics of sensors and actuators used in robotic systems.	20
CO2	Analyze the working principles and applications of various types of sensors, and select the most appropriate sensor for specific robotic tasks.	20
CO3	Apply knowledge of sensor and actuator systems to design and develop robotic systems.	20
CO4	Evaluate the performance of different actuators and motion transmission systems .	20
CO5	Integrate sensor and actuator technologies in robotic systems.	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	3	-	-	-	-	-	-	2	2	3	-
CO2	3	3	3	-	3	-	-	-	-	-	-	2	2	3	-
CO3	3	3	3	-	3	-	-	-	-	-	-	2	2	3	-
CO4	3	3	3	-	3	-	-	-	-	-	-	2	2	3	-
CO5	3	3	3	-	3	-	-	-	-	-	-	2	2	3	-
Avg	**3**	**3**	**3**	-	**3**	-	-	-	-	-	-	**2**	**2**	**3**	-

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30

Applying	50	50	50	50	50
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) : 20
Marks Assignment/Quiz/Course project : 14
Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1(CO1):

1. Explain the difference between active and passive sensors. Provide examples of each and describe their application in robotics.
2. Analyze the role of sensor characteristics such as sensitivity, resolution, and accuracy in selecting the appropriate sensor for a robotic application like object detection or manipulation.
3. Discuss the factors that influence sensor performance in a robot, and explain how environmental conditions could affect the choice of sensors for an outdoor robotic system.

Course Outcome 2(CO2):

1. Describe how infrared (IR) sensors and photodiodes function in robotic systems. What are their primary uses in robot sensing and interaction?
2. Compare the various types of tactile sensors (resistive, capacitive, piezoelectric) and explain how each is used for robotic touch and pressure sensing in tasks like object manipulation.
3. Explain the importance of collision sensors in robots. How do proximity and distance sensors help prevent collisions in robotic systems?

Course Outcome 3 (CO3):

1. Explain the principle of optical encoders and potentiometers in position measurement for robots. How are these sensors used in robot control systems for accurate positioning?
2. Discuss the role of gyroscopes and accelerometers in providing inertial feedback for a robot. How do these sensors help stabilize a mobile robot in dynamic environments?
3. How would you integrate 2D and 3D cameras for real-time object tracking and position measurement in a robotic system? Discuss the advantages and limitations of each.

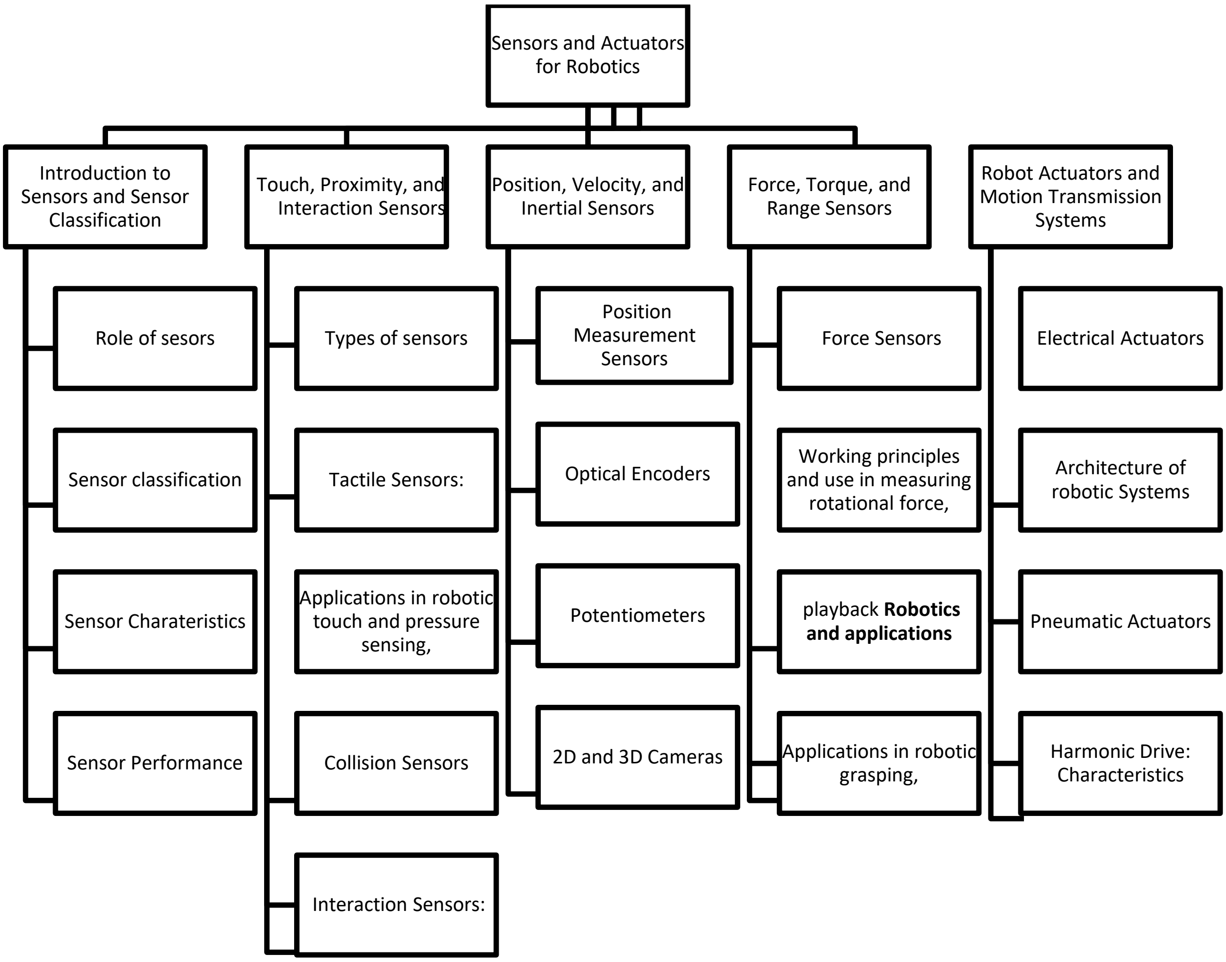
Course Outcome 4 (CO4):

1. Describe how strain gauges and piezoelectric sensors work as force sensors. Provide an example of a robotic application that uses these sensors for manipulation tasks.
2. Explain the principle of torque sensors and how they are used in robotic arms for rotational feedback. How does this contribute to motor control?
3. Compare the applications of infrared (IR), ultrasonic, and laser range finders in robotics. Which type of range sensor would you choose for a robot designed to navigate complex indoor environments and why?

Course Outcome 5(CO5):

1. Explain the difference between hydraulic, pneumatic, and electrical actuators. For a task requiring high precision and fast movement, which actuator would you recommend and why?
2. Describe how a DC motor works and explain its typical applications in robotic systems. How do control methods such as PWM (Pulse Width Modulation) help in controlling the motor’s speed and position?
3. Discuss the role of harmonic drives in robotics. How do they differ from traditional gear or belt transmissions, and in what situations are they particularly useful?

Concept Map



Syllabus

Module 1 Introduction to Sensors and Sensor Classification

Overview of Sensors and their Role in Robotics, Sensor Classification: Passive vs. Active Sensors, Analog vs. Digital Sensors, Contact vs. Non-contact Sensors, Sensor Characteristics: Sensitivity, Resolution, Accuracy, Range, Response Time, Linearity Factors influencing sensor performance and selection in robotic applications

Module 2 Touch, Proximity, and Interaction Sensors

Touch and Proximity Sensors: Infrared (IR) Sensors, Photodiodes and their use in robotic systems, Tactile Sensors: Types of tactile sensors: Resistive, Capacitive, Piezoelectric, Applications in robotic touch and pressure sensing, Collision Sensors: Function and importance in obstacle detection. Interaction Sensors: Proximity/Distance Sensors, Capacitive and Inductive sensors, Use in human-robot interaction

Module 3 Position, Velocity, and Inertial Sensors

Position Measurement Sensors: Optical Encoders: Working principle, applications, and types, Potentiometers: Principle, applications, and types, 2D and 3D Cameras: Vision systems for position and object tracking, Velocity Measurement Sensors: Tachometers and encoders for velocity sensing in robotics, Use in controlling robot movement and speed Inertial Sensors: Gyroscopes: Working principle and applications in measuring angular velocity, Accelerometers: Measuring acceleration and use in motion sensing, Applications of inertial sensors in mobile robots and stabilization systems

Module 4 Force, Torque, and Range Sensors

Force Sensors: Types of force sensors: Strain gauges, piezoelectric sensors, Applications in robotic grasping, manipulation, and feedback control Torque Sensors: Working principles and use in measuring rotational force, Applications in robotic arms and motor feedback, Range Sensors: IR Sensors: Basics of range measurement and applications, Ultrasonic Sensors: Working principle and use in distance measuring, Laser Range Finders: Applications in high-precision distance measurement

Module 5 Robot Actuators and Motion Transmission Systems

Robot Actuators: Hydraulic Actuators: Principles, advantages, and applications, Pneumatic Actuators: Principles, advantages, and applications, Electrical Actuators: Types and characteristics, applications in robotic arms and mobile robots, Introduction to Motors: DC Motors: Working principle, control methods, and applications, AC Motors: Types (induction, synchronous), applications in robotic, Stepper Motors: Characteristics and use in precise motion control, Servo Motors: Working principle, control systems, and use in robotic positioning, Motion Transmission Systems: Gear Transmission: Types of gears and their applications in robotic movement, Belt Transmission: Advantages, types, and applications, Harmonic Drive: Characteristics, advantages, and applications in robotics

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Nathan Ida	Sensors, Actuators, and Their Interfaces: A Multidisciplinary introduction,	2nd Edition	Pearson International Education,	2020
2	Mikell P Groover	Industrial Robotics: Technology Programming and Applications	2nd Edition	Tata McGraw Hill Education Private Limited	2012

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	John J Craig,	Introduction to Robotics, Mechanics and control	2nd Edition	Addison – Wesley	1999

Online study materials:

1. https://www.youtube.com/watch?v=ycortgPW178

2. https://www.youtube.com/watch?v=XnCHWxX4eRo
3. https://www.youtube.com/watch?v=tqbxliGiIYU
4. https://www.youtube.com/watch?v=9wYkWJeS3lM
5. https://www.youtube.com/watch?v=hjcvCkQCy4g
6. https://www.youtube.com/watch?v=a-R-FsiyhIU
7. https://www.youtube.com/watch?v=fvHDwlxqYFY

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**Module 1 Introduction to Sensors and Sensor Classification**	9	CO1
1.1	Overview of Sensors and their Role in Robotics, Sensor Classification: Passive vs. Active Sensors,	2	
1.2	Analog vs. Digital Sensors, Contact vs. Non-contact Sensors	2	
1.3	Sensor Characteristics: Sensitivity, Resolution, Accuracy, Range, Response Time, Linearity	2	
1.4	Factors influencing sensor performance and selection in robotic applications	3	
2	**Module 2 Touch, Proximity, and Interaction Sensors**	9	CO2
2.1	Touch and Proximity Sensors: Infrared (IR) Sensors, Photodiodes and their use in robotic systems,	2	
2.2	Tactile Sensors: Types of tactile sensors:	2	
2.3	Resistive, Capacitive, Piezoelectric, Applications in robotic touch and pressure sensing	3	
2.4	Collision Sensors: Function and importance in obstacle detection.	1	
2.5	Interaction Sensors: Proximity/Distance Sensors, Capacitive and Inductive sensors, Use in human-robot interaction	1	
3.	**Module 3 Position, Velocity, and Inertial Sensors**	9	CO3
3.1	Position Measurement Sensors: Optical Encoders: Working principle, applications, and types, Potentiometers: Principle, applications, and types	2	
3.2	2D and 3D Cameras: Vision systems for position and object tracking,	1	
3.3	Velocity Measurement Sensors: Tachometers and encoders for velocity sensing in robotics,	2	
3.4	Use in controlling robot movement and speed Inertial Sensors: Gyroscopes: Working principle and applications in measuring angular velocity,	1	

3.5	Accelerometers: Measuring acceleration and use in motion sensing,	1	
3.6	Applications of inertial sensors in mobile robots and stabilization systems	2	
4.	**Module 4 Force, Torque, and Range Sensors**	9	CO4
4.1	Force Sensors: Types of force sensors: Strain gauges, piezoelectric sensors, Applications in robotic grasping, manipulation, and feedback control	3	
4.2	Torque Sensors: Working principles and use in measuring rotational force, Applications in robotic arms and motor feedback,	2	
4.3	Range Sensors: IR Sensors: Basics of range measurement and applications, Ultrasonic Sensors: Working principle and use in distance measuring,	2	
4.4	Laser Range Finders: Applications in high-precision distance measurement	2	
5.	**Module 5 Robot Actuators and Motion Transmission Systems**	9	CO5
5.1	Robot Actuators: Hydraulic Actuators: Principles, advantages, and applications,	1	
5.2	Pneumatic Actuators: Principles, advantages, and applications, Electrical Actuators: Types and characteristics, applications in robotic arms and mobile robots,	2	
5.3	Introduction to Motors: DC Motors: Working principle, control methods, and applications	2	
5.4	AC Motors: Types (induction, synchronous), applications in robotic, Stepper Motors: Characteristics and use in precise motion control, Servo Motors: Working principle, control systems, and use in robotic positioning,	2	
5.5	Motion Transmission Systems: Gear Transmission: Types of gears and their applications in robotic movement, Belt Transmission: Advantages, types, and applications, Harmonic Drive: Characteristics, advantages, and applications in robotics	2	
	TOTAL	**45 Hours**	

Course Designers:

COURSE DESIGNED BY	VERIFIED BY
Mr.Sree Sankar. J Asst. Professor, ECE, JCET E Mail ID: sreesankar4228.ece@jawaharlalcolleges.com	Mr. Sanish V S Asst. Professor, ECE, JCET E Mail ID: sanishvs@jawaharlalcolleges.com

24ECIPAT733	INDUSTRIAL PROCESS AUTOMATION SYSTEMS	Category	L	T	P	Credit
		PEC	2	1	0	3

Preamble

To introduce fundamental concepts of industrial process automation, provide knowledge of various sensors, actuators, and controllers used in industries, familiarize students with industrial communication protocols and standards, develop skills for designing and implementing automation systems, equip students with the ability to analyze and troubleshoot automation processes.

