HYDERABAD INSTITUTE OF TECHNOLOGY AND MANAGEMENT

B.TECH. HR-2021 COURSE STRUCTURE

ELECTRONICS AND COMMUNICATION ENGINEERING

(Applicable from the batch admitted during 2021-22 and onwards)

V – Semester (III – Year)

S. No.	Course code	Subject	Hours Per Week			Credits	Scheme of Evaluation		
			L	T	P		Maximum Marks		
							Int.	Ext.	Tot.
1	21PC5EC14	Digital Communication	3	-	-	3	30	70	100
2	21PC5EC15	Antennas and Wave Propagation	3	1	-	4	30	70	100
3	21PC5EC16	Microcontroller and Applications	3	-	-	3	30	70	100
4		**Professional Elective-I**	3	-	-	3	30	70	100
5		**Open Elective-I**	3	-	-	3	30	70	100
6	21PC5EC17	Digital Communication-Lab	-	-	3	1.5	30	70	100
7	21PC5EC18	Microcontroller and Applications Lab	-	-	2	1	30	70	100
8	21HS5EG05	Advanced English Communication Skills-Lab	-	-	2	1	30	70	100
9	21PR5EC02	**Doing Engineering-2**	-	1	1	1.5	30	70	100
10	21PR5IN02	**Internship-2**	-	1	-	1	100	0	100
TOTAL						**22**	**370**	**630**	**1000**
Non Credit Courses									
11	21MC5HS03	Analytical Reasoning	2	-	-	0	100	0	**100**

VI – Semester (III – Year)

S. No.	Course code	Subject	Hours Per Week			Credits	Scheme of Evaluation		
			L	T	P		Maximum Marks		
							Int.	Ext.	Tot.
1	21ES6CS03	Python Programming	3	-	-	3	30	70	100
2	21PC6EC19	Digital Signal Processing	3	1	-	4	30	70	100
3	21PC6EC20	VLSI Technology and Design	3	-	-	3	30	70	100
4	21HS6MB02	Fundamentals of Engineering Management	2	-	-	2	30	70	100
5		**Professional Elective-II**	3	-	-	3	30	70	100
6		**Open elective-II**	3	-	-	3	30	70	100
7	21PC6EC21	VLSI Design Laboratory	-	-	3	1.5	30	70	100
8	21ES6CS04	Python Programming-Lab	-	-	3	1.5	30	70	100
9	21PC6EC22	Digital Signal Processing Laboratory	-	-	2	1	30	70	100
TOTAL						**22**	**270**	**630**	**900**
Non Credit Courses									
9	21MC6HS04	Quantitative Aptitude	2	-	-	0	100	0	**100**

Subject Code	Professional Elective-I
21PE5EC11	Transmission lines and waveguides
21PE5EC12	Computer Organization and Architecture
21PE5EC13	Analog Integrated Circuit Design
21PE5EC14	Computer Networks

Subject Code	Professional Elective-II
21PE6EC21	ARM Microprocessor and Interfacing
21PE6EC22	Digital system design
21PE6EC23	Optical Communications
21PE6EC24	Artificial Neural Networks

Sl.no	SUBJECT CODE	Open Elective-I	Offering Department
1	21OE6CS06	Computer Organization and Architecture	CSE
2	21OE5EC01	Electronics measurement & Instrumentation	ECE
3	21OE5ME01	Hybrid & Electric Vehicles	MECH
4	21OE5EE01	Fundamentals of Electric Circuit Analysis	EEE
5	21OE5HS01	Nanoscience and Technology	H&S
6	21OE5CM01	Introduction to Artificial Intelligence	CSE-AI&ML
7	21OE5CD01	Statistics for Data Science	CSE-DS
8	21OE5CO01	Introduction to IoT	CSE-IOT
9	21OE5CC01	Data Security	CSE-CS

Sl.no	SUBJECT CODE	Open Elective-II	Offering Department
1	21OE5CS09	OOPS using Java	CSE
2	21OE6EC02	Fundamentals of Digital Electronics	ECE
3	21OE6ME02	Total Quality Measurement & Six Sigma Applications	MECH
4	21OE6EE02	Fundamentals of Industrial Electronics	EEE
5	21OE6HS02	Medical Instrumentation	H&S

6	21OE6CM06	Expert Systems	CSE-AI
7	21OE6CD02	Data Mining and Data Analytics	CSE-DS
8	21OE6CO05	Sensors & Devices	CSE-IOT
9	21OE6CC02	Computer Hardware and System Essentials	CSE-CS

B. Tech III Year – I Sem	**L**	**T**	**P**	**C**
Subject Code:21PC5EC14	3	0	0	3

DIGITAL COMMUNICATION

Prerequisites:

Knowledge of Fourier series, Fourier transforms, and Signal Processing

Course objectives: This course will enable students to:

1. To know various band-pass signalling schemes
2. To understand the use of synchronization using multiplexing
3. To learn the various spreading of signals
4. To know the fundamentals of source coding and channel coding

Course outcomes:

Upon completion of the course, the student should be able to

1. Explain various coding techniques for reliable digital communications
2. Analyse the performance of given digital modulation techniques
3. Analyse different spread spectrum techniques
4. Employ coding techniques for transmission in digital communication.

Module I

Introduction to digital communication system: Definition, Block diagram of digital communication system, sampling theorem, Aliasing, Uniform and non-uniform quantization, Signal to quantization noise ratio, Pulse code modulation.

Baseband transmission: Waveform representation of binary digits, Types of PCM waveforms, Differential PCM, Delta modulation, Line codes, Types of line codes, Duo binary encoding and decoding.

Module II

Digital Modulation Techniques: Binary signaling techniques: PSK, FSK, ASK; Generation and coherent detection of ASK, Generation and coherent detection of PSK, Coherent detection of QPSK, Coherent detection of FSK, non-coherent detection: PSK, FSK.

Error performance for Binary Systems: Probability of bit error for coherent BPSK, Probability of bit error for QPSK, Probability of bit error BFSK, Performance analysis of all the schemes in terms of probability of bit error, bandwidth and Power.

Module III

Multiplexing and Multiple Access: Orthogonal frequency division multiplexing, Frequency division multiple access, Time division multiple access, Code division multiple access, Access algorithms: Aloha, Slotted Aloha, Reservation Aloha.

Spread Spectrum: Introduction to spread spectrum, Benefits of spread spectrum, PN sequence and its properties, Direct Sequence Spread Spectrum (DSSS), Frequency Hopping Spread Spectrum (FHSS).

Module-IV

Introduction to Information theory: Measurement of Information, Information rate, Average information, Entropy, Shannon's Channel Capacity theorem, Shannon limit.

Source coding: Discrete sources, source coding for digital data: Properties of source codes, Huffman codes, Example of source coding in audio and image compression.

Module V

Introduction to Channel coding: Need for channel coding, Linear Block codes, Error-detecting and correcting capability, Hamming code, BCH Codes, Cyclic codes.

Convolutional Encoding: Channel models, Convolutional encoder, State representation and the state Diagram, Tree diagram, Trellis diagram, Viterbi Algorithm.

Text books:

1. Digital Communications Fundamentals and Applications, Benard Sklar, Second Edition, Pearson Education Asia, 2011.
2. Principles of Communication Systems - H. Taub and D. L. Schilling, 4th edition, Tata McGraw Hill, New Delhi, 2012
3. Digital Communications by Simon Haykins , John Wiley & Sons, Inc. 4th Edition, 200

Reference Books:

1. Modern Analog and Digital Communications, Lathi and Ding ,Third generation OXFORD University Press, NEW YORK, 1998.
2. Concepts of Information theory and coding, P.S. Satyanarayana, Medtech, 2016.

