

**MALNAD COLLEGE OF ENGINEERING,
HASSAN**

(An Autonomous Institution Affiliated to VTU, Belagavi)



**Autonomous Programme
Bachelor of Engineering**

**Department of Electronics and
Communication Engineering**

**VII and VIII Semester
SCHEME and SYLLABUS
(2023-24 Admitted Batch)**

Academic Year 2026-27



MALNAD COLLEGE OF ENGINEERING, HASSAN
(An Autonomous Institution Affiliated to VTU, Belagavi)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VISION OF THE INSTITUTE

To be an institute of excellence in engineering education and research, producing socially responsible professionals.

MISSION OF THE INSTITUTE

1. Create conducive environment for learning and research
2. Establish industry and academia collaborations
3. Ensure professional and ethical values in all institutional endeavors

VISION OF THE DEPARTMENT

To produce industry ready, research oriented and socially responsible Electronics & Communication Engineers.

MISSION OF THE DEPARTMENT

- To create an ambience for learning.
- To conduct research, beneficial to the society.
- To promote industry-academic interaction at all-levels.
- To be continuously agile to the needs of the stake holders.



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PROGRAM EDUCATIONAL OBJECTIVES(PEOs)

The graduates will:

PEO1: Design and test Electronics & Communication systems and be successful professional in the field of ECE and allied areas.

PEO2: Be a good leader, team worker with strong communication skills.

PEO3: Possess capability to pursue higher education and be involved in research in the core and allied areas of E&C engineering and be a lifelong learner.

PROGRAM OUTCOMES (POs)

1. **Engineering knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
3. **Design/Development of solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
4. **Conduct investigations of complex problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
5. **Engineering tool usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
6. **The engineer and the world:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).



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PROGRAM OUTCOMES (POs)

7. **Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
8. **Individual and collaborative team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary settings.
9. **Communication:** Communicate effectively and inclusively within the community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.
10. **Project management and finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
11. **Life-long learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: An ability to understand the basic concepts in Electronics and Communication Engineering and to apply them to various areas, like Signal and image processing, VLSI, Embedded systems, photonics, networks, MEMS, antennas, in the design and implementation of complex systems.

PSO2: An ability to solve problems using latest hardware and software tools available in E&C Engineering along with analytical skills to arrive at appropriate, cost effective solution.



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Assessment	Marks
CIE 1	10
CIE 2	10
CIE 3	10
Activities as decided by course faculty	20
SEE	50
Total	100

Scheme of Evaluation (Laboratory Courses)

Assessment	Marks
Continuous Evaluation in every lab session by the Course Coordinator	10
Record Writing	20
Laboratory CIE conducted by the Course Coordinator	20
SEE	50
Total	100

Examination	Maximum Marks	Minimum marks to qualify
CIE	50	20
SEE	50	20



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Scheme of Teaching for 2023-24 Admitted Batch (IV Year)

Seventh Semester					
Course Category	Course Code	Course Title	L-T-P in hours	Credit	Contact Hours
PCC	23EC701	Computer Networks and Protocols	4-0-0	4	50
IPCC	23EC702	Wireless and Cellular Communication (integrated)	3-0-2	4	50
PCC	23EC703	Radar and satellite Communication	3-0-0	3	40
PI	23EC704	Main Project work Phase-2	8	4	50
PI	23EC705	Technical Seminar	0-2-0	1	12
PEC	23PEC7XX	Professional Elective Course	3-0-0	3	40
OEC	23OEECXX	Open Elective Course-II	3-0-0	3	40
Total				22	

Professional Elective Course - III	
Course Code	Course Name
23EC731	MEMS
23EC732	Nanotechnology
23EC733	Digital Image Processing
23EC734	Soft Computing
23EC735	Network Security
23EC736	Cloud Computing

Open Elective Course - II	
Course Code	Course Name
23OEEC71	Sensors and Actuators
23OEEC72	Quantum Information Theory
23OEEC73	Satellite Communication
23OEEC74	Radar Systems
23OEEC75	Digital Image Processing
23OEEC76	E-Waste Management

Eighth Semester					
Course Category	Course Code	Course Title	L-T-P in hours	Credit	Contact Hours
PE	23EC8XX	Professional Elective Course (Online Courses) Only through NPTEL*	3-0-0	3	40
PEC	Swayam2	Open Elective (Online Courses) Only through NPTEL	3-0-0	3	40
INT	23INT	Internship (Industry/Research) (14-20weeks)	0-0-12	10	
Total				16	

*Courses will be announced by the department NPTEL Coordinators



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VII Semester

Course Title	COMPUTER NETWORKS AND PROTOCOLS		
Course Code	23EC701	(L-T-P) C	(4-0-0) 4
Exam	3 hours	Hours/Week	4
SEE	50marks	Total Hours	52

Course Objective: Overall knowledge gained in this course will enhance the ability of Electronics and Communication Engineering students to deal with analysis and design of computer networks and protocols associated with them in their profession.

Course Outcomes (COs){with mapping shown against the Program Outcomes (POs)}

Upon completion of the course, students shall be able to:

COs	Statement	POs	PSOs
1.	Recognize the functionalities of the various layers of the OSI and TCP/IP models and identify the different internetworking devices and protocols associated with them.	1,2	1,2
2.	Design fixed-length and variable-length network blocks to carry out, deliver, forward, and route using IPv4 and IPv6 addresses	1,2, 3	1,2
3.	Describe the functionalities associated with the transport layer.	1,2	1,2
4.	Illustrate the working of application layer protocols such as DNS, FTP, SMTP, DHCP, RTP and VOIP for data communication over the Internet	1,2	1,2

Course Contents:

MODULE-1	Teaching Hours
Introduction- History, protocols and standards, OSI Model and TCP/IP Protocol suite, Layers, addressing modes, IP versions, framing techniques. [Self-Learning: RFC report] LAN-Wired LANs- Multiple Access Techniques, Wired LAN(Ethernet) and Wireless LANs (wi-fi 802.11), Point to point WAN technologies, Connecting Devices. Self study: 802.15 –Bluetooth, Short range IoT networking Technologies(Z wave, Zigbee, Thread, RFID-NFC)	13 Hrs.
MODULE – 2	
IP Addressing- Introduction, Classful and classless addressing, IPv4 and IPv6 address formats and types, Variable length blocks in IPv4. Delivery, forwarding and routing IP Packets- Types of delivery, forwarding techniques with classful and classless addressing, Network Address translation Introduction to Routing protocols- Distance vector Routing, Link State Routing, OSPF routing Self study: ARP, RARP and DHCP protocols	13 Hrs.
MODULE-3	
Internet Protocol- Datagram formats of IPv4 and IPv6, fragmentation, ICMP message types and formats. UDP and TCP- Process to process communication, frame format of UDP packets, UDP operation, Services and features of TCP, TCP segment format, TCP Connection establishment and Termination, Congestion control in TCP. Self study: Extension headers of IPv6 datagram.	13 Hrs.
MODULE-4	
Applications- DNS definition, DNS in internet, resolution in DNS, FTP-File transfer, SMTP, SNMP-Network Management, Network Security- Network Layer security, transport layer security, application layer security, firewalls and packet filters. Self study: VOIP	13 Hrs.

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Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1	TCP/IP Protocol Suit	Behrouz A. Forouzan	4 th	Mcgraw Hill	2010
2	Computer Networks	Andrew S Tenenbaum	5 th	Prentice Hall	2011

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	TCP/IP Illustrated	Gopalan and Siva Selvan	4th	PHI	2008
2	Data Communications and Networking: With TCP/IP Protocol Suite	Behrouz A. Forouzan	6th	McGraw Hill	2021

Online course and video lecture:

1. https://onlinecourses.nptel.ac.in/noc22_cs19/preview

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
Internals	Three tests conducted for 20 marks each and reduced to 10 marks	30
Activity	1) Assignments covering questions from self study components.	10
Details	2) Visit to study network architecture at various institutes and submitting a report about the same.	10
Total		50

Activity-1

Simulation experiments using NS2/ NS3/ OPNET/ NCTUNS/ NetSim/ QualNet or any other equivalent tools:

1. Implement a point to point network with four nodes and duplex links between them. Analyze the network performance by setting the queue size and varying the bandwidth.
 2. Implement a four node point to point network with links n0-n2, n1-n2 and n2-n3. Apply TCP agent between n0-n3 and UDP between n1-n3. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP/UDP.
 3. Implement Ethernet LAN using n (6-10) nodes. Compare the throughput by changing the error rate and data rate.
 4. Implement Ethernet LAN using n nodes and assign multiple traffic to the nodes and obtain congestion window for different sources/ destinations.
 4. Implement ESS with transmission nodes in Wireless LAN and obtain the performance parameters.
 6. Implementation of Link state routing algorithm
- 10 Marks

Activity-2

Assignment questions covering self-study topics and emerging protocols in the internet society. 10 marks

Course Articulation Matrix

[illegible]



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Course Title	Wireless and Cellular Communication
Course Code :23EC702	LTPC:3-0-2-4
Exam Hours : 3	Hours / Week: 4
SEE:50 Marks	Total hours: 52

Course Objective: To enable students to analyze wireless communication systems, evaluate network performance, and assess contemporary wireless technologies and standards.