Prerequisite :

Industrial Instrumentation

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Understand the role of industrial process automation in various industries.	20
CO2	Select and integrate appropriate sensors and actuators for specific applications	20
CO3	Design and program basic automation systems using PLCs and controllers.	20
CO4	Analyze and apply communication protocols for efficient process automation	20
CO5	Develop and troubleshoot automated systems considering safety and efficiency	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	2	-	3	-
CO2	3	3	-	-	2	-	-	-	-	-	-	2	-	3	-
CO3	3	3	-	-	2	-	-	-	-	-	-	2	-	3	-
CO4	3	3	-	-	2	-	-	-	-	-	-	2	2	3	-
CO5			-	-		-	-	-	-	-	-	-	-	3	-
Avg	**3**	**3**	**-**	-	**2**	-	-	-	-	-	-	**2**	**2**	**3**	-

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30
Applying	50	50	50	50	50

Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance	:	6 Marks
Continuous Assessment Test (2 numbers)	:	20
Marks Assignment/Quiz/Course project Marks	:	14

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1(CO1):

1. Define and understand the concept of Industrial Automation
2. Classify and differentiate Automation Strategies
3. Explain the Role of Electronics in Automation:

Course Outcome 2(CO2):

1. Identify and Explain Different Types of Sensors:
2. Understand the Role of Transducers
3. Apply Knowledge of Sensor Selection and Integration:

Course Outcome 3 (CO3):

1. Understand Different Types of Actuators:
2. Describe the Role and Working of Controllers:
3. Learn to Program PLCs:

Course Outcome 4(CO4):

1. Understand the Importance of Communication in Automation:
2. Identify and Describe Industrial Communication Protocols:
3. Understand SCADA Systems:

Course Outcome 5(CO5):

1. Understand the Process of Automation Design:
2. Explain the Role of Human-Machine Interface (HMI) in Automation:
3. Explore Industrial Robotics and Their Applications:

Syllabus

Module 1

Introduction to Industrial Automation

Overview of Automation Systems: Definition, history, and importance of industrial automation, Automation Strategies: Hard automation, soft automation, and flexible automation, Control Systems: Overview of open-loop and closed-loop systems, Role of Electronics in Automation: Sensors, actuators, and controllers, Safety in Automation: Standards and protocols.

Module 2

Sensors and Transducers in Automation

Types of Sensors: Proximity sensors, temperature sensors, pressure sensors, level sensors, and flow sensors. Transducers: Principles and types of transducers. Sensor Selection and Integration: Factors for sensor selection, calibration, and signal conditioning. Applications: Industrial use cases for sensors and transducers.

Module 3

Actuators and Controllers

Actuators: Electric actuators, pneumatic actuators, hydraulic actuators, and stepper motors.Controllers: PID controllers, PLCs (Programmable Logic Controllers), and microcontrollers.Programming PLCs: Ladder logic diagrams, functional block diagrams, and structured text.Case Studies: Examples of actuator-controller integration in industrial systems.

Module 4

Industrial Communication and Protocols

Industrial Communication Basics: Importance of communication in automation.Protocols: MODBUS, PROFIBUS, HART, CAN, and Ethernet/IP.SCADA Systems: Supervisory Control and Data Acquisition systems - architecture and components.IoT in Industrial Automation: Introduction to IIoT and Industry 4.0.Network Security: Cybersecurity challenges in automation systems.

Module 5

Process Automation Design and Implementation

Automation Design Process: Requirement analysis, system architecture, and design.HMI Systems: Human-Machine Interface and its importance in process automation. Industrial Robotics: Introduction to robotic systems and their applications. Testing and Troubleshooting: Tools and techniques for system testing and fault diagnosis.

Case Studies: Real-world applications of industrial automation in sectors like manufacturing, oil & gas, and pharmaceuticals

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Jon Stenerson	Industrial Automation and Process Control	1st	**Prentice Hall**.	2005
2	William C. Dunn	Industrial Instrumentation and Control" by	2nd	McGraw-Hill Education	2005
3	Carlos A. Smith	Process Control: Designing Processes and Control Systems for Dynamic Performance"	3rd	Wiley	2005

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Frank D. Petruzella.	Programmable Logic Controllers"	5th	McGraw-Hill Education	**2016**
2	B.W. Bequette.	"Process Control: Modeling, Design, and Simulation	1st	Prentice Hall	2003

3	Clarence W. de Silva	**Sensors and Actuators: Engineering System Instrumentation"**	1st	CRC Press	2007

Online study materials:

Course Contents and Lecture Schedule

Module No.	Topic.	No. of Hours	Course Outcome
1.	**Introduction to Industrial Automation**	9	CO1
1.1	**Overview of Automation Systems**: Definition, history, and importance of industrial automation.	2	
1.2	**Automation Strategies**: Hard automation, soft automation, and flexible automation.	2	
1.3	**Control Systems**: Overview of open-loop and closed-loop systems	2	
1.4	**Role of Electronics in Automation**: Sensors, actuators, and controllers.	2	
1.5	**Safety in Automation**: Standards and protocols	1	
2	**Sensors and Transducers in Automation**	9	CO2
2.1	**Transducers**: Principles and types of transducers	2	
2.2	**Types of Sensors**: Proximity sensors, temperature sensors, pressure sensors, level sensors, and flow sensors	2	
2.3	**Sensor Selection and Integration**: Factors for sensor selection, calibration, and signal conditioning.	2	
2.4	**Applications**: Industrial use cases for sensors and transducers.	3	
3.	**Actuators and Controllers**	9	CO3
3.1	**Actuators**: Electric actuators, pneumatic actuators, hydraulic actuators, and stepper motors.	2	
3.2	**Controllers**: PID controllers, PLCs (Programmable Logic Controllers), and microcontrollers.	2	
3.3	**Programming PLCs**: Ladder logic diagrams, functional block diagrams, and structured text.	2	
3.4	**Case Studies**: Examples of actuator-controller integration in industrial systems.	3	
4	**Industrial Communication and Protocols**	9	
4.1	**Industrial Communication Basics**: Importance of communication in automation.	2	

4.2	**Protocols**: MODBUS, PROFIBUS, HART, CAN, and Ethernet/IP.	2	
4.3	**SCADA Systems**: Supervisory Control and Data Acquisition systems - architecture and components.	2	
4.4	**IoT in Industrial Automation**: Introduction to IIoT and Industry 4.0.	2	
4.5	**Network Security**: Cybersecurity challenges in automation systems.	2	
5	**Process Automation Design and Implementation**	9	C05
5.1	**Automation Design Process**: Requirement analysis, system architecture, and design.	2	
5.2	**HMI Systems**: Human-Machine Interface and its importance in process automation.	2	
5.3	**Industrial Robotics**: Introduction to robotic systems and their applications	2	
5.4	**Testing and Troubleshooting**: Tools and techniques for system testing and fault diagnosis	2	
5.5	**Case Studies**: Real-world applications of industrial automation in sectors like manufacturing, oil & gas, and pharmaceuticals	1	
	TOTAL	**45 Hours**	

Course Designers:

COURSE DESIGNED BY	**VERIFIED BY**
Ms Aswathy J Asst. Professor, ECE, JCET E Mail ID: aswathy4088.ece@jawaharlalcolleges.com	Mr. Sanish V S Asst. Professor, ECE, JCET E Mail ID: sanishvs@jawaharlalcolleges.com

24ECLPVT743	LOW POWER VLSI DESIGN	Category	L	T	P	Credit
		PEC	3	0	0	3

Preamble

This course aims to impart the basic knowledge in designing of Low power VLSI Circuits

Prerequisite

24ECDSDT404 Digital System Design

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Identify various short channel effects and various sources of power dissipation in MOSFET (Understanding)	20
CO2	Apply various power reduction techniques to circuits (Applying)	20
CO3	Apply various clocked and non-clocked design styles for logic implementation (Applying)	20
CO4	Apply Adiabatic and reversible logic for circuit implementation (Applying)	20
CO5	Analyze and design low-power CMOS VLSI circuits (Analyzing)	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3		1				2		2		3	
CO2	1		2									2		3	
CO3	3	1										2	2	3	2
CO4	3	3	1	2								2	2	3	2
CO5	3	1	1	2	2	1	3	3	3	3	3	2	2	3	
Avg	2.6	1.6	1.4	1.4	0.4	0.4	0.6	0.6	0.6	1	0.6	2	1.2	3	0.8

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	**2**	**1**	**2**	
Remembering					
Understanding	20	20	10	10	20

Applying	50	50	50	50	50
Analyzing	30	30	40	40	30
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) : 20
Marks Assignment/Quiz/Course project : 14
Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Course Level Assessment Questions

Course Outcome 1 (CO1): Identify various short channel effects and various sources of power dissipation in MOSFET

1. Derive the expression of switching power in static CMOS circuit.
2. Explain impact ionization and Hot electron effect.

3. Explain the various factors causing leakage power in MOSET.

Course Outcome 2 (CO2): Apply various power reduction techniques to circuits**.**

1. Describe the use of transistor and Gate sizing for power deduction.
2. Describe supply voltage scaling method for power reduction.
3. Apply various power reduction schemes to memory cells..

Course Outcome 3 (CO3) : Apply various clocked and non clocked design styles for logic implementation

1. Implement XOR gate in domino logic.
2. Implement the function F= [AB+CD] in DCVS.
3. Implement basic gates in nmos and pseudo nmos logic.

Course Outcome 4 (CO4): Apply Adiabatic and reversible logic for circuit implementation.

1. Implement Y=AB using adiabatic logic
2. Explain one stage adiabatic buffer.

Implement logic functions using different Reversible logic structures.

Course Outcome 5 (CO5): Analyze and design low-power CMOS VLSI circuits (Analyzing)

1. Analyze the impact of supply voltage scaling on the power dissipation of a CMOS inverter.
2. Design a low-power CMOS NAND gate and compare its performance with a traditional CMOS NAND gate in terms of power dissipation.
3. Analyze the sources of static and dynamic power dissipation in a CMOS logic gate and propose techniques to minimize each type of dissipation.

Syllabus

Module 1: Physics of Power dissipation in MOSFET devices
Need for low power circuit design, MIS Structure, Short channel effects-surface scattering, punch through, velocity saturation, impact ionization Hot electron effects, Drain Induced Barrier Lowering, Deep submicron transistor design issues.

Module 2: Sources of power dissipation in CMOS-Dynamic Power Dissipation: Charging and Discharging capacitance power dissipation, Short Circuit Power: Short Circuit Current of Inverter, Short circuit current dependency with input and output load, Glitching Power, Static Power Dissipation, Leakage Power Dissipation, Gate level power analysis : Capacitive, internal and Static power dissipation of gate level circuit.

Module 3: Power Reduction Techniques :Supply voltage Scaling Approaches**:** Multi VDD and Dynamic VDD, leakage power reduction Techniques – Transistor stacking, VTCMOS,MTCMOS, DTCMOS, Power gating, Clock gating for Dynamic power dissipation, Transistor and Gate Sizing for Dynamic and Leakage Power Reduction.

Module 4: Circuit design style- clocked design style- Basic concept, Domino logic (domino NAND gate), Differential Current Switch Logic. Non clocked circuit design style-fully complementary logic. NMOS and pseudo –NMOS logic, differential cascade voltage switch logic (DCVS)

Module 5: Adiabatic switching – Adiabatic charging, adiabatic amplification, one stage and two stage adiabatic buffer, Adiabatic logic gates, pulsed power supplies, Reversible logic basic concepts.

