PAAVAI ENGINEERING COLLEGE, NAMAKKAL - 637 018

(AUTONOMOUS)

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

ACADEMIC REGULATIONS – 2019

CHOICE BASED CREDIT SYSTEM

SEMESTER V

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1	HS	BA19151	Entrepreneurship Development	3	0	0	3
2	PC	EC19501	Analog and Digital Communication	3	0	0	3
3	PC	EC19502	RF Transmission lines	3	0	0	3
4	PC	EC19503	Digital Signal Processing	3	1	0	4
5	PC	EC19504	Computer Communication Networks	3	0	0	3
6	PE	EC1915*	Professional Elective I	3	0	0	3
Practicals							
7	PC	EC19505	Digital Signal Processing Laboratory	0	0	4	2
8	PC	EC19506	Communication and Networks Laboratory	0	0	4	2
9	EE	EN19501	Career Development Laboratory I	0	0	2	1
			TOTAL	**18**	**1**	**10**	**24**

SEMESTER VI

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1	PC	EC19601	Embedded Systems	3	0	0	3
2	PC	EC19602	VLSI Design	3	0	0	3
3	PC	EC19603	Wireless Communication	3	0	0	3
4	PE	EC1925*	Professional Elective II	3	0	0	3
5	PE	EC1935*	Professional Elective III	3	0	0	3
6	OE	EC1990*	Open Elective I	3	0	0	3
Practicals							
7	PC	EC19604	Embedded Systems Laboratory	0	0	4	2
8	PC	EC19605	VLSI Laboratory	0	0	4	2
9	EE	EN19601	Career Development Laboratory II	0	0	2	1
			TOTAL	**18**	**0**	**10**	**23**

PROFESSIONAL ELECTIVE - I

S.No.	Category	Course Code	Course Title	L	T	P	C
1	PE	EC19151	Medical Electronics	3	0	0	3
2	PE	EC19152	Wireless System and Standards	3	0	0	3
3	PE	EC19153	Digital Switching and Transmission	3	0	0	3
4	PE	EC19154	Computer Architecture and Organisation	3	0	0	3

PROFESSIONAL ELECTIVE - II

S.No.	Category	Course Code	Course Title	L	T	P	C
1	PE	EC19251	Speech Processing	3	0	0	3
2	PE	EC19252	Wireless Networks	3	0	0	3
3	PE	EC19253	Display Technologies	3	0	0	3
4	PE	IT19255	Object Oriented Programming	3	0	0	3

PROFESSIONAL ELECTIVE - III

S.No.	Category	Course Code	Course Title	L	T	P	C
1	PE	EC19351	Digital Image Processing	3	0	0	3
2	PE	EC19352	Network Security	3	0	0	3
3	PE	EC19353	NanoElectronics	3	0	0	3
4	PE	IT19355	Artificial Intelligence	3	0	0	3

OPEN ELECTIVE COURSES

OPEN ELECTIVE - I

S.No.	Category	Course Code	Course Title	L	T	P	C
1	OE	EC19901	Basics of Communication Engineering	3	0	0	3
2	OE	EC19902	Introduction to Geographic Information System	3	0	0	3

BA19151 ENTREPRENEURSHIP DEVELOPMENT 3 0 0 3

COURSE OBJECTIVES

To enable students to

- understand the management principles.
- build the entrepreneurial competencies and analyse the support rendered by government and other agencies in entrepreneurship development.
- understand the business opportunities and to prepare a feasibility report.
- propose a business plan.
- appraise and comprehend the various factors to be considered for launching a small business.

UNIT I **Basics of Management:** 9

Management: Meaning, Definition, Nature and Importance: Roles of management, Functions of Management, Levels of Management. Functional areas of Management: Marketing, Finance, Production, HRM, IT, Research and Development.

The Evolution and Development of Management Thought: Classical, Neo-classical, System and Contingency Approaches, An Overview.

UNIT II **Entrepreneurial Competence and Environment** 9

Entrepreneurial Competence: Entrepreneurship, Definition, Role and expectations, Entrepreneurial styles and types, Characteristics of the Entrepreneur, Entrepreneurial Competencies, Functions of an Entrepreneur.

Entrepreneurial Environment: Role of Socio-Cultural, Economic and Political Environment, Institutional Support for small entrepreneurs, Assistance Programme for Small Scale Units, Institutional Framework, Central and State Government Industrial Policies and Regulations.

UNIT III **Entrepreneurial Development** 9

Ownership Structures, Proprietorship, Partnership, Company, Co-operative, Franchise.

Identification of Business Opportunity, Preparation of Feasibility Report, Financial and Technical Evaluation, Project Formulation, Common Errors in Project Formulation, Specimen Project Report.

Entrepreneurial Development Programs, Role of SSI Sector in the Economy, IAS Units, Failure, Causes and Preventive Measures, Turnaround Strategies.

UNIT IV **Business Plan Preparation, Financing Ventures** 9

Business Plan: Business opportunities-SWOT, Business plan process, Feasibility Study, Functional plan, Marketing plan, Operational plan, Organizational plan, financial plan, Evaluation Criteria.

Financing ventures: sources of raising capital, seed funding, venture capital funding, funding opportunities for start-ups in India.

UNIT V **Women Entrepreneurship & Entrepreneurship in various sectors** 9

Women Entrepreneurship: Growth of women Entrepreneurship, Problems faced by Women Entrepreneurs, Development of women Entrepreneurship.

Entrepreneurship in Informal Sector: Rural Entrepreneurship, Entrepreneurship in Sectors like Agriculture, Tourism, Health care, Transport and allied services.

TOTAL PERIODS: 45

COURSE OUTCOMES

At the end of this course, the students will be able to

- implement the necessary managerial skills to become an entrepreneur.
- take up self-employment having been exposed to entrepreneurial environment.
- select a best business idea by using appropriate methods to assess its viability.
- formulate a business plan and deploy the resources for sustainable growth.
- analyse channels and means of launching a small business in any sector.

TEXT BOOKS

1. Khanka S.S, "Entrepreneurial Development", S. Chand and Company Limited, New Delhi, 2016.
2. Saravanavel. P, "Entrepreneurial Development", Ess Pee Kay Publishing House, Chennai, 2013.

REFERENCES

1. Donald L. Sexton and Raymond W.Smilor, "The Art and Science of Entrepreneurship", Ballinger Publishing Company, 2008.
2. Clifford M.Baumback & Joseph R.Maneuso, "Entrepreneurship and Venture Management", Prentice Hall, 1975.
3. Gifford Pinchot, "Intrapreneuring" Harper & Row Publishers, New York, 2005.
4. Mathew Manimala, "Entrepreneurship Theory at the Crossroads", Paradigms and Praxis, Biztantra, 2nd Edition, 2015.

CO – PO Mapping:

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	2	-	-	-	-	-	-	-
CO2	-	-	-	-	-	3	-	-	2	-	1	-	-	2
CO3	-	-	2	-	-	-	-	-	-	-	-		1	2
CO4	-	-	-	2	-	-	-	-	-	-	-	-	-	1
CO5	-	-	-	-	-	-	-	2	-	-	3	-	-	-

EC19501 **ANALOG AND DIGITAL COMMUNICATION** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the concepts of analog communication techniques
- learn the transition of analog to digital communication techniques
- comprehend the various types of digital communication methods
- know the basics of statistical theory of communication
- be familiar with error control codes and techniques

UNIT I ANALOG COMMUNICATION **9**

Modulation - Types, Need for Modulation,Theory of Amplitude Modulation, Double Side Band Modulation, Single side band Modulation,Vestigial Side band Modulation; Theory of Frequency and Phase Modulation; Comparison of Analog Communication Systems - AM, FM, PM; Noise-Internal Noise.

UNIT II ANALOG TO DIGITAL TRANSITION SYSTEMS **9**

Pulse Amplitude Modulation, Pulse Width Modulation, Pulse Position Modulation, Comparison of various Pulse Communication System - PAM,PWM, PPM ; Pulse Code Modulation, Delta Modulation, Differential Pulse Code Modulation.

UNIT III DIGITAL COMMUNICATION **9**

Baseband Pulse transmission, InterSymbol Interference problem, Nyquist criterion, Raised cosine pulse; Passband Transmission; Digital modulation - Amplitude Shift Keying, Frequency Shift Keying, Phase Shift Keying, Binary Amplitude Shift Keying, Binary Phase Shift Keying, Binary Frequency Shift Keying, Quadrature Amplitude Modulation; Comparison of various Digital Communication System - ASK, FSK, PSK, QAM .

UNIT IV INFORMATION THEORY **9**

Uncertainty, Information and entropy, source coding theorem, Shannon fano coding, Huffman coding; Discrete Memoryless channels, Mutual Information, Channel capacity, Channel coding theorem, Differential entropy, Information capacity theorem.

UNIT V ERROR CONTROL CODING **9**

Types of Error Control; Linear block codes - Hamming Codes, Syndrome decoding; Cyclic codes; Convolutional codes - Code Tree,Trellis, State diagram,Viterbi algorithm.

TOTAL PERIODS **45**

COURSE OUTCOMES

At the end of this course, the students will be able to

- analyze the various types of analog communication techniques.
- evaluate analog to digital communication techniques.

- investigate the types of digital communication methods.
- apply the coding techniques of statistical theory of communication.
- validate various error control coding schemes and techniques.

TEXT BOOKS

1. Simon Haykin and Michael Moher, "Communication systems", John Wiley & Sons, 5th Edition, 2016.
2. Samuel O. Agbo and Matthew O. Sadiku, "Principles of Modern Communication Systems", Cambridge University Press, Cambridge, United Kingdom, 2017.

REFERENCES

1. Wayne Tomasi, "Advanced Electronic Communication Systems", Pearson Education, 6th Edition, 2009.
2. John G.Proakis, Masoud Salehi, "Digital Communication", 5th Edition, 2018.
3. H.Taub, D L Schilling and G.Saha, "Principles of Communication", Pearson Education, 3rd Edition, 2009.
4. B.P. Lathi and Zhi Ding, Modern Digital and Analog Communication Systems, 4th Edition Oxford University Press, New York, 2009.

CO-PO MAPPING :

Mapping of Course Outcomes with Programme Outcomes : **(1,2,3 indicates the strength of correlation) 3 – Strong , 2 – Medium , 1 – Weak**														
COs	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	1	2	-	2	-	-	-	-	2	3	3	3
CO2	3	3	1	2	-	1	-	-	-	-	2	3	3	3
CO3	3	3	1	2	-	2	-	-	-	-	2	3	3	3
CO4	3	3	1	3	-	-	-	-	-	-	2	3	3	3
CO5	3	3	1	3	-	-	-	-	-	-	2	3	3	3

EC19502 **RF TRANSMISSION LINES** 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- introduce passive filters with the basic knowledge of active RF components
- inculcate understanding of the basics required for the design of RF system
- give thorough understanding about transmission line concepts
- impart technical knowledge in impedance matching using Smith chart
- understand the concepts of waveguides and resonators

UNIT I TWO PORT NETWORK THEORY 9

Review of Low frequency parameters - Impedance, Admittance, Hybrid and ABCD parameters, Different types of interconnection of Two port networks, High Frequency parameters, Formulation of S parameters, Properties of S parameters, Reciprocal and lossless Network, Transmission matrix, RF behavior of Resistors, Capacitors and Inductors.