Course Outcomes: {with mapping shown against the Program Outcomes (POs)}

Upon completion of the course, students shall be able to:

CO's	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Understand the basics of Wireless Communication and Networks.	1,2,11	1
2	Realize the complicated nature of wireless propagation and use of simple models to determine power requirements.	1,2,5,11	1,2
3	Differentiate multipath channel models and assess the effectiveness of various diversity combining techniques	1,2,5,11	1,2
4	Interpret the functionalities and applications of cellular and non-cellular wireless communication systems.	1,2,3,11	1,2

Course Contents:

MODULE-1	Teaching Hours
Introduction to Wireless Communication and Cellular Concept: Evolution, Frequency Reuse, Channel Assignment Strategies, Handoff Strategies, Interference and System Capacity, Improving Coverage and Capacity in Cellular systems. Mobile Radio Propagation: Large scale path loss- Free Space Propagation model, Three basic propagation mechanisms, reflection, Diffraction, Scattering. Self study: 2G, 2.5G, 3G, 4G, 5G Networks, Ground Reflection (Two-ray) Model.	10 Hours
MODULE-2	
Mobile Radio Propagation: Small scale path loss- Small scale multipath propagation, Parameters of Mobile Multipath Channels, Types of Small-scale fading Diversity Techniques: Selection diversity Improvement, Maximal ratio Combining Improvement, Selection Diversity, Scanning Diversity, Maximal and Equal Gain Combining, Polarization, Time, Frequency diversity Self study: RAKE Receiver	10 Hours
MODULE-3	
Non-Cellular Networks: Bluetooth, WiFi, LoRA technology, Zigbee, Z-Wave, SIGFOX Wireless Systems and Standards-I: AMPS-Overview, Call Handling, CDMA Digital Cellular Standard (IS-95)-Frequency and Channel Specification Self study: Forward CDMA and Reverse CDMA Channels	10 Hours
MODULE-4	
Wireless Systems and Standards-II: Global System for Mobile (GSM)-Services, Features, System Architecture, Radio Subsystem, Frame Structure, Signal Processing. Wireless Systems and Standards-III: DECT- Features and Specifications, Architecture, Functional Concept, Radio Link, PACS-System Architecture, Radio Interface. Self study: GSM channel types	10 Hours

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Course Title	RADAR AND SATELLITE COMMUNICATION		
Course Code	23EC703	(L-T-P) C	LTPC: (3-0-0)3
Exam	3	Hours/Week	3
SEE	50 Marks	Total Hours	50
Course Objective: The objective is to introduce the basic principles and operation of radar systems. Students will learn the concept of radar, the simple radar equation, radar block diagram, radar frequency bands, and various radar applications like CW-Radar, FM – CW Radar, MTI Radar and their antennas. The fundamentals of satellite communication, covering satellite orbits, spacecraft subsystems, link budget analysis, earth stations, and practical satellite applications. Course Outcomes: {with mapping shown against the Program Outcomes (POs)} Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Comprehend the fundamentals of radar systems and analyze radar equations, performance parameters, and range ambiguities.	1,2, 3,5	1, 2
2	Analyze the operation and applications of CW and FM-CW radar systems and solve related numerical problems.	1,2,5, 8	1, 2
3	Apply the principles of satellite orbital mechanics to determine orbital parameters, look angles, visibility, and the characteristics of geostationary and non-geostationary satellites.	1, 2, 3, 5,8	1, 2
4	Analyze satellite communication systems, including space segment components, satellite link design, link budget calculations, and performance impairments.	1, 2, 5, 8	1, 2
MODULE-1			No. of Hrs. 10
Basics of Radar: Introduction, Maximum Unambiguous Range, Radar Waveforms, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications, Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Modified Radar Range Equation, Related Problems. Radar Equation: SNR, Envelope Detector-False Alarm Time and Probability, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets - sphere, cone-sphere).			
MODULE-2			No. of Hrs. 10
CW and Frequency Modulated Radar: Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar, Related Problems. FM-CW Radar: FM-CW Radar, Range and Doppler Measurement, Block Diagram and Characteristics (Approaching/ Receding Targets),			
MODULE-3			No. of Hrs. 10
SATELLITE ORBITS: Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping, geo stationary and non Geo-stationary orbits – Look Angle Determination- Limits of visibility – eclipse-Sub satellite point –Sun transit outage-Launching Procedures -launch vehicles and propulsion.			
MODULE-4			No. of Hrs. 10
SPACE SEGMENT AND SATELLITE LINK DESIGN: Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command. Satellite uplink and downlink Analysis and Design, link budget, E/N calculation- performance impairments-system noise, inter modulation and interference, Propagation Characteristics and Frequency considerations- System reliability and design lifetime.			



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Prescribed Text Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1.	Introduction to Radar Systems	Merrill I. Skolnik	2 nd	McGraw-Hill	2001
2.	Radar: Principles, Technology, Applications	Byron Edde	-	Pearson Education	2004
3.	Satellite Communication	Dennis Roddy	4 nd	McGraw-Hill	2006
4.	Satellite Communication Systems Engineering	Wilbur L. Pritchard, Hendri G. Suyderhoud, Robert A. Nelson	-	Prentice Hall/Pearson	2007

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1.	Introduction to Radar Systems	Merrill I. Skolnik	3 rd	McGraw-Hill	2007

Online Courses and Video Lectures:

- <https://www.youtube.com/watch?v=K1pOShhWGhk&list=PLgwJf8NK-2e6lqeQT5Kz8Ls1lnYuNHOZz>
- <https://www.youtube.com/watch?v=VtPUPdGiPpM&list=PL3rE2jS8zxAwdVGmzgxYOrpqrJQPixOk>
- <https://www.youtube.com/watch?v=XIUx9xDJqeg>

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted Simulation of RADAR systems	20
Total		50

Course Articulation Matrix

Course Outcomes	Program Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1		1							3	2
CO2	3	2	1		1			1				2	2
CO3	2	2	3		1			1				2	2
CO4	3	2			1			1				3	2



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Course Title	MAIN PROJECT PHASE-2		
Course Code	23EC704	(L-T-P) C	(0-0-8)4
Exam	3	Hours/Week	8
SEE	50 Marks	Total Hours	-

Course Objective: Design and Implement solution for the identified real world problem in Phase 1.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Implement the design with appropriate techniques, resources and contemporary tools	2,3,5	1,2
2	Communicate effectively with team members and mentors, make presentations and prepare technical document	8,9,10,11	2
3	Use ethical practices in all endeavors	7	1,2
4	Share the responsibilities for carrying out the project & playing individual roles appropriately	8	1,2
5	Implement the design with appropriate techniques, resources and contemporary tools	3,5	1,2

The project teams will implement the project started in their sixth semester

The project work is to be evaluated in three stages:

- Project Stage 1 (30M) – First Internal evaluation shall be taken up during this phase. This includes presentation on fine tuning of Software, Hardware Requirements and Design carried out in sixth semester.
- Project Stage 2 (20M) – Mid phase evaluation shall be taken up during this phase. This includes presentation, intermediate project demonstration, draft copy of the paper.
- Project Stage 3 (50M) – Final project Demo, report submission and details of technical paper publication.

The evaluation of the project stages shall be carried out by the evaluation committee comprising of project guide & other faculty members. The committee will be constituted by the project coordinators in consultation with the Head of the department. ***For Multidisciplinary projects guides will be allotted from each concerned branch.***

Rubrics for Evaluation of project

Stage I (Project Progress):

Evaluation of project phase II is carried out by evaluation committee.