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Neil H.E. Weste, David Harris	CMOS VLSI Design: A Circuits and Systems Perspective	5th Edition	Pearson	2020
2	M. J. Shur	Physics of Semiconductor Devices	3rd Edition	Wiley	2022

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Kang, Leblebici	CMOS Digital Integrated Circuits: Analysis and Design	4th Edition	McGraw-Hill	2020
2	Jan Rabaey, Anantha Chandrakasan, Borivoje Nikolic	Digital Integrated Circuits: A Design Perspective	3rd Edition	Prentice Hall	2021
3	Kiat Seng Yeo, Kaushik Roy	Low Voltage, Low Power VLSI Subsystems	2nd Edition	Springer	2020

Online study materials:

https://archive.nptel.ac.in/courses/106/105/106105034/

Course Contents and Lecture Schedule

No	Topic	No. of Lecture	Course Outcome
1	**Physics of Power dissipation in MOSFET devices**		**CO1**
1.1	Need for low power circuit design, MIS Structure.	3	
1.2	Short channel effects-surface scattering, punch through, velocity saturation, impact ionization, Hot electron effects, Drain Induced Barrier Lowering.	3	
1.3	Deep submicron transistor design issues.	3	
2	**Sources of power dissipation in CMOS**		
2.1	Dynamic Power Dissipation: Charging and Discharging capacitance power dissipation	3	

2.2	Short Circuit Power: Short Circuit Current of Inverter , Short circuit current dependency with input and output load .	2	**CO2**
2.3	Glitching Power, Static Power Dissipation, Leakage Power Dissipation,	2	
2.4	Gate level power analysis : Capacitive, internal and Static power dissipation of gate level circuit.	2	
3	**Power Reduction Techniques**		**CO3**
3.1	Supply voltage Scaling Approaches**:** Multi VDD and Dynamic VDD	2	
3.2	Leakage power reduction Techniques – Transistor stacking VTCMOS, MTCMOS, DTCMOS	2	
3.3	Power gating, Clock gating for Dynamic power dissipation,	2	
3.4	Transistor and Gate Sizing for Dynamic and Leakage Power Reduction	3	
4	**Circuit design style**		**CO4**
4.1	Clocked design style- Basic concept, Domino logic	2	
4.2	Differential Current Switch Logic	2	
4.3	**Non clocked circuit design style**-fully complementary logic. NMOS and pseudo –NMOS logic	2	
4.4	Differential Cascade Voltage Switch logic(DCVS)	3	
5	**Adiabatic switching**		**CO5**
5.1	Adiabatic charging, adiabatic amplification,.	3	
5.2	One stage and two stage adiabatic buffer	2	
5.3	Adiabatic logic gates, pulsed power supplies	2	
5.4	Reversible logic basic concepts..	2	

Course Designers:

COURSE DESIGNED BY	**VERIFIED BY**
Mr.Jayesh T P Asst. Professor, ECE, JCET E Mail ID:jayesh4205.ece@jawaharlalcolleges.com	Mr.Sanish V S Asst. Professor, ECE, JCET E Mail ID: sanishvs@jawaharlalcolleges.com

24ECDSAT753	DATA STRUCTURES AND ALGORITHMS	Category	L	T	P	Credit
		PEC	3	0	0	3

Preamble

This course will enable the students to learn about widely used signal processing techniques, emphasizing biomedical applications. This course aims at moulding the learner to understand the various data structures, their organization and operations. The course helps the learners to assess the applicability of different data structures and associated algorithms for solving real world problem which requires to compare and select appropriate data structures to solve the problem efficiently. This course introduces abstract concepts for data organization and manipulation using data structures such as stacks, queues, linked lists, binary trees, heaps and graphs for designing their own data structures to solve practical application problems.

Prerequisite

Basics Programming Knowledge

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Design an algorithm for a computational task and calculate the time/space complexities of that algorithm.	20
CO2	Identify the suitable data structure to represent a data item required to be processed to solve a given computational problem	20
CO3	Identify an appropriate Hash Function to enable efficient access of data in the given set.	20
CO4	Apply suitable sorting algorithms to be used in specific circumstances.	20
CO5	Design and implement Data Structures for solving real world problems efficiently.	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	3	-	-	-	-	-	2	-	-	-
CO2	3	3	3	3	-	3	-	-	-	-	-	2	-	-	-
CO3	3	3	3	3	-	3	-	-	-	-	-	2	-	-	-
CO4	3	3	3	3	-	3	-	-	-	-	-	2	-	-	-
CO5	3	3	3	3	-	3	-	-	-	-	-	2	-	-	-
Avg	**3**	**3**	**3**	**3**	**-**	**3**	-	-	-	-	-	**2**	**-**	**-**	-

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests	Assignment	Terminal Examination

	1	**2**	**1**	**2**	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30
Applying	50	50	50	50	50
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) : 20
Assignment/Quiz/Course project : 14

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1(CO1):

1. Calculate the time complexity of matrix multiplication.
2. Explain the System Life Cycle in detail.
3. Write algorithms for Linear Search and Binary Search and Compare their time
4. Complexities.

Course Outcome 2(CO2):

1. Write algorithms to insert and delete elements from a double ended queue.
2. Compare and contrast Circular Queue with a Normal Queue.
3. Discuss an algorithm to convert an infix expression to a prefix expression.

Course Outcome 3 (CO3):

1.Write an algorithm to multiply two polynomials represented using linked list.

2. Explain How doubly linked list can be used to find palindromes?

3. Discuss the advantages and disadvantages of First-fit, Best-fit and Worst-fit allocation Schemes.

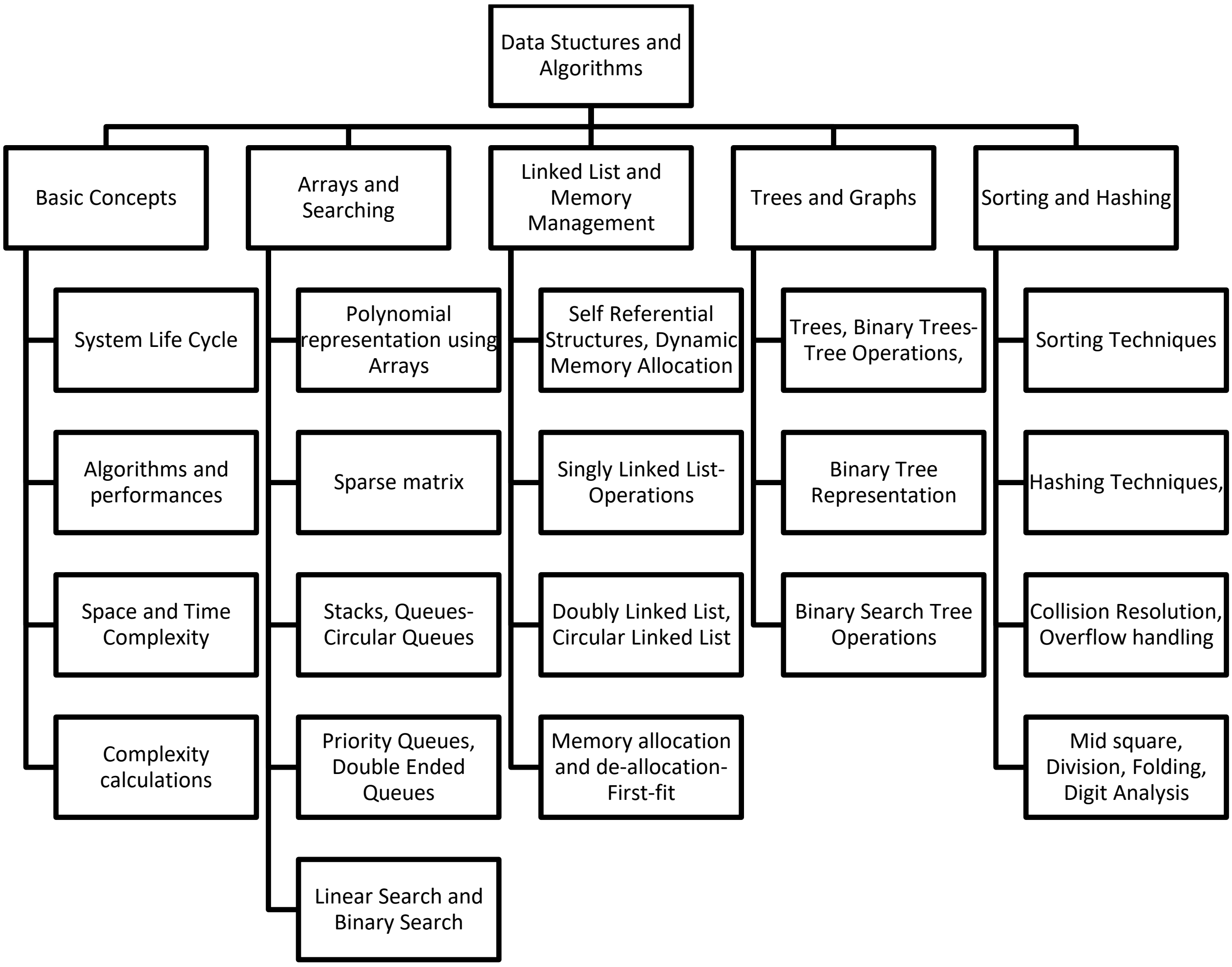
Course Outcome 4 (CO4):

1. List the properties of Binary Search Tree. Write an algorithm to search an element from a Binary Search Tree
2. Write an iterative algorithm for in-order traversal of a Binary Tree.
3. Give algorithms for DFS and BFS of a graph and explain with examples.

Course Outcome 5(CO5):

1. Write algorithms for Merge sort and Quick Sort.
2. Illustrate the working of Quick sort on the following input 38, 8, 0, 28, 45, -12, 89, 66, 42.
3. Discuss the different hash functions used for hashing.

Concept Map



Syllabus

Module 1

Basic Concepts of Data Structures

System Life Cycle, Algorithms, Performance Analysis, Space Complexity, Time Complexity, Asymptotic Notation, Complexity Calculation of Simple Algorithms

Module 2

Arrays and Searching

Polynomial representation using Arrays, Sparse matrix, Stacks, Queues-Circular Queues, Priority Queues, Double Ended Queues, Evaluation of Expressions Linear Search and Binary Search

Module 3

Linked List and Memory Management

Self Referential Structures, Dynamic Memory Allocation, Singly Linked List-Operations on Linked List. Doubly Linked List, Circular Linked List, Stacks and Queues using Linked List, Polynomial representation using Linked List Memory allocation and de-allocation-First-fit, Best-fit and Worst-fit allocation schemes

Module 4

Trees and Graphs

Trees, Binary Trees-Tree Operations, Binary Tree Representation, Tree Traversals, Binary Search Trees- Binary Search Tree Operations Graphs, Representation of Graphs, Depth First Search and Breadth First Search on Graphs, Applications of Graphs

Module 5

Sorting and Hashing

Averaged Sorting Techniques – Selection Sort, Insertion Sort, Quick Sort, Merge Sort and Heap Sort
Hashing- Hashing Techniques, Collision Resolution, Overflow handling, Hashing functions –
Mid square, Division, Folding, Digit Analysis

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed	Fundamentals of Data Structures in C	1st edition	Universities Press	2008
2	Samanta D	Classic Data Structures	1st edition	Prentice Hall of India	2010

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Tremblay J. P. and P. G. Sorenson	Introduction to Data Structures with Applications,	2nd edition	Tata -McGraw-Hill	2006
2	Aho A. V., J. E. Hopcroft and J. D. Ullman	Data Structures and Algorithms	1st edition	Pearson Publication	2002

Online study materials:

1. https://www.youtube.com/watch?v=5Y8Lfsreeck
2. https://www.youtube.com/watch?v=zWg7U0OEAoE
3. https://digimat.in/nptel/courses/video/106102064/L22.html
4. http://www.digimat.in/nptel/courses/video/106106145/L01.html
5. https://digimat.in/nptel/courses/video/106102064/L22.html

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**Module 1**	9	CO1
1.1	System Life Cycle,	1	
1.2	Algorithms , Performance Analysis	2	
1.3	Space Complexity, Time Complexity	3	
1.4	Asymptotic Notation (Big O Notation)	2	
1.5	Complexity Calculation of Simple Algorithms	1	
2	**Module 2**	9	CO2
2.1	Polynomial representation using Arrays	2	
2.2	Sparse matrix	1	
2.3	Stacks, Queues, Circular Queues	1	
2.4	Priority Queues,	1	
2.5	Double Ended Queues,	2	
2.6	Conversion and Evaluation of Expressions	1	
2.7	Linear Search and Binary Search	1	
3.	**Module 3**	9	CO3
3.1	Self Referential Structures, Dynamic Memory Allocation,	2	
3.2	Singly Linked List-Operations on Linked List. Doubly Linked List, Circular Linked List	2	
3.3	Stacks and Queues using Linked List,	2	
3.4	Polynomial representation using Linked List	2	
3.5	Memory allocation and de-allocation-First-fit, Best-fit and Worst-fit allocation schemes	1	
4.	**Module 4**	9	

4.1	Trees, Binary Trees-Tree Operations	2	CO4
4.2	Binary Tree Representation, Tree Traversals, Binary Search Trees	2	
4.3	Binary Search Tree Operations	2	
4.4	Graphs, Representation of Graphs	1	
4.5	Depth First Search and Breadth First Search on Graphs	1	
4.6	Applications of Graphs	1	
5.	**Module 5**	9	CO5
5.1	Sorting Techniques – Selection Sort, Insertion Sort	3	
5.2	Quick Sort, Merge Sort and Heap Sort	3	
5.3	Hashing- Hashing Techniques	2	
5.4	Collision Resolution, Overflow handling	1	
5.5	Hashing functions – Mid square, Division, Folding, Digit Analysis	1	
	TOTAL	**45 Hours**	

Course Designers:

COURSE DESIGNED BY	VERIFIED BY
Mr.Sree Sankar. J Asst. Professor, ECE, JCET E Mail ID: sreesankar4228.ece@jawaharlalcolleges.com	Mr. Sanish V S Asst. Professor, ECE, JCET E Mail ID: sanishvs@jawaharlalcolleges.com

24ECCOVT805	COMPREHENSIVE VIVA	Category	L	T	P	R	Credit
		PCC	0	0	0	2	2

Preamble The objective of this Course viva is to ensure the basic knowledge of each student in the most fundamental core courses in the curriculum. The viva voce shall be conducted based on the core subjects studied from third to eighth semester. This course helps the learner to become competent in placement tests and other competitive examinations.

Guidelines

1. The course should be mapped with a faculty and classes shall be arranged for practicing questions based on the core courses listed in the curriculum.
2. The viva voce will be conducted by the same three member committee assigned for final project phase II evaluation. It comprises of Project coordinator, expert from Industry/research Institute and a senior faculty from a sister department.
3. The pass minimum for this course is 25.
4. The mark will be treated as internal and should be uploaded along with internal marks of other courses.
5. Comprehensive Viva should be conducted along with final project evaluation by the three member committee.

Mark Distribution

Total marks: 50, only CIE, minimum required to pass : 25 Marks

Course Designers:

COURSE DESIGNED BY	VERIFIED BY
Ms Sayana M Asst. Professor, ECE, JCET E Mail ID: sayanam@jawaharlalcolleges.com	Mr Sanish V S Asst. Professor, ECE, JCET E Mail ID: sanishvs@jawaharlalcolleges.com

24ECVACP807	RTL Coding and FPGA Design	Category	L	T	P	Credit
		PCC	0	0	3	2

Preamble

This course aims to impart the knowledge of RTL coding methodologies and FPGA design.