UNIT II RF SYSTEM CONCEPTS 9

Active RF components - Semiconductor basics in RF, bipolar junction transistors, RF field effect transistors, High electron mobility transistors; Basic concepts of RF design, Mixers, Low noise amplifiers, transducer power gain, stability considerations.

UNIT III TRANSMISSION LINE THEORY 9

Transmission line equations; Solutions for different terminations; Waveform distortion; Loading - Methods, Reflection coefficient, Input and transfer impedance, Open, short-circuited lines - reflection factor, reflection loss; Input impedance of the dissipation-less line.

UNIT IV IMPEDANCE MATCHING AND TRANSFORMATION 9

Reflection Phenomena - Standing waves, nodes - $\lambda/8$, $\lambda/4$, $\lambda/2$ lines; Stub Matching - Single, Double Stub; Smith Chart and Applications - Solutions of problems using Smith chart.

UNIT V WAVEGUIDES AND RESONATORS 9

Excitation of waves in Parallel planes - TE, TM and TEM mode of propagation in Rectangular and circular waveguides, Rectangular and circular cavity resonators - Q-factor.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the students will be able to

- explain the active and passive microwave devices, components used in RF systems.
- synthesis the multi- port RF networks knowledge about filter system.
- explain the characteristics of transmission lines and its losses and examine the propagation of signals through transmission lines.

- analyze impedance matching by stubs using smith charts.
- apply the concept of radio propagation in guided systems and evaluate waveguides and cavity resonators in several applications.

TEXT BOOKS

1. Reinhold Ludwig and Gene Bogdanov, "RF Circuit Design: Theory and Applications", Pearson Education Inc., 2011
2. John D Ryder, "Networks, lines and fields", 2nd Edition, Prentice Hall India, 2010.

REFERENCES

1. Mathew M Radmanesh, "RF and Microwave Electronics", Prentice Hall, 2000.
2. Devendra.K. Misra," Radio Frequency and Microwave communication Circuits - Analysis and Design", John Wiley and Sons, Newyork, 2004.
3. G.S.N Raju, "Electromagnetic Field Theory and Transmission Lines" Pearson Education, First Edition 2005.
4. E.C.Jordan and K.G. Balmain, Electromagnetic Waves and Radiating Systems Prentice Hall of India, 2006.

CO-PO MAPPING :

Mapping of Course Outcomes with Programme Outcomes : **(1,2,3 indicates the strength of correlation) 3 – Strong , 2 – Medium , 1 – Weak**														
COs	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	2	-	3	-	-	-	-	2	-	3	3
CO2	3	3	2	2	-	-	-	-	-	-	2	-	3	3
CO3	3	3	2	2	-	3	-	-	-	-	2	-	3	3
CO4	3	3	3	1	-	-	-	-	-	-	2	-	3	3
CO5	3	3	3	1	-	3	-	-	-	-	2	-	3	3

EC19503 **DIGITAL SIGNAL PROCESSING** **3 1 0 4**

COURSE OBJECTIVES

To enable the students to

- infer the concepts of discrete Fourier transform, properties of DFT and FFT algorithms
- know the characteristics and design of IIR filters
- understand the characteristics of FIR filters for filtering the undesired signals
- enumerate the effects of Finite word length
- study the concept of Digital signal processors and its implementation

UNIT I DISCRETE FOURIER TRANSFORM AND FAST FOURIER TRANSFORM 12

Review of signals and systems - Concept of frequency in discrete-time signals; Summary of analysis, synthesis equations for FT, DTFT - Frequency domain sampling; Review of DFT - Properties of DFT; FFT algorithms - Radix-2 FFT algorithm, Decimation in time, Decimation in frequency algorithms; Linear and circular convolution - Overlap add and save method.

UNIT II INFINITE IMPULSE RESPONSE FILTERS 12

Characteristics of practical frequency selective filters - Characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters; Design of IIR filters from analog filters - LPF, HPF, BPF, BRF; Approximation of derivatives, Impulse invariance method, Bilinear transformation, Frequency transformation in the analog domain; Structure of IIR filter - Direct form I, Direct form II, Cascade, Parallel realizations.

UNIT III FINITE IMPULSE RESPONSE FILTERS 12

Design of FIR filters - Symmetric and Anti-symmetric FIR filters, Design of linear phase FIR filters using Fourier series method; FIR filter design using windows - Rectangular, Hamming and Hanning window; Frequency sampling method; FIR filter structures - Linear phase structure, Direct form realizations.

UNIT IV FINITE WORD LENGTH EFFECTS 12

Fixed point and floating-point number representation - ADC, quantization, truncation and rounding; Quantization noise - input, output quantization, coefficient quantization error, product quantization error, overflow error; Limit cycle oscillations - scaling to prevent overflow.

UNIT V DSP PROCESSORS AND ITS IMPLEMENTATION 12

Introduction to programmable DSPs - TMS320C67xx, Architecture of C67X, C67X buses, Memory organization, CPU, ALU; Barrel shifter - Multiplier/adder unit, addressing modes, instruction set, application programs; Applications of DSP processors.

TOTAL PERIODS 60

COURSE OUTCOMES

At the end of this course, the students will be able to

- apply DFT for the analysis of digital signals and systems.
- solve design problems in IIR filters.
- analyze the design of FIR filters.
- apply the concepts of finite word length effects in DSP processors.
- implement DSP algorithms in DSP processors.

TEXT BOOKS

1. John G. Proakis & Dimitris G. Manolakis, "Digital Signal Processing - Principles, Algorithms & Applications", Fourth edition, Pearson Education / Prentice Hall, 2014.
2. Dr.B.Venkataramani, M.Bhaskar, "Digital signal Processors:Architecture, Programming and Applications", Second edition,Tata Mc Graw Hill, 2010.

REFERENCES

1. A. V. Oppenheim, R.W. Schafer and J.R. Buck, "Digital Signal Processing" First Edition, Pearson, 2015.
2. P. Ramesh Babu "Digital Signal Processing"- Sixth Edition- Scitech-2015.
3. Emmanuel C. Ifeachor & Barrie. W. Jervis, "Digital Signal Processing", Second edition Pearson Education / Prentice Hall, 2002.
4. Sanjit K. Mitra, "Digital Signal Processing - A Computer Based Approach", Tata Mc Graw Hill, 2007.

CO-PO MAPPING :

Mapping of Course Outcomes with Programme Outcomes : (1,2,3 indicates the strength of correlation) 3 – Strong , 2 – Medium , 1 – Weak														
COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	3	3
CO2	3	2	2	2	2	-	-	-	-	-	-	-	3	3
CO3	3	2	2	2	2	2	2	-	-	-	-	-	3	3
CO4	3	2	2	2	2	-	-	-	-	-	-	-	3	3
CO5	3	2	2	2	2	2	2	-	-	-	-	-	3	3

EC19504 COMPUTER COMMUNICATION NETWORKS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the network functionalities of different layers.
- be familiar with flow and error control protocols and its techniques
- know about the routing protocols
- explain the functions of the congestion control algorithms and Quality of Service
- acquaint knowledge about various application layer protocols with its security features.

UNIT I DATA COMMUNICATION AND PHYSICAL LAYER 9

Data Communication - Components - Data flow; Networks - Criteria, Physical Structure, Topology; OSI Model; Transmission Impairment; Transmission media - Guided media, twisted pair cable, Coaxial cable, Fiber optic cable; Unguided media; Switching - Circuit switching networks, Packet switching networks; Telephone networks.

UNIT II DATA LINK LAYER 9

Data Link - Services; Link-Layer Addressing; Framing; Noiseless Channels - Noisy channel protocols; PPP; HDLC; CSMA/CD, CSMA/CA; IEEE 802.3; IEEE802.11; Bluetooth; Zigbee.

UNIT III NETWORK LAYER 9

Network Layer - Services; Performance; IPV4 addresses - Classful Addressing - Classless Addressing; ARP, RARP, DHCP, ICMP; IGMP; IPV6; Routing algorithm - Distance Vector Routing, Link State Routing; Unicasting - RIP, OSPF; Multicast routing - DVMRP, PIM.

UNIT IV TRANSPORT LAYER 9

Transport Layer - Services; Connectionless and Connection Oriented Protocols; Port Numbers; UDP; TCP - Flow Control, Error Control, TCP Congestion control - Congestion avoidance-DECbit, RED; QoS - Token bucket and Leaky bucket.

UNIT V APPLICATION LAYER AND NETWORK SECURITY 9

Domain Name Space; E-Mail-SMTP, POP, IMAP; WWW; HTTP; Network Security - Categories-Symmetric Key Cryptography, Asymmetric-Key Cryptography; Firewalls.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the students will be able to

- analyze the different types of layers in a network
- elaborate flow and error control techniques to send data in a network.
- acquire knowledge about the routing algorithms.

- synthesize the congestion control techniques.
- elucidate about the various applications and security issues.

TEXT BOOKS

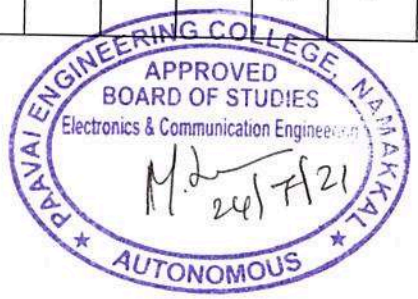
1. Behrouz A. Foruzan - "Data communications and Networking"- The McGraw-Hill Companies - Inc.5th edition, 2013.
2. William Stallings - "Data and Computer Communications" - 10th Edition, Pearson Education, 2015.

REFERENCES

1. Andrew S. Tannenbaum - "Computer Networks"- Prentice Hall, 2010.
2. James F. Kurose & Keith W. Ross - "Computer Networking - A Top-down Approach Featuring the Internet" Prentice Hall, 2013.
3. Larry L. Peterson & S. Peter Davie - "Computer Networks" - Harcourt, 2008.
4. Nader F. Mir, "Computer and Communication Networks", Second Edition, Prentice Hall, 2014.

CO-PO MAPPING :

Mapping of Course Outcomes with Programme Outcomes : (1,2,3 indicates the strength of correlation) 3 – Strong , 2 – Medium , 1 – Weak														
COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	3	-	-	-	-	2	2	-	3	3	3
CO2	3	2	2	2	-	-	-	-	2	-	-	3	2	3
CO3	3	3	2	3	-	-	-	-	2	-	2	3	3	3
CO4	3	3	2	2	-	-	-	-	2	3	-	3	3	3
CO5	3	1	2	2	-	-	-	-	2	-	2	3	2	3



EC19505 **DIGITAL SIGNAL PROCESSING LABORATORY** **0 0 4 2**

COURSE OBJECTIVES

To enable the students to

- generate the basic types of signals using SCILAB
- practice Linear and Circular Convolution using MATLAB
- understand concepts of FIR and IIR filters
- know the generation and convolution of signals using TMS320C5X/TMS320C 67XX DSP processors

LIST OF EXPERIMENTS: MATLAB /SCILAB / EQUIVALENT SOFTWARE PACKAGE

1 Generation of Signals using SCILAB.
2 Linear Convolution
3 Circular Convolution
4 Spectrum Analysis using DFT
5 FIR filter design
6 IIR filter design

DSP PROCESSOR TMS320C5X/TMS320C 67XX BASED IMPLEMENTATION

7 Study of Digital Signal Processor architecture
8 Waveform generation
9 Linear convolution
10 Circular convolution

TOTAL PERIODS 60

COURSE OUTCOMES

At the end of this course, the students will be able to

- simulate basic types of signals using SCILAB.
- demonstrate Linear and Circular Convolution using MATLAB.
- design different FIR and IIR filters.
- implement generation and convolution usingTMS320C5X/TMS320C 67XX DSP processors.