Sl. No.	Performance Indicators	Needs Improvement (0-2 marks)	Average (4-6 marks)	Good (7-10 marks)	Max Marks
1.	System design and development	System specification is not identified.	System specification is identified but not satisfactory.	System specification is identified correctly.	10
2.	Identification of appropriate tool for application	Application tools are not identified.	Application tools identified but not used.	Application tools identified and used.	10
3.	Oral Presentation	Entire contents not delivered.	Contents not delivered clearly.	Contents delivered clearly with confidence.	10
Total					30

Stage II (Mid Phase Project Demonstration with Draft paper):

Evaluation of this phase is done by evaluation committee.



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Sl. No.	Performance Indicators	Needs Improvement (0-1 marks)	Average (2-3 marks)	Good (4-5 marks)	Total Marks Allocated
1.	Design and Implementation	Design not complete	Design partially completed	Design completed	5
2.	Demonstration	Incomplete	Complete but not satisfactory	Complete and satisfactory	5
3.	Technical paper Draft	Organization and technical content not relevant	Organization and technical content of paper complete but needs improvement	Organization and technical content of report are complete and satisfactory	5
4.	Oral Presentation	Presentation slides are not clear	Presentation slides are clear, but not satisfactory.	Presentation slides are clear and satisfactory.	5
Total					20

Stage III (Final Project Demonstration):

Evaluation of this phase is done by evaluation committee.

Sl. No.	Performance Indicators	Needs Improvement	Average	Good	Total Marks Allocated
1.	Final project demonstration	Project incomplete (4M)	Project complete but needs improvement in interface design/ functionality, etc. (7M)	Project completed (10M)	10
2.	Oral Presentation	Disorganized and ineffective presentation (4M)	Organized, but ineffective presentation (7M)	Effective organized presentation (10M)	10
3.	Report Submission	Disorganized and contents are not sufficient (10M)	Organized but not good content wise (16M)	Effectively organized and well framed contents (20M)	20
4.	Technical paper publication	Paper submitted for National Conference (8M)	Paper submitted / published in an International Conference (9M)	Paper submitted / published in a Journal (10M)	10
Total					50

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2
CO1		2	3	-	3	-	-	-	-	-	-	2	2
CO2	-	-	-	-	-	-	-	3	3	3	3	-	3
CO3	-	-	-	-	-	-	3	-	-	-	-	3	3
CO4	-	-	-	-	-	-	-	3	-	-	-	3	3
CO5	-	-	3	-	5	-	-	-	-	-	-	2	2



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Course Title	Technical Seminar		
Course Code	23EC705	(L-T-P) C	(0-0-2) 1
Exam	3 hours	Hours/Week	2
SEE	50marks	Total Hours	26

Course Objective: Overall knowledge gained in this course will enhance the ability of Electronics and Communication Engineering students in technical literature review, presentation, and communication skills.

Course Outcomes (COs){with mapping shown against the Program Outcomes (POs)}

Upon completion of the course, students shall be able to:

COs	Statement	POs	PSOs
5.	Identify and analyze a contemporary topic in Electronics and Communication Engineering	1,2	1,2
6.	Conduct a systematic literature survey using technical journals and conference publications	2,4, 8, 11	1,2
7.	Prepare a professional technical report with proper citations and references	7, 8, 9	1,2
8.	Deliver an effective technical presentation using appropriate communication tools	5, 8, 9	1,2

INSTRUCTIONS FOR STUDENTS:

- Students may choose topics from last 3 years quartile journals in the emerging areas, with consultation from the mentor, such as:
 - 6G/5G Wireless Communication
 - Internet of Things (IoT)
 - Artificial Intelligence in Communication Systems
 - Quantum Communication
 - Embedded Systems
 - VLSI Design
 - RF and Microwave Engineering
 - Antenna Design
 - Software Defined Radio
 - Cognitive Radio
 - Optical Communication
 - Satellite Communication
 - Robotics and Automation
 - MEMS and NEMS
 - Biomedical Electronics
 - Cyber Security for Embedded Systems
 - Edge Computing
 - Digital Signal Processing Applications
 - Semiconductor Devices
 - Electric Vehicle Electronics



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2. Technical report should contain

- Abstract
- Introduction
- Literature review
- Methodology
- Results and discussion
- Applications
- Challenges and future scope
- Conclusion
- References
- Similarity report with less than 20% similarity using Drillbit tool.

3. Presentation

- PPTs should be prepared in consultation with mentor incorporating the suggestions. 15-20 minutes individual presentation to be given.

4. Rubrics for evaluation:

Parameter	Excellent	Good	Satisfactory	Need Improvement
Literature Survey (10 marks)	Extensive literature survey using quality journals/conferences, proper references (8-10 marks)	Adequate literature review and references (6-7 marks)	Limited literature survey, mostly secondary sources (4-5 marks)	Inadequate or no literature review (0-3 marks)
Technical Content & Understanding(10 marks)	Accurate, in-depth technical knowledge with critical analysis(8-10 marks)	Good understanding with minor omissions(6-7 marks)	Basic understanding with limited analysis(4-5 marks)	Weak technical knowledge and major inaccuracies(0-3 marks)
Report Preparation (08 Marks)	Well-structured report, proper formatting, IEEE citations, no plagiarism (7-8 marks)	Good organization with minor formatting issues (6-7 marks)	Adequate report with several formatting/citation errors(3-5 marks)	Poorly organized report, missing references or plagiarism concerns (0-2 marks)
Presentation Skills (10 Marks)	Clear, confident delivery, effective slides, excellent time management (8-10 marks)	Good communication and organization with minor issues(6-7 marks)	Average delivery, over-reliance on slides or notes(4-5 marks)	Unclear presentation, poor organization, ineffective communication(0-3 marks)
Question & Answer Session (07 Marks)	Answers confidently with sound technical justification(7 marks)	Answers most questions correctly (5-6 marks)	Answers simple questions with limited confidence(3-4 marks)	Unable to answer most questions(0-2 marks)
Professionalism & Participation (05 Marks)	Regular participation, punctual, professional conduct, active engagement(5 marks)	Consistent participation and professional behaviour (4 marks)	Occasional participation(2-3 marks)	Poor attendance, limited participation, unprofessional conduct(0-1 marks)



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Course Outcomes	Program Outcomes											Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PSO2
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PSO2
CO1	3	2										2	-
CO2		2		1				3			2	2	-
CO3							3	3	3			2	-
CO4					2			3	3			2	-



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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

PROFESSIONAL ELECTIVE COURSE-III

Course Title	MEMS		
Course Code	23EC731	(L-T-P) C	(3-0-0)3
Exam	3 Hrs	Hours/Week	03
SEE	50 Marks	Total Hours	40

Course Objective: The objective of this course is to introduce the concepts of MEMS and Nanotechnology, and their design and fabrication methods.

Course Outcomes: with mapping shown against the Program Outcomes (POs)}

Upon completion of the course, students shall be able to

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Understand the working principles of MEMS and their applications.	1, 2	1
2	Apply Science and Engineering Mechanics for Microsystem Design and Fabrication	1, 2,3	1
3	Apply appropriate miniaturization, fabrication, and manufacturing techniques for MEMS and microsystems	1,2, 3,7,8,9	1
4	Analyze various simulation FEM techniques for the design of MEMS and microsystems	1,2, 3,5,7,8,9	1,2

MODULE-1

**No. of Hrs.
10**

OVERVIEW OF MEMS & MICROSYSTEMS: MEMS & Microsystems, Microsystems and Microelectronics, The multidisciplinary nature of Microsystems design and manufacture, Applications of MEMS and microsystems,

Materials for MEMS and Microsystems: Substrates and Wafers, Active Substrate Materials, Silicon as a Substrate Material.

MODULE-2

**No. of Hrs.
10**

WORKING PRINCIPLES OF MICROSYSTEMS: Introduction, Micro sensors, Micro actuation, MEMS with Micro actuators, Micro accelerometers, Microfluidics

ENGINEERING MECHANICS FOR MICROSYSTEMS DESIGN: Static Bending of Thin Plates, Mechanical Vibration, Thermo mechanics, Fracture Mechanics, Thin-Film Mechanics

MODULE-3

**No. of Hrs.
10**

SCALING LAWS IN MINIATURIZATION: Introduction to scaling, scaling in geometry, scaling in rigid body dynamics, scaling electrostatic forces, electromagnetic forces, electricity, scaling in fluid mechanics & heat transfer.