E Books:

Digital Communication-Authors: Barry, John R., Lee, Edward A., Messerschmitt, David G.

MOOC's Courses: NPTEL lecture Digital Communications-IIT Madras

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3		-	-	2	-	-	-	-	-	-	-	-	2
CO2	3	2	-	-	2	-	-	-	-	-	-	-	-	3
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	2
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	2

B. Tech III Year – I Sem	**L**	**T**	**P**	**C**
Subject Code:21PC5EC15	3	1	0	4

ANTENNA AND WAVE PROPAGATION

Prerequisite: Electro Magnetic fields**,** Analog and Digital Communication

Course Objectives: This course will enable students to:

1. To understand the concept of radiation, antenna definitions and significance of antenna parameters, to derive and analyze the radiation characteristics of thin wire dipole antennas and solve numerical problems.
2. To analyze the characteristics and design relations of UHF, VHF and Microwave Antennas.
3. To understand the concepts of Antenna arrays and set-up requirements for microwave measurements, and familiarize with the procedure to enable antenna measurements.
4. To define and distinguish between different phenomenon of wave propagation (ground wave, space wave and sky wave), their frequency dependence, and applications

Course Outcomes: Upon completing this course, the student will be able to

1. Describe the fundamental antenna engineering parameters and terminology
2. Analyze the basic concepts of electromagnetic wave radiation and reception
3. Design prototypes of practical antennas with antenna parameters measurements
4. Analyze the atmospheric and terrestrial effects on radio wave propagation

Module-I

Antenna Basics: Basic Antenna Parameters – Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity, Gain, Antenna Apertures, Effective Height. Fields from Oscillating Dipole, Field Zones, Front - to-back Ratio, Retarded Potentials.

Thin Linear Wire Antennas: Radiation from Small Electric Dipole, Radiation from Half-Wave Dipole & Quarter-Wave Monopole. Loop Antennas - Small Loop, Comparison of Far Fields of Small Loop and Short Dipole, Radiation Resistances and Directivities of Small Loops (Qualitative Treatment).

Module-II

Antenna Arrays: Point Sources – Definition, Patterns**,** arrays of 2 Isotropic Sources **–** with 3 different Cases, Principle of Pattern Multiplication, Uniform Linear Arrays – Broadside Arrays, End fire Arrays, EFA with Increased Directivity, Derivation of their Characteristics and Comparison, BSAs with Non-uniform Amplitude Distributions, Binomial Arrays, Phased arrays.

Antenna Measurements: Introduction, Concepts - Reciprocity, Near and Far Fields, Patterns measurement, Directivity Measurement, Gain Measurements (by Comparison, Absolute and 3-Antenna Methods)

Module - III

VHF, UHF and Microwave Antennas - I: Arrays with Parasitic Elements, Yagi-Uda Array, Folded Dipoles and their Characteristics.

Helical Antennas – Helical Geometry, Helix Modes, Horn antenna, Lens antenna

Module – IV

VHF, UHF and Microwave Antennas - II: Microstrip Antennas – Introduction, Features, Advantages and Limitations, Rectangular Patch Antennas – Geometry and Parameters, Characteristics of Microstrip Antennas. Reflector Antennas – Introduction, Flat Sheet and Corner Reflectors, Paraboloidal Reflectors – Geometry, Pattern Characteristics, Feed Methods, Reflector Types – Related Features.

Module - V:

Wave Propagation: Definitions, Categorizations and General Classifications, Different Modes of Wave Propagation, Attenuation characteristics for Ground Wave Propagation, Losses due to earth constants. Field Strength Variation with Distance and Height, Super Refraction, M-Curves and Duct Propagation, Scattering Phenomena, Structure of Ionosphere, Refraction and Reflection of Sky Waves by Ionosphere, Ray Path, Critical Frequency, MUF, Virtual Height and Skip Distance, Relation between MUF and Skip Distance, Multi-hop Propagation.

Course project: Prototypic design of any one Antenna/Simulation of an any one antenna using MATLAB/HFSS/any other equivalent tool.

Text Books:

1. Antennas and Wave Propagation – K.D. Prasad, Satya Prakashan, Tech India Publications, New Delhi, 2001.
2. Antennas and Wave Propagation – J.D. Kraus, R.J. Marhefka and Ahmad S. Khan, TMH, New Delhi, 4th ed., (Special Indian Edition), 2010.
3. Antenna Theory - C.A. Balanis, John Wiley & Sons, 3rd Ed., 2005.

Reference books:

1. Electromagnetic Waves and Radiating Systems, E.C. Jordan and K.G. Balamain,b2nd ed., pearson, 2015.
2. Antennas, John D Kraus, 3rd ed., Mc Graw-Hill, 2001.
3. Transmission and Propagation – E.V.D. Glazier and H.R.L. Lamont, The Services Text Book of Radio, vol. 5, Standard Publishers Distributors, Delhi

CO-PO Mapping:

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 – Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	2
CO3	3	-	3	-	3	-	-	-	3	-	-	-	-	2
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	2

B. Tech III Year – I Sem	**L**	**T**	**P**	**C**
Subject Code: 21PC5EC16	3	0	0	3

Microcontroller and Applications

Pre-requisite: Digital Logic Design

Course Objective: This course will enable students to:

1. To Differentiate the Computers, microprocessor and Microcontroller
2. To introduce the Architecture of 8086 Microprocessor.
3. To understand the architecture and programming of Microcontrollers.
4. To understand the interfacing on chip peripherals of Microcontroller.

Course Outcomes:
Upon completion of the course, the student should be able to

1. Demonstrate the impact of instruction set architecture on cost-performance of Computer design.
2. Explain the internal architecture, organization and Addressing modes of 8086 Microprocessors.
3. Utilize the architectural features and instruction set of 16 bit microcontroller for low power applications
4. Describe the functions of various peripherals which are interfaced with microcontroller for different applications.

Module I
Computers, Microprocessors and Microcontrollers: Introduction, Common Terminologies Associated with Computing Systems, Microprocessors and Microcontrollers, CISC and RISC Systems, Computing Languages, Memory - Random Access Memory (RAM), Read-Only Memory (ROM), Cache Memory, Memory Latency, Computer Architecture: Harvard and Von-Neumann, Evolution of Microcontrollers-4 bit to 32 bit

Module II
8086 Microprocessor: Architecture and features of 8086, Pin configuration of 8086, Minimum mode and Maximum mode, Timing diagrams, addressing modes

Module III
MSP Microcontroller Introduction and Key Features: Introduction, Low Power Applications, MSP430 RISC CPU Architecture, Details of 16-Bit RISC CPU, Clock System, Memory subsystem, Key differentiating factors between different families, Digital I/O Ports

Module IV
Programming the MSP430: Addressing Modes, Instruction Set of MSP430, Double Operand Core Instructions, Single Operand Core Instructions (Format II), Program Flow control, Emulated Instructions, Movement Instructions, Implementation of Decimal Arithmetic, Shift and Rotate Instructions, Programing in ALP

Module V
On Chip Peripherals, Interfacing and Applications of MSP430: Watchdog Timer, Timers, Real Time Clock, DAC: Digital-to-Analog Conversion, Direct Memory Access (DMA), LCD

Controller, Case studies of applications of MSP 430 data Acquisition system **,** UART and SPI

Text Books:

1. ”The 8051 and MSP430 Microcontrollers: Architecture,Programming and Applications”, K. Uma Rao, Andhe Pallavi,Wiley Publication, 2019
2. Advanced microprocessor and Peripherals - A.K.Ray and K.M.Bhurchandi, Tata Mc Hill,2000.
3. Microprocessors and Interfacing (8086, 8051, 8096 and Advanced processors) – N.Senthil Kumar, M. Saravanan, Oxford University Press, 2012.