CO-PO MAPPING :

Mapping of Course Outcomes with Programme Outcomes : (1,2,3 indicates the strength of correlation) 3 – Strong , 2 – Medium , 1 – Weak														
COs	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	3	2	3	-	-	-	3	-	2	3	3	3
CO2	3	2	3	2	3	-	-	-	3	-	1	3	3	3
CO3	3	2	3	2	3	-	-	-	3	-	2	3	3	3
CO4	3	2	3	2	3	-	-	-	3	-	1	3	3	3

EC19506 COMMUNICATION AND NETWORKS LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable the students to

- understand the concept of sampling, analog modulation and digital modulation schemes
- identify the method for error control
- find the different ARQ protocols for error free transmission
- know the routing algorithms

LIST OF EXPERIMENTS: (MATLAB/SIMULINK/NETSIM)

1 Verification of sampling theorem and Simulation of Time Division Multiplexing
2 Simulation of Amplitude Modulation and Frequency Modulation
3 Simulation of Pulse Amplitude Modulation and Pulse Width Modulation
4 Simulation of ASK, PSK and DPSK schemes
5 Simulation of signal constellations of BPSK, QPSK and QAM
6 Simulation of Error control coding schemes - Linear Block Codes
7 Implementation and study of stop and wait protocol
8 Implementation and study of Go back-N and selective repeat protocols
9 Implementation of Data encryption and decryption
10 Implementation of Link state routing algorithm

TOTAL PERIODS 60

COURSE OUTCOMES

At the end of this course, the students will be able to

- verify sampling theorem, analog modulation and digital modulation schemes.
- simulate and verify error control schemes.
- implement ARQ protocols.
- generate the shortest path route in the network.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcomes : (1,2,3 indicates the strength of correlation) 3 – Strong , 2 – Medium , 1 – Weak														
COs	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	2	-	-	-	3	-	-	3	3	3
CO2	3	3	3	3	3	-	-	-	2	-	-	2	3	3
CO3	3	3	3	3	2	-	-	-	3	-	-	2	3	3
CO4	3	3	3	3	3	-	-	-	3	-	-	3	3	3

EN19501 **CAREER DEVELOPMENT LABORATORY I** **0 0 2 1**

COURSE OBJECTIVES

To enable students to

- enhance their own potential strength and reduce weakness to survive in corporate world
- evaluate their own personality skills to face the interviews in a successful way
- solve the quantitative aptitude problems and improve their problem-solving skills
- solve the quantitative aptitude in advance level tests to get placed in Tier 1 companies
- improve their reasoning skills to get placed in reputed companies

UNIT I BASICS - SELF ANALYSIS **6**

Introduction - Self Explorations -Who Am I; Know yourself; SWOT Analysis - Corporate resume building - Group Discussion: Level - 0 - Role Play: Team

UNIT II PERSONALITY DEVELOPMENT **6**

Just A Minute (JAM): Level 0-Extempore - Johari Window Model - Goal Setting - Achievement worksheet - Group Discussion: Leve-1 - Mock Interview Practice: Level 0

UNIT III QUANTITATIVE APTITUDE I **6**

Number System - LCM & HCF - Square root & Cube root - Percentage - Time - Speed & Distance

UNIT IV QUANTITATIVE APTITUDE II **6**

Trains - Boats & Streams - Average - Ages - Area

UNIT V LOGICAL AND VERBAL REASONING **6**

Series Completion: Number Series, Letter Series, Symbol Series - Blood Relation - Coding and Decoding - Logical Sequence - Analogy - Character Puzzles – Classification - Data Sufficiency

TOTAL PERIODS 30

COURSE OUTCOMES

Upon completion of the course, the students will be able to

- demonstrate the interpersonal skills in Group Discussions
- enhance their verbal and written ability
- practice soft skills to excel in their jobs
- compute problems based on quantitative aptitude
- reveal their logical and verbal reasoning by scoring the expected percentage to get placed in reputed companies

TEXTBOOKS

1. Agarwal, R.S." A modern approach to Verbal & Non Verbal Reasoning", S.Chand & Co Ltd, New Delhi
2. Agarwal, R.S. "Objective General English", S.Chand & Co.

REFERENCES

1. Abhijit Guha, "Quantitative Aptitude ", Tata-Mcgraw Hill.
2. Word Power Made Easy By Norman Lewis , Wr.Goyal Publications
3. Johnson, D.W. Reaching out - Interpersonal Effectiveness and self-actualization. Boston: Allyn and Bacon.
4. Infosys Campus Connect Program – students' guide for soft skills

CO-PO MAPPING :

Mapping of Course Outcomes with Programme Outcomes : (1,2,3 indicates the strength of correlation) 3 – Strong , 2 – Medium , 1 – Weak														
COs	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	3	3	1	-	-	-	-	-	-	3	2
CO2	-	2	3	-	2	-	2	-	-	-	-	-	3	2
CO3	3	2	2	2	-	-	1	-	-	-	-	-	2	3
CO4	3	2	2	-	-	1	-	-	-	-	2	-	2	3
CO5	2	3	3	2	1	3	3	1	-	1	2	-	2	3

EC19601 **EMBEDDED SYSTEMS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the overview of Embedded System Architecture.
- know the process of Embedded system development.
- enumerate the basic concepts of real time Operating System.
- be familiar with software development tools.
- acquaint knowledge about the concepts of embedded applications.

UNIT I ARCHITECTURE OF EMBEDDED SYSTEMS **9**

Categories of Embedded Systems - Specifications of Embedded Systems, Recent trends in Embedded Systems; Hardware Architecture - Software Architecture; Communication Software - Process of generation of executable image - development/testing tools.

UNIT II PROCESS OF EMBEDDED SYSTEM DEVELOPMENT **9**

Development Process; Requirements Engineering Design - Implementation - Integration and Testing Packaging; Configuration Management - Managing Embedded System Development Project; Design trade-offs due to process compatibility - thermal considerations.

UNIT III REAL - TIME OPERATING SYSTEMS CONCEPTS **9**

Architecture of the Kernel - task and task Scheduler - Interrupt Service Routines; DMA and DMA controllers, Semaphores, Mutex Mailboxes, Message Queues, Event Registers, Pipelining, Signals; Timers-Memory Management; Priority Inversion Problem - super scalar execution - Co-processors and Hardware Accelerators; Inter-process Communication.

UNIT IV SOFTWARE DEVELOPMENT TOOLS **9**

Software Development environment - IDE, assembler, compiler, linker, simulator, debugger, in-circuit emulator; Target Hardware Debugging, Need for Hardware - Software Partitioning and Co-Design; Overview of UML, Scope of UML modelling;

UNIT V APPLICATIONS OF EMBEDDED SYSTEMS **9**

Applications - Data compressor, Alarm Clock, Audio player, Software modem, Digital still camera, Telephone answering machine, Engine control unit, Video accelerator, Washing Machine, Set-top Box, Inkjet Printer.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the students will be able to

- describe the hardware and software architectures of Embedded Systems.
- distinguish the devices and buses used for Embedded Networking
- interpret the concepts of a Real Time Operating System.
- elucidate the special features of software development tools.
- implement real-time applications using embedded-system concepts.

TEXT BOOKS

1. K.V.K.K. Prasad "Embedded /Real-Time Systems: Concepts, Design and Programming" Wiley 2016.
2. Raj Kamal, "Embedded Systems Architecture Programming and Design", Second Edition, McGraw Hill, 2017

REFERENCES

1. Andrew N. Sloss, Dominic Symes, Chris Wright, "ARM System Developers Guide Designing and Optimizing system Software", Morgan Kaufmann Publishers, Elsevier, 2014.
2. Jonathan W. Valvano, "Embedded Microcomputer Systems Real Time Interfacing", Third Edition Cengage Learning, 2012.
3. David. E. Simon, "An Embedded Software Primer", 1st Edition, Fifth Impression, Addison Wesley Professional, 2017
4. Wolf, W. "Computers as Components - Principles of embedded computing system design", Second edition, Academic Press, 2008

CO-PO MAPPING :

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COs	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	2	-	-	-	-	-	-	1	2	3	2
CO2	3	2	2	3	-	-	-	-	-	-	-	2	2	3
CO3	3	3	2	2	-	-	-	-	-	-	1	2	3	2
CO4	3	2	2	2	-	-	-	-	-	-	-	2	2	3
CO5	3	3	2	2	-	-	-	-	-	-	1	2	3	2

EC19602 **VLSI DESIGN** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the MOS circuit realization and various processing technologies.
- identify the transistor circuit level design and realization for digital operation.
- learn the circuit characteristics and performance estimation.
- recognize the knowledge about various VLSI system components.
- acquire the basics of Verilog in different types of Modeling.

UNIT I MOS TRANSISTOR THEORY AND PROCESS TECHNOLOGY **9**

NMOS and PMOS transistors ; Threshold voltage ; Body effect ; MOS device design equations-Second order effects; Small signal AC characteristics ; Basic CMOS Technology.

UNIT II INVERTERS AND LOGIC GATES **9**

NMOS and CMOS inverters ; Stick diagram ; Inverter ratio ; DC characteristics - Transmission gates ; CMOS logic structures - Static CMOS design - Dynamic CMOS design.

UNIT III CIRCUIT CHARACTERISATION AND PERFORMANCE ESTIMATION **9**

Resistance estimation; Capacitance estimation; Switching characteristics - Transistor sizing - Design margining; Charge sharing - scaling.

UNIT IV VLSI SYSTEM COMPONENTS **9**

Architectures of ripple carry adder-carry look ahead adder; High speed adders-carry select adder carry save adder; Multipliers; Barrel shifter; Speed and area trade off.

UNIT V SPECIFICATION USING VERILOG HDL **9**

Overview of digital design with Verilog HDL - VLSI design flow,operators; Gate level modeling, Data flow modeling , Behavioral modelling ; HDL programs for simple combinational and sequential circuits.

TOTAL PERIODS **45**

COURSE OUTCOMES

At the end of this course, the students will be able to

- apply the basic concepts of MOS transistor logic.
- compare different CMOS designs.
- distinguish the performance of CMOS circuits.
- exercise the CMOS logic to design various digital modules for VLSI system design.
- work on modeling concepts of hardware description language.

TEXT BOOKS

1. Neil.H.E Weste David Harris -"CMOS VLSI Design: A Circuits and Systems Perspective", 4th Edition, Pearson Addison Wesley, 2015.
2. Wayne Wolf - "Modern VLSI Design System on chip"- Pearson Education - 2012.