MICROSYSTEM FABRICATION PROCESSES: Introduction, Photolithography, Ion Implantation, Diffusion, Oxidation, Chemical Vapor Deposition, Physical Vapor Deposition –Plasma, Sputtering

MODULE-4

**No. of Hrs.
10**

MICRO MANUFACTURING. Bulk micro manufacturing, Surface Micromachining, The LIGA Process.

MICROSYSTEMS DESIGN: Introduction, Design Considerations, Process Design, Mechanical Design, Mechanical Design Using Finite Element Method, Design of a Silicon Die for a Micro Pressure Sensor.



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Prescribed Textbooks:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	MEMS and Microsystems Design and Manufacture	Tai Ran Hsu	2 nd	Tata McGraw-Hill	2002
2	Fundamentals of Microfabrication	Marc Madou	1 st	CRC press	1997

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1.	Microsystem Design	Stephen D. Senturia	2 nd	Kluwer Academic Publishers	2001
2.	Foundations of MEMS	Chang Liu	2 nd	Pearson Education India limited	2006

EBooks and online course materials:

1. <https://www.taylorfrancis.com/books/mono/10.1201/9781482274004/fundamentals-microfabrication-marc-madou>
2. <https://link.springer.com/book/10.1007/b117574>

Online Courses and Video Lectures:

1. <https://nptel.ac.in/courses/117105082>
2. <https://nptel.ac.in/courses/118102003>

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs were conducted for 20 marks each and reduced to 10 marks	30
Activity Details	1) Presentation of journals related to the MEMS based sensors (IEEE or Elsevier or any standard Publishers) 2) Presentation of journals related to the MEMS based actuators (IEEE or Elsevier or any standard Publishers)	20
Total		50

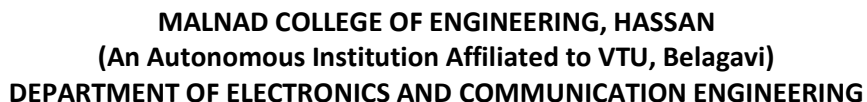
Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1 1	PSO 1	PSO 2
CO1	3	2										2	
CO2	2	2	3									2	
CO3	1	2	2				2		2			2	
CO4	2	2	2		2		2		2			1	2



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Course Title	Nanotechnology																						
Course Code	23EC732	(L-T-P) C	3-0-0-3																				
Exam	3 Hrs	Hours/Week	3																				
SEE	50 Marks	Total Hours	40																				
Course Objective: To enable students to understand the applications of nano materials and associated technology in industrial sector. Course Outcomes: with mapping shown against the Program Outcomes (POs)} Upon completion of the course, students shall be able to <table> <tr> <th></th><th></th><th>POs</th><th>PSos</th></tr> <tr> <td>CO1</td><td>Enhance basic engineering science and technological knowledge of nano electronics.</td><td>1 2</td><td>1</td></tr> <tr> <td>CO2</td><td>Illustrate basics of top-down and bottom-up fabrication process, devices and systems.</td><td>1 2</td><td>1</td></tr> <tr> <td>CO3</td><td>Analyze technologies involved in modern day electronic devices.</td><td>2 3</td><td>2</td></tr> <tr> <td>CO4</td><td>Interpret the complexities in scaling down the electronic devices in the future.</td><td>2 3</td><td>2</td></tr> </table>						POs	PSos	CO1	Enhance basic engineering science and technological knowledge of nano electronics.	1 2	1	CO2	Illustrate basics of top-down and bottom-up fabrication process, devices and systems.	1 2	1	CO3	Analyze technologies involved in modern day electronic devices.	2 3	2	CO4	Interpret the complexities in scaling down the electronic devices in the future.	2 3	2
		POs	PSos																				
CO1	Enhance basic engineering science and technological knowledge of nano electronics.	1 2	1																				
CO2	Illustrate basics of top-down and bottom-up fabrication process, devices and systems.	1 2	1																				
CO3	Analyze technologies involved in modern day electronic devices.	2 3	2																				
CO4	Interpret the complexities in scaling down the electronic devices in the future.	2 3	2																				
MODULE-1			No. of Hrs.10																				
Introduction: Overview of nanoscience and engineering. Development Milestones in microfabrication and electronic industry. Moores' law and continued miniaturization, Classification of Nanostructures, Electronic properties of atoms and solids: Isolated atom, Bonding between atoms, Giant molecular solids, Free electron models and energy bands, crystalline solids, Periodicity of crystal lattices, Electronic conduction, effects of nanometerlength scale, Fabrication methods: Top down processes, Bottom up processes methods for templating the growth of nanomaterials, ordering of nanosystems																							
MODULE-2			No. of Hrs.10																				
Characterization: Classification, Microscopic techniques, Field ion microscopy, scanning probe techniques, diffraction techniques: bulk and surface diffraction techniques .																							
MODULE-3			No. of Hrs.10																				
Characterization: spectroscopy techniques: photon, radiofrequency, electron, surface analysis and dept profiling: electron, mass, Ion beam, Reflectometry, Techniques for property measurement: mechanical, electron, magnetic, thermal properties. Inorganic semiconductor nanostructures: overview of semiconductor physics. Quantum confinement in semiconductor Nanostructures: quantum wells, quantum wires, quantum dots, super-lattices, band offsets, electronic density of states																							
MODULE-4			No. of Hrs.10																				
Fabrication techniques: requirements of ideal semiconductor, epitaxial growth of quantum wells, lithography and etching, cleaved-edge over growth, growth of vicinal substrates, strain induced dots and wires, electrostatically induced dots and wires, Quantum well width fluctuations, thermally annealed quantum wells, semiconductor nanocrystals, colloidal quantum dots, self-assembly techniques. Physical processes: modulation doping, quantum hall effect, resonant tunneling, charging effects, ballistic carrier transport, Inter band absorption, intraband absorption, Light emission processes, phonon bottleneck, quantum confined stark effect, nonlinear effects, coherence and dephasing, characterization of semiconductor nanostructures: optical electrical and structural (Text 1).																							



Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Nanoscale Science and Technology	Ed Robert Kelsall, Ian Hamley, Mark Geoghegan,	2nd	John Wiley and Sons	2005
2	Introduction to Nanotechnology	Charles P Poole, Jr, Frank J Owens	4th	John Wiley and Sons	2011

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	“Hand Book of Nanoscience Engineering and Technology	Ed William A Goddard III, Donald W Brenner, Sergey E. Lyshevski, Gerald J Iafrate,	5th	CRC press,	2003.

1. https://onlinecourses.nptel.ac.in/e-learning/preview/noc24_mm29
2. <https://www.youtube.com/watch?v=1hH4UXo0QqQ>

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Course Title	DIGITAL IMAGE PROCESSING		
Course Code	23EC733	(L-T-P) C	(3-0-0) 3
Exam	CIE 50	Hours/Week	03
SEE	50 Marks	Total Hours	40
Course Objective: Understanding of Image Processing basic concepts such as Image Enhancement, Restoration, and Image transforms, image compression and color image processing. Course Outcomes: (COs) {with mapping shown against the Program Outcomes (POs)} Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Understand the image fundamental concepts in digital image processing, and also understand image formation and the role of human visual system.	1, 2	1
2	Apply image transform techniques in spatial and frequency domain and able to understand image Compression and transmission techniques.	1, 2,	1
3	Analyze the basic concepts of DIP operations such as Enhancement in spatial domain and frequency domain using filters.	1, 2, 3	1
4	Implement the basic concepts of image restoration and degradation along with Noise models and mathematical models using filters.	1, 2, 3	1
MODULE-1			No. of Hrs. 10
Introduction: Fundamental steps in Digital Image Processing, Components of an Image Processing Systems, , Elements of Visual Perception ,Basic Concepts in Sampling and Quantization, Representing Digital Images, Some basic Relationships between Pixels. Color Fundamentals: Color Models, Pseudocolor Image Processing, Basics of Full Color Image Processing, Smoothing and Sharpening			
MODULE-2			No. of Hrs. 10
Image Enhancement in the Spatial Domain: Some basic Gray Level Transformation, Histogram Processing, Basics of Spatial filtering, Spatial Filters Image Enhancement in the Frequency Domain: Introduction to the Fourier Transform and the Frequency Domain, Smoothing frequency domain filters.			
MODULE-3			No. of Hrs. 10
Image Restoration: A Model of the Image degradation/Restoration process, Noise Models, Restoration in the presence of Noise Only—Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Inverse Filtering. Image Compression: Fundamentals, Image Compression Models, Error –free (Lossless) Compression, Lossy Compression.			
MODULE-4			No. of Hrs. 10
Morphological Image Processing: Preliminaries, Dilation and Erosion, Opening and Closing, The hit or Miss Transformation. Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection,.			