Prerequisite

24ECVDET502 – VLSI Design

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Understand the fundamentals of FPGA architecture and digital design principles.	20
CO2	Design RTL code using Verilog/VHDL for digital systems design.	20
CO3	Design and simulate combinational and sequential logic circuits.	20
CO4	Understsnd FPGA development tools to synthesize, implement, and debug FPGA designs.	20
CO5	Understand and apply the synthesis and implementation process in FPGA design.	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2					1					2	2	2	
CO2	3	2	2			2							1	1	1
CO3	3	2			1								2	2	2
CO4	3	2			2								2	2	1
CO5	3	2											1	1	1
Avg	3.00	2.00	2.00	0.00	1.50	2.00	1.00	0.00	0.00	0.00	0.00	2.00	1.60	1.60	1.25

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	
Set	Hands-on Sessions
Guided Response	Exercises
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	100	-	-

Continuous Internal Evaluation Pattern:

Attendance: 15 marks

Practical: 50 marks

Assessment Test:35 marks

Syllabus

Module 1: Introduction to FPGA and Digital Design.

Introduction to FPGA: Difference between FPGA and ASIC. FPGA Architecture: Logic blocks, interconnects, I/O blocks. Design Flow: From specification to bitstream generation. Tools Overview: Xilinx Vivado, Intel Quartus, other FPGA design software.

Module 2: Introduction to RTL Design

RTL Concept: RTL design and its importance in FPGA. Introduction to Hardware Description Languages (HDLs): VHDL and Verilog Syntax and Semantics. Data types, operators, and basic constructs. Design Units: Entity and Architecture (VHDL), Module (Verilog). Simulation Basics: Writing testbenches for simulation

Module 3: Verilog/VHDL Constructs for FPGA Design

Process Statements in VHDL / Always Blocks in Verilog. Concurrent and Sequential Statements.FSM Design in Detail: Design of a simple vending machine or elevator controller using FSM. Delay and Timing Constraints.

Module 4: Simulation, Verification, and Debugging

Testbenches in Verilog/VHDL: Writing efficient and reusable testbenches. Simulation Tools: ModelSim, Vivado Simulator, or Quartus Simulator. Debugging Techniques: Signal probing, waveform analysis, logic analyzers. FPGA Debugging: Using FPGA development boards for on-chip debugging (e.g., ILA cores in Vivado).

Module 5: Synthesis and Implementation

Synthesis Process: Converting RTL code to gate-level netlist. Implementation: Floorplanning, placement, routing. FPGA Constraints: Timing, I/O, and placement constraints. Bitstream Generation: Creating the bitstream file for FPGA.

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Pong P. Chu	FPGA Prototyping by VHDL Examples: Xilinx MicroBlaze MCS SoC	2nd	Willey	2017
2	Blaine Readler	Verilog by Example: A Concise Introduction for FPGA Design	3rd	Full ARC Press	2011

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	David Harris Sarah Harris	Digital Design and Computer Architecture	2nd	Morgan Kaufmann	2010
2	Vaibbhav Taraate,	Digital Logic Design Using Verilog: Coding and RTL Synthesis	1st	Springer, India, Private Ltd	2016

Online study materials:
https://www.takshila-vlsi.com/product/rtl-coding-and-fpga-design-online/

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**MODULE 1**	12	CO1
1.1	Introduction to FPGA	3	
1.2	Difference between FPGA and ASIC. FPGA Architecture. Logic blocks, interconnects, I/O blocks,	3	
1.3	Design Flow: From specification to bitstream generation.	3	
1.4	Tools Overview: Xilinx Vivado, Intel Quartus, other FPGA design software.	3	
2	**MODULE 2**	12	CO2
2.1	RTL Concept: RTL design and its importance in FPGA Introduction to Hardware Description Languages (HDLs	3	
2.2	VHDL and Verilog Syntax and Semantics Data types, operators, and basic constructs	3	
2.3	Design Units: Entity and Architecture (VHDL), Module (Verilog).	3	
2.4	Simulation Basics: Writing testbenches for simulation	3	
3.	**MODULE 3**	12	CO3
3.1	Verilog/VHDL Constructs for FPGA Design Process Statements in VHDL / Always Blocks in Verilog	3	
3.2	Concurrent and Sequential Statements	3	
3.3	FSM Design in Detail. Design of a simple vending machine an elevator controller using FSM.	3	
3.4	Delay and Timing Constraints	3	
4.	**MODULE 4**	12	CO4

4.1	Testbenches in Verilog/VHDL Writing efficient and reusable testbenches.	3	
4.2	Simulation Tools: ModelSim, Vivado Simulator, or Quartus Simulator.	3	
4.3	Debugging Techniques: Signal probing, waveform analysis, logic analyzers.	3	
4.4	FPGA Debugging: Using FPGA development boards for on-chip debugging (e.g., ILA cores in Vivado).	3	
5.	**MODULE 5**	12	CO5
5.1	Synthesis Process: Converting RTL code to gate-level netlist.	3	
5.2	Implementation: Floor planning, placement, routing	3	
5.3	FPGA Constraints: Timing, I/O, and placement constraints	3	
5.4	Bitstream Generation: Creating the bitstream file for FPGA.	3	
	TOTAL	**60 Hours**	

Course Designers:

COURSE DESIGNED BY	**VERIFIED BY**
Ms. Remya K P Asst. Professor, ECE, JCET E Mail ID: sanishvs@jawaharlalcolleges.com	Mr Sanish V S Asst. Professor, ECE, JCET E Mail ID: sanishvs@jawaharlalcolleges.com

24ECBITT811	BIOTELEMETRY	Category	L	T	P	Credit
		PEC	3	0	0	3

Preamble

To gain basic knowledge of different telemetry techniques.

To gain knowledge about the different signal transmission techniques

Prerequisite

Medical Instrumentation

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Understand the concept of fundamental Telemetry system	20
CO2	Explain various Electrical Telemetry Systems	20
CO3	Illustrate Radio Telemetry system – Transmitting and receiving techniques	20
CO4	Describe Optical fibers for signal transmission	20
CO5	Summarize the use of computers in distance mode of healthcare delivery, Web technology, Satellite communication systems	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3											2			
CO2	3	3			3							2			
CO3	3	3	3									2			
CO4	3	3	3		3							2			
CO5	3	3	3		3							2			
Avg	**3**	**3**	**3**		**3**							**2**			

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30
Applying	50	50	50	50	50
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) : 20Marks
Assignment/Quiz/Course project :14 Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Course Level Assessment Questions

Course Outcome 1 (CO1): Understand the concept of fundamental Telemetry system

1. Which are the elements of bio-telemetry system?
2. What are the types of telemetry systems?

Course Outcome 2 (CO2): Explain various Electrical Telemetry Systems

1.Current Telemetry system -Motion Balance System, Force Balance System

2.

Course Outcome 3 (CO3): Illustrate Radio Telemetry system – Transmitting and receiving techniques

1. Explain different types of Radio Frequency Telemetry.
2. Write about different types of Transmission and reception methods.
3. Different types of modulation methods.

Course Outcome 4 (CO4): Describe Optical fibers for signal transmission

1.What are the advantages and applications of Optical fiber communication system.

2. Explain the block diagram of optical fiber communication system.

Course Outcome 5 (CO5): Summarize the use of computers in distance mode of healthcare delivery, Web technology, Satellite communication systems

1. Define Satellite Telemetry, Different types of links in satellite communication.
2. Draw the diagram of a basic satellite communication system.

Syllabus

Module 1:

Fundamental concepts – Significance, Principle, functional blocks of Telemetry and Telecontrol system-Methods of telemetry – Electrical, Pneumatic, Hydraulic and Optical Telemetry – State of the art-Telemetry standards.

Module 2:

Electrical Telemetry-Current Systems – Voltage Systems – Synchro Systems – Frequency systems – Position and Pulse systems – Example of a landline telemetry system.

Module 3:

Block diagram of a Radio Telemetry system – Transmitting and receiving techniques – AM, FM, PM, Multiplexing and demultiplexing – Transmitting and receiving techniques – Digital coding methods – Advantages of PCM, PWM, PM, FSK – Delta modulation – coding and decoding equipment – Example of a radio telemetry system

Module 4:

Optical fibers for signal transmission – Sources for fiber optic transmission – Optical detectors – trends in fiber – optic device development – Example of an optical telemetry System

Module 5:

Use of computers in distance mode of healthcare delivery, Web technology, Satellite communication systems; hypertext, voice & image transfer protocols, Medical image scanning, Data compression and Transfer, Capturing of medical signals, Analog to digital conversion, Video conferencing, Remote sensing, Rural primary setups, Referral and Super specialty centers, Societal medico legal aspects, Networking (local, national & global).

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Khandpur R.S	Hand Book of Biomedical instrumentation	1st Edition	Tata McGraw Hill	2005
2	D.Patranabis	Hand book of Telemetry and Remote control	1st Edition	Tata McGraw Hill	2013
3	Patranabis D.	Telemetry Principles,	1st Edition	Tata McGraw Hill	2003

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Charles J. Amlaner, David W.Macdonald	A Handbook on Biotelemetry and Radio Tracking	1 st Edition	Pergamon press oxford	2013
2	S Karger, Basel	Biotelemetry	1st Edition	Munchen-Paris London	1974

Online study materials:

Course Contents and Lecture Schedule

No.	Topic	No. of Lectures	Course Outcome
1	**Introduction To Telemetry**	9	CO1
1.1	Fundamental concepts – Significance, Principle, functional blocks of Telemetry system	3	
1.2	Tele control system	1	
1.3	Methods of telemetry- Electrical, Pneumatic telemetry.	2	
1.4	Hydraulic and Optical Telemetry	1	
1.5	State of the art-Telemetry standards.	2	
2	**Electrical Telemetry**	9	CO2
2.1	Current Systems	2	
2.2	Voltage Systems	1	
2.3	Synchro Systems –Frequency systems	2	
2.4	Position and Pulse systems	2	
2.5	Example of a landline telemetry system	2	
3	**Radio Telemetry system**	9	
3.1	Block diagram of a Radio Telemetry system	1	

3.2	Transmitting and receiving techniques – AM, FM, PM	2	CO3
3.3	Multiplexing and demultiplexing	2	
3.4	Transmitting and receiving techniques Digital coding methods	2	
3.5	Advantages of PCM, PWM, PM, FSK – Delta modulation	1	
3.6	Coding and decoding equipment – Example of a radio telemetry system	1	
4	**Optical fibers**	9	
4.1	Optical fibers for signal transmission	2	CO4
4.2	Sources for fiber optic transmission	2	
4.3	Optical detectors – trends in fiber	2	
4.4	Optic device development	1	
4.5	Example of an optical telemetry System	2	
5		9	
5.1	Use of computers in distance mode of healthcare delivery, Web technology	2	CO5
5.2	Satellite communication systems; hypertext, voice & image transfer protocols, Medical image scanning	2	
5.3	Data compression and Transfer, Capturing of medical signals,	1	
5.4	Analog to digital conversion, Video conferencing,	2	
5.5	Remote sensing, Rural primary setups, Referral and Super specialty centers	1	
5.6	Societal medico legal aspects, Networking (local, national & global)	1	
	TOTAL	**45**	

Course Designers:

COURSE DESIGNED BY	**VERIFIED BY**
Mr .Jisha K V Asst. Professor, ECE, JCET E Mail ID:jishakv.ece@gmail.com	Dr. Sandeep C S Asso. Professor and HoD, ECE, JCET E Mail ID:hodece@jawaharlalcolleges.com

24ECMORT821	MOBILE ROBOTICS	Category	L	T	P	Credit
		PEC	3	0	0	3

Preamble

The objective of this course is to introduce to the students the emerging field of robotics by imparting the fundamental knowledge on the design and control of robots, their multi-disciplinary engineering aspects and applications.

Prerequisite

Nil

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Attain a thorough understanding of different types of Robots and their applications	20
CO2	Select appropriate sensors and actuators based on the robotic applications	20
CO3	Perform kinematic and dynamic analyses for robots	20
CO4	Carry out the design and control of a simple robot.	20
CO5	Integrate mechanical and electrical hardware for making a robotic device	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	2	-	-	-	-	-	-	-	-	-	-	-
Avg	**3**	**3**	**-**	**2**	**-**	-	-	-	-	-	-	**-**	**-**	**-**	-

1-Low; 2-Medium; 3- Strong

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	10	10			20
Understanding	30	30			60
Applying	10	10			20

Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) : 20 Marks
Assignment/Quiz/Course project : 14 Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1(CO1): Appreciate the classification of robots, fundamental systems and their applications in various domains

1. Write down the brief history and growth of robotics.
2. Describe the different basic components of a robotic system and their functions.
3. Explain the principle of degree of freedom or connectivity in terms of robotic joints.

Course Outcome 2(CO2): Compare and contrast the working principles and applications of various sensors and actuators used in robotic systems.

1. With neat sketches elucidate the working of any one type of tactile sensor used for contact and proximity assessment.
2. Describe the imaging, sensing and digitization processes in a basic robotic vision system.
3. List and justify any two applications where pneumatic actuators are preferred over hydraulic ones.

Course Outcome 3 (CO3): Apply the principles and techniques of kinematic and dynamic modelling in robotics.

1. Describe the techniques and methods for the representation of position and orientation of objects, their translation and rotation, as well as the coordinate transformation in the workspace of a robot.
2. Explain the Denavit-Hartenberg (D-H) convention for selecting frames of reference in robotics applications.
3. Apply the D-H convention to represent the different serial kinematic arrangements fitted with various end effectors.

Course Outcome 4 (CO4): Perform basic programming for the control of robotic devices.

1. Explain the process of control of position and force of manipulators in robots.
2. Illustrate the working of a robotic device using the closed-loop control system with a suitable example.
3. Describe the commonly used methods for robot programming.