REFERENCES

1. John P. Uyemura - "Introduction to VLSI Circuits and Systems"- John Wiley and Sons,2016
2. Kamran Eshraghian, Douglas A. Pucknell - "Essentials of VLSI Circuits and Systems", Prentice Hall of India, 2015
3. Keng,Lable bick - "CMOS Digital Integrated Circuits", Tata McGraw Hill, 2014.
4. Bhasker J - "A Verilog HDL Primer"- 2nd Edition,B. S. Publications, 2001.

CO-PO MAPPING :

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CO1	3	3	3	-	3	-	1	-	1	-	2	3	3	3
CO2	3	3	3	-	3	-	1	-	1	-	2	3	3	3
CO3	3	3	3	-	3	-	1	-	1	-	2	3	3	3
CO4	3	3	3	-	3	-	1	-	1	-	2	3	3	3
CO5	3	3	3	-	3	-	1	-	1	-	2	3	3	3

EC19603 WIRELESS COMMUNICATION 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- acquire knowledge about the design of a cellular system.
- understand the basic concepts of wireless channels.
- acquaint with the basic signal processing techniques.
- be familiar with the multipath mitigation techniques.
- know the different antenna techniques for wireless communication.

UNIT I CELLULAR SYSTEM DESIGN 9

Evolution of mobile communication system; Cellular concept - Frequency reuse; channel assignment strategies; Handoff-Considerations; Interference and system capacity - Co-channel, adjacent channel, power control; Trunking; grade of service; Coverage and capacity improvement; Multiple access techniques - FDMA, TDMA, CDMA, SDMA.

UNIT II WIRELESS CHANNELS 9

Large scale path loss - Path loss models - Free Space and Two-Ray models ; Link Budget design ; Small scale fading - Parameters of mobile multipath channels - Time dispersion parameters, Coherence bandwidth, Doppler spread , Coherence time; Fading due to Multipath time delay spread - flat fading, frequency selective fading; Fading due to Doppler spread - fast fading , slow fading.

UNIT III SIGNAL PROCESSING FOR WIRELESS COMMUNICATION 9

Modulation techniques - M-QAM, M-PSK, GMSK, OFDM; Spread Spectrum Systems - PN sequence, Direct Sequence Spread Spectrum, Frequency Hopping Spread Spectrum, Synchronization techniques for Spread Spectrum signals.

UNIT IV MULTIPATH MITIGATION TECHNIQUES 9

Equalisation - Adaptive equalization, Linear and Non-Linear equalization; Zero forcing and LMS Algorithms; Diversity - Micro and Macro diversity, Diversity combining techniques; Error probability in fading channels with diversity reception, Rake receiver.

UNIT V MULTIPLE ANTENNA TECHNIQUES 9

MIMO systems - spatial multiplexing, System model, Pre-coding, Beam forming, transmitter diversity, receiver diversity; Channel state information-capacity in fading and non-fading channels.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the students will be able to

- design a cellular system based on resource availability and traffic demands.
- characterize a wireless channel and evolve the system design specifications.
- analyze modulation schemes used in wireless standards

- identify suitable signaling and multipath mitigation techniques for the wireless channel and system under consideration.
- distinguish different MIMO techniques.

TEXT BOOKS

1. Rappaport, T.S., "Wireless Communications-Principles and Practice", Pearson Education, Second Edition, 2014.
2. Andreas.F. Molisch, "Wireless Communications", John Wiley - India, Second Edition,2011.

REFERENCES

1. Andrea Goldsmith - "Wireless Communication", Cambridge University Press, 2011.
2. Upena Dalal, "Wireless Communication", Oxford University Press, 2014.
3. Van Nee, R. and Ramji Prasad, "OFDM for Wireless Ccommunications", Artech House, 2004.
4. David Tse and Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2005.

CO-PO MAPPING :

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COs	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	3	1	-	-	-	-	1	-	2	3	3	3
CO2	3	2	2	1	-	-	-	-	1	-	2	3	3	3
CO3	3	2	2	1	-	-	-	-	2	-	1	3	3	3
CO4	3	2	1	1	-	-	-	-	1	-	1	3	3	3
CO5	3	2	2	1	-	-	-	-	2	-	1	3	3	3

EC19604 **EMBEDDED SYSTEMS LABORATORY** **0 0 4 2**

COURSE OBJECTIVES

To enable the students to

- examine the working of ARM processor
- differentiate the building blocks of Embedded Systems
- interpret the concept of memory map and memory interface
- recognize the characteristics of Real Time Systems and infer the interrupt performance.

LIST OF EXPERIMENTS

1. Flashing of LEDS.
2. Interface Switches and LED's.
3. Interface LCD and Display "Hello World".
4. Interface 4*4 Matrix Keypad.
5. Interfacing seven segments and analysis the Interrupts.
6. Interfacing EPROM.
7. Interfacing RTC.
8. Images read and write in GLCD.
9. Interfacing stepper motor with Arduino UNO.
10. Interfacing DC Motor with Arduino UNO.
11. Interfacing Servo Motor with Arduino UNO.
12. DIY project using sensors with Arduino UNO.

TOTAL PERIODS 60

COURSE OUTCOMES

At the end of this course, the students will be able to

- write programs in ARM for a specific application.
- experiment interface memory and write programs related to memory operations
- analyze the performance of interrupts.
- write programs for interfacing keyboard, display, motor.

CO-PO MAPPING :

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COs	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	2	-	-	-	3	-	-	3	3	3
CO2	3	3	3	3	3	-	-	-	2	-	-	2	3	3
CO3	3	3	3	3	2	-	-	-	3	-	-	2	3	3
CO4	3	3	3	3	3	-	-	-	3	-	-	3	3	3

PAAVAI ENGINEERING COLLEGE, NAMAKKAL
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EC19605 **VLSI LABORATORY** **0 0 4 2**

COURSE OBJECTIVES

To enable the students to

- understand various combinational and sequential circuits
- know the design of combinational and sequential circuits using FPGA
- learn the implementation of real time clock using FPGA
- study and implement CMOS circuits using Microwind.

LIST OF EXPERIMENTS

1 Design and Simulation of adders and subtractors using Verilog HDL.
2 Design and Simulation of ripple carry adder using Verilog HDL.
3 Design and Simulation of flipflops using Verilog HDL.
4 Implementation of multiplexer and demultiplexer using FPGA.
5 Implementation of synchronous up and down counter circuits using FPGA.
6 Implementation of Real time clock using FPGA.
7 Design and Implementation of encoder and decoder circuits using Schematic entry.
8 Design and Simulation of CMOS inverter using Microwind.
9 Design and Simulation of basic logic gates using Microwind.
10 Study of Pin Assignment, Placement and routing using FPGA.

TOTAL PERIODS 60

COURSE OUTCOMES

At the end of this course, the students will be able to

- design various Combinational and Sequential Circuits.
- analyze pin assignment- placement and routing using FPGA.
- implement Real time clock using FPGA.
- acquire the knowledge about CMOS circuits and basic logic gates using Microwind.

CO-PO MAPPING :

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

EN19601 **CAREER DEVELOPMENT LABORATORY II** **0 0 2 1**

COURSE OBJECTIVES

To enable students to

- enhance their own potential strength and reduce weakness to survive in corporate world
- evaluate their own personality skills to face the interviews in a successful way
- solve the quantitative aptitude problems and improve their problem-solving skills
- solve the quantitative aptitude in advance level tests to get placed in Tier 1 companies
- improve their reasoning skills to get placed in reputed companies

UNIT I **CORPORATE READINESS** **6**

Writing Skills: Email Writing - Paragraph writing -Time Management - Stress Management - JAM: Level 1 - Self Introduction - JAM: Level 2 – Buddy Presentation - Role Play: Individual

UNIT II **INTERVIEW SKILLS** **6**

Group Discussion: Level II - Group Discussion: Level III - General - Interview Techniques - Selection process - Grooming - Dress code - Body Language – Mock Interview Practice: Level 1

UNIT III **QUANTITATIVE APTITUDE I** **6**

Simplification - Time and work - Pipes and cisterns - Ratio and Proportion - Partnership

UNIT IV **QUANTITATIVE APTITUDE II** **6**

Simple interest and Compound interest - Profit and loss - Permutation and combination Probability - Calendar

UNIT V **LOGICAL AND VERBAL REASONING** **6**

Seating arrangement - Direction - Arithmetic reasoning - Syllogisms - Making Judgments - Statements and conclusions - Matching definition - Cause and effect

TOTAL PERIODS 30

COURSE OUTCOMES

Upon completion of the course, the students will be able to,

- demonstrate the interpersonal skills in Group Discussions
- enhance their verbal and written ability
- practice soft skills to excel in their jobs
- compute problems based on quantitative aptitude
- reveal their logical and verbal reasoning by scoring the expected percentage to get placed in reputed companies

TEXTBOOKS

1. Agarwal, R.S." a modern approach to Verbal & Non Verbal Reasoning", S.Chand & Co Ltd, New Delhi
2. Agarwal, R.S. "Objective General English", S.Chand & Co

REFERENCES

1. Abhijit Guha, "Quantitative Aptitude ", Tata-McGraw Hill.
2. Word Power Made Easy By Norman Lewis ,Wr.Goyal Publications
3. Johnson, D.W. Reaching out - Interpersonal Effectiveness and self actualization. Boston: Allyn and Bacon.
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CO1	3	2	2	3	3	1	-	-	-	-	-	-	3	2
CO2	-	2	3	-	2	-	2	-	-	-	-	-	3	2
CO3	3	2	2	2	-	-	1	-	-	-	-	-	2	3
CO4	3	2	2	-	-	1	-	-	-	-	2	-	2	3
CO5	2	3	3	2	1	3	3	1	-	1	2	-	2	3

PROFESSIONAL ELECTIVES (PE)

PROFESSIONAL ELECTIVE - I

S.No.	Category	Course Code	Course Title	L	T	P	C
1	PE	EC19151	Medical Electronics	3	0	0	3
2	PE	EC19152	Wireless System and Standards	3	0	0	3
3	PE	EC19153	Digital Switching and Transmission	3	0	0	3
4	PE	EC19154	Computer Architecture and Organisation	3	0	0	3

PROFESSIONAL ELECTIVE - II

S.No.	Category	Course Code	Course Title	L	T	P	C
1	PE	EC19251	Speech Processing	3	0	0	3
2	PE	EC19252	Wireless Networks	3	0	0	3
3	PE	EC19253	Display Technologies	3	0	0	3
4	PE	IT19255	Object Oriented Programming	3	0	0	3

PROFESSIONAL ELECTIVE - III

S.No.	Category	Course Code	Course Title	L	T	P	C
1	PE	EC19351	Digital Image Processing	3	0	0	3
2	PE	EC19352	Network Security	3	0	0	3
3	PE	EC19353	Nanoelectronics	3	0	0	3
4	PE	IT19355	Artificial Intelligence	3	0	0	3

EC19151 **MEDICAL ELECTRONICS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- gain knowledge about the various electro-physiological parameters, it's methods of recording and also transmitting.
- understand the different bio-chemical and non - electrical parameters.
- learn about the various assist devices used in the hospitals.
- be familiar with the equipments used for physical medicine and biotelemetry
- know about recent trends in medical instrumentation.