Prescribed Text Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Digital Image Processing	Rafael C.Gonzalez and Richard E.Woods	3 rd	Pearson Education	2009
2	Fundamentals of Digital Image Processing	Anil K. Jain	3 rd	Pearson Education	2001



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Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Digital Image Processing	S. Jayaraman, S. Esakkirajan, T. Veerkumara	1st	TMH	2008
2	Digital image Processing	S. Sridhar	-	Oxford university press, India	2011

EBooks and online course materials:

1. <https://freecomputerbooks.com/Digital-Image-Processing.html>
2. <https://www.geeksforgeeks.org/computer-graphics/digital-image-processing-basics/>

Online Courses and Video Lectures:

1. https://onlinecourses.nptel.ac.in/noc22_ee116/preview

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIE s conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 1) Details of activity 1 Presentation- Image Processing Applications 2) Details of activity 2 Simulation using C programs/ Matlab	20
Total		50

Activity 2- Details:
1.Program on reducing the Size of an Image
2.Program on histogram of an image
3. Program on histogram on equalization of an image
4. Program on spatial filtering
5.program on smoothing filters in spatial filtering
6.Implement Butterworth low power filters in frequency domain
7. Implement Gaussian low power filters in frequency domain
8. program on removing salt and pepper and noise using mean and median filter

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9. program on removing Gaussian noise and uniform noise using mean filter
10. Write a program in pseudo color image processing
11. Write a program on color compliments

Course Articulation Matrix

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Course Title	SOFT COMPUTING		
Course Code	23EC734	(L-T-P) C	(3-0-0)3
Exam	50	Hours/Week	3
SEE	50	Total Hours	40

Course Objective: This course introduces fundamental soft computing techniques including neural networks, fuzzy systems, genetic algorithms, and swarm intelligence. It aims to develop an understanding of biologically inspired computing methods and their practical applications.

Course Outcomes: {With mapping shown against the Program Outcomes (POs)}

Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Understand the fundamental principles of soft computing techniques including ANN, Fuzzy Logic, and Genetic Algorithms.	1,2,8,9	1
2	Apply artificial neural network models to solve classification and pattern recognition problems.	1,2,5,8,9	1
3	Design fuzzy logic-based systems to handle uncertainty and approximate reasoning in real-world applications.	1,2,3,5	1
4	Implement genetic algorithms to solve optimization problems and compare their effectiveness with traditional methods.	1,2	1

MODULE-1

10 Hrs

Introduction to soft computing: ANN, FS,GA, SI, ES, Comparing among intelligent systems ANN: introduction, biological inspiration, BNN&ANN, classification, first Generation NN, perceptron, illustrative problems.

Text Book 1: Chapter1: 1.1-1.8, Chapter2: 2.1-2.6

Self study: Comparative Study and Real-World Applications of Soft Computing Techniques in Smart Systems

MODULE-2

10 Hrs

Adaline, Medialine, ANN: (2nd generation), introduction, BPN, KNN, HNN, BAM, RBF,SVM and illustrative problems. Text Book 1: Chapter2: 3.1,3.2,3.3,3.6,3.7,3.10,3.11

Self study: Role of Second Generation Neural Networks in Solving Non-Linear Classification Problems

MODULE-3

10 Hrs

Fuzzy logic: Introduction, human learning ability, undecidability, probability theory, classical set and fuzzy set, fuzzy set operations, fuzzy relations, fuzzy compositions, natural language and fuzzy interpretations, structure of fuzzy inference system, illustrative problems.

Text Book 1: Chapter 5

Self study: Comparison Between Classical Set Theory and Fuzzy Set Theory with Examples

MODULE-4

10 Hrs

Genetic Algorithms: Introduction to GA, GA, procedures, working of GA, GA applications, applicability, evolutionary programming, working of EP, GA based Machine learning classifier system, illustrative problems.

Text Book 1: Chapter 7

Self study: Advantages and Limitations of Genetic Algorithms in Solving Complex Search Problems

Prescribed Text Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1.	Soft computing	N. P Padhy and S P Simon	1 st	Oxford University Press	2015

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1.	Principles of Soft Computing,	Shivanandam, Deepa S. N	3 rd	Wiley India, 2011.	2011

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Course Title	NETWORK SECURITY		
Course Code	23EC735	(L-T-P) C	(3-0-0) 3
Exam	3 hours	Hours/Week	3
SEE	50marks	Total Hours	40

Course Objective: This course will equip students with a basic foundation of Network Security by deliver basics of Transport Level Security, Secure Socket Layer, Internet Protocol security, Intruders, Intrusion detection Malicious Software, Firewalls, Firewall characteristics, Biasing and Configuration

Course Outcomes: {With mapping shown against the Program Outcomes (POs)}

Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Understand the basic Network security concepts	1,2	1,2
2	Analyze the network security threats	1,2,5,8,9,11	1,2
3	Apply appropriate security techniques to mitigate and address threats	1,2,5,8,9,11	1,2
4	Evaluate network security mechanisms and their effectiveness	1,2,5,8,9,11	1,2

MODULE-1	No. of Hrs.10
Attacks on Computers and Computer Security: Need for Security, Security Approaches, Principles of Security Types of Attacks. Security Mechanisms, Services and Attacks, A model for Network security, Numericals on Substitution Techniques and Transposition Techniques. Self Study: Network Access Control	

MODULE-2	No. of Hrs.10
Transport Level Security Web Security Considerations, Secure Sockets Layer, Transport Layer Security, HTTPS, Self study: Secure Shell (SSH)	

MODULE-3	No. of Hrs.10
IP Security Overview of IP Security (IPSec), IP Security Architecture, Modes of Operation, Security Associations (SA), Authentication Header (AH), Encapsulating Security Payload (ESP), Self study: Internet Key Exchange	

MODULE-4	No. of Hrs.10
Intruders: Intruders, Intrusion Detection, Password Management. Malicious software, Viruses and Related Threats, Virus Countermeasures Firewalls : The Need for firewalls, Firewall Characteristics, Types of Firewalls, Firewall Biasing Self study: Next Generation Firewalls	

Prescribed Text Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Cryptography and Network Security Principles and Practice	William Stallings	5 th Edition	Pearson Education	2014
2	Cryptography and Network Security	AtulKahate	2 nd Edition	TMH	2008



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Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Cryptography and Network Security	Behrouz A Forouzan	1st Edition	TMH	2008
2	Introduction to Computer Security	Matt Bishop, Sathyanarayana S V	3 rd Edition	Pearson Education,	2009

EBooks and online course materials:

1. <https://edu.anarcho-copy.org/TCP%20IP%20-%20Network/Network%20Security.pdf>
2. <https://training.apnic.net/wp-content/uploads/sites/2/2016/12/TSEC01.pdf>
3. <https://content.e-bookshelf.de/media/reading/L-568883-4a133940ff.pdf>

Online Courses and Video Lectures:

1. <https://nptel.ac.in/courses/106105031>
2. <https://nptel.ac.in/courses/128106006>
3. https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_ee54

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Programming Assignments / Mini Projects can be given to improve programming skills.	20
Total		50

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1 1	PSO 1	PSO 2
CO1	3	2										2	1
CO2	3	2			1			2	2		1	2	1
CO3	3	2			1			2	2		1	2	1
CO4	3	2			1			2	2		1	2	1



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Course Title	CLOUD COMPUTING		
Course Code	23EC736	(L-T-P) C	(3-0-0)3
Exam	50	Hours/Week	3
SEE	50	Total Hours	40

Course Objective: To introduce the fundamental concepts of cloud computing, virtualization, cloud services, storage and security mechanisms, and enable students to develop and deploy applications using cloud computing platforms and tools.

Course Outcomes: {With mapping shown against the Program Outcomes (POs)}

Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Explain the fundamentals, characteristics and service models of cloud computing.	1,2,5	1
2	Analyze virtualization technologies and cloud deployment architectures.	1,2,5	1
3	Apply cloud storage and distributed computing concepts for data management and processing.	1,2,5	1
4	Demonstrate cloud-based application deployment and security mechanisms using suitable cloud platforms and tools.	1,2,5,8	1

MODULE-1

10 Hrs

Introduction to Cloud Computing: Overview of cloud computing, characteristics, benefits and challenges, evolution of cloud computing, distributed systems, grid computing and utility computing, cloud deployment models: public, private, hybrid and community cloud.