Course Outcome 5(CO5): Design robotic devices by integrating mechanical and electrical hardware.

1. List out the various industrial Applications of Robots with examples.
2. Illustrate the significance of Artificial Intelligence (AI) in Robotics
3. Evaluate the role of robotics and automation in Industry 4.0.

Syllabus

Module 1

Introduction to Robotics: Definition and Origin of Robotics. Robot Anatomy. Robot Specifications. Robot Characteristics – Accuracy, Precision, and Repeatability. Classification of Robots. Advantages and Disadvantages of Robots. Robot Structure - Types of Joints and End Effectors, Mechanisms and Manipulators. Common Kinematic Arrangements. Degree of Freedom. Robot Coordinates. Reference Frames. Robot Workspace. Areas of Application for Robots.

Module 2

Introduction to Sensors and Actuation Systems for Robots: Actuators: Types of Robotic Drive Systems and Actuators: Hydraulic, Pneumatic and Electric drives. Transmission: Gears, Timing Belts and Bearings. Parameters for selection of actuators. Specification. Areas of

Application for: Stepper Motor, Servo Motor and Brushless DC Motor. Microprocessor Control of Motors. Speed Control using PWM and Direction Control using H- Bridge. Sensors: Types and Applications of Sensors in Robotics: Position, Displacement and Velocity Sensors. Tactile Sensors for Contact and Proximity Assessment. Strain Gauge based Force and Torque Sensors. Tachometers, etc. Robotic Vision Systems- Robotic Operating System

Module 3

Introduction to Robot Kinematics and Dynamics: Introduction to Kinematics: Position and Orientation of Objects. Rotation. Euler Angles. Rigid Motion Representation using Homogenous Transformation Matrix. Kinematic Modelling: Translation and Rotation Representation, Coordinate Transformation, Forward and Inverse Kinematics. *Forward Kinematics*-Link Coordinates, *Inverse Kinematics* – General Properties of Solutions, Kinematic Decoupling, *Velocity Kinematics* – Derivation of the Jacobian, Application of Velocity Kinematics for Serial Manipulators,

Module 4

Introduction to Robot Control: Basics of Control: Open Loop- Closed Loop, Transfer Functions, Control Laws: P, PD, PID, Linear and Non-linear Controls; Control Hardware and Interfacing; Embedded Systems: Microcontroller Architecture and Integration with Sensors, Actuators, Components. Introduction to Robot Programming – Programming Methods, Robot Language Classification, Robot Language Structure, Elements and its Functions. Motion, End-Effecter and Sensor Commands in VAL Programming Language. Simple Programs.

Module 5

Recent Developments in Robotics. Mobile Robots: Mobile Robot Kinematics, Navigation. Humanoid Robotics: Biped Locomotion, Imitation Learning. Collaborative Robots: Collaborative Robot, Collaborative Operation, Applications. Artificial Intelligence in Robotics: Applications in Unmanned Systems, Defense, Medical, Industries, etc. Industrial Applications of Robots in Material Handling and Assembly. Robotics and Automation for Industry 4.0., Robot Safety. Social Robotics.

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	S.K. Saha	Introduction to Robotics	2nd Edition	Tata McGraw Hill	2014
2	Saeed B. Niku	Introduction to Robotics:Analysis, Systems,Applications	2nd Edition	John Wiley & Sons	2011
3	Spong and Vidyasagar	Robot Dynamics and Control	1st Edition	John Wiley & Sons	1990

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR

1	John. J. Craig	Introduction to Robotics: Mechanics and Control	1st Edition	PHI	2005
2	Ashitava Ghosal	Robotics, Fundamental concepts and analysis	1st Edition	OXFORD University Press	2006

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**Module 1: Introduction to Robotics**	9	CO1
1.1	Definition and Origin of Robotics: What is the basic definition of a robot? How the field of robotics originated? What are the basic components of a robot? How to specify a robot?	2	
1.2	Characteristics, Classification, Advantages and Disadvantages of Robots: What are the different characteristic parameters of robots? How robots are classified? What are the advantages of using robots in various applications? Are there any disadvantages to employing robots?	2	
1.3	Robot Structure, and Common Kinematic Arrangements: What are the different structural arrangements for robots? What are the different types of joints, end effectors, mechanisms and manipulators commonly used in robotics? How to express the structure of robots in terms of common kinematic arrangements?	2	
1.4	Concepts of Degree of Freedom (DOF), Coordinates, Reference Frames, Workspace in Robotics: How to define the degree of freedom of any robot? What are the commonly used coordinate systems for robots? How the concept of reference frames helps in a robot design? How to determine the workspace of a robot?	1	
1.5	Areas of Application for Robots: What are different fields/areas where robots find applications? How the size, structure, sensors, DOF and end effector change with applications?	1	
1.6	Areas of Application for Robots: Suggest some new or futuristic fields/areas where robots may find applications?	1	
2	**Module 2: Introduction to Robotic Sensors and Actuators**	9	CO2
2.1	Robotic Drive Systems and Actuators: What are the different types of drive systems used in robotics? Describe the different	2	

	transmission systems used in robots and their specific applications.		
2.2	Types and Applications of Actuators in Robotics: What are the different deciding parameters for selecting appropriate actuators for robots? How are actuators specified? What are the specific applications for stepper motors, servo motors and brushless DC motors in robotics?	2	
2.3	Types and Applications of Sensors in Robotics: What are the different position, displacement and velocity sensors used in robots? How do the tactical sensors used in robotic devices sense contact and proximity of objects? What are the commonly used force and torque sensors in robots? How do tachometers help in robotic operation and application?	1	
2.4	Control of Motors in Robotics: How to perform microprocessor-based control in electric motors? How speed control is carried out using pulse-width modulation? Describe direction control using H-Bridge.	2	
2.5	Robotic Vision Systems: What is the role of cameras in robots? Describe how imaging, sensing and digitization processes are performed in robotic applications. What are the vision applications of robots?	1	
2.6	Control of Robotics: Conduct exercises to develop small control programs for joints/links/end effectors of robots.	1	
3.	**Module 3: Introduction to Robot Kinematics and Dynamics**	9	CO3
3.1	Introduction to Kinematics: How to specify the position and orientation of links and joints in robotics? What are the common methods for describing robot orientations? Describe how rigid motion representation can be made using a homogenous transformation matrix.	2	
3.2	Kinematic Modelling: How to determine the position and orientation of an end effector of a robot under translation and/or rotation? What is the coordinate transformation method? How transformations can be performed between the coordinate frames attached to different robotic links and joints. What are the purposes for forward and inverse kinematics in robotics?	1	
3.3	Forward Kinematics: How to compute the position of the end effector from joint parameters? What is Denavit-Hartenberg representation? How the D-H convention can be applied to different serial kinematic arrangements.	1	
3.4	Inverse Kinematics: How to predict the joint angles from the known coordinates of the end effector of a robot? How	2	

	kinematic decoupling is performed in robotic manipulators?		
3.5	Velocity Kinematics: How can the linear and angular velocities of the end effector get related to the joint velocities to form the velocity relationship? How can velocity kinematics be applied to serial robots? What are the different singularities that affect the degree of freedom of robots?	2	
3.6	Introduction to Dynamic Modelling: What are the functions of forward and inverse dynamics in robotics? How can we develop the equations of motion using the Euler-Lagrange formulation? What is the role of Newton-Euler formulation in the dynamic modelling of robots?	1	
4.	**Module 4: Introduction to Robot Control**	9	CO4
4.1	Basics of Control: Describe the basic control parameters and systems used in robotics? How P, PD, PID, Linear and Non-linear Controls are employed in robotic practices?	2	
4.2	Control Hardware and Interfacing: What are the advantages of using the embedded system in robotics? How microcontrollers can integrate sensors, actuators and components within a robotic system?	1	
4.3	Introduction to Robot Programming: What is robot programming? What are different programming methods for robots? How the robot languages are classified? Describe the structure, elements, and functions of robot language.	2	
4.4	Introduction to Robot Programming: What is the role of variable assembly language (VAL) programming in robotics? What are the common commands used for motion, end effector and sensors?	2	
4.5	Introduction to Robot Programming: Using simple programs, conduct exercises to develop the robot programming skills of students.	2	
5.	**Module 5: Recent Developments in Robotics.**	9	CO5
5.1	Mobile Robots: What are mobile robots? How the kinematics change with mobile robots? Describe the navigation of mobile robots.	2	
5.2	Humanoid Robotics: How to humanoid robots are different from other types? What is biped locomotion? What are the challenges involved in the static and dynamic balance of biped robots? What is the application of imitation learning in humanoid robots?	1	
5.3	Collaborative Robots: What are collaborative robots? How can collaborative operation put it into practice for robots? What are the different applications of collaborative robots?	2	

5.4	Artificial Intelligence (AI) in Robotics: What are the different applications of AI in robotics? How AI helps in the development of unmanned robotic systems What are the different applications of AI-based robots in the defense, medical, industrial and other domains?	1	
5.5	Industrial Applications of Robots: What are the applications of robots in different industries? How robots have a greater role today in material handling and assembly? What is the contribution of robotics towards Industry 4.0.	2	
5.6	Robot Ethics, Robot Safety and Social Robotics What the ethical practices necessary for the design, production and application of robots today? What are the aspects of occupational safety and health of humans when robots are used in the workplace? What are social robots? How are social robots supposed to help humans?	1	
	TOTAL	**45 Hours**	

Course Designers:

COURSE DESIGNED BY	VERIFIED BY
Mr. Srikanth K Asst. Professor, ECE, JCET E Mail ID: srikanth4019.ece@jawaharlalcolleges.com	Dr. Sandeep C S Asso. Professor and HoD, ECE, JCET E Mail ID:hodece@jawaharlalcolleges.com

24ECISDT831	INSTRUMENTATION SYSTEM DESIGN	Category	L	T	P	Credit
		PE5	2	1	0	3

Preamble

This course aims

The aim of this course is to improve the ability of students to comprehend and design various types of instrumentation systems.

Prerequisite

Industrial instrumentation I and II, Linear integral circuits, Process control Instrumentation

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Design the commonly occurring electronic circuits in instrumentation system	20
CO2	Select control valves based on applications and also design flow measuring devices	20
CO3	Explain instrumentation diagrams and documentation for instrumentation project control	20
CO4	Discuss how to perform better supervision, Construction, installation, and commissioning in instrumentation industry.	20
CO5	Explain about the electric and intrinsic aspect of safety and about control panel design.	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	2	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	2	-	3	-
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-	3	-
CO4	2	-	-	-	-	3	-	-	-	-	-	2	-	3	-
CO5	2	-	-	-	-	3	3	-	-	-	-	2	-	3	-
Avg	**2.4**	**3**	**--**	-	**-**	3	-	-	-	-	-	**2**	**-**	**3**	-

1-Low; 2-Medium; 3 Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests	Assignment	Terminal Examination

	1	2	1	2	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30
Applying	50	50	50	50	50
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) : 20
Marks Assignment/Quiz/Course project : 14
Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1(CO1):

1.Design a RTD circuitry with lead wire compensation and conversion of its output to 4 to 20mA current**.**

Course Outcome 2(CO2):

1.Describe any three criterions for selecting a control valve.

Course Outcome 3 (CO3):

1.Briefly explain about the vendor selection, shipping, receiving and storing instruments.

Course Outcome 4 (CO4):

1.List out any three points to be taken care for good installation and maintenance job hinges.

Course Outcome 5(CO5):

1.Briefly discuss about electrical safety risks.

Syllabus

Module 1

Introduction to engineering system design-Design process skills of engineering design-Introduction to Instrumentation system design- System configuration-Experimental engineering analysis- Instrument design- The designer's viewpoint. Electronic processing modules for handling transducer output- P/I Conversion- I/P conversion- V/I and I/V -conversion -Carrier amplifier, Charge amplifier. Design of thermo couple circuitry with cold junction compensation, linearization, amplification and conversion of its output. Design of RTD with lead wire compensation and conversion of its output.

Module 2

Control valve selection- Pressure drop requirements for good control- Rangeability- Split ranging control valves- Introduction to control valve sizing- Illustration of typical valve sizing calculation for liquid, steam, and gas (one each). Design of pneumatic and electronic controllers. Design of flow measuring devices such as orifice plate, flow nozzle and venturi meter - Introduction to process piping- Material selection- Pipe fitting..

Module 3

Instrument project control- Documents to be produced- Process flow- Mechanical flow-Instrument index and instrument specification sheets- Loop wiring diagrams-Panel drawing and specification- Instrument specification and standard- Piping specifications- Electrical specification- Bid documents- Project procedures- Project scheduler work- Coordination-Project manager- Process engineers- Equipment engineers –Piping design supervisor- Job execution-

Module 4

Specification of various measurement and control loops (flow, pressure, level, temperature etc.) Processes connections- Location of taps- sealing Instruments from process- Manifolds and gauge valves- Selection of units- Charts and ranges- Instrument identification-Winderising- Packaged equipment system. Construction - organizing- Documents required- Planning schedule- Cost control- Ordering and receiving equipment and method- Purchase order- Material status- Instrument installation and commissioning -Instrument piping and tubing system-

Module 5

Start-up- Turning control lopes- evaluating process upsets and disturbers – Special requirements- lope analysis based design procedure for automatic design-Control panels – Introduction- Control room lay out – Instrument power requirements and distribution-Control room lighting- Communication system- Control panel types- Flat faced and break front panel- Consoles- Comparison of panel type- Panel lay out face layout, rear layout – Auxiliary racks and cabinet- Panel piping and tubing – Air headers- Graphic displays- Panel bid Specification.