UNIT I ELECTRO-PHYSIOLOGY AND BIOPOTENTIAL RECORDING 9

Origin of Bio-potentials, biopotential electrodes; bioamplifiers; ECG, EEG, EMG, PCG, lead systems and recording methods, typical waveforms, signal characteristics.

UNIT II BIO-CHEMICAL AND NON-ELECTRICAL PARAMETER MEASUREMENT 9

pH, PO2, PCO2, Colorimeter; Auto analyzer, Blood flow meter; cardiac output respiratory measurement; Blood pressure, temperature, pulse rate; Blood cell counters.

UNIT III ASSIST DEVICES 9

Cardiac pacemakers - Need, different types; Ventilators; DC defibrillators - asynchronous and synchronous; Hemodialyser - Membrane, Dialysate; Heart lung machine - Block diagram, oxygenators and pumps.

UNIT IV PHYSICAL MEDICINE AND BIOTELEMETRY 9

Diathermies - Shortwave, ultrasonic, microwave type, applications, Surgical Diathermy; Telemetry principles, frequency selection, biotelemetry, radiopill; electrical safety.

UNIT V RECENT TRENDS IN MEDICAL INSTRUMENTATION 9

Thermography - principle, detectors; Endoscopy unit; Applications of Laser in medicine, cryogenic application, Introduction to telemedicine.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of the course, the students will be able to

- analyze the various biosignals and vital parameters.
- explain the function and application of various diagnostic equipments.
- illustrate the working of various assist devices.

- work with the equipments used for physical medicine.
- explain about the recent developments in the field of medical engineering.

TEXT BOOKS

1. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, "Biomedical Instrumentation and Measurements", Pearson Education India, 2nd Edition, 2015.
2. John G. Webster, "Medical Instrumentation Application and Design", John Wiley and Sons, New York, 4th Edition, 2009.

REFERENCE BOOKS

1. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw Hill, New Delhi, 3rd Edition, 2014.
2. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson Education, 4th Edition, 2014.
3. John Denis Enderle, Joseph D. Bronzino, Susan M. Blanchard, Introduction to Biomedical Engineering: 'Academic Press, 3rd Edition 2012.
4. C.Raja Rao, Sk Guha, "Principles of Medical Electronics and Biomedical Instumentation", University Press,2000.

CO-PO MAPPING :

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

EC19152 **WIRELESS SYSTEM AND STANDARDS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- know the concepts of TDMA, GSM, CDMA in 2G and 3G UMTS in wireless cellular networks
- understand the wireless system operstions and standards
- gain knowledge about various wireless application protocols
- be familiar with the different wireless network standards
- possess knowledge on Personal Area Network

UNIT I SECOND AND THIRD GENERATION: ARCHITECTURE AND PROCESS FLOW **9**

Second Generation TDMA - GSM Architecture, Air Interface, Channels, Voice-call setup, Handover, EDGE architecture; Second Generation CDMA - Forward and Reverse channel, Call Handoff; Third Generation systems - UMTS network architecture.

UNIT II WIRELESS SYSTEM OPERATIONS AND STANDARDS **9**

Cordless systems -Time Division Duplex, DECT Operation, ADPCM; Wireless Local Loop - Propagation considerations for WLLOFDM, WiMAX and IEEE 802.16; Broadband Wireless Access Standards - Architecture, Services, MAC Layer, Physical Layer; Long-Term Evolution-System Architecture, Transmission Techniques, Channels in the radio interface, Radio Resource Management.

UNIT III WIRELESS APPLICATION PROTOCOLS **9**

Wireless Application Protocol - Architectural Overview, Wireless Markup Language, WML Script, Wireless Application Environment, Wireless Session Protocol, Wireless Transaction Protocol, Wireless Transport Layer Security, Wireless Datagram Protocol.

UNIT IV WIRELESS LANS **9**

Spread Spectrum LANs - Configuration, Transmission issues; Narrowband Microwave LANs - Licensed Narrow Band RF, Unlicensed narrowband RF; IEEE 802.11- Architecture and services, Wi-Fi alliance, Medium Access Control, Reliable Data Delivery, IEEE 802.11a/b Physical Layer - Introduction to 802.11n - Infrared LANs - Strengths and Weakness, Transmission techniques.

UNIT V WIRELESS PAN **9**

PAN - Radio Specification, Baseband and Specification, Link Manager Specification, Logical Link Control and Adaptation Protocol; IEEE 802.15-IEEE 802.15.3/a, IEEE 802.15.4; UWB, Optical Wireless Wavelength Division Multiplexing.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the students will be able to

- outline the concepts of TDMA, GSM, CDMA in the second-generation wireless cellular networks.
- describe the working principles of various wireless standards and its operations
- explain the various wireless application protocols
- analyse the various types wireless LANs and summarize the Wireless LAN Standards
- enumerate the features and operations of various Wireless Personal Area Networks and its standards

TEXT BOOKS

1. Clint Smith, P.E. and Daniel Collins, "3G Wireless Networks", Tata McGraw Hill, 2nd Edition, 2017.
2. Kaveh Pahlavan and Prashant Krishnamurthy, "Principles of Wireless networks - A unified Approach", Prentice Hall, 2013.

REFERENCE BOOKS

1. William Stallings, "Wireless Communications and Networks", Prentice Hall, 2nd Edition 2009.
2. Dharma Prakash Agarwal and Qing-An Zeng, "Introduction to Wireless and Mobile Systems", Thomson India, 3rd Edition, 2011.
3. Vijay. K. Garg, "Wireless Communication and Networking", Morgan Kauffmann Publishers, 2007.
4. Mischa Schwartz, "Mobile Wireless Communications", Cambridge University Press, 2005.

CO-PO MAPPING:

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CO1	3	3	3	3	2	-	1	-	-	-	-	3	3	3
CO2	3	3	3	3	2	-	1	-	-	-	-	3	3	3
CO3	3	3	3	3	2	-	1	-	-	-	-	3	3	3
CO4	3	3	3	3	2	-	1	-	-	-	-	3	3	3
CO5	3	3	3	3	2	-	1	-	-	-	-	3	3	3

EC19153 **DIGITAL SWITCHING AND TRANSMISSION** 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- gain knowledge about the different types of signaling in digital telephony.
- learn the technology involved in space switching, time switching and combination switching.
- get exposed to the complete fundamentals and essential features in the statistical modeling of telephone traffic.
- know about the evolution of switching systems and the synchronization.
- understand the basics of telecommunication networks and digital transmission of data.

UNIT I EVOLUTION AND BUILDING BLOCKS OF SWITCHING SYSTEMS 9

Message switching and Circuit switching - Building blocks of a digital switching system, functions of switching systems - Distribution systems; Digital Switching Systems - Switching system hierarchy - Evolution of digital switching systems - Stored program control switching system; Basic Call processing - Call signaling - SS7 signalling, Basics of crossbar systems, electronic switching.

UNIT II DIGITAL SWITCHING TECHNOLOGIES 9

Introduction, Single stage networks, Gradings, Link Systems, GOS of Linked systems Space Division switching - Folded switches - Digital Time Division switching - Combinational Two dimensional switching, SpaceTime and Time-Space switching, Three dimensional - Space-Time-Space and Time Space Time switching ; Digital Cross Connect Systems - DCS hierarchy, Multiplexing , Framing- types and standards; Trunk signaling; Optical Transmission-line codes and Muxing: SONET/SDH; ATM; Microwave and Satellite Systems.

UNIT III TELECOMMUNICATION TRAFFIC 9

Unit of traffic - congestion - traffic parameters - Mathematical model, lost call systems, Queuing systems; Busy Hours Call attempt, Traffic Intensity, Call processing capacity; Call Completion Ratio - Call Blocking Probability, Grade of Service, Holding time distributions, Arrival time Distributions, Loss Systems , Erlang B-Formula , Delay Systems ,Service Times - Erlang C Formula.

UNIT IV NETWORK SYNCHRONISATION 9

Timing Recovery - Clock instability, Jitter, Slips; Asynchronous Multiplexing - space and time switching, Time switching networks; Synchronisation - Plesiochronous Network Synchronisation, Pulse stuffing , Mutual synchronization , Master Slave synchronization , Hierarchical synchronization; Switching System Software - Basic software architecture, Software architecture for level 1- 3 control.

UNIT V TRANSMISSION SYSTEMS 9

Network Structure - services, regulations, standards; Digital Transmission - PDH, SDH - SDH Features - Network evolution - Cross connect - Add-Drop Mux - SDH Frame structure; Analog Local Loop; ISDN

local loop; DSL,ADSL; Wireless Local Loop; Fiber in the loop; Mobile,Satellite Phone local loop.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the students will be able to

- explain the electromechanical switching systems and its comparison with the digital switching.
- define the technologies associated with the data switching operations
- analyze and determine traffic parameters related to call connect and grade of service.
- describe the operating principles of network synchronization and clock recovery.
- design transmission and switching systems to meet out the required blocking probability.

TEXT BOOKS

1. J.C. Bellamy, "Digital Telephony", Third Edition, Wiley, 2006.
2. J.E. Flood, "Telecommunication Switching, Traffic and Networks", Pearson, 2007.

REFERENCES

1. Thiagarajan Viswanathan, "Telecommunication Switching Systems and Networks", Prentice Hall India, 2015.
2. Viswanathan, "Telecommunication Switching Systems and Networks", Prentice Hall India, 2006.
3. Wayne Tomasi "Advanced electronic communications systems", Prentice Hall India, 2014.
4. E. Keiser & E. Strange, "Digital Telephony and Network Integration", Second Edition,Van Nostrand, 1995.

CO-PO MAPPING :

Mapping of Course Outcomes with Programme Outcomes : (1,2,3 indicates the strength of correlation) 3 – Strong , 2 – Medium , 1 – Weak														
COs	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	-	3	-	-	-	-	-	2	3	3	2
CO2	3	3	3	-	3	-	-	-	-	-	1	3	3	2
CO3	3	3	3	1	3	-	-	-	-	-	2	3	3	2
CO4	3	3	3	-	3	-	-	-	-	-	1	3	3	2
CO5	3	3	3	1	2	-	-	-	-	-	3	3	3	2

EC19154 COMPUTER ARCHITECTURE AND ORGANISATION 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- know the basic structure and operation of a digital computer
- learn the arithmetic and logic unit and implementation of processing unit.
- gain knowledge about the concepts of pipelining.
- understand the hierarchical memory system including cache and virtual memories.
- make the different ways of communication with I/O devices.

UNIT I STRUCTURE OF COMPUTERS **9**

Functional Units; Basic Operational Concepts; Performance; Instruction Set Architecture - Instructions and Instruction Sequencing - Addressing Modes; RISC and CISC; Fixed Point and Floating-Point Operations.

UNIT II PROCESSING UNIT **9**

Fundamental Concepts; Instruction Execution; Hardware Components; Instruction Fetch and Execution Steps; Hardwired Control - Micro Programmed Control; Nano Programming.

UNIT III PIPELINING **9**

Basic Concepts; Pipeline Organization - Pipelining Issues; Data Dependencies; Memory Delays - Branch Delays; Resource Limitations; Performance Evaluation; Superscalar Operation.

UNIT IV MEMORY SYSTEM **9**

Basic Concepts; Semiconductor RAM Memories - Read Only Memories, Memory Hierarchy, Cache Memories; Performance Considerations; Virtual Memory - Memory Management Requirements- Secondary Storage Devices.