Reference Books:

1. Microprocessors & Interfacing, Douglas.V. Hall, 3 rd Edition, Pearson/ PHI. 2007
2. Micro Controllers – Deshmukh, Tata McGraw Hill Edition.6th reprint,2007.

CO-PO MAPPING:

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**
CO2	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
CO3	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**
CO4	**2**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**

B. Tech III Year – I Sem	L	T	P	C
Subject Code: 21PC5EC17	0	0	3	1.5

Digital Communication Lab

Prerequisites: Basic knowledge of Analog and Digital signals.

Course Objectives: This course will enable students to:

1. This gives the basics of communications required for all Electronics and Communication Engineering related courses.
2. To understand the behavior of Analog and Pulse Modulations.
3. To understand the characteristics of Frequency Division Multiplexing.
4. To understand Analog and Digital demodulations

Course Outcomes: Upon successful completion of the course, the student is able to

1. Describe sampling theorem.
2. Design modulation techniques.
3. Illustrate different demodulation techniques
4. Analyze the difference between time and frequency division multiplexing.

List of Experiments: (Any 12 experiments should be perform)

1. Verification of Sampling Theorem.
2. Study of generation of Unipolar NRZ, Polar NRZ, Unipolar RZ and Polar RZ line code.
3. Study of generation and detection of Pulse Code Modulation (PCM).
4. Study of generation and detection of Delta Modulation.
5. Study of generation and detection of Amplitude Shift Keying (ASK).
6. Study of generation and detection of Phase Shift Keying (PSK).
7. Study of generation and detection of Frequency Shift Keying (FSK).
8. Study of generation and detection of Differential Phase Shift Keying (DPSK).
9. Analysis of the process of Time Division Multiplexing and Demultiplexing
10. Analysis Frequency Division Multiplexing and Demultiplexing.
11. Write OCTAVE/MATLAB program to implement the Quadrature Phase Shift Keying.
12. Write OCTAVE/MATLAB program to implement the Linear Block Code Encoder.
13. Write OCTAVE/MATLAB program to implement the Binary Cyclic Codes Encoder and Decoder.

Text Books:

1. Communication Systems by Simon Haykin, John Wiley & Sons, 4th Edition, 2006.
2. Electronics & Communication System – George Kennedy and Bernard Davis, McGraw Hill Education 2004.

Reference Books:

1. Communication Systems, 2E, R. P. Singh, S. D. Sapre, McGraw-Hill Education, 2008.
2. Analog and Digital Communication – K. Sam Shanmugam, Willey, 2005.
3. Electronics Communication Systems- Wayne Tomasi, 6th Edition, Person 2009.

Web Resources:

1. https://nptel.ac.in/courses/117/105/117105143/
2. https://nptel.ac.in/courses/117/102/117102059/
3. https://nptel.ac.in/courses/117/108/117108107/

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	-	-	-	3	-	-	-	-	-	-	-	-	1
CO2	3	2	-	-	3	-	-	-	-	-	-	-	-	1
CO3	3	-	2	-	3	-	-	-	-	-	-	-	-	1
CO4	3	-	-	-	3	-	-	-	-	-	-	-	-	1

B. Tech III Year – I Sem	**L**	**T**	**P**	**C**
Subject Code: 21PC5EC18	0	0	2	1

Microcontroller and Applications Lab

Prerequisite: Digital Logic Design

Course Objective: This course will enable students to:

1. To study programming based on 8086 Microprocessor and MSP430.
2. To study 8086 microprocessor based ALP using arithmetic, logical, shift, string operations,
3. To study to interface MSP 430 with I/O and other devices.
4. To study serial communication using MSP430

Course Outcomes: Upon successful completion of the course, the student is able to

1. Develop assembly language programs for various applications using 8086 Microprocessor
2. Apply appropriate techniques, resources, and Code Composer Studio based IDE for modelling system designs with understanding of limitations.
3. Analyze usage of various resources like GPIO, Timers, Interrupts, ADC, UART, Comparator
4. Make an effective report based on experiments.

List of Experiments:

1. 16-bit Signed and unsigned Arithmetic operations, ASCII –arithmetic operations
2. Arithmetic operations – Multi byte Addition and Subtraction
3. Logical operations, Sum of Squares, Sum of Cubes
4. Write ALP to find smallest, largest number, arrange numbersin Ascending order, Descending order in a given series.
5. Using string operation and Instruction prefix: Move Block,Reverse string, String comparison
6. Introduction to MSP430 launch pad and ProgrammingEnvironment. (Study Experiment)
7. Read input from switch and Automatic control/flash LED(soft-ware delay).
8. Read Temperature of MSP430 with the help of ADC.
9. PWM Generator
10. Enabling serial communication with UART on Lunchbox
11. Interfacing the 7-segment display to MSP430
12. Interfacing the stepper motor to MSP430

Text Books:

1. The 8051 and MSP430 Microcontrollers: Architecture, Programming and Applications, K. Uma Rao, Andhe Pallavi,Wiley Publication, 2019.
2. Advanced microprocessor and Peripherals - A.K.Ray and K.M.Bhurchandi, 3rd edition Tata Mc Hill,2013.

Reference Books:

1. Microprocessors & Interfacing, Douglas.V. Hall, 3 rd Edition, Pearson/ PHI. 2007
2. Micro Controllers – Deshmukh, Tata McGraw Hill Edition, 6th reprint, 2007.

Web Resources:

1. http://freevideolectures.com/Course/3018/Microprocessors-and-Microcontrollers

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 – Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	-	-	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	-	-	-

B. Tech III Year – I Sem	**L**	**T**	**P**	**C**
Subject Code: 21HS5EG05	0	0	2	1

Advanced English Communication Skills Lab

Pre-requisite:

1. Basic knowledge of interpersonal and communication skills
2. Enriching the speaking and writing ability
3. Basic grammar rules of LSRW
4. Basic spoken English skills

Course Objectives: This course will enable students to:

1. To equip students of engineering and technology with effective speaking and listening skills in English.
2. To develop their soft skills and interpersonal skills for promoting excellence.
3. To understand the concept of employability skills and enhancing ones' communication skills, body language, behavior in the personal, professional and social forum.
4. To enrich their problem solving, critical and analytical skills.
5. To enhance the performance of the students at placement interviews, Group discussions and other recruitment exercises.

Course Outcomes: Upon completion of the course, the student should be able to

1. Understand the communication theory to interact skilfully and ethically.
2. Identify the challenges and abilities to persuade the people.
3. Apply communication strategies (both verbal and non-verbal skills) to bring out the results on social and industry demands.
4. Communicate effectively and deliver professional presentations.

Exercise 1- Activities on Fundamentals of 7C's of Effective Communication, Behavior skills and Building Vocabulary

Fundamentals of 7C's of Effective Communication and Building Vocabulary

Starting a conversation – responding appropriately and relevantly – Concise - Clear - Concerts - Coherent - Complete – Correct- Courtesy- using the right body language - attitude - Grooming - Formal and Informal Communication, Synonyms and Antonyms-root words, One-word substitutes, Prefixes and Suffixes, Study of word origin, Business vocabulary, Analogy, Idioms and phrases, Collocations, Usage of vocabulary.

Behaviour skills- Time Management– Role Play in different situations- Discourse Skills - Articulateness – Assertiveness – Psychometrics – Innovation and Creativity - Stress Management & Poise

Exercise 2- Activities on Reading Comprehension and Business English

General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading, Effective Business Conversation with dialogues reading and speaking activity.