Self study: Comparison between traditional computing and cloud computing models.

MODULE-2

10 Hrs

Cloud Service Models and Virtualization:

Cloud service models: IaaS, PaaS and SaaS, virtualization concepts, hypervisors, virtual machines, containerization, server virtualization, storage virtualization and network virtualization.

Self Study:

Study of Docker and Kubernetes architecture.

MODULE-3

10 Hrs

Cloud Storage and Distributed Computing:

Cloud storage architecture, distributed file systems, cloud databases, NoSQL databases, Hadoop Distributed File System (HDFS), MapReduce framework and distributed data processing concepts.

Self Study:

Big data analytics in cloud computing.

MODULE-4

10 Hrs

Cloud Security and Applications:

Cloud security challenges, authentication and access control, data security, backup and disaster recovery, SLA management, cloud applications in healthcare, education, IoT and AI.

Self Study:

Case studies of AWS, Microsoft Azure and Google Cloud Platform.

Prescribed Text Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1.	Cloud Computing: A Practical Approach	Anthony T. Velte, Toby J. Velte, Robert Elsenpeter	1 st	McGraw-Hill	2010
2.	Mastering Cloud Computing	Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi	1 st	McGraw-Hill	2013



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Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1.	Cloud Computing Bible	Barrie Sosinsky	1 st	Wiley India	2011
2.	Distributed and Cloud Computing	Kai Hwang, Geoffrey Fox, Jack Dongarra	1 st	Morgan Kaufmann	2012
3.	Cloud Security and Privacy	Tim Mather, Subra Kumaraswamy, Shahed Latif	1 st	O'Reilly	2009

EBooks and online course materials:

1. <https://nptel.ac.in/courses/106105167>
2. <https://aws.amazon.com/training/digital/aws-cloud-practitioner-essentials/>

Online Courses and Video Lectures:

1. NPTEL Course on Cloud Computing
2. Introduction to Cloud Computing – Google Cloud YouTube Series

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 1) Poster Presentation 2) Experiments executed using AWS / Microsoft Azure / Google Cloud / OpenStack / Docker (but not limited to) • Creating and managing virtual machines. • Deployment of applications on cloud platforms. • Cloud storage configuration and access management. • Container creation and deployment using Docker. • Virtual network configuration in cloud environment. • Hosting a web application on cloud. • User authentication and access management in cloud. • Monitoring and managing cloud resources. • Implementation of cloud-based file sharing system. • Mini project using cloud services and deployment tools.	20
Total		50

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2
CO1	3	2			2							1	
CO2	3	2			2							1	
CO3	3	2			2							1	
CO4	3	2			2			2				1	



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OPEN ELECTIVE COURSE-II

Course Title	Sensors and Actuators		
Course Code	23OEEC71	(L-T-P) C	(3-0-0) 3
Exam	3 Hrs	Hours/Week	03
SEE	50 Marks	Total Hours	40

Course Objectives: The objective of the course is to educate students in microtechnology and its application in fabricating sensors and systems.

Course Outcomes: (COs) {with mapping shown against the Program Outcomes (POs)}

Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Understand the basics of sensors, actuators, and their operating principle.	1,2	1
2	Illustrate the working principles of different types of sensors and actuators used in industrial applications	1,2	1
3	Apply different types of deposition methods for designing and developing sensors.	1,2,3,5,8,9,10	1,2
4	Analyze the fabrication and manufacturing processes for the design of sensors and Actuators	1,2,3,5,8,9,10	1,2

MODULE-1

No. of Hrs. 12

Basics of Energy Transformation: Transducers-Types of transducers, Sensors: - Sensor Classification, Selection criteria, Sensor Descriptions-Temperature sensor, magnetic field sensor, light sensor, and Strain Gauge, Actuators descriptions -Piezoelectric actuator, Thermal actuator, and electrical actuator.

Understanding of thin film physics: MOSFET Characteristics, Application in MOSFET and its variants -GASFET, OGFET, ADFET, ISFET, PRESSFET, CEMFETs, and BIOFET.

Self-Study: Basics of MOSFET and FET

MODULE-2

No. of Hrs. 10

Thin Film Deposition Techniques I: Chemical Vapor Deposition, APCVD, LPCVD, PECVD, HDPCVD.
Thin Film Deposition Techniques II: Physical Vapor Deposition, Thermal Deposition, E-beam Evaporation, Sputtering, Pulsed Laser Deposition.

Self-Study: Ion Implantation and Oxidation

MODULE-3

No. of Hrs. 10

Processing techniques: Photolithography, silicon micromachining, Bulk silicon micromachining, Surface silicon micromachining, LIGA process.

Micro Sensors: Principles and examples, Force and pressure micro sensors, position and speed micro sensors, acceleration micro sensors, chemical sensors, biosensors, temperature micro sensors and flow micro sensors.

Self-Study: Materials for MEMS and Microsystems.

MODULE-4

No. of Hrs. 10

Micro Actuators: Working principles of Actuators. Piezoelectric actuators, electrostatic actuators, micropumps, and micro-actuators with practical applications

Microsystems Design: Mechanical Design Using Finite Element Method, Design of a Silicon Die for a Micro Pressure Sensor

Self-Study: Practical applications of sensors and actuators



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Prescribed Textbooks:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Sensors and Signal Conditioning	Pallas-Areny Ramón, and John G. Webster			
2	Instrumentation: Devices and Systems,	C S Rangan, G R Sarma, V S V Mani,	2 nd	McGraw-Hill Education (India),	2014.
3	MEMS and Microsystems Design and Manufacture	TaiRanHsu	2 nd	TataMcGraw-Hill	2002

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Microsystem Design	Stephen D.Senturia	2 nd	Kluwer Academic Publishers	2001
2	Foundations of MEMS	ChangLiu	2 nd	Pearson Education India limited	2006

EBooks and online course materials:

1. <https://www.taylorfrancis.com/books/mono/10.1201/9781482274004/fundamental-s-microfabrication-marc-madou>
2. <https://link.springer.com/book/10.1007/b117574>

Online Courses and Video Lectures:

1. <https://nptel.ac.in/courses/117105082>
2. <https://nptel.ac.in/courses/118102003>

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs were conducted for 20 marks each and reduced to 10 marks	30
Activity Details	1) Presentation of journals related to the sensors (IEEE or Elsevier or any standard Publishers) 2) Presentation of journals related to the actuators (IEEE or Elsevier or any standard Publishers)	20
Total		50

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2										2	
CO2	2	2										2	
CO3	1	2	2					1	1	2		1	2
CO4	2	2	2					1	1	2		1	2



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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Course Title	Quantum Information Theory		
Course Code	23OEEC72	(L-T-P) C	(3-0-0)-3
Exam	3 hrs.	Hours/Week	3
SEE	50 Marks	Total Hours	40

Course Objective: This course will enable students to:

- The objective of this course is to provide a strong foundation in quantum computing theory and practical applications.
- It introduces the basic principles of quantum mechanics, qubits, circuit model of quantum computing, etc., and provides hands-on experience on programming a quantum computer using IBM Qiskit.
- It also includes an introduction to quantum machine learning.

Course Outcomes: The students should be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1	Understand the fundamental concepts of quantum mechanics and quantum computing.	1,2	1,2
2	Represent quantum states and operations mathematically using Dirac notation and matrix forms.	1	1
3	Design and implement quantum circuits using Qiskit.	1, 2,3, 5,9,10,11	2
4	Develop simple quantum Computation and learning solutions.	1, 2,3, 5,9,10,11	2

MODULE-1	No. of Hrs.
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Quantum Computation: History & Overview, Review of linear algebra: Dirac notation, Hilbert spaces, Unitary, Hermitian, and Normal matrices, Inner product, Outer product, Tensor product, Postulates of Quantum Mechanics, Stern and Gerlach experiment, Qubit, Bloch Sphere.

Self-Study: Basics of Qubits

10Hours

MODULE-2	
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Circuit model of Quantum Computing: Quantum gates and Circuit, Qiskit programming. Entanglement: Bell state, Quantum Teleportation, Superdense coding, Phase kickback, No-cloning theorem, Quantum parallelism, Deutsch-Jozsa algorithm, Bernstein-Vazirani algorithm, Grover search algorithm

Self-Study: Basics of Quantum Computing,

10 Hours

MODULE-3	
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Quantum Fourier Transform, Quantum Phase Estimation, Shor's algorithm, Quantum Error Correction, Gottesman-Knill Theorem, Surface codes,

Quantum Machine Learning: Data encoding – Basis encoding, Amplitude encoding, Hamiltonian Encoding, Swap test, Q-means clustering.