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Andrew.W.G and Williams.H.B,	Applied instrumentation in the process industries-vol-1,2,3”	3rd	Gulf Publishing Co.	1993
2	Arora.Y.L	Flow measurement Techniques”,	1st	University Book.corp.	2007

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Anderson.N.A,	“Instrumentation for Process measurement and control”,		CRC Press.	
2	Les Driskell,	“Control Valve Selection & Sizing”		ISA (Instrument Society of America)	

Online study materials:

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**Module 1**	9	CO1
1.1	Introduction to engineering system design-Design process skills of engineering design-	1	
1.2	Design process skills of engineering design- Introduction to Instrumentation system design- System configuration- Problem analysis- Experimental engineering analysis- Instrument design- The designer's viewpoint	1	
1.3	Electronic processing modules for handling transducer output- P/I Conversion- I/P conversion- V/I and I/V - conversion-	2	
1.4	Carrier amplifier, Charge amplifier- Impedance converters - Phase sensitive detector	1	
1.5	RMS converters- ratio metric conversion- Logarithmic compression	1	
1.6	Design of thermo couple circuitry with cold junction compensation, linearization, amplification, and conversion of its output to 4 to 20 ma current	2	
1.7	Design of RTD with lead wire compensation and conversion of its output to 4 to 20 ma current. Design of Capacitance based Level Transmitter- Signal conditioning circuit for pH measurement.	1	
2	**Module 2**	9	CO2
2.1	Control valve selection- Pressure drop requirements for good control- Rangeability- Split ranging control valves- Introduction to control valve sizing	2	
2.2	Illustration of typical valve sizing calculation for liquid, steam and gas (one each). Design of pneumatic and electronic controllers	2	
2.3	Design of flow measuring devices such as orifice plate, flow nozzle and venturimeter -Introduction to process piping- Material selection- Pipe fitting	2	

2.4	***Cabling- General requirements- Cable types- Cable segregation Earthing-*** Testing and pre commissioning – pre installation testing- piping and cable testing- loop testing- Plant commission	3	
3.	**Module 3**	9	CO3
3.1	Instrument project control- Documents to be produced- Process flow- Mechanical flow-Instrument index and instrument specification sheets- Loop wiring diagrams-Panel drawing and specification	2	
3.2	Instrument specification and standard- Piping specifications-Electrical specification- Bid documents- Project procedures-Project scheduler work- Coordination- Project manager- Process engineers- Equipment engineers	2	
3.3	Piping design supervisor- Job execution- Planning hints-scheduling- Specifying instruments- ***Vendor selection- Shipping-Receiving and storing instruments***	2	
3.4	***Installation and project checkout- Project chart list-*** Design consideration- Pneumatics vs electronic- Process control requirements- Control centers- Location- Lay out-Electrical classification	3	
4.	**Module 4**	9	CO4
4.1	Specification of various measurement and control loops (flow, pressure, level, temperature etc.)	2	
4.2	Processes connections- Location of taps- sealing Instruments from process- Manifolds and gauge valves- Selection of units- Charts and ranges- Instrument identification- Winderising- Packaged equipment system	2	
4.3	Construction - organizing- Documents required- Planning schedule- Cost control- Ordering and receiving equipments and method-	2	
4.4	Purchase order- Material status- Instrument installation and commissioning -Instrument piping and tubing system	2	
4.5	Air supplies- Pneumatic signal -Checklist of installation practices - calibration- testing- typical flow transmitter checkout procedures – typical control valve-check out procedure	1	

5.	**Module 5**	9	CO5
5.1	Start up- Turning control lopes- evaluating process upsets and disturbers – Special requirements- lope analysis based design procedure for automatic design-Control panels	2	
5.2	Introduction- Control room lay out – Instrument power requirements and distribution- Control room lighting- Communication system	2	
5.3	***Control panel types- Flat faced and break front panel- Consoles- Comparison of panel type- Panel lay out face layout, rear layout*** – Auxiliary racks and cabinet- Panel piping and tubing – Air headers- Graphic displays- Panel bid Specification	2	
5.4	Safety- Introduction- Electric circuits risk- Flammable atmosphere- Other safety aspects- Electrical Safety- Purging and pressurizing endorser- Intrinsic safety.	3	
	TOTAL	**45 Hours**	

Course Designers:

COURSE DESIGNED BY	VERIFIED BY
Ms Aswathy J Asst. Professor, ECE, JCET E Mail ID: aswathy4088.ece@jawaharlalcolleges.com	Mr. Srikanth K Asst. Professor, ECE, JCET E Mail ID: srikanth4019.ece@jawaharlalcolleges.com

24ECHIVT841	HIGH SPEED INTERCONNECTS FOR VLSI DESIGN	Category	L	T	P	Credit
		PEC	3	0	0	3

Preamble

This course aims to provide understanding the behavior of interconnects in VLSI circuits. It covers RC and RLC models, power dissipation, thermal effects, cross-talk, and timing jitters. Students will learn to apply techniques for mitigating interconnect issues and optimizing performance. By the end, students will be proficient in extracting key interconnect parameters and advanced modeling approaches.

Prerequisite

24ECEATT501 Electromagnetics & Antenna Theory

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Analyze the concept of interconnects and the RC model in VLSI circuits. (Analyzing)	20
CO2	Apply RLC interconnect modeling and high-frequency signal propagation concepts. (Applying)	20
CO3	Evaluate the effects of power dissipation and thermal modeling on interconnects. (Evaluating)	20
CO4	Assess the impact of cross-talk and timing jitters on VLSI interconnects. (Evaluating)	20
CO5	Design techniques for extracting key interconnect parameters and advanced modeling techniques. (Applying)	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3		1				2		2		3	
CO2	1		2									2		3	
CO3	3	1										2	2	3	2
CO4	3	3	1	2								2	2	3	2
CO5	3	1	1	2	2	1	3	3	3	3	3	2	2	3	
Avg	2.6	1.6	1.4	1.4	0.4	0.4	0.6	0.6	0.6	1	0.6	2	1.2	3	0.8

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering					
Understanding					
Applying	20	20	10	10	20
Analyzing	30	30	40	40	30
Evaluating	50	50	50	50	50
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) 20 Marks
Assignment/Quiz/Course project 14 Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Course Level Assessment Questions

Course Outcome 1 (CO1)

1. Explain the concept of RC modelling in VLSI interconnects and calculate the Elmore delay for a given RC interconnect.
2. Describe the equivalent circuit of an RC interconnect and discuss the impact of scaling on resistance, capacitance, and delay.
3. Analyze the techniques used to mitigate delay in RC interconnects, including buffer insertion and optimization of interconnect width.

Course Outcome 2 (CO2)

1. Explain the RLC interconnect model and perform frequency-domain analysis for an RLC interconnect.
2. Derive the transmission line equations for interconnects and explain when inductive effects become significant.
3. Analyze the time-domain response of an RLC interconnect, including the effects of transient responses and the skin effect at high frequencies.

Course Outcome 3 (CO3)

1. Calculate the power dissipation due to resistive and capacitive effects in interconnects and optimize the interconnect width for minimal power loss.
2. Discuss the thermal effects and temperature rise due to power dissipation in interconnects and model these effects using thermal analysis techniques.
3. Explain electromigration and propose methods for mitigating its impact on interconnect reliability, including adjusting current density and material selection.

Course Outcome 4(CO4)

1. Explain the phenomenon of capacitive coupling in interconnects and analyze its effect on signal integrity.
2. Analyze the effects of cross-talk and timing jitters between interconnects and propose techniques to reduce these effects.
3. Apply matrix methods for modeling coupled interconnects and explain the process of decoupling interconnects to minimize coupling effects.

Course Outcome 5 (CO5)

1. Extract capacitance and inductance values for interconnects from simulations or measurements and analyze their effects on performance.
2. Estimate the electrical properties (resistance, capacitance, inductance) of interconnects using S-parameters and interpret the results.
3. Apply the two-pole model for RLC interconnects using ABCD parameters and analyze high-frequency performance in interconnects.

Syllabus

Module 1: Introduction to VLSI Interconnects and RC Modeling

Distributed RC Interconnect Model: Introduction to interconnects and the RC model. Elmore Delay: Calculation of delay in RC interconnects and its extension to RC trees and branched interconnects. Equivalent Circuit of RC Interconnects: Understanding the equivalent circuit representation of RC interconnects. Scaling Effects: The impact of scaling on interconnect resistance, capacitance, and delay. Delay Mitigation in RC Interconnects: Techniques to reduce delay, including buffer insertion and interconnect width optimization.

Module 2: RLC Interconnects and High-Frequency Effects

Distributed RLC Interconnect Model: Introduction to the RLC model and frequency-domain analysis. Transmission Line Equations: Derivation and understanding of transmission line equations for interconnects. Inductive Effects in Interconnects: Discussion of when inductive effects become significant in high-frequency designs. Time-Domain Response of Lumped RLC Circuits: Analyzing RLC circuits' time-domain response, including transient effects. Skin Effect: Origin and impact of skin effect on high-frequency signal propagation. Effective Resistance at High Frequencies: How the skin effect increases the effective resistance in interconnects.

Module 3: Power Dissipation, Thermal Modeling, and Electromigration

Power Dissipation Due to Interconnects: Estimating power losses from resistive and capacitive effects. Optimum Interconnect Width for Minimizing Power Dissipation: Finding the optimal width for minimal power loss. Heating Effects and Thermal Modeling: Modeling the thermal effects and temperature rise due to interconnect power dissipation. Electromigration in Interconnects: Understanding electromigration and its effect on reliability. Mitigation of Electromigration: Techniques for reducing electromigration, such as adjusting current density and material selection.

Module 4: Cross-Talk, Timing Jitters, and Mitigation Techniques

Capacitive Coupling in Interconnects: Explaining capacitive coupling and its impact on signal integrity. Cross-talk and Timing Jitters: Analyzing cross-talk between interconnects and its effect on signal timing. Techniques for Mitigation of Cross-Talk: Methods to reduce cross-talk, including interconnect spacing, shielding, and differential signaling. Matrix Formulation of Coupled Interconnects: Using matrix methods to model coupled interconnects.Decoupling of Interconnects: Techniques for decoupling interconnects to reduce coupling effects, including diagonalization of matrix formulations.

Module 5: Parameter Extraction, and Advanced Interconnect Modeling

Extraction of Capacitance and Inductance: Methods to extract capacitance and inductance values from simulations or measurements. Estimation of Interconnect Parameters from S-Parameters: Using S-parameters to estimate electrical properties such as resistance, capacitance, and inductance.Two-Pole Model for RLC Interconnects: Using ABCD parameters to model two-pole systems for RLC interconnects. Analysis of RLC interconnects for high-frequency performance.

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Douglas A. Pucknell & Kamran Eshraghian	VLSI Design: A Practical Introduction	4th Edition	Prentice Hall	2021
2	Neil H.E. Weste & David Harris	CMOS VLSI Design: A Circuits and Systems Perspective	6th Edition	Pearson	2021

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Howard Johnson & Martin Graham	High-Speed Digital Design	2nd Edition	Howard Johnson & Martin Graham	2022
2	Michael Steer	Microwave and RF Design: A Systems Approach	3rd Edition	Wiley	2020
3	G. L. (Larry) Dutton, Michael S. Sze	Thermal Management in Electronics Systems	2nd Edition	Springer	2021

Online study materials:

https://onlinecourses.nptel.ac.in/noc22_ee125/preview

Course Contents and Lecture Schedule

No	Topic	No. of Lecture	Course Outcome
1	**Introduction to VLSI Interconnects and RC Modeling**		

1.1	Distributed RC Interconnect Model, Elmore Delay: Calculation of delay in RC interconnects and its extension to RC trees and branched interconnects.	2	**CO1**
1.2	Equivalent Circuit of RC Interconnects: Understanding the equivalent circuit representation of RC interconnects.	2	
1.3	Scaling Effects: The impact of scaling on interconnect resistance, capacitance, and delay.	2	
1.4	Delay Mitigation in RC Interconnects: Techniques to reduce delay, including buffer insertion and interconnect width optimization.	3	
2	**RLC Interconnects and High-Frequency Effects**		**CO2**
2.1	Distributed RLC Interconnect Model, Transmission Line Equations: Derivation and understanding of transmission line equations for interconnects.	2	
2.2	Inductive Effects in Interconnects: Discussion of when inductive effects become significant in high-frequency designs.	2	
2.3	Time-Domain Response of Lumped RLC Circuits: Analyzing RLC circuits' time-domain response, including transient effects.	2	
2.4	Skin Effect: Origin and impact of skin effect on high-frequency signal propagation.	1	
2.5	Effective Resistance at High Frequencies: How the skin effect increases the effective resistance in interconnects.	2	
3	**Power Dissipation, Thermal Modeling, and Electromigration**		**CO3**
3.1	Power Dissipation Due to Interconnects: Estimating power losses from resistive and capacitive effects.	2	
3.2	Optimum Interconnect Width for Minimizing Power Dissipation: Finding the optimal width for minimal power loss.	2	
3.3	Heating Effects and Thermal Modeling: Modeling the thermal effects and temperature rise due to interconnect power dissipation.	3	
3.4	Electromigration in Interconnects: Understanding electromigration and its effect on reliability.	1	
3.5	Mitigation of Electromigration: Techniques for reducing electromigration, such as adjusting current density and material selection.	1	
4	**Cross-Talk, Timing Jitters, and Mitigation Techniques**		**CO4**
4	Capacitive Coupling in Interconnects: Explaining capacitive coupling and its impact on signal integrity.	2	
4.1	Cross-talk and Timing Jitters: Analyzing cross-talk between interconnects and its effect on signal timing.	2	