Exercise 3- Activities on Writing Skills

Structure and presentation of different types of writing – letter writing/Resume writing/ E-correspondence/Technical report writing, Planning for writing- five elements of writing – Purpose, grabbing audience, maintaining clarity, unity, coherence - improving one's writing,

Exercise 4- Activities on Presentation Skills
Elements of effective presentation – Structure of presentation - Presentation tools – Voice Modulation -Oral presentations (individual and group) through JAM sessions/seminars/PPTs
Audience analysis - written presentations through Posters/Projects/Reports writing/ e-mails

Exercise 5: Activities on Group Discussion and Interview Skills
Dynamics of group discussion-Intervention- Structure of GD – types of GDs- Strategies in GD – Team work - summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation

Interview skills- Kinds of interviews -Concept and process- Required Key Skills - Pitfalls in interview- Pre-interview planning- opening strategies, answering strategies, post-Interview skills, Interview through tele-conference, video-conference and Mock Interviews.

Text Books:

1. Effective Technical Communication ,M Asharaf Rizvi, 2nd Edition, McGraw Hill Education (India) Pvt. Ltd, 2017
2. Academic Writing: A Handbook for International Students by Stephen Bailey, 5thEdition, Routledge, 2017

Reference Books:

1. Technical Communication, Anderson, P.V, Thomson Wadsworth, Sixth Edition, New Delhi, 2007.
2. Professional Communication by Aruna Koneru, McGraw Hill Education (India) Pvt. Ltd, 2016.
3. Verbal and Non-Verbal Reasoning, Prakash, P, Macmillan India Ltd., Second Edition, New Delhi, 2004.
4. The Oxford Guide to Writing and Speaking, John Seely, Oxford University Press, New Delhi, 2004.
5. Handbook for Technical Communication, David A. McMurrey & Joanne Buckley. 2012Cengage Learning.
6. Objective English, Thorpe, E, and Thorpe, S, Second Edition, Pearson Education, New Delhi, 2007.
7. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
8. Job Hunting by Colm Downes, Cambridge University Press 2008.
9. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc graw Hill, 2009.

Web Resources:
1. https://eltlearningjourneys.com/2015/05/19/websites-for-learning-english/

MOOC's Courses:
1. NPTEL https://onlinecourses.swayam2.ac.in/nou22_lb28/preview
2. Communication Skills (Library and Information Science)
3. By Prof. Zuchamo Yanthan | Indira Gandhi National Open University

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	-	-	-	-	-	-	-	-	-	3	-	2	-	-
CO2	-	-	-	-	-	-	-	-	2	2	-	2	-	-
CO3	-	-	-	-	-	-	-	-	-	3	-	3	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	3	-	-

B. Tech III Year – I Sem	**L**	**T**	**P**	**C**
Subject Code: 21PR5EC03	0	1	1	1.5

Doing Engineering -2
IOT

Pre-requisite: Basic Knowledge on Computer and C language

Course Objectives:

1. Program IoT devices using MicroPython (Python for Microcontrollers).
2. Learn to use microcontrollers like ESP32.
3. Sensor Interfacing with ESP32: Light, Temperature and Humidity Sensing

Course Outcomes: Upon completion of the course, the student should be able to

1. Design commercial cloud platforms using sensors and actuators
2. Describe services offered by ThingSpeak Cloud platform
3. Design APK and monitoring with cloud techonology
4. Design code and Build IoT Projects with Raspberry pi and NodeMCU

Module I:

Introduction to ESP32, ESP 32 interfacing and configuring the setup.
Introduction to thingspeak and webserver. Creating account in things speak and various options.
Introduction and Interfacing to soil moister sensor, gas sensor, Ultra Sonic sensor and its pin configuration,

Module II:

Interfacing to Bluetooth and its pin configuration, Interfacing to WiFi module and its pin configuration
How to receive commands from web server, getting data from web server.
Design a baby health monitor system and uploading data from web server

Module III:

Smart gardening by using NODEMCU How to upload data into web server and monitor status, soil Moisture sensor, Upload Soil Moisture data and observing graph,
Design a system to control home appliance from web server.
Design a system to counts number of students entering and leaving classroom and display data on web page.

Module IV:

Making IOT Devices Interact with Mobile Applications: Introducing Mobile Application (APK), Making A mobile APK and ESP32 Interact, Controlling ESP32 from a mobile APK, Buliding IOT monitoring with Cloud Technology.

Module V:

Introduction to Raspberry Pi, Installing OS on Raspberry Pi, Downloading Image and writing image to SD card, Collecting sensor Data, Installing GPIO pins, Interfacing LED, 7-segment display

Text books:

1. MicroPython for the Internet of Things: A Beginner's Guide to Programming with Python on Microcontrollers, Charles Bell, Apress, 2017.

2. Electronics Projects with the ESP8266 and ESP32 Building Web Pages, Applications, and WiFi Enabled Devices, Neil cameron, Apress, 1st edition, 2020**.**

Reference Books:

1. IOT Based Simple and efficient projects using Arduino, Raspberry pi NAS Server, Node MCU ESP8266 and Cloud Platforms, Anbazhagan k, Ambika Parameswari k, 2019.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	**3**	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	**3**	-	-	-	-	-	-	-	-	-
CO4	2	1	**2**	-	-	-	-	-	-	-	-	-	-	-

B. Tech III Year- I Sem **L T P C**
Subject Code: 21MC7HS05 **1 0 0 0**

Analytical Reasoning
(Common to CSE/EEE/ECE/CSM/CSD/CSC/CSO/ME)

Pre-requisite: Nil

Course Objectives:

1. Improve logical thinking to solve various questions and puzzles in Reasoning.
2. To help the student understand the importance of having his language skills kept ready for effective use
3. To understand the concept of employability skills
4. To enrich their problem solving, critical and analytical skills

Course Outcomes: Upon completion of the course, the student should be able to

1. Improve logical thinking to solve various questions and puzzles in Reasoning.
2. To help the student understand the importance of having his language skills kept ready for effective use
3. To understand the concept of employability skills
4. To enrich their problem solving, critical and analytical skills

Module I:

Coding and Decoding: Coding and Decoding, Arrow Method, Chinese coding, Series, Analogy, Odd man out

Articles and Tenses: Introduction, usage of articles, Omission of Articles, Types of tenses, Forms and Usage of tenses.

Module II:

Direction Sense: Introduction, Distance method, Facing Method and Shadow Method.
Blood Relations: Introduction, Direct, Puzzle and Coded models.

Module III:

Voices and Forms of Speech: Introduction, conversion of active and passive voice, conversions of direct and indirect speech.

Module IV:

Data Arrangements: Linear Arrangement, Circular Arrangement, Multiple Arrangements.
Syllogisms: Introduction, Tick-Cross method, Inferential Technique, Venn-Diagram method.

Module V:

Visual Reasoning: Patterns, Folded Images, Cubes and Analytical Reasoning.
Sentence Correction: Subject-Verb Agreement, Pronoun Antecedent, Parallelism, Verb-Time Sequence Error, Determiners and Modifiers.

Text Books:

1. Quick Learning Objective General English, R.S. Aggarwal, Vikas Aggarwal, 2nd edition, S.Chand, 2003.
2. A Modern Approach to Logical Reasoning, R.S. Aggarwal, Revised Edition, 2nd edition, S Chand & Co Ltd, 2018.