UNIT V I/O ORGANIZATION **9**

Accessing I/O Devices - Programmed I/O - Interrupt Initiated I/O; Direct Memory Access; Buses - Bus Arbitration; Interconnection Standards - SCSI, USB, SATA - I/O Devices and Processors.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the students will be able to

- demonstrate the instruction sets with various addressing modes.
- outline the execution of instructions and working of hardwired control, micro programmed control.
- summarize pipelining concepts and superscalar operation.
- evaluate the performance of memory in commercial processor
- analyze the organization of I/O devices.

TEXT BOOKS

1. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software interface", 5th Edition, Elsevier, 2014.
2. John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata McGraw Hill,2012

REFERENCES

1. M. Morris Mano, "Computer System Architecture", 3rd Edition, McGraw Hill Reprint, 2012.
2. William Stallings, "Computer Organization and Architecture - Designing for Performance", 8th Edition, Prentice Hall, 2010
3. John L. Hennessey and David A. Patterson, "Computer Architecture - A Quantitative Approach" Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012.
4. D.A. Patterson y J.L.Hennessy, "Computer Organization and Design: The Hardware/Software Interface."Morgan Kaufmann. 4th Edition, 2009.

CO-PO MAPPING :

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CO1	3	-	1	-	2	2	-	-	3	-	2	3	3	3
CO2	3	2	-	1	2	-	-	-	-	-	2	3	3	3
CO3	3	-	1	-	2	-	-	-	-	-	2	3	3	3
CO4	2	-	-	2	2	-	-	-	-	-	2	2	2	3
CO5	3	-	-	-	2	3	-	-	2	-	2	3	3	3

EC19251 **SPEECH PROCESSING** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the fundamentals of speech concepts and its related parameters.
- show the computation and use of techniques such as short time Fourier transform, linear predictive coefficients and other coefficients in the analysis of speech.
- know the different speech modeling procedures such as Markov,its implementation procedures
- learn the various speech recognition methods and its applications.
- gain knowledge about the speech synthesis methods and its applications

UNIT I SPEECH CONCEPTS **9**

Speech Fundamentals: Articulatory Phonetics - Production and Classification of Speech Sounds; Acoustic Phonetics - acoustics of speech production; Review of Digital Signal Processing concepts - Short-Time Fourier Transform, Filter-Bank, LPC Methods.

UNIT II SPEECH ANALYSIS **9**

Features, Feature Extraction and Pattern Comparison Techniques - Speech distortion measures, mathematical and perceptual, Log Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients; Time Alignment and Normalization - Dynamic Time Warping, Multiple Time-Alignment Paths.

UNIT III SPEECH MODELING **9**

Hidden Markov Models - Markov Processes, HMMs-Evaluation, Optimal State Sequence, Viterbi Search, Baum - Welch Parameter Re-estimation, Implementation issues.

UNIT IV SPEECH RECOGNITION **9**

Large Vocabulary Continuous Speech Recognition - Architecture of a large vocabulary continuous speech recognition system, acoustics and language models, n-grams, context dependent sub-word units; Applications.

UNIT V SPEECH SYNTHESIS **9**

Text-to-Speech Synthesis - Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness, role of prosody; Applications.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the students will be able to

- model speech production system and describe the fundamentals of speech.
- extract and compare different speech parameters.
- choose an appropriate statistical speech model for a given application.

- design a speech recognition system.
- use different speech synthesis techniques.

TEXT BOOKS

1. Lawrence Rabiner and Biing-Hwang Juang, "Fundamentals of Speech Recognition", Pearson Education, 2009.
2. Daniel Jurafsky and James H Martin, "Speech and Language Processing - An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Pearson Education, 2009.

REFERENCES

1. Steven W. Smith, "The Scientist and Engineer"s Guide to Digital Signal Processing", California Technical Publishing, 1999.
2. Thomas F Quatieri, "Discrete-Time Speech Signal Processing - Principles and Practice", Pearson Education, 2004.
3. Claudio Becchetti and Lucio Prina Ricotti, "Speech Recognition", John Wiley and Sons, 1999.
4. Frederick Jelinek, "Statistical Methods of Speech Recognition", MIT Press, 1998.

CO-PO MAPPING :

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COs	**Programme Outcomes (POs)**													
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CO1	3	2	2	1	1	-	-	-	-	-	2	2	3	2
CO2	3	3	3	2	2	-	-	-	-	-	2	2	3	2
CO3	3	3	3	2	2	-	-	-	-	-	2	2	3	2
CO4	3	3	3	2	2	-	-	-	-	-	2	2	3	2
CO5	3	3	3	2	2	-	-	-	-	-	2	2	3	2

EC19252 **WIRELESS NETWORKS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the concept about Wireless networks, protocol stack and standards
- be exposed to analyse the network layer solutions for Wireless networks
- be familiar with the fundamentals of 3G services, its protocols and applications
- have in depth knowledge on internetworking between WLAN and WWAN
- acquire knowledge about about evolution of 4G Networks, its architecture and applications

UNIT I CHALLENGES IN WLAN **9**

Medium access alternatives - Fixed assignment for voice oriented networks, random access for data oriented networks; WLAN technologies - IEEE802.11b WLAN - Architecture, services, installation, other IEEE standards; Hiper LAN: WATM, BRAN, HiperLAN2; Bluetooth - Architecture ;Wireless USB, Zigbee, 6LoWPAN, Wireless HART.

UNIT II MOBILE NETWORK LAYER **9**

Mobile IP - IP packet delivery, agent discovery, tunneling and encapsulation, IPV6-Network layer in the internet - Mobile IP session initiation protocol - mobile ad-hoc network: Routing - Destination Sequence distance vector; IoT- CoAP.

UNIT III 3G OVERVIEW **9**

Overview of UMTS Terrestrial Radio access network - UMTS Core network Architecture, 3GPP Architecture, User equipment; CDMA2000 overview - Radio and Network components, Network structure, Radio Network, TD - CDMA, TD - SCDMA.

UNIT IV INTERNETWORKING BETWEEN WLANS AND WWANS **9**

Internetworking objectives and requirements; Schemes to connect WLANS and 3G Networks; Session Mobility; Internetworking Architecture - WLAN,GPRS; System Description, Local Multipoint Distribution Service, Multichannel Multipoint Distribution System.

UNIT V 4G BEYOND **9**

4G vision - 4G features and challenges, applications of 4G; 4G Technologies - Multicarrier Modulation, Smart antenna techniques, IMS Architecture, LTE, Advanced Broadband Wireless Access and Services, MVNO.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the students will be able to

- implement wireless network environment for any application using latest wireless protocols and standards.
- explain the concepts of mobile IP.

- compare the different 3G services and standards.
- ability to select the suitable network depending on the availability and requirements.
- implement different type of applications for smart phones and mobile devices with latest network strategies.

TEXT BOOKS

1. Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education 2012.
2. Vijay Garg,"Wireless Communications and networking", First Edition, Elsevier 2007.

REFERENCES

1. P. Nicopolitidis , M. S. Obaidat , G. I. Papadimitriou , A. S. Pomportsis "Wireless Networks",Wiley, 2009.
2. Anurag Kumar, D.Manjunath, Joy kuri, "Wireless Networking" , First Edition, Elsevier 2011.
3. Simon Haykin, Michael Moher, David Koilpillai, "Modern Wireless Communications", First Edition, Pearson Education 2013.
4. Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, "3G Evolution HSPA and LTE for Mobile Broadband", Second Edition, Academic Press, 2008.

CO-PO MAPPING:

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

EC19253 **DISPLAY TECHNOLOGIES** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- know the fundamentals of eye
- acquire knowledge of various LCD technologies
- understand the working of LED displays
- determine the relation between the various 3-D technologies
- illustrate the operation of micro displays

UNIT I EYE CHARACTERISTICS **9**

Properties of Light, Geometric Optics, Optical Modulation; Vision and Perception - Anatomy of Eye, Light Detection and Sensitivity, Spatial Vision and Pattern Perception, Binocular Vision and Depth Perception; Driving Displays - Direct Drive, Multiplex and Passive Matrix, Active Matrix Driving.

UNIT II LIQUID CRYSTAL DISPLAY **9**

Display Glasses, Inorganic Semiconductor TFT Technology, Organic TFT Technology; Transparent Conductors, Liquid Crystal Displays - Properties of Liquid Crystals, Optics and Modeling of Liquid Crystals; LCD Device Technology - Twisted Numeric and Super twisted Numeric Displays.

UNIT III ADVANCED LED DISPLAYS **9**

Cathode Ray Tubes, Displays - Vacuum Florescent Displays, Filed Emission Displays; Plasma Display Panels, LED Display Panels; Inorganic Electroluminescent Displays - Thin Film Electroluminescent Displays, OLEDs, Active Matrix for OLED Displays.

UNIT IV 3-D TECHNOLOGY **9**

Paper like and Low Power Displays - Colorant Transposition Displays, MEMs Based Displays, 3-D Displays; 3-D Cinema Technology, Autostereoscopic 3-D Technology, Volumetric and 3-D Volumetric Display Technology, Holographic 3-D Technology; Mobile Displays - Transreflective Displays for Mobile Devices, Liquid Crystal Optics for Mobile Displays, Energy Aspects of Mobile Display Technology

UNIT V MICRO DISPLAYS **9**

Micro display Technologies - Liquid Crystals on Silicon Reflective Microdisplay, Trans missive Liquid Crystal Micro-display, MEMs Microdisplay, DLP Projection Technology; Micro-display Applications: Projection Systems, Head Worn Displays; Electronic View Finders, Multifocus Displays, Occlusion Displays, Cognitive Engineering and Information Displays; Display Metrology, Green Technologies in Display Engineering.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the students will be able to

- determine the charactertics of eye.
- analyze the function of LCD display.
- enumerate the operation of LED displays.
- explain the various operation of 3-D displays.
- determine the various operation on micro displays.

TEXT BOOKS

1. Janglin Chen,Wayne Cranton,Mark Fihn," Handbook of Visual Display technology",Springer Publication,2012.
2. Shoichi Matsumoto, "Electronic Display Devices" , Wiley, 1990.

REFERENCES

1. Jacques I. Pankove, D.J. Channin, "Display Devices",Springer Berlin Heidelberg, 2014.
2. Joseph Castellano , "Handbook of Display Technology" First Edition , 2012.
3. R.R.Gulati, "Monochrome & Color Television," New Age International Publisher, 2003.
4. A.M.Dhake, "TV and Video Engineering", Tata McGraw-Hill Education, 1999.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcomes : (1,2,3 indicates the strength of correlation) 3 – Strong , 2 – Medium , 1 – Weak														
COs	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	2	2	-	-	-	-	-	-	2	3	3
CO2	3	3	3	2	2	-	-	-	-	-	-	2	3	3
CO3	3	3	3	-	2	-	-	-	-	-	-	2	3	3
CO4	3	3	3	2	2	-	-	-	-	-	-	2	3	3
CO5	3	3	3	2	2	-	-	-	-	-	-	3	3	3

IT19255	OBJECT ORIENTED PROGRAMMING	3	0	0	3

COURSE OBJECTIVES

To enable the students to

- understand Object Oriented Programming concepts.
- study the concept of constructor and operator overloading.
- compile of basic concepts of inheritance and the utilization.
- know the concepts of Java using Packages and Arrays.
- use of Interface and I/O streams.