4.2	Techniques for Mitigation of Cross-Talk: Methods to reduce cross-talk, including interconnect spacing, shielding, and differential signaling.	3	
4.3	Matrix Formulation of Coupled Interconnects: Using matrix methods to model coupled interconnects.	1	
4.4	Decoupling of Interconnects: Techniques for decoupling interconnects to reduce coupling effects, including diagonalization of matrix formulations.	1	
5	**Parameter Extraction, and Advanced Interconnect Modeling**		**CO5**
5.1	Extraction of Capacitance and Inductance: Methods to extract capacitance and inductance values from simulations or measurements.	3	
5.2	Estimation of Interconnect Parameters from S-Parameters: Using S-parameters to estimate electrical properties such as resistance, capacitance, and inductance.	2	
5.3	Two-Pole Model for RLC Interconnects: Using ABCD parameters to model two-pole systems for RLC interconnects.	2	
5.4	Analysis of RLC Interconnects for High-Frequency Performance: Evaluating the performance of RLC interconnects at high frequencies.	2	

Course Designers:

COURSE DESIGNED BY	VERIFIED BY
Mr.Jayesh T P Asst. Professor, ECE, JCET E Mail ID:jayesh4205.ece@jawaharlalcolleges.com	Dr.Sandeep C S Asso. Professor and HoD, ECE, JCET E Mail ID:hodece@jawaharlalcolleges.com

24ECCYST851	CYBERSECURITY	Category	L	T	P	Credit
		OEC	3	0	0	3

Preamble

This course aims

- To familiarize various types of cyber-attacks and cyber-crimes.
- To give an overview of the cyber laws
- To study the defensive techniques against these attacks

Prerequisite

Basics of Computer Communication

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Learn the basics of vulnerability scanning and tools like OpenVAS and Metasploit.	20
CO2	Understand network scanning tools like Netcat, Nmap, and Wireshark to find vulnerabilities.	20
CO3	Understand firewalls, VPNs, and intrusion detection systems for network security.	20
CO4	Identify web application issues using tools like Nikto, Sqlmap, and Zed Attack Proxy.	20
CO5	Understand cybercrimes, legal aspects, and methods for investigation and forensics.	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	-	2	-	3	-
CO2	3	3	3	-	-	-	-	-	-	-	-	2	-	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	2	-	3	-
CO4	3	3	3	-	-	-	-	-	-	-	-	2	-	3	-
CO5	3	3	3	-	-	-	-	-	-	-	-	2	-	3	-
Avg	**3**	**3**	**3**	-	-	-	-	-	-	-	-	**2**	-	**3**	-

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	**2**	**1**	**2**	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30
Applying	50	50	50	50	50

Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance	: 6 Marks
Continuous Assessment Test (2 numbers)	20 Marks
Assignment/Quiz/Course project	14 Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1(CO1):

1. Explain the process of performing a vulnerability scan using OpenVAS. Highlight the steps involved in identifying, analyzing, and reporting vulnerabilities.
2. Perform a security assessment using Metasploit to exploit a vulnerable service. Document your findings and suggest mitigation strategies.

Course Outcome 2(CO2):

1. Compare the functionalities of Nmap and Netcat for network reconnaissance. Illustrate their differences with examples of practical use cases.
2. Capture and analyze network traffic using Wireshark. Identify unusual patterns or malicious activities and explain your observations.

Course Outcome 3 (CO3):

1. Configure a basic firewall using iptables (Linux) or Windows Firewall. Write a report on how it can be used to filter traffic based on protocols or ports.
2. Describe how a Virtual Private Network (VPN) works and create a diagram showing how it secures data transmission between two remote locations.

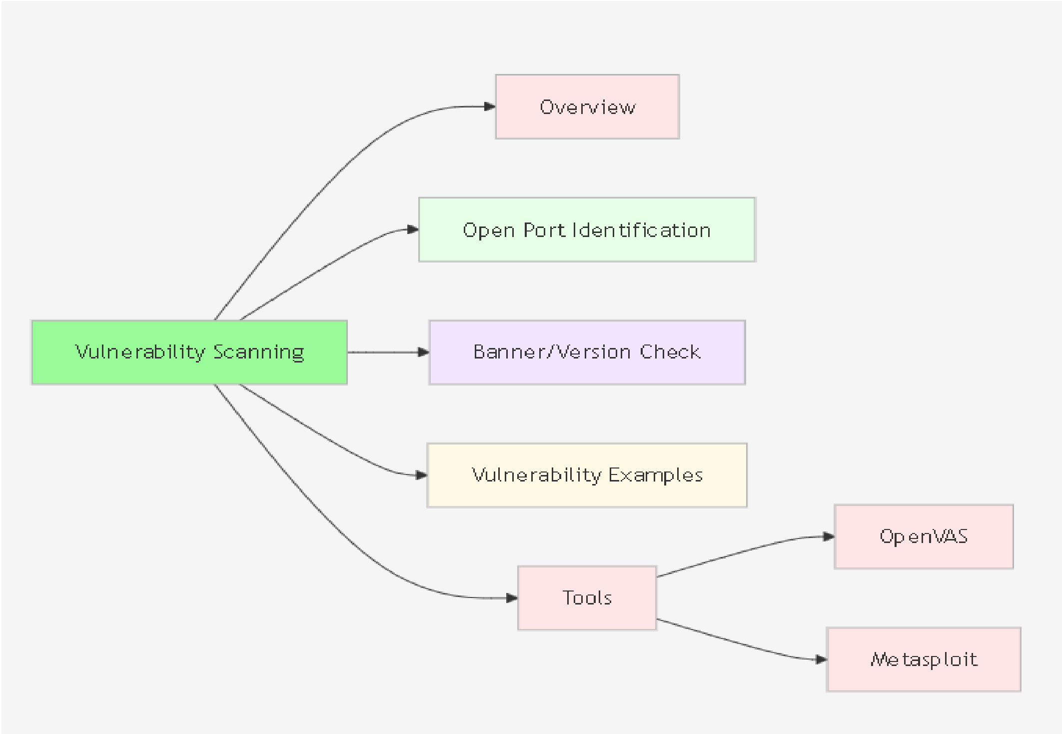
Course Outcome 4 (CO4):

1. Use Nikto to scan a web application for vulnerabilities. Document the detected issues and propose remediation strategies.
2. Demonstrate a SQL injection attack using Sqlmap on a vulnerable database. Discuss the impact of such an attack and the importance of secure coding practices.

Course Outcome 5(CO5):

1. Research a recent cybercrime incident and analyze it based on attack vectors, damages, and the legal consequences under the Indian IT Act 2000.
2. Create a step-by-step digital forensic analysis plan for investigating a data breach in a corporate environment. Explain the tools and techniques you would use.

Concept Map



Syllabus

Module 1

Introduction to Vulnerability Scanning: Overview of vulnerability scanning, Open Port / Service- Identification, Banner / Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, OpenVAS, Metasploit.

Module 2

Network Vulnerability Scanning Networks Vulnerability Scanning - Netcat, Socat, understanding Port and Services tools - Datapipe, Fpipe, WinRelay, Network Reconnaissance – Nmap, THC-Amap and System tools, Network Sniffers and Injection tools – Tcpdump and Windump, Wireshark, Ettercap, Hping, Kismet

Module 3

Network Defense tools: Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless Vs Stateful Firewalls, Network Address Translation (NAT) and Port Forwarding, the basic of Virtual Private Networks, Linux Firewall, Windows Firewall, Snort: Introduction Detection

Module 4

Web Application Tools: Scanning for web vulnerabilities tools: Nikto, W3af, HTTP utilities -
Curl, OpenSSL and Stunnel, Application Inspection tools – Zed Attack Proxy, Sql map. DVWA, Webgoat, Password Cracking and Brute-Force Tools – John the Ripper, L0htcrack, Pwdump, HTC- Hydra

Module 5

Introduction to Cyber Crime and law: Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behavior, Clarification of Terms, Traditional Problems Associated with Computer Crime.

Introduction to Cyber Crime Investigation: Firewalls and Packet Filters, password Cracking, Keyloggers and Spyware, Virus and Warms, Trojan and backdoors, Steganography, Attack on wireless Networks

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Mike Shema	Anti-Hacker Tool Kit	4^{th}	Mc Graw Hill	2014
2	Nina Godbole and Sunit Belpure	Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives	1st	Wiley India	2011

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	James Graham, Ryan Olson, Rick Howard	Cyber Security Essentials	1st	Auerbach Publications (an imprint of CRC Press)	2010
2	Chwan-Hwa (John) Wu, J. David Irwin	Introduction to Computer Networks and Cybersecurity	1st	Taylor & Francis	2013

Online study materials:

https://nptel.ac.in/courses/106106248/

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	Introduction to Vulnerability Scanning	9	CO1
1.1	Overview of vulnerability scanning	2	
1.2	Open Port / Service- Identification	2	
1.3	Banner / Version Check	2	
1.4	Traffic Probe, Vulnerability Probe	1	
1.5	Vulnerability Examples, OpenVAS	1	
1.6	Metasploit	1	
2	Network Vulnerability	9	CO2
2.1	Scanning Networks Vulnerability Scanning - Netcat, Socat	2	
2.2	Understanding Port and Services tools - Datapipe, Fpipe, WinRelay,	2	
2.3	Network Reconnaissance – Nmap, THC-Amap and System tools	3	
2.4	Network Sniffers and Injection tools – Tcpdump and Windump	1	
2.5	Wireshark, Ettercap, Hping, Kismet	1	
3.	Network Defense tools	9	CO3
3.1	Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall	2	
3.2	How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless Vs Stateful Firewalls	2	
3.3	Network Address Translation (NAT) and Port Forwarding	2	
3.4	The basic of Virtual Private Networks	2	

3.5	Linux Firewall, Windows Firewall, Snort: Introduction Detection	1	
4.	**Web Application Tools**	9	CO4
4.1	**Scanning for web vulnerabilities tools: Nikto, W3af**	2	
4.2	**HTTP utilities - Curl, OpenSSL and Stunnel, Application Inspection tools – Zed Attack Proxy, Sql map.**	2	
4.3	**DVWA, Webgoat, Password Cracking and Brute-Force Tools**	2	
4.4	**John the Ripper, L0htcrack, Pwdump, HTC- Hydra**	3	
5.	**Introduction to Cyber Crime and law: Cyber Crimes, Types of Cybercrime,**	9	CO5
5.1	**Hacking, Attack vectors, Cyberspace and Criminal Behavior, Clarification of Terms**	2	
5.2	**Traditional Problems Associated with Computer Crime.**	2	
5.3	**Introduction to Cyber Crime Investigation: Firewalls and Packet Filters, password Cracking, Keyloggers and Spyware**	2	
5.4	**Virus and Warms, Trojan and backdoors, Steganography, Attack on wireless Networks**	3	
	TOTAL	**45 Hours**	

Course Designers:

COURSE DESIGNED BY	**VERIFIED BY**
Dr Aswani K Asst. Professor, ECE, JCET E Mail ID: draswani4316.ece@jawaharlalcolleges.com	Dr.Sandeep C S Asso. Professor and HoD, ECE, JCET E Mail ID: hodece@jawaharlalcolleges.com

24OEBMIT812	**BIOMEDICAL INSTRUMENTATION**	**Category**	**L**	**T**	**P**	**Credit**
		OEC	**3**	**0**	**0**	**3**

Preamble

This course aims to give a brief introduction to human physiology and various instrumentations system used for measurement and analysis of physiological parameters.

Prerequisite

Nil

Course Outcomes

After the completion of the course the student will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Explain the human anatomy and physiological signal Measurements.	20
CO2	Illustrate various techniques used for measurement of Blood flow, blood pressure and respiration rate and body temperature.	20
CO3	Analyze the recording of ECG, EEG, EMG and ERG signals.	20
CO4	Summarize the concept of assisting and therapeutic devices.	20
CO5	Describe the advances in medical imaging techniques.	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3													
CO2	3	3													
CO3	3	3													
CO4	3	3													
CO5	3	3													
Avg	**3**	**3**													

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	20	20	10	10	20
Understanding	30	30	40	40	30
Applying	50	50	50	50	50
Analyzing					
Evaluating					
Creating					

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Mark Distribution

Total Mark	CIA	ESE	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) : 20 Marks
Assignment/Quiz/Course project : 14 Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment

Course Outcome 1(CO1): Introduction to human physiological system

1. Describe in detail the formation of resting potential and action potential in human body.
2. Briefly explain the physiological functions of human circulatory system
3. Briefly explain the physiological functions of human respiratory system

Course Outcome 2(CO2): Bio potential electrodes and ECG

1. Describe different bio-potential electrode used to measure bioelectric events.
2. Explain in details the electro conduction system of a human heart. Illustrate the same with PQRS waveform of the ECG.

Course Outcome 3 (CO3): Measurement of blood pressure, blood flow and heart sound

1. With help of neat diagram explain how the oscilloetric method helps to measure blood pressure.
2. Write a short note on phonocardiography.

Course Outcome 4 (CO4): Measurement of EEG, EMG and Respiratory Parameters and therapeutic aid

1. Write a short note on tidal volume and vital capacity in breathing mechanism with neat diagram.
2. Explain heart lung machine with the help of neat diagram.
3. Explain spirometer for measurement of respiratory parameters
4. Explain standard 10-20 electrode placement system for EEG measurement.

Course Outcome 5(CO5): Advances in Radiological Imaging and Electrical safety

1. Draw the block diagram and explain the principle of ultrasound imaging.
2. What are the biological effects of NMR imaging over CT?
3. What is the basic principle of CT? How image reconstruction is done in CT

Syllabus

Module 1:

Introduction to human physiological system

Physiological systems of the body (brief discussion on Heart and cardio vascular system, Anatomy of nervous system, Physiology of respiratory systems) problems encountered in biomedical measurements. Sources of bioelectric potentials – resting and action potentials -propagation of action potentials – bio electric potentials example (ECG, EEG, EMG, ERG, EOG, EGG etc.)

Module 2:

Bio potential electrodes and ECG

Bio potential electrodes – theory – microelectrodes – skin surface electrodes – needle electrodes – biochemical transducers –transducers for biomedical applications. Electro conduction system of the heart. Electro cardiograph –electrodes and leads – Einthoven triangle, ECG read out devices, ECG machine – block diagram.