Reference Books:

1. Test of Reasoning for all competitive examinations, Edgar Thorpe, 6th Edition, McGraw Hill Education, 2017.
2. How to Prepare for Logical Reasoning for CAT and other Management Examinations, Arun Sharma, 4th edition, McGraw Hill Education, 2017.
3. English Grammar and Verbal Reasoning – The Toolkit for Success, Simbo Nuga, Trafford Publishing, 2013

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	-	-	-	-	-	1	-	-	-	-	2	3	-	-
CO2	-	-	-	-	-	1	-	-	-	-	2	3	-	-
CO3	-	-	-	-	-	1	-	-	-	-	2	3	-	-
CO4	-	-	-	-	-	1	-	-	-	-	2	3	-	-

B. Tech III Year – I Sem	**L**	**T**	**P**	**C**
Subject Code: 21PE5EC11	3	0	0	3

TRANSMISSION LINES AND WAVEGUIDES
(Professional Elective –I)

Pre-requisite: Electromagnetic Waves and Fields.

Course Objectives: This course will enable students to:

1. To understand the concepts of Transmission Line and their characteristics, estimate the distortions present, Smith Chart and its applications, acquire knowledge to configure circuit elements to apply the same for practical problems.
2. To develop the theory related to planar transmission lines and their characteristics.
3. To get familiarized with microwave frequency bands, their applications and to understand the limitations and losses of waveguides at these frequencies.
4. Understand radio propagation in guided systems and to become familiar with resonators.

Course Outcomes:

Upon completion of the course, the student should be able to

1. Analyze basic transmission line parameters for different lines, SC, OC Lines, characterize the distortions and estimate the characteristics for different lines.
2. Explain the Smith Chart profile and stub matching features, and gain ability to practically use the same for solving practical problems.
3. Distinguish between the different types of planar transmission lines and cavity resonator, explain their functioning and select proper microstrip line and cavity resonator for engineering applications.
4. Describe the rectangular waveguides, their mode characteristics, and design waveguides for solving practical microwave transmission line problems.

Module I:

Basics of Transmission Lines: Types, Parameters, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristics Impedance, Propagation Constant, Phase and Group Velocities. Illustrative Problems.

Infinite Line Concepts, Lossless/Low Loss Characterization, Types of loading, Distortion - Condition for Distortion less and Minimum Attenuation, Illustrative Problems.

Module II:

UHF Lines and Impedance Matching : Input Impedance Relations, SC and OC Lines, Reflection Coefficient, VSWR, $\lambda/4$, $\lambda/2$, $\lambda/8$ Lines - Impedance Transformations, Significance of Z_{min} and Z_{max}, Illustrative Problems.

Smith Chart - Configuration and Applications, Matching with Lumped Elements, Single Stub Matching, Double stub matching, Quarter-Wave Transformer, Illustrative Problems.

Module III:

Strip Type transmission lines: Introduction, multi conductor transmission lines-

Coaxial lines, strip lines, micros trip lines, Types of microstrip lines.

Parallel strip lines, coplanar strip lines, slot line and coplanar waveguide, microstrip line

advantages and disadvantages, design considerations of microstrip lines, Illustrative Problems.

Module IV:
Guided Waves: Electromagnetic Spectrum and Bands. Applications of Microwaves. Rectangular Waveguides – Solution of Wave Equations in Rectangular Coordinates, TE/TM mode analysis, Expressions for Fields, Characteristic Equation and Cut-off Frequencies

Dominant and Degenerate Modes, Sketches of TE and TM mode fields in the cross-section, Phase and Group Velocities, Wavelengths and Impedance Relations, Equation of Power Transmission, Impossibility of TEM Mode.

Module V:
Circular waveguides and Cavity Resonators -Introduction, Bessel functions – Solution of field equations in cylindrical co-ordinates – TM and TE waves in circular guides – wave impedances and characteristic impedance – Dominant mode in circular waveguide.

Introduction to cavity Resonators, Rectangular Cavities, Dominant Modes and Resonant Frequencies, Q Factor and Coupling Coefficients, Illustrative Problems

Text Books:

1. Networks, Lines and Fields, J. D. Ryder, PHI, New Delhi, 2003.
2. Foundations for Microwave Engineering – R.E. Collin, IEEE Press, John Wiley, 2nd Edition, 2002.

Reference Books:

1. Microwave Engineering, David M. Pozar, 2nd Edition, John Wiley.
2. Microwave Devices and Circuits — Samuel V. Liao, Pearson, 3rd Edition, 2003.
3. Electro Magnetic Waves and Radiating System, E.C. Jordan and K. G. Balmain, PHI, New Delhi, 2003.

Web Resources:

1. https://nptel.ac.in/courses/117101056
2. https://nptel.ac.in/courses/108101112
3. https://www.youtube.com/watch?v=mpI2AZqoO4g

CO-PO MAPPING:

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	2	2	-	-	-	-	-	-	-	-	2	3
CO2	3	2	1	2	-	-	-	-	-	-	-	-	2	2
CO3	3	-	-	1	-	-	-	-	-	-	-	-	-	3
CO4	3	2	1	-	-	-	-	-	-	-	-	-	-	2

B. Tech III Year – I Sem	**L**	**T**	**P**	**C**
Subject Code: 21PE5EC12	3	0	0	3

Computer Organization and Architecture
(Professional Elective –I)

Prerequisite: Digital logic Design

Course Objectives: This course will enable students to:

1. To describe the functional blocks of a computer to interpret the instructions and various addressing modes for the execution of instruction cycle
2. To perform Arithmetic micro operations on integers and floating-point numbers
3. To study the design of data path unit and control unit for processor
4. To discuss the different ways of communicating with I/O devices & interfaces and the design techniques to enhance the performance using pipelining, parallelism.

Course Outcomes: Upon completing this course, the student will be able to

1. Describe data representation, instruction formats and the operation of a digital computer
2. Analyze the fixed point and floating-point arithmetic for ALU operation
3. Discuss about implementation schemes of control unit and pipeline performance
4. Explain the concept of various memories, interfacing and organization of multiple processors.

Module-I

Functional Blocks of a Computer: CPU, memory, input-output subsystem, control unit. Instruction set architecture of a CPU – registers. Instruction execution cycle, **RTL:** Register Transfer Language and Micro Operations: Register Transfer Language, Register Transfer Bus and Memory Transfers, Arithmetic Micro Operations, Logic Micro Operations, Shift Micro Operations, Arithmetic Logic Shift Unit, Instruction Codes, Computer Registers, Computer Instructions – Instruction Cycle. Memory – Reference Instructions, Input – Output and Interrupt, STACK Organization, Instruction Formats, Addressing Modes, DATA Transfer and Manipulation, Program Control, Reduced Instruction Set Computer.

Module-II

Data Representation: Signed number representation, fixed and floating point representations, character representation. Computer Arithmetic: Integer Addition and Subtraction - Ripple carry adder, carry look- ahead adder. Multiplication – Shift-and add, Booth multiplier, carry save multiplier. Division – Restoring and non-restoring techniques, floating point arithmetic

Module-III

The Memory System: Virtual Memories Secondary Storage, Introduction to RAID.
Input - Output Organization : Input-Output Interface, Asynchronous Data Transfer Modes, Priority Interrupt, Direct Memory Access, Input –Output Processor (IOP), Serial Communication; Introduction to Peripheral Components, Interconnect (PCI) Bus, Introduction to Standard Serial Communication Protocols like RS232, USB, IEEE1394

Module-IV

Peripheral Devices and their Characteristics: Input-output subsystems, I/O device interface, I/O transfers, - program controlled, Interrupt driven and DMA, privileged and non –privileged instructions, software interrupts and exceptions. Programs and processes – role of interrupts in

process state transitions, I/O device interfaces – SCSI, USB .The Processor: Introduction, Logic Design Conventions, Building a Data path – A Simple Implementation scheme. Data Hazards: Forwarding versus Stalling, Control Hazards, Exceptions, Parallelism via Instructions.