Self-Study: Basic ideas of quantum communication,

10 Hours

MODULE-4	
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Quantum information and Cryptography: Von Neumann entropy and properties, Schumacher compression, noisy-coding theorem, quantum key distribution, entropic uncertainty relations Distance measures, Graph states and codes, Quantum error correction, fault-tolerant computation

Self-Study: Basics of Quantum information

10 Hours



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Prescribed Textbook:

Sl. No	Book Title	Authors	Publisher	Year
1	Quantum Computation and Quantum Information	Michael A. Nielsen	Cambridge University Press	
2	Quantum computation and quantum information	Nielsen M. A., and Chuang I. L.	Cambridge University Press	2000

Reference Books:

Sl. No	Book Title	Authors	Publisher	Year
1	Introduction to Quantum Computation and Information.	H.-K. Lo, T. Spiller, S. Popescu,	World Scientific,	1998
2	An Introduction to Quantum Computing	Phillip Kaye, Raymond Laflamme, and Michele Mosca	Oxford University Press	2006

E-Books and online course materials:

- <https://tinyurl.com/yka8ts5w>
- <https://tinyurl.com/3wcrwxc7>
- <https://tinyurl.com/5e5f8vsx>

Web links and Video Lectures (e-Resources):

- <https://tinyurl.com/2tec5d6c>
- <https://tinyurl.com/2tjnzcy>
- nptel.ac.in/courses/115101092
- <https://tinyurl.com/32jpwsch>
- [NPTEL : NOC:Quantum Information and Computing \(Physics\)](#)

Activities

Activity 1 Term paper Activity 2 • Learn the coding exercises to help to build fluency in quantum programming. • Simulate using IBM's Qiskit and QuTiP libraries in Google Colab, model, and build quantum circuits. • Practice through real-world examples on IBM's quantum computers. • Build quantum circuit, modeling, and cryptography emphasizes Computing the theoretical principles and practical skills. • To construct and test quantum circuits independently.	
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Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2
CO1	3	2								2		2	1
CO2	2	3								2		3	
CO3	2	2	3		3				1	2	1		3
CO4	2	2	2		3				1	2	1		3



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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Course Title	SATELLITE COMMUNICATION		
Course Code	23OEEC73	(L-T-P) C	LTPC: (3-0-0)3
Exam	3	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Objective: The objective is understand the fundamentals of satellite communication, covering satellite orbits, spacecraft subsystems, link budget analysis, earth stations, and practical satellite applications. Course Outcomes: {with mapping shown against the Program Outcomes (POs)} Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Explain the fundamentals of satellite orbits, spacecraft subsystems, and earth station technologies.	1,2,5	1, 2
2	Apply satellite communication principles to perform link budget and system performance calculations.	1,2,3,5, 8,11	1, 2
3	Analyze satellite communication link performance considering propagation effects, noise, interference, and reliability.	1, 2, 3, 5,8,11	1, 2
4	Asses satellite communication systems and applications based on operational requirements and service capabilities..	1, 2, 5, 8,11	1, 2
MODULE-1			No. of Hrs. 10
SATELLITE ORBITS: Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping, geo stationary and non Geo-stationary orbits – Look Angle Determination- Limits of visibility – eclipse-Sub satellite point –Sun transit outage-Launching Procedures -launch vehicles and propulsion.			
MODULE-2			No. of Hrs. 10
SPACE SEGMENT AND SATELLITE LINK DESIGN: Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command. Satellite uplink and downlink Analysis and Design, link budget, E/N calculation- performance impairments-system noise, inter modulation and interference, Propagation Characteristics and Frequency considerations- System reliability and design lifetime.			
MODULE-3			No. of Hrs. 10
EARTH SEGMENT: Earth Station Technology-- Terrestrial Interface, Transmitter and Receiver, Antenna Systems TVRO, MATV, CATV, Test Equipment Measurements on G/T, C/No, EIRP, Antenna Gain			
MODULE-4			No. of Hrs. 10
SATELLITE APPLICATIONS: VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. Direct Broadcast satellites (DBS)- Direct to Home Broadcast (DTH), Digital audio broadcast (DAB) - World space services, Business TV (BTV),			

Prescribed Text Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1.	Satellite Communication	Dennis Roddy	4 nd	McGraw-Hill	2006
2.	Satellite Communication Systems Engineering	Wilbur L. Pritchard, Hendri G. Suyderhoud, Robert A. Nelson	-	Prentice Hall/Pearson	2007



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Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1.	Electronic Communication Systems	KENNAEDY DAVIS	4 th	TMH	-

Online Courses and Video Lectures:

1. <https://www.youtube.com/watch?v=dt4Ce8gQPns&list=PLAnjLC20C-XQnoowCtt-67WmyxoQPu2Fi>
2. <https://www.youtube.com/watch?v=vFypCugyFoM>
3. https://www.youtube.com/watch?v=WARM4fwsoT4&list=PLVsrfTSIZ_43SERuuAZZ-u1PBnwwn2ZfC

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted Simulation or case study on Satellite sub-blocks	20
Total		50

Course Articulation Matrix

Course Outcomes	Program Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2			1							3	1
CO2	3	2	1		1			1			1	3	2
CO3	3	2	2		1			1			1	2	2
CO4	3	2			1			1			1	3	2



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Course Title	RADAR SYSTEMS		
Course Code	23OEEC74	(L-T-P) C	LTPC: (3-0-0)3
Exam	3	Hours/Week	3
SEE	50 Marks	Total Hours	40
Course Objective: The objective is to understand the fundamental principles and operation of radar systems, including radar equation, system block diagram, frequency bands, and major radar types such as CW, FM-CW, and MTI. Course Outcomes: {with mapping shown against the Program Outcomes (POs)} Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Comprehend the fundamental radar principles, including radar equations, Doppler effect, CW/FM-CW operation, and applications..	1,2,5,11	1, 2
2	Analyze MTI and Pulse Doppler radar performance using Doppler processing, delay-line cancellers, and PRF concepts.	1,2,3,5,8,11	1, 2
3	Illustrate radar tracking techniques including sequential lobing, conical scan, monopulse, and range tracking.	1, 2, 3, 5,8	1, 2
4	Assess radar antennas and related systems including radiation patterns, reflector/lens antennas, radomes, and stabilization techniques.	1, 2, 5, 8,11	1, 2
MODULE-1			No. of Hrs. 10
RADAR FUNDAMENTALS: Introduction, The Simple Form of the Radar Equation, Radar Block Diagram and Operation, Radar Frequencies, Applications of Radar, Doppler effect, CW Radar: Isolation between transmitter and receiver, Intermediate-frequency. Receiver. Frequency modulated CW Radar: FM CW radar using sideband super heterodyne receiver, FM-CW radar extracting the third harmonic.			
MODULE-2			No. of Hrs. 10
MTI AND PULSE DOPPLER RADAR: Delay-Line Cancelers, Multiple, or Staggered, Pulse Repetition Frequencies, Range-Gated Doppler Filters, Other MTI Delay Lines, Example of an MTI Radar Processor, Limitations to MTI Performance, Noncoherent MTI, Pulse Doppler Radar, MTI from a Moving Platform.			
MODULE-3			No. of Hrs. 10
TRACKING RADAR: Tracking with Radar, Sequential Lobing, Conical Scan, Monopulse Tracking Radar, Target-Reflection Characteristics and Angular Accuracy, Tracking in Range, Acquisition, Other Topics, Comparison of Trackers, Tracking with Surveillance Radar.			
MODULE-4			No. of Hrs. 10
RADAR ANTENNAS: Antenna Parameters, Antenna Radiation Pattern and Aperture Distribution, Parabolic-Reflector Antennas, Scanning-Feed Reflector Antennas, Lens Antennas, Pattern Synthesis, Coscant-Squared Antenna Pattern, effect of Errors on Radiation patterns, Radomes, Stabilization of Antennas.			