UNIT I INTRODUCTION 9

Object-Oriented Paradigm - Elements of Object Oriented Programming, Merits and Demerits of OO Methodology; C++ fundamentals - Classes and Objects, Function, Function overloading, Static data and member functions, inline function.

UNIT II CONSTRUCTOR AND OPERATOR OVERLOADING 9

Constructor - Copy Constructors, and Default Arguments; Array of Objects - Pointer to Object member; Friend Function; Operator Overloading - binary and Unary operator overloading.

UNIT III TEMPLATE AND INHERITENCE 9

Templates - Function Template, Class Template; Inheritance - Derived class, Abstract class, Types of Inheritance; Virtual Functions; Exception Handling.

UNIT IV INTRODUCTION TO JAVA 9

Introduction to JAVA - bytecode, virtual machines, objects, classes, Javadoc, packages, Arrays, Strings.

UNIT V INHERITANCE, THREADING AND I/O 9

Inheritance; interfaces and inner classes; exception handling; threads; Streams and I/O.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end this course, students will be able to

- understand the principles of Object Oriented Programming.
- create a program using Constructor.
- re-write solutions to a given problems using inheritance and polymorphism concepts.

- develop simple Java program using class, methods and objects.
- perform the concepts of concurrent programming.

TEXT BOOKS

1. Herbert Schildt "C++: The Complete Reference", Tata McGraw Hill, 4th Edition, 2003.
2. Herbert Schildt, "JAVA, The Complete Reference" Tata Mcgraw Hill, 8th edition, 2011.

REFERENCES

1. Bjarne Stroustrup, "The C++ Programming Language", Addison Wesley, 2014.
2. K.R. Venugopal, Rajkumar Buyya, T.Ravishankar, "Mastering C++", TMH, 2009.
3. Bruce Eckel, "Thinking in JAVA", Prentice Hall,2006 6. Kathy Sierra, Bert Bates," Head First JAVA",O"Rielly,2005.
4. Kathy Sierra, Bert Bates," Head First JAVA",O"Rielly,2005.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcomes (3/2/1 indicates strength of correlation) 3-Strong,2-Medium,1-Weak														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	1	-	-	-	-	-	-	2	1	2	2
CO2	3	2	2	1	-	-	-	-	1	1	2	1	2	2
CO3	3	2	2	1	-	-	-	-	1	1	-	1	2	2
CO4	3	2	2	1	1	-	-	-	1	1	-	1	2	2
CO5	3	2	2	1	1	-	-	-	1	1	2	1	2	2

EC19351 **DIGITAL IMAGE PROCESSING** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand digital image fundamentals.
- be exposed to simple image processing techniques.
- be familiar with image restoration and segmentation techniques.
- know the concept of image compression and morphological operations
- learn to represent image in the form of features

UNIT I DIGITAL IMAGE CONCEPTS **9**

Steps in Digital Image Processing, Components, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Relationships between pixels, Colour models.

UNIT II IMAGE ENHANCEMENT **9**

Spatial Domain - Gray level transformations, Histogram processing, Basics of Spatial Filtering, Smoothing and Sharpening Spatial Filtering; Frequency Domain - Introduction to Fourier Transform, Smoothing and Sharpening frequency domain filters (Ideal, Butterworth and Gaussian filter).

UNIT III IMAGE RESTORATION AND SEGMENTATION **9**

Noise models, Mean Filters, Order Statistics, Adaptive filters, Band reject Filters, Band pass Filters, Notch Filters, Optimum Notch Filtering, Inverse Filtering, Minimum Mean Square Error, Wiener Filtering; Segmentation - Point, Line, Edge Detection, Thresholding, Region-Based Segmentation, Segmentation Using Morphological Watersheds.

UNIT IV IMAGE COMPRESSION AND MORPHOLOGICAL OPERATIONS **9**

Image Compression - Fundamentals of redundancies, Basic Compression Methods - Huffman coding, Arithmetic coding, LZW coding, JPEG Compression standard.

Morphological Image Processing - Erosion, Dilation, Opening, Closing; Basic Morphological Algorithms - hole filling, connected components, thinning, skeletons.

UNIT V IMAGE REPRESENTATION AND OBJECT RECOGNITION **9**

Boundary representation, Boundary description, Fourier descriptor; Regional descriptors, Topological feature, Texture; Object Recognition, Patterns and pattern classes, Recognition based on matching.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the students will be able to

- apply the digital image fundamentals on images.
- operate on images using the simple image processing techniques.
- work on images using image restoration and segmentation techniques.
- exercise the concept of image compression and morphological operations

- represent image in the form of features

TEXT BOOKS

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", 3rd Edition, Tata Mc Graw Hill Pvt. Ltd., 2020.
2. Anil Jain K. "Fundamentals of Digital Image Processing", Prentice Hall India, 2011.

REFERENCES

1. Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", First Edition, Prentice Hall India, Learning Pvt. Ltd., 2011.
2. Milan Sonka, Vaclav Hlavav, Roger Boyle, "Image Processing, Analysis and Machine Vision", 2nd Edition, Thomson Learning, 2001.
3. Willliam K Pratt, "Digital Image Processing", 3rd Edition, John Wiley & Sons, 2007.
4. Rangaraj M. Rangayyan, "Biomedical Image Analysis", 2nd Edition, CRC Press, 2005.

CO-PO MAPPING:

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CO2	3	3	3	-	3	-	-	-	-	-	-	3	3	3
CO3	3	3	3	-	3	-	-	-	-	-	-	3	3	3
CO4	3	3	3	-	3	-	-	-	-	-	-	3	3	3
CO5	3	3	3	-	3	-	-	-	-	-	-	3	3	3

EC19352 **NETWORK SECURITY** 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- know the concepts of securing computer network protocols.
- understand the concepts of cryptography techniques.
- gain knowledge about hash function.
- be familiar with the authentication principles.
- be exposed with various security control and firewalls.

UNIT I CRYPTOGRAPHY 9

Basic of cryptography - Conventional and public-key cryptography, hash functions, authentication, digital signatures; Key Management and Distribution - Symmetric Key Distribution, Distribution of Public Keys, X.509 Certificates, Public-Key Infrastructure.

UNIT II SECRET KEY CRYPTOGRAPHY 9

Block Encryption, DES rounds, S-Boxes IDEA- Overview, comparison with DES, Key expansion, IDEA rounds, Uses of Secret key Cryptography; ECB, CBC, OFB, CFB, Multiple encryptions DES.

UNIT III FUNCTIONS AND MESSAGE DIGESTS 9

Length of hash, uses, algorithms - MD2, MD4, MD5, SHS; MD2 - Algorithm, Padding, checksum, passes; MD4 and 5 - Algorithm, padding, stages, digest computation; SHS: Overview, padding, stages.

UNIT IV AUTHENTICATION 9

User Authentication - Remote User - Authentication Principles, Remote User-Authentication Using Symmetric Encryption, Kerberos Systems, Remote User Authentication Using Asymmetric Encryption.

Malicious Software - Viruses, Worms, System Corruption, Attack Agents, Information Theft Keyloggers, Phishing, Spyware Payload Stealthing, Backdoors, Rootkits, Distributed Denial of Service Attacks.

UNIT V SECURITY CONTROL 9

Network Access Control - Network Access Control, Extensible Authentication Protocol, IEEE 802.1X Port-Based Network Access Control; IP Security- IP Security Overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange (IKE); Wireless Network Security - Mobile Device Security, Wireless LAN Security; Firewalls and Intrusion Detection Systems; Concepts - Blockchains, Cloud Security and IoT security.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the student will be able to

- identify suitable cryptography method for particular application.
- enumerate the various secret key cryptographic techniques.
- explain about the hash function in cryptography.
- utilise various authentication measures in cryptography.
- work on different security control aspects.

TEXT BOOKS

1. William Stallings, "Cryptography and Network Security": Principles and Practice, 6th Edition,Pearson, 2017.
2. M. Speciner, R. Perlman, C. "Network Security: Private Communications in a Public World", Kaufman, Prentice Hall, 2017.

REFERENCES

1. Atul Kahate, "Cryptography and Network Security", McGraw Hill,2017.
2. Stallings, W,"Cryptography and Network Security: Principles and Practice", 3rd Edition, Prentice Hall ,2003.
3. J. Michael Stewart, "Network Security, Firewalls and VPNs", Jones & Bartlett Learning, 2013.
4. Michael Gregg, "The Network Security Test Lab: A Step-By-Step Guide" , Dreamtech Press, 2015.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcomes : (1,2,3 indicates the strength of correlation) 3 – Strong , 2 – Medium , 1 – Weak													
COs	Programme Outcomes (POs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	2	2	2	1	-	-	2	3	3
CO2	3	3	3	3	-	2	1	1	1	-	-	2	3	3
CO3	3	3	3	-	-	2	2	2	1	-	-	2	3	3
CO4	3	3	3	3	-	2	1	1	1	-	-	2	3	3
CO5	3	3	3	-	-	2	2	2	1	-	-	2	3	3

EC19353 **NANOELECTRONICS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the basic concepts for nanostructured materials.
- explore the basics of nanomaterial synthesis and characterization.
- be familiar with the measurement concepts of nanoelectronic materials
- know the basics of nanostructures.
- acquire knowledge about different applications of nanostructures.

UNIT I NANOSTRUCTURED MATERIALS **9**

Importance of Nanotechnology; History of Nanotechnology; Opportunity at the nanoscale length and time scale in structures; Basic Structure of Nanoparticles - Kinetics in Nanostructured Materials - Zero-dimensional, size and shape of nanoparticles; one-dimensional and two-dimensional nanostructures.

UNIT II FABRICATION AND CHARACTERIZATION OF NANOMATERIALS **9**

Types of Nanomaterials - Quantum dots, Nanoparticles, Nanocrystals, Dendrimers, Buckyballs, Nanotubes); Gas, liquid, and solid - phase synthesis of nanomaterials; Lithography techniques - Photolithography, Dip-pen, Electron beam lithography; Nanoparticles, nanoclusters, nanotubes, nanowires and nanodots; Semiconductor nanocrystals.

UNIT III MEASUREMENT OF NANOMATERIALS **9**

Electronic and optoelectronic properties of molecular materials - Absorption, Fluorescence, Resonance; Methods for the measurement of nanomaterials; Microscopy measurements - SEM, TEM, AFM, STM; Confocal and TIRF imaging.

UNIT IV NANOSTRUCTURES **9**

Carbon Nanotubes, Fullerenes, Nanowires, Quantum Dots; Applications of nanostructures; Reinforcement in Ceramics, Drug delivery, Giant magneto resistance; Cells response to Nanostructures.

UNIT V APPLICATIONS OF NANOSTRUCTURES **9**

Nanoelectronic architectures and computations, Nanosensors, Nanotechnology in Diagnostics applications, Environmental and Agricultural Applications of nanotechnology, Nanotechnology for energy systems.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the students will be able to

- describe the basic science behind the properties of materials.
- interpret the creation, characterization, and manipulation of nanoscale materials.
- comprehend the exciting applications of nanotechnology at the leading edge of scientific research.
- identify the different nano structure materials.
- apply their knowledge of nanotechnology to identify how they can be used for new applications.