Module-V

Advanced Computer Architecture: Parallel processing architectures and challenges, Hardware multithreading, Multicore and shared memory multiprocessors, Introduction to Graphics Processing Units, Clusters and Warehouse scale computers – Introduction to Multiprocessor network topologies. Pipeline and Vector Processing: Parallel Processing, Pipelining, Pipelining concepts, Types of Data Hazards and Control Hazards, Understanding various techniques to handle these hazards, Arithmetic Pipeline, Instruction pipe line, RISC pipeline Vector Processing, Array Processors

Textbooks:

1. Computer Organization and Design, David A. Patterson and John L. Hennessey, Fifth edition, Morgan Kauffman / Elsevier, 2014.
2. Computer Architecture and Organization: An Integrated approach, Miles J. Murdocca and Vincent, P. Heuring, Second edition, Wiley India Pvt Ltd, 2015

Reference Books:

1. Computer Organization, V. Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky,Fifth edition, Mc Graw-Hill Education India Pvt Ltd, 2014.
2. Computer Organization and Architecture‖, William Stallings, Seventh Edition, Pearson Education, 2006.
3. Computer Architecture and Organization, Design Principles and Applications, Govindarajalu, Second edition, McGraw-Hill Education India Pvt Ltd, 2014.

Web Resources:

1. https://www.sites.google.com/site/coaexpert/useful-links

CO-PO MAPPING:

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 – Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	-	-	-	2	-	-	-	-	-	-	-	-	3
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	2
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	2
CO4	3	-	1	-	1	-	-	-	-	-	-	-	-	2

B. Tech III Year – I Sem	**L**	**T**	**P**	**C**
Subject Code: 21PE5EC13	3	0	0	3

ANALOG INTEGRATED CIRCUIT DESIGN
(Professional Elective-I)

Pre-requisite: Basic circuit theory and analysis, signals and systems and Analog electronics, MOS Transistor basics

Course Objectives: This course will enable students to
1. To understand operation of Analog IC circuits.
2. To determine the model parameters of different MOS Amplifiers.
3. To apply concepts for the design of Amplifiers, Comparators and Oscillators
4. To differentiate the MOS technology with BJT in terms of accuracy

Course Outcomes: Upon completion of the Course, the students will be able to:
1. Design MOSFET based analog integrated circuits.
2. Analyze analog circuits at least to the first order.
2. Explain the importance of noise and distortion in analog circuits.
3. Design CMOS Op-amps at the transistor level.

Module I
Basic MOS Device Physics General Considerations, MOS I/V Characteristics, Second Order effects, MOS Device models. Short Channel Effects, Current Sinks and Sources.
CMOS Device Modelling: Simple MOS Large-Signal Model, Other Model Parameters, Small-Signal Model for the MOS Transistor, Computer Simulation Models, Sub-threshold MOS Model.

Module II
Single Stage Amplifiers: Basic Concepts, Common Source Stage, Source Follower, Common Gate Stage, Cascode Stage.
Differential Amplifiers: Single Ended and Differential Operation, Basic Differential Pair, Common Mode Response, Differential Pair with MOS loads, Gilbert Cell. Passive and Active

Module III
Current Mirrors: Current mirror with Beta Helper, Degeneration, Cascode current Mirror and Wilson Current Mirror, Current and Voltage References, Band gap Reference.
Frequency Response of Amplifiers – General Considerations, Common Source Stage, Source Followers, Common Gate Stage, Cascode Stage, Differential Pair, Noise – Types of Noise, Representation of Noise in circuits.

Module IV
Feedback Amplifiers General Considerations, Feedback Topologies, Effect of Loading, Gain Boosting, Common – Mode Feedback.
Operational Amplifiers :General Considerations, One Stage Op Amps, Two Stage Op Amps, Input Range limitations, Slew Rate, Power Supply Rejection, Noise in Op Amps.

Module V
Comparators: Characterization of Comparator, Two-Stage, Open-Loop Comparators, Improving the Performance of Open-Loop Comparators, Discrete-Time Comparators.

Oscillators & Phase-Locked Loops: General Considerations, Ring Oscillators, LC Oscillators, Voltage Controlled Oscillators, Simple PLL, Charge Pump PLLs, Non-Ideal Effects in PLLs, Delay Locked Loops, Applications.

TEXT BOOKS:

1. "CMOS Analog Circuit Design", Philip E. Allen and Douglas R. Holberg, Oxford University Press, International 2nd Edition/Indian Edition, 2010.
2. "Analysis and Design of Analog Integrated Circuits", Paul R. Gray, Paul J. Hurst, S. Lewis and R. G. Meyer, Wiley India, 5th Edition, 2010.

REFERENCE BOOKS:

1. "Analog Integrated Circuit Design", David A. Johns, Ken Martin, Wiley Student Edition, 2013.
2. "Design of Analog CMOS Integrated Circuits", Behzad Razavi, TMH Edition.
3. , "CMOS: Circuit Design, Layout and Simulation", Baker, Li and BoycePHI.

CO-PO/PSO Mapping:

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	1	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-

B. Tech III Year – I Sem	**L**	**T**	**P**	**C**
Subject Code: 21PE5EC14	3	0	0	3

COMPUTER NETWORKS
(Professional Elective –I)

Pre requisites:

1. A course on "Programming for problem solving"
2. A course on "Data Structures"

Course Objective: This course will enable students to:

1. The objective of the course is to equip the students with a general overview of the concepts and fundamentals of computer networks.
2. Familiarize the students with the standard models for the layered approach to communication between machines in a network and the protocols of the various layers

Course Outcomes: Upon completion of the course, the student should be able to

1. Describe the layered protocol model.
2. Analyse a number of datalink, network, and transport layer protocols.
3. Explain essential networking applications with working
4. Analyse networks and services for homes, data centres, IoT/IoE, LANs and WANs.

Module I

Network hardware, Network software, OSI, TCP/IP Reference models, Example Networks: ARPANET, Internet. Physical Layer: Guided Transmission media: twisted pairs, coaxial cable, fiber optics, Wireless transmission.

Module II

Data link layer: Design issues, framing, Error detection and correction. Elementary data link protocols: simplex protocol, A simplex stop and wait protocol for an error-free channel, A simplex stop and wait protocol for noisy channel.

Sliding Window protocols: A one-bit sliding window protocol, A protocol using Go-Back-N, A protocol using Selective Repeat

Module III

Multiple access protocols: ALOHA, Carrier sense multiple access protocols, collision free protocols. Wireless LANs, Data link layer switching.

Network Layer: Design issues, Routing algorithms: shortest path routing, Flooding, Hierarchical routing, Broadcast, Multicast, distance vector routing, Congestion Control Algorithms

Module IV

Transport Layer: Transport Services-Services Provided to the Upper Layers, Transport Service Primitives, Elements of Transport protocols- Addressing, Connection Establishment, Release, Error Control and Flow Control, Bandwidth Allocation, UPD Protocol- Remote procedure Call, Real- Time Transport Protocols, TCP Protocol- Service Model, Protocol, segment Header, Connection Establishment, Release and Management

Application Layer –Domain name system-Lookup Process, Name space and Hierarchy, Name Resolution, SNMP, Electronic Mail-Architecture services, User Agent, Message Formats, Message Transfer, Final Delivery, The World WEB, HTTP

Module V

Wireless and Mobile Networks: Cellular Internet Access: An Overview of Cellular Network Architecture, Cellular Data Networks (3G & 4 G)

Mobile Ad-Hoc Networks: Overview of Wireless Ad-Hoc Networks, Routing in Ad-Hoc Networks.