Module 3:

Measurement of blood pressure, blood flow and heart sound

Measurement of blood pressure – direct and indirect measurement– oscillometric measurement – ultrasonic method, measurement of blood flow and cardiac output, plethysmography –photo Electric and impedance plethysmographs. Measurement of heart sounds –phonocardiography

Module 4:

Measurement of EEG, EMG and Respiratory Parameters

Electro encephalogram –neuronal communication – EEG measurement, recording and analysis. Muscle response– Electromyogram (EMG) – Nerve Conduction velocity measurements Electromyogram Measurements. Respiratory parameters – Spiro meter, pneumograph.

Module 5:

Advances in Radiological Imaging

X-rays- principles of generation, uses of X-rays- diagnostic stillpicture, fluoroscopy, angiography, endoscopy, and diathermy. Basic principle of computed tomography, magnetic resonanceimaging system and nuclear medicine system – radiation therapy. Ultrasonic imaging system - introduction and basic principle.

Electrical safety

Electrical safety– physiological effects of electric current –shock hazards from electrical equipment –method of accident prevention, introduction to tele-medicine

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	J. G. Webste	Medical Instrumentation, Application and Design		John Wiley and Sons	
2	L. Cromwell, F. J. Weibell and L. A. Pfeiffer	Biomedical Instrumentation Measurements,		Pearson education	1990
3	R. S. Khandpur	Handbook of Biomedical Instrumentation,		Tata Mc Graw Hill	

4	J. J. Carr and J. M. Brown	Introduction to Biomedical Equipment Technology		Pearson Education	

REFERENCE BOOKS

S. No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	John Enderele , Susan Blanchard, Joseph Bronzino	Introduction to Biomedical Engg,		Academic Press	
2	Welkovitz	Biomedical Instruments, Theory and Design		Elselvier	
3	Jerry L Prince, Jonathan M Link	,Medical Imaging Signals & Systems		Pearson Education	

Online study materials:

https://nptel.ac.in/courses

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	**Introduction to human physiological system**	9	CO1
1.1	Physiological systems of the body (brief discussion on Heart and cardio vascular system, Anatomy of nervous system, Physiology of respiratory systems) problems encountered in biomedical measurements.	3	
1.2	Sources of bioelectric potentials – resting and action potentials	3	
1.3	Propagation of action potentials – bio electric potentials example(ECG, EEG, EMG, ERG, EOG, EGG etc.)	3	
2	**Bio potential electrodes and ECG**	9	CO2
2.1	Bio potential electrodes –basic theory – microelectrodes – skin surface electrodes – needle electrodes	2	
2.2	Biochemical transducers –transducers for biomedical applications	1	
2.3	Instrumentation for clinical laboratory: Bio Potential amplifiers-instrumentation amplifiers, isolation amplifiers, chopper amplifier	2	
2.4	Electro conduction system of the heart, Electro cardiograph –electrodes and leads – Einthoven triangle,	2	
2.5	ECG read out devices, ECG machine – block diagram.	2	
3.	**Measurement of blood pressure, blood flow and heart sound**	9	CO3
3.1	Measurement of blood pressure – direct and indirect measurement– oscillometric measurement –ultrasonic method	3	

3.2	Measurement of blood flow and cardiac output, plethysmography –photo electric and impedance plethysmographs	3	
3.3	Measurement of heart sounds –phonocardiography	3	
4.	**Measurement of EEG,EMG and Respiratory Parameters, Therapeutic Aid**	9	CO4
4.1	Electro encephalogram –neuronal communication – EEG measurement, recording and analysis	2	
4.2	Muscle response– Electromyogram (EMG) – Nerve Conduction velocity measurements- Electromyogram Measurements.	2	
4.3	Respiratory parameters – Spiro meter, pneumograph	1	
4.4	Cardiac pacemakers – internal and external pacemakers, defibrillators.	1	
4.5	Ventilators, heart lung machine, hemodialysis, lithotripsy, infantincubators	3	
5.	**Advances in Radiological Imaging and Electrical Safety**	9	CO5
5.1	X-rays- principles of generation, uses of X-rays- diagnostic stillpicture, fluoroscopy, angiography, endoscopy, diathermy	2	
5.2	Basic principle of computed tomography, magnetic resonanceimaging system and nuclear medicine system	3	
5.3	Ultrasonic imaging system - introduction and basic principle	2	
5.4	Electrical safety– physiological effects of electric current – shock hazards from electrical equipment –method of accident prevention, introduction to tele- medicine	2	
	TOTAL	**45 Hours**	

Course Designers:

COURSE DESIGNED BY	**VERIFIED BY**
Ms. Jisha K V Asst. Professor, ECE, JCET E Mail ID: jishakv.ece@gmail.com	Mr.Sanish V S Asst. Professor, ECE, JCET E Mail ID: sanishvs@jawaharlalcolleges.com

24OEREST822	RENEWABLE ENERGY SYSTEMS	Category	L	T	P	Credit
		OEC	2	1	0	3

Preamble

This course helps the students to understand environmental issues with conventional fuels, the new methodologies/technologies for the effective utilization of renewable energy sources. They will be conversant with the characteristics of solar PV and wind power sources. Also, they will have an in-depth understanding of electronic conversion systems application to renewable energy generation systems and the synchronization with smart grid systems. The courses equip the students to pursue further specialized areas of study such as renewable energy and green consumer electronics, industrial control systems and smart grid, and renewable energy system which are essentially based on this course.

Prerequisite

Nil

Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Understand the need, importance and scope of various Non-Conventional sources of energy	20
CO2	Outline the concepts and technologies related to renewable energy systems using wind and Solar-PV	20
CO3	Understand the integration of smart grid with renewable energy systems	20
CO4	Explain the concept of distribution management system.	20
CO5	Describe the fundamentals of Smart metering	20

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2						2					1	-	-	-
CO2	2												-	-	-
CO3	2		1										-	-	-
CO4	2												-	-	-
CO5	3												-	-	-
Avg	2.2	-	1	-	-	-	2	-	-	-	-	1	-	-	-

1-Low; 2-Medium; 3- Strong;

Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remembering	30	30	-	-	20
Understanding	30	30	-	-	30
Applying	40	40	100	100	50
Analyzing	-	-	-	-	-
Evaluating	-	-	-	-	-
Creating	-	-	-	-	-

Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	Assignment
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

Continuous Internal Assessment Pattern:

Attendance : 6 Marks
Continuous Assessment Test (2 numbers) : 20 Marks
Project : 14 Marks

Question Paper Pattern:

Type of Test	Pattern
Internal Series Test I & II	**Total = 50 Marks; Duration = 90 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 7 = 35 Marks
End Semester Exam	**Total = 60 Marks** **Duration = 150 Minutes** Part A: 5 X 3 = 15 Marks Part B: 5 X 9 = 45 Marks

Sample Questions for Course Outcome Assessment**

Course Outcome 1

1. Describe the energy scenario in India. What are the various non-conventional energy resources relevant to India?
2. Explain how current scenario of world energy consumption leads to the exploitation of renewable energy sources.

Course Outcome 2

1. Explain grid connected solar PV systems with block diagram.
2. Explain solar power extraction using PV-Cells.

Course Outcome 3

1. Describe the sources and potentialsof wind energy power system in India?
2. Give the classification of wind turbines and explainit with neat sketches?

Course Outcome 4

1. Draw and explain intelligent islanding detection techniques.
2. Explain the influence of WECS on system transient response

Course Outcome 5

1. Give the classification of SCADA system and what is it application in industry.
2. Draw and explain a smart meter

Syllabus

Module I

Introduction to Renewable Energy (RE)Sources:World energy scenario, Over view of conventional energy sources, their limitation, need of renewable energy, potential & development of renewable energy sources,Renewable energy in India, An overview of types of renewable energy systems - Wind power, Hydropower (micro and mini), Solar energy, Biomass, Bio-fuel, Geothermal Heat energy, Pros and cons; Applications.

Module II

Solar Energy: Introduction to photovoltaic (PV) systems - Principle of PV conversion; Commercial solar cell, Thin film PV device fabrication - LPCVD, APCVD, PECVD; Tandem Solar cell fabrication; Solar power extraction using PV-Cells, I-V Characteristics, PV-Inverters without D.C. to D.C. converters, stand alone and grid collected PV systems, Grid interfacing-with isolation, without isolation, Maximum power point tracking- Methods(MPPT), PV-Inverters with D.C. to D.C. converters-on low frequency side and high frequency side with isolation, without isolation.

Module III

Wind Energy: Sources and potentials, Evaluation of Wind Intensity, Topography, General Classification of Wind Turbines-Rotor Turbines, Multiple-Blade Turbines, Drag Turbines, Lifting Turbines, System Toroidal Rotor Amplifier Platform (TARP)–Wind amplified rotor platform (WARP), Generators and speed control used in wind power energy: Fixed speed with capacitor bank, Rotor resistance control, SCIG and DFIG, Synchronous Generator- external magnetized, Synchronous Generator-permanent magnets.

Module IV

Electronic conversion systems application to renewable energy generation systems: Basic schemes and functional advantages, Power control and management systems for grid integration, island detection systems, synchronizing with the grid; Issues in integration of converter based sources; Network voltage management; Power quality management and Frequency management; Influence of PV/WECS on system transient response

Module V

Introduction to grid connectivity of RE systems, smart grid and emerging technologies, operating principles and models of smart gird components, key technologies for generation, networks, loads and their control capabilities; Evolution of electricity metering, key components of smart metering, overview of the hardware used for smart meters, smart metering protocols. Structure and main components of a distribution management system, Supervisory control and data acquisition (SCADA), distribution system modelling, new trends for smart grids, topology analysis, power flow analysis.

Learning Resources

TEXT BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Nayak J. K. and Sukhatme S. P	Solar Energy: Principles of Thermal Collection and Storage	3rd Edition	Tata McGraw Hill.	2009
2	Ali Keyhani	Design of Smart Power Grid Renewable Energy Systems	3rd Edition	Wiley-IEEE Press	2016

REFERENCE BOOKS

S.No	AUTHORS	TITLE	EDITION	PUBLISHERS	YEAR
1	Goswami D. Y	Principles of Solar Engineering	3rd Edition	Taylor and Francis	2012
2	Teodorescu R. Liserre M. Rodriguez P	Grid Converters for Photovoltaic and Wind Power Systems	1st Edition	Wiley-IEEE Press	2011

Online study materials:

https://onlinecourses.nptel.ac.in/noc22_ch27/preview

(Use of Standard and approved Steam Table, Mollier Chart is permitted)

Course Contents and Lecture Schedule

SI No.	Topic	No. of lectures
1	**Module 1:Introduction to Renewable Energy (RE) Sources**	**9**
1.1	World energy scenario, Over view of conventional energy sources, their limitation	2
1.2	Over view of conventional energy sources, their limitation,	2
1.3	need of renewable energy, need, potential & development of renewable energy sources, Renewable Energy in India	1
1.4	An overview of types of renewable energy systems	1

1.5	Wind power, Hydropower (micro and mini)	1
1.6	Solar energy, Biomass, Bio-fuel, Geothermal Heat energy	1
1.7	Pros and cons; Applications	1
2	**Module 2:Solar Energy**	**9**
2.1	Introduction to photovoltaic (PV) systems and Principle of PV conversion	2
2.2	Commercial solar cell, Tandem Solar cell fabrication	1
2.3	Solar power extraction using PV-Cells	1
2.4	PV-Inverters without D.C. to D.C. converters	1
2.5	Stand alone and grid collected PV systems	1
2.6	Grid interfacing-with isolation, without isolation	1
2.7	Maximum power point tracking-Methods	1
2.8	PV-Inverters with D.C. to D.C. converters-on low frequency side and high frequency side with isolation, without isolation.	1
3	**Module 3: Wind energy**	**9**
3.1	Wind energy: Sources and potentials, Evaluation of Wind Intensity, Topography	2
3.2	General Classification of Wind Turbines-Rotor Turbines, Multiple-Blade Turbines, Drag Turbines, Lifting Turbines	2
3.3	Toroidal Rotor Amplifier Platform (TARP)– Wind amplified rotor platform (WARP)	1
3.4	Introduction: Generators used in wind power energy	2
3.5	SCIG, DFIG, Synchronous Generator-external magnetized, Synchronous Generator-permanent magnets	1
3.6	Speed control used in wind power energy, Fixed speed with capacitor bank, Rotor resistance control,	1
4	**Module 4:Electronic conversion systems**	**9**
4.1	Electronic conversion systems application to renewable energy generation systems, Basic schemes and functional advantages	2
4.2	Power control and management systems for grid integration, island detection systems, synchronizing with the grid	1
4.3	Issues in integration of converter based sources	2

4.4	Network voltage management	1
4.5	Power quality management and Frequency management	1
4.6	Influence of PV/WECS on system transient response	2
5	**Module 5:G**rid connectivity of RE systems	**9**
5.1	Introduction to grid connectivity of RE systems, Emerging technologies, operating principles and models of smart gird	1
5.2	Key technologies for generation, networks, loads and their control capabilities	1
5.3	Evolution of electricity metering, key components of smart metering,	1
5.4	An overview of the hardware used for smart meters, smart metering protocols.	1
5.5	Structure and main components of a distribution management system	2
5.6	Supervisory control and data acquisition (SCADA)	1
5.7	Distribution system modelling	1
5.8	New trends for smart grids, topology analysis, power flow analysis.	1

Course Designers:

COURSE DESIGNED BY	VERIFIED BY
Dr.Sandeep C S Asso. Professor and HoD, ECE, JCET E Mail ID:hodece@jawaharlalcolleges.com	Mr.Sanish V S Asst. Professor, ECE, JCET E Mail ID: sanishvs@jawaharlalcolleges.com