Prescribed Text Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1.	INTRODUCTION TO RADAR SYSTEMS	Merrill I. Skolnik	2 nd	McGraw-Hill	1980
2.	Fundamentals of Microwave and Radar Engineering	Er.K.K. SHARMA	1 st	S. Chand & Company Ltd.	2011



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Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1.	Electronic Communication Systems	KENNEDY DAVIS	4 th	TMH	-

Online Courses and Video Lectures:

- <https://www.youtube.com/watch?v=K1pOShhWGhk&list=PLgwJf8NK-2e6lqeQT5Kz8Ls1lnYuNHOZz>
- <https://www.youtube.com/watch?v=VtPUPdGiPpM&list=PL3rE2jS8zxAwdVGmzgxYOripcrJQPixOk>
- <https://www.youtube.com/watch?v=XIUx9xDJqeg>

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted Simulation or case study on RADAR System	20
Total		50

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2			1						1	3	2
CO2	3	2	1		1			1			1	2	2
CO3	3	1	2		1			1			1	2	2
CO4	2	2			1			1			1	2	2



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Course Title	DIGITAL IMAGE PROCESSING		
Course Code	23OEEC75	(L-T-P) C	(3-0-0) 3
Exam	CIE 50	Hours/Week	03
SEE	50 Marks	Total Hours	40
Course Objective: Understanding of Image Processing basic concepts such as Image Enhancement, Restoration, and Image transforms, image compression and color image processing. Course Outcomes: (COs) {with mapping shown against the Program Outcomes (POs)} Upon completion of the course, students shall be able to:			
#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Understand the image fundamental concepts in digital image processing, and also understand image formation and the role of human visual system.	1, 2	1
2	Apply image transform techniques in spatial and frequency domain and able to understand image Compression and transmission techniques.	1, 2,	1
3	Analyze the basic concepts of DIP operations such as Enhancement in spatial domain and frequency domain using filters.	1, 2, 3	1
4	Implement the basic concepts of image restoration and degradation along with Noise models and mathematical models using filters.	1, 2, 3	1
MODULE-1			No. of Hrs. 10
Digital Image Fundamentals: Digital Image Processing, fundamental Components and steps of an Image processing system, Elements of Visual Perception, Image sensing and acquisition. Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships between Pixels. Self study: Types of Image Sensors			
MODULE-2			No. of Hrs. 10
Image Transforms: Two-dimensional orthogonal & unitary transforms, properties of unitary transforms, Basis images. Image Compression: Fundamentals, Image compression models, Lossless compression, Lossy compression. Self study: One dimensional unitary transforms and DFT			
MODULE-3			No. of Hrs. 10
Image Enhancement : Image Enhancement in Spatial domain, Some Basic Gray Level Trans -formations, Histogram Processing. Image enhancement in the Frequency Domain filters, Smoothing Frequency Domain filters, Sharpening Frequency Domain filters, Homomorphic filtering. Self study: Linear Filtering using Spatial domain			
MODULE-4			No. of Hrs. 10
Model of image degradation/restoration process, Noise models, Restoration in the Presence of Noise, Only-Spatial Filtering Periodic Noise Reduction by Frequency Domain Filtering. [Self-Learning: noise models]			
Color Fundamentals. Color Models, Pseudo color Image Processing., processing Basics of full color image processing. Self-Learning: CMY and CMYK Color models			



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Prescribed Text Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Digital Image Processing	Rafael C.Gonzalez and Richard E.Woods	3 rd	Pearson Education	2009
2	Fundamentals of Digital Image Processing	Anil K. Jain	3 rd	Pearson Education	2001

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Digital Image Processing	S. Jayaraman, S. Esakkirajan, T. Veerkumara	1st	TMH	2008
2	Digital image Processing	S. Sridhar	-	Oxford university press, India	2011

EBooks and online course materials:

3. <https://freecomputerbooks.com/Digital-Image-Processing.html>
4. <https://www.geeksforgeeks.org/computer-graphics/digital-image-processing-basics/>

Online Courses and Video Lectures:

2. https://onlinecourses.nptel.ac.in/noc22_ee116/preview

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIE s conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted 3) Details of activity 1 Presentation- Image Processing Applications 4) Details of activity 2 Simulation using C programs/ Matlab	20
Total		50

Activity 2- Details:

- 1.Program on reducing the Size of an Image
- 2.Program on histogram of an image
3. Program on histogram on equalization of an image

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4. Program on spatial filtering
5. program on smoothing filters in spatial filtering
6. Implement Butterworth low power filters in frequency domain
7. Implement Gaussian low power filters in frequency domain
8. program on removing salt and pepper and noise using mean and median filter
9. program on removing Gaussian noise and uniform noise using mean filter
10. Write a program in pseudo color image processing
11. Write a program on color compliments

Course Articulation Matrix

[illegible]



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Course Title	E-Waste Management		
Course Code	23OEEC76	(L-T-P) C	(3-0-0)3
Exam	3 Hours	Hours/Week	3 Hours
SEE	50 Marks	Total Hours	40

Course Objective: The objective of this course is to provide students with a comprehensive understanding of the issues, challenges, and strategies related to electronic waste (e-waste) management. It aims to equip learners with the knowledge of environmental and health impacts, legal frameworks, and sustainable practices involved in the handling, recycling, and disposal of e-waste.

Course Outcomes: {with mapping shown against the Program Outcomes (POs)} Upon completion of the course, the student shall be able to:

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Understand the multidisciplinary nature, scope, and importance of environmental studies and the need for public awareness in sustainable resource use.	6,7,8,11	-
2	Analyze the types, uses, and environmental impacts of renewable and non-renewable natural resources, and evaluate individual and collective roles in their conservation.	6,7,8,11	-
3	Demonstrate knowledge of biodiversity, its value, threats, and conservation strategies, and apply this understanding to national and global ecological contexts.	6,7,8,11	-
4	Evaluate various types of environmental pollution and e-waste hazards, and explain current technologies and methods for effective waste management and resource recovery.	1,6,7,8,11	-

MODULE-1

10 Hours

Multidisciplinary nature of environmental studies- Definition, scope and importance. Need for public awareness. Natural Resources-Renewable and non-renewable resources: Natural resources and associated problems. a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer, pesticide problems, water logging, salinity, case studies. e) Energy resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources, Case studies. f) Land resources: Land as a resource, land degradation, man induced and slides, soil erosion and desertification Role of individual in conservation of natural resources. Equitable use of resources for sustainable life styles.

MODULE-2

10 Hours

Biodiversity and its conservation-Introduction Biogeographical classification of India, Value of biodiversity: consumptive, productive, social, ethical, aesthetic and option values. India as a mega-diversity nation Hot-spots of biodiversity Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts Endangered and endemic species of India.

Environmental Pollution-Definition Causes, effects and control measures of Air pollution, Water pollution Soil pollution Marine pollution Noise pollution Thermal pollution nuclear hazards. Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

MODULE-3

10 Hours

E-waste growth- An overview, hazards of E-waste, what is E-waste, digital dump yard, how to minimize E-waste, Hazardous substances waste Electrical and Electronic Equipment, characteristics of pollutants, batteries, electrical and electronic components, plastic and flame retardants, circuit boards, pollutants in waste electrical and electronic equipment.



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MODULE-4	10 Hours
E-Waste Recycling Technologies for recovery of resources from electronic waste, resource recovery potential of e-waste, steps in recycling and recovery of materials-mechanical processing, technologies for recovery of materials.	

Prescribed Text Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1.	Environmental Studies for undergraduate Courses	Bharucha Erach	2 nd	Oxford university press	2013
2.	E-Waste Managing the Digital Dump Yard	Vishakha Munshi	-	ICFAI University Press	-
3.	E-waste: Implications, Regulations and Management in India and Current Global Best Practices	Rakesh Johri	-	The Energy and Resources Institute, New Delhi	-

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1.	Principles & Practice of Management	Prof. Vani Laturkar Dr. Amarpreet Kaur Randhawa	1 st	Yashwantrao Chavan Maharashtra Open University	2012

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Three CIEs conducted for 20 marks each and reduced to 10 marks	30
Activity Details	Details of activities to be conducted	
	1. Activity 1 - Take any article that you use in daily life – a bucket full of water, or an item of food, a table, or a book. Trace its components journey backwards from your home to their origins as natural resources in our environment. How many of these components are renewable resources and how many non-renewable?	10
	2. Activity 2 - Assignment/Quizz	10
Total		50

Course Articulation Matrix:

Course Outcomes	Program Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1						3	3	3			2	-	-
CO2						3	3	3			2	-	-
CO3						3	3	3			2	-	-
CO4	2					3	3	3			2	-	-