TEXT BOOKS:

1. Computer Networks -Andrew S Tanenbaum, David. j. Wetherall, 5th Edition. Pearson Education/PHI, 2010
2. Holger Karl , Andreas willig, ―Protocol and Architecture for Wireless Sensor Networks‖, John wiley publication, Jan 2006

REFERENCE BOOKS:

1. An Engineering Approach to Computer Networks-S. Keshav, 2nd Edition, Pearson Education, 2010
2. Data Communications and Networking – Behrouz A. Forouzan. 4th Edition, TMH, 2007
3. Wireless Communications and networking, Vijay Garg, First Edition, Elsevier 2007

CO-PO &PSO Mapping:

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO2	-	3	-	-	2	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-	-	2
CO4	2	1	-	-	1	-	-	-	-	-	-	-	-	-

B. Tech III Year–V Sem	L	T	P	C
Subject Code: 21OE5CS06	3	0	0	3

Computer Organization and Architecture

Pre-requisite: NIL

Course Objective:

1. The purpose of the course is to introduce principles of computer organization and the basic architectural concepts
2. Understand the representation fixed-point and floating-point numbers in computer and develop hardware algorithms using them for fixed-point and floating-point arithmetic.
3. The course would display understanding of instruction set of RISC processor and develop understanding of how memory is organized and managed in a modern digital computer, including cache, virtual and physical memory.
4. It discusses input-output units and how they communicate with the processor, and howtheir performance is computed.

Course Outcomes:

1. Understand the theory and architecture of Digital computer system
2. Define different number systems, compliments, combinational circuits and Sequential circuits
3. Explain and use fixed point addition, subtraction, multiplication (Booth's) and division (Restoring and non-restoring) algorithms
4. Explain the concept of Computer I/O Organization, Memory, RISC, CISC Characteristics

Module I:

Digital Computers: Introduction to digital computers, need of Computer Organization and Computer Architecture, Basic of Computer Architecture and Organisation, Von Neumann Computers

Data Representation: Data Types, (r-1)'s Compliment, r's compliment, Fixed point Representation, conversion of Fractions, Floating point representation, Gray code, Error detection code

Module II:

Digital Logic Circuits -I: Logic gates, Boolean Algebra, Map simplification, Combinational circuits-Half Adder and Full Adder, Decoders and Multiplexers

Digital Logic Circuits -II: Flip-Flops- SR, JK, D, T and Edge triggered, Excitation Tables, Registers, Shift Registers, Binary Counters

Module III:

Computer Arithmetic -I: Addition and subtraction, multiplication Algorithms, Division Algorithms

Computer Arithmetic –II: Floating – point Arithmetic operations. Decimal Arithmetic unit, Decimal Arithmetic operations.

Module IV:

Basic Computer Organization: Instruction Codes, Computer Registers, Computer Instructions, Timing and control, Instruction Cycle, Memory- Reference Instructions, Input-Output and Interupt

Input-Output Organization: Priority interrupt, Peripheral devices, Input output interface, Data transfer schemes, Program control and interrupts, Direct memory access transfer, Input/output processor.

Module V:

Memory Unit: Memory Hierarchy, Main Memory, Auxiliary Memory, Associate Memory and Cache Memory

Computer Architecture: CISC Characteristics, RISC Characteristics.

Text Books:

1. Computer System Architecture by Morris Mano, Prentice hall, 3rd Edition, (2007)
2. Computer Organization by Carl Hamacher, Zvonko Vranesic, SafwatZaky, Tata McgrawHill, 5th Edition, (2011)

References:

1. Computer Architecture: A Quantitative Approach by Hennessy, J. L, David A Patterson, and Goldberg, Pearson Education, 4th Edition, (2006)
2. Computer Organization and Architecture – William Stallings Sixth Edition, Pearson/PHI.

CO-PO/PSO Mapping Chart:

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes*		
CO-PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO-1	2													**2**	
CO-2	2	2	3											2	
CO-3	2	2	2											2	
CO-4	2	2	2											2	

B. Tech III Year – V Sem	L	T	P	C
Subject Code: 21OE5EC01	3	0	0	3

ELECTRONIC MEASUREMENTS & INSTRUMENTATION

(OPEN ELECTIVE)

Prerequisite: Basic Electrical and Electronics

Course Objectives: This course will enable students to:

1. Learn and understand functioning of various measuring system and metrics for performance analysis.
2. Acquire knowledge of principle of operation, working of different electronic instruments viz. signal generators, signal analyzers, recorders and measuring equipment.
3. To Compare various measuring bridges and their balancing conditions.
4. Learn and understand the use of various measuring techniques for measurement of different physical parameters using different classes of transducers.

Course Outcomes: Upon completion of the course, the student should be able to

1. Explain the instrument and measurements of the parameters
2. Describe signal generators and analyzers
3. Categorize oscilloscopes for different applications
4. Apply the transducers for measurement of different parameters

MODULE I : Performance characteristics of instruments

Static characteristics: Accuracy, Resolution, Precision, Expected value, Error, Sensitivity.

Dynamic Characteristics: Speed of response, Fidelity, Lag and Dynamic error.

Types of errors in measurements and their analysis. Design of multi-range AC , DC meters (voltmeter &ammeter) and ohmmeter(series &shunt type) using D'arsonval movement. True rms meter.

MODULE II

Bridge circuits : Wheat stone bridge, measurement of very low resistance, Measurement of inductance- Maxwell's bridge, Anderson bridge. Measurement of capacitance-Schearing Bridge. Wien Bridge, Errors and precautions in using bridges.

Q-meter: principle of operation, measurement methods and sources of errors.

Counters : principle of operation -modes of operation- totalizing mode, frequency mode and time period mode- sources of errors.

MODULE III

Specifications and designing aspects of Signal Generators: AF sine and square wave signal generators, Function Generators, Random noise generators, arbitrary waveform generators.

Wave Analyzers: Harmonic Distortion Analyzers, Spectrum Analyzers, Digital Fourier Analyzers.

MODULE IV:

General purpose CROs: Block diagram, functions and implementation of various blocks, specifications, various controls and their functions, types of probes used in CROs. Measurement of frequency and phase difference using Lissajous patterns.

Special purpose CROs: sampling oscilloscope, analog storage oscilloscope, digital storage oscilloscope.

MODULE V:

Transducers: Transducers, Active & Passive transducers: Resistance, Capacitance, inductance; Strain gauges, LVDT, Piezo Electric transducers.

Measurement of physical parameters: Temperature, force, pressure, velocity, acceleration and displacement.

Textbooks :

1. Electronic instrumentation, second edition - H.S. Kalsi, Tata McGrawHill,2004.
2. Modern Electronic Instrumentation and Measurement Techniques – A.D. Helfrickand W.D. Cooper, PHI, 5th Edition, 2002.
3. Electronic Measurements And Instrumentation- A.K. Sawhney, Dhanpat Rai&CO(P) Limited, Jan2015.

Reference books:

1. Electronic Instrumentation & Measurements - David A. Bell, PHI, 3rd Edition,2013.
2. Electrical and Electronic Measurement and Instrumentation A.K. Sawhney. Dhanpat Rai & Co, 12thEdition,2002.

CO-PO &PSO Mapping:

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	2	-	-	-	-	-	-	-	-	-	1	2	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-	2	-
CO4	2	2	-	-	-	-	-	-	-	-	-	1	2	-

B. Tech III Year–V Sem	L	T	P	C
Subject Code: 21OE5ME01	3	0	0	3

Hybrid & Electric Vehicles

Pre-requisites: IC engines, automobile engineering, basic electrical electronics engineering

Objectives: To understand the fundamental concepts, and principles, of hybrid and electric vehicles.

To know the various aspects of hybrid and electric drive trains such as their configuration,

Students should understand various automotive systems and the basics of the drive train in automobiles.

Module I

Introduction: Layout of the automobile–introduction chassis and body components. Types of Automobile engines–Power unit -working of two stroke and four stroke engine–Introduction to engine lubrication–engine servicing

Fuel System: Fuel supply systems working in IC engines,–fuel injection an its types.

Cooling System: Cooling Requirements, Air Cooling, Forced Circulation System–Radiators–Types–Cooling Fan-water pump, thermostat, evaporative cooling-antifreeze solutions.

Module II

Ignition System: Function of an ignition system, battery ignition system, constructional features ofstorage, battery, auto transformer, contact breaker points, condenser, and spark plug.

Electrical System: Charging circuit, generator, current – voltage regulator – starting system, Bendixdrive mechanism solenoid switch, lighting systems, Horn, wiper, fuel gauge–oil pressure gauge, engine temperature indicator etc.

Transmission System: -components and working principle. The layout of the power transmission system in a conventional and hybrid vehicle (fuel vs electrical)-introduction of components

Suspension System: Objects of suspension systems –, Dependent and Independent suspension system, air suspension system. Vehicle stability assist supplemental restraint system (SRS).

Module III

Braking System: Hydraulic brake system, Master cylinder, wheel cylinder tandem master cylinder Requirement of brake fluid, Pneumatic..

Steering System: Steering geometry – Ackerman Steering Mechanism, Davis Steering Mechanism ,Hydraulic and electric power steering-working principle ,construction and working.

Introduction To Hybrid Vehicles:

History of hybrid and electric vehicles, social and The environmental importance of hybrid and electric vehicles, the impact of modern drive-trains on energy supplies.

Module IV

Hybrid Electric Drive-Trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

Electric Trains: Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

Module V

Energy Storage: Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

Energy Management Strategies: Energy Management Strategies: Introduction to energy

management strategies used in hybrid and electric vehicles, classification of different energy management strategies,

TEXTBOOKS:

1. Automobile Engineering/WilliamHCrouse.
2. A Text Book Automobile Engineering–Manzoor, Nawazish Mehdi & Yosuf Ali, Frontline Publications.
3. T. Denton, Electric and Hybrid Vehicles, Routledge, 2016

Reference Books:

1. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2011.
2. T. Denton, "Electric and Hybrid Vehicles", Routledge, 2016
3. K. Netwon, W. Steeds, T. K.Garrett, ―Automotive Engineering‖, Butterworth-Heinamann, 13th Edition, 2016.

Course Outcomes: At the end of the course, the students will be able to

1. Understand the working of IC engines,
2. Demonstrate the working of power transmission and brakes.
3. Understand the models to describe conventional, and hybrid vehicles and their performance.
4. Understand the different strategies related to energy storage systems.

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – High; 2 – Medium; 1 –Low

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes*	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1											2	2
CO2	3	1											2	2
CO3	3	1											2	2
CO4	3	1											2	2

	L	T	P	C
B.Tech III Year – V Sem				
Subject Code: 21OE5EE01	**3**	**0**	**0**	**3**

FUNDAMENTALS OF ELECTRICAL CIRCUIT ANALYSIS

Pre-requisite: Basic Mathematics & Physics

Course Objectives:

1) To introduce the concepts of electrical circuits and their components
2) To Analyze electrical circuits with the help of network theorems
3) To understand DC circuits and single-phase AC circuits
4) To analyse the magnetic circuits

Course Outcomes:

At the end of course student will be able to do

1. CO1 – To understand the electrical circuits with DC excitation.
2. CO2 – To analyze electrical circuits with the help of network theorems
3. CO3 – To analyze electrical circuits with AC excitation
4. CO4 – To analyse the magnetic circuits.

Module I: D.C. Circuits

Introduction to Electrical Circuits: Current, Voltage, Power, Energy, Ohm's law, types of elements, Kirchoff laws, types of sources, resistive networks, inductive networks, capacitive networks, series, parallel circuits, analysis of simple circuits with dc excitation.

Network Analysis: Mesh and Nodal analysis, Voltage and current divide rule, source transformation technique, and star-delta and delta star transformation, simple problems.

Module II:Network Theorems

Network Theorems -I: Superposition, reciprocity, Thevenin's, Norton's theorems for DC excitations, numerical problems.

Network Theorems -II: Tellegen's, Maximum power transfer, Milliman's for DC excitations, numerical problems.

Module III:A.C. Circuits

Single Phase AC Circuits: Representation of sinusoidal waveforms, Average and RMS values, peak factor, and Formfactor. Real power, Reactive power, Apparent power, power factor, Numerical problems.

RLC Analysis:Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, and RLC combinations for both series and parallel, Numerical problems.

Module IV:Magnetic Circuits

Absolute and Relative Permeability of a Medium, Laws of Magnetic Force,Flux Density (B),Faraday's laws of electromagnetic induction –concept of self and mutual inductance – dot convention

Coefficient of coupling –composite magnetic circuit - Analysis of series and parallel magnetic circuit, Simple Problems.

Module V: Network Topologies

Network Topology-I
Basic definitions of graph theory, Incidence Matrices, Branch path incidence matrices**,** and numerical problems.

Network Topology-II
Cut set matrices, Relation between branch currents I_b and loop currents I_l, Tie set matrices, the relation between branch voltages and node voltages. Duality concept and numerical problems.

TEXTBOOKS:

1. A Chakrabarty, "Electric Circuits", Dhanipat Rai & Sons, 6th Edition, 2010. L.S. Bobrow, Fundamentals of Electrical Engineering", Oxford University Press, 2011
2. M E Van Valkenberg, "Network Analysis", PHI, 3rd Edition, 2014.

REFERENCE BOOKS:

1. A Sudhakar, Shyammohan S Palli, "Circuits and Networks", Tata McGraw-Hill, 4th Edition, 2010.
2. David A Bell, "Electric circuits", Oxford University Press, 7th Edition, 2009.
3. Electrical Engineering Fundamentals, Vincent Deltoro, Second Edition, Prentice-Hall India, 1989

Web Resources:

1. **https://nptel.ac.in/courses/108/104/108104139/**

2. https://nptel.ac.in/courses/117/106/117106108/

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	2			3								2	2
CO2	2	3											2	
CO3	2	3											2	
CO4	2	1											2	

B.Tech III Year – V Sem	**L**	**T**	**P**	**C**
Subject Code: 21OE5CM01	**3**	**0**	**0**	**3**

INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Course Objectives

1. To provide a strong foundation of fundamental concepts in artificial intelligence.
2. To provide a basic exposition to the goals and methods of Artificial intelligence
3. To provide the exposition to uncertainty management, decision making and learning methods.
4. To provide different knowledge representation, reasoning, and learning techniques.

Course Outcomes

1. Discuss basic concepts of Artificial Intelligence, AI principles, AI Task domains and application.
2. Apply searching techniques, constraint satisfaction problem and game playing techniques which involve perception, reasoning and learning.
3. Explain working of uncertainty management, decision making and learning methods.
4. Apply different knowledge representation, reasoning, and learning techniques to real world problems.

MODULE-I

Introduction: Artificial Intelligence, AI Problems, AI Techniques, the Level of the Model, Criteria for Success. Problem Space and Search, Defining the Problem as a State Space Search, Problem Characteristics; Tic-Tac-Toe Problem, Production Systems.

Basic Search Techniques: Solving Problems by searching; Issues in The Design of Search Programs; Uniform search strategies; Breadth first search, depth first search, depth limited search, bidirectional