TEXT BOOKS

1. Robert Puers, Livio Baldi, "Nano electronics: Materials, Devices and Applications",Wiley 2017.
2. Bharat Bhushan, "Springer Handbook of Nanotechnology", 2004

REFERENCES

1. Carl.C Koch, "Nanostructured Materials: Processing, Properties and Potential Applications", William Andrew Publishing Norwich, 2006.
2. Michael Ashby, Paulo Ferreira, Daniel L. Schodek, Butterworth-Heinemann "Nanomaterials, Nanotechnologies and Design: an Introduction to Engineers and Architects",2009.
3. Z.L. Wang, Y. Liu, Z. Zhang "Handbook of Nanophase and Nanostructured Materials",Kluwer Academic/Plenum Publishers, 2003.
4. Tseung-Yuen Tseng and Hari Singh Nalwa, "Handbook of Nanoceramics and their Based Nanodevices" American Scientific Publishers,2003.

CO-PO MAPPING :

Mapping of Course Outcomes with Programme Outcomes : (1,2,3 indicates the strength of correlation) 3 – Strong , 2 – Medium , 1 – Weak														
COs	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	2	-	-	-	-	-	-	-	3	3
CO2	3	3	3	2	3	-	-	-	-	-	-	-	3	3
CO3	3	3	3	-	2	-	-	-	-	-	-	-	3	3
CO4	3	3	3	3	2	-	-	-	-	-	-	-	3	3
CO5	3	3	3	-	2	-	-	-	-	-	-	-	3	3

IT19355	ARTIFICIAL INTELLIGENCE	3	0	0	3

COURSE OBJECTIVES

To enable the students to

- acquire a knowledge of various methods of different problem solving and searching.
- understand the concepts of knowledge representation.
- understand about inference and how to solve the problems using various inference technique.
- realize the concepts of planning and learning.
- design various AI systems.

UNIT I INTRODUCTION 9

Introduction to AI - Problem formulation, Problem Definition; Production systems - Control strategies, Search strategies, Problem characteristics, Production system characteristics, Specialized productions system; Problem solving methods; Problem graphs; Matching; Indexing and Heuristic functions; Hill Climbing; Depth first and Breath first; Constraints satisfaction; Related algorithms; Measure of performance and analysis of search algorithms.

UNIT II REPRESENTATION OF KNOWLEDGE 9

Game playing; Knowledge representation - Knowledge representation using Predicate logic, Introduction to predicate calculus, Resolution, Use of predicate calculus; Knowledge representation using other - Structured representation of knowledge.

UNIT III KNOWLEDGE INFERENCE 9

Knowledge representation; Production based system; Frame based system. Inference - Backward logic chaining, Forward chaining; Rule value approach; Fuzzy reasoning.

UNIT IV PLANNING AND EXPERT SYSTEM 9

Basic plan generation systems - Strips, Advanced plan generation systems, K strips; Strategic explanations - Why, Why not and how explanations; Expert systems - Architecture of expert systems, Roles of expert systems, Knowledge Acquisition; Typical expert systems Applications - MYCIN, DART, XOON.

UNIT V AI APPLICATIONS 9

AI Applications - Language Models, Information Retrieval, Information Extraction, Natural Language Processing, Machine Translation, Speech Recognition; Robot - Hardware, Perception, Planning, Moving.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of the course, the students will be able to

- demonstrate awareness of intelligent agents and problem solving using uninformed, informed and local search methods.
- develop knowledge about usage of propositional logic and first order logic for making inferences.
- use the knowledge and the process of inference to derive new facts.
- describe the use of planning and explain about various expert systems.
- design and develop various AI systems.

TEXT BOOKS

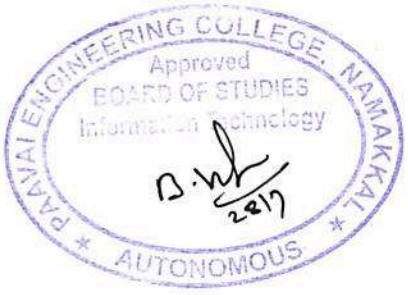
1. Kevin Night and Elaine Rich, Nair B, "Artificial Intelligence", 3rd edition, McGraw Hill- 2017.
2. Stuart Russel and Peter Norvig, "AI -A Modern Approach", 3rd Edition, Pearson Education 2015.

REFERENCES

1. Lavika Goel "Artificial Intelligence Concepts and Applications", Wiley 2021.
2. Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2015.
3. Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education 2013.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcomes (3/2/1 indicates strength of correlation) 3-Strong,2-Medium,1-Weak														
COs	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	2	-	-	-	-	-	-	1	3	2
CO2	3	3	3	3	2	-	-	-	-	-	-	1	3	2
CO3	3	3	3	3	2	-	-	-	-	-	-	1	3	2
CO4	3	3	3	3	2	-	-	-	-	-	-	1	3	2
CO5	3	3	3	3	2	2	-	-	-	-	-	1	3	3



EC19901 BASICS OF COMMUNICATION ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- acquire knowledge about the different methods of Analog Modulation and its significance.
- understand the concepts of various pulse modulation techniques
- know the basics of Digital Modulation techniques
- be familiar with the principles behind information theory and coding techniques.
- have an in-depth knowledge about Satellite, Optical Fiber - Power line, SCADA.

UNIT I ANALOG MODULATION **9**

Modulation - Types, Need for modulation; AM, DSBSC, SSBSC, VSB; AM - Modulators and demodulators; Angle modulation - PM and FM; FM - Modulators and demodulators; Superheterodyne receivers.

UNIT II PULSE MODULATION **9**

Low pass sampling theorem - Quantization; Pulse Amplitude Modulation - Line coding - Pulse Code Modulation, Differential PCM, Delta Modulation, Adaptive DPCM and ADM; Channel Vocoders - Time Division Multiplexing, Frequency Division Multiplexing.

UNIT III DIGITAL MODULATION AND TRANSMISSION **9**

Phase shift keying - BPSK, DPSK, QPSK; Principles of M-ary signaling; M-ary PSK, QAM; Comparison, ISI - Pulse shaping - Duo binary encoding - Cosine filters - Eye pattern, equalizers.

UNIT IV INFORMATION THEORY AND CODING **9**

Measure of information - Entropy, Source coding theorem, Shannon Fano coding, Hufman Coding, LZ Coding - Channel capacity, Shannon-Hartley law, Shannon's limit; Error control codes - Cyclic codes, Syndrome calculation - Convolution Coding, Sequential and Viterbi decoding.

UNIT V MODERN COMMUNICATION SYSTEMS **9**

Satellite communication - Orbits, types of satellites, frequency links, Multiple access techniques in satellite communication, earth station, aperture actuators - Intelsat and Insat; Fiber optic communication - fibres, types, sources, detectors, digital filters, optical link; Power Line Carrier communications;SCADA.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the students will be able to

- apply the basic concepts of analog modulation and demodulation techniques.
- analyse the concepts behind different pulse modulation methods.
- describe the digital modulation and transmission techniques.
- solve problems using coding techniques
- explain the different techniques of modern communication systems.

TEXT BOOKS

1. Taub & Schiling "Principles of Communication Systems" Tata Mc Graw Hill 2009.
2. Samuel O. Agbo and Matthew O. Sadiku, "Principles of Modern Communication Systems", Cambridge University Press, Cambridge, United Kingdom, 2017.

REFERENCES

1. John G. Proakis, Masoud Salehi, "Digital Communication", 5th Edition, 2018.
2. B.Sklar, Pabitra Kumar Ray,Digital Communications Fundamentals and Applications" 2nd Edition Pearson Education, 2009.
3. B.P.Lathi, Zhi Ding "Modern Digital and Analog Communication Systems" Oxford University Press, 2017
4. Bary le, Memuschmidt, Digital Communication, Kluwer Publication, 2004.

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CO1	3	3	1	1	-	-	-	-	-	-	-	3	3	3
CO2	3	3	1	2	-	-	-	-	-	-	-	3	3	3
CO3	3	3	1	2	-	-	-	-	-	-	-	3	3	3
CO4	3	3	1	1	-	-	-	-	-	-	-	3	3	3
CO5	3	3	1	2	-	-	-	-	-	-	-	3	3	3

EC19902	INTRODUCTION TO GEOGRAPHIC INFORMATION SYSTEM	3	0	0	3

COURSE OBJECTIVES

To enable the students to

- acquire knowledge about the basic components of GIS
- be familiar with the spatial data models
- understand different data types of inputs and topologies
- know the different data analysis tools and models
- identify various applications of GIS

UNIT I GEOGRAPHIC INFORMATION SYSTEM 9

Introduction to GIS - Basic spatial concepts, Coordinate Systems, GIS and Information Systems, Definitions, History of GIS, Components of a GIS - Hardware, Software, Data, People, Methods - Proprietary and open-source Software, Types of data - Spatial, Attribute data, types of attributes - scales/ levels of measurements.

UNIT II SPATIAL DATA MODELS 9

Database Structures - Relational, Object Oriented, ER diagram, spatial data models - Raster Data Structures, Raster Data Compression, Vector Data Structures - Raster Vs Vector Models, TIN and GRID data models, OGC standards, Data Quality.

UNIT III DATA INPUT AND TOPOLOGY 9

Scanner, Raster Data Input, Raster Data File Formats, Vector Data Input, Digitiser, Topology- Adjacency, connectivity and containment, Topological Consistency rules, Attribute Data linking- ODBC, GPS - Concept GPS based mapping.

UNIT IV DATA ANALYSIS 9

Data Analysis tools, Vector Data Analysis tools, Network Analysis, Digital Education models - 3D data collection and utilization.

UNIT V APPLICATIONS 9

GIS Application, Natural Resource Management , Engineering , Navigation , Vehicle tracking and fleet management, Marketing and Business applications , Case studies.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the students will be able to

- have an idea about the fundamentals of GIS.
- distinguish the different types of data models.
- explain about the topologies involved in GIS.

- develop different data analysis tools and models.
- use their knowledge for implementing the applications of GIS.

TEXT BOOKS

1. Ian Heywood, Sarah Cornelius, Steve Carver, "An Introduction to Geographical Information Systems", Pearson Education, 4th Edition, 2012.
2. Kang-tsung Chang, "Introduction to Geographic Information Systems": 9th Edition, McGraw-Hill Education, 2018

REFERENCES

1. Lo, C.P. and Yeung, Albert K.W., "Concepts and Techniques of Geographic Information Systems", Pearson, 2016.
2. Paul Longley., "Geographic Information systems and Science", John Wiley & Sons, 2005
3. Thanappan Subash., "Geographical Information System", Lambert Academic Publishing, 2011.
4. Jonathan Campbell, Michael Shin, "Essentials of Geographic Information Systems", 2011.

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CO1	-	-	3	-	2	-	-	-	-	-	-	-	3	3
CO2	3	2	2	-	1	-	-	-	-	-	-	-	3	3
CO3	3	2	2	-	1	2	2	-	-	-	-	-	3	3
CO4	2	2	1	-	-	1	-	-	-	-	-	-	3	3
CO5	3	2	2	2	-	-	2	-	-	-	-	-	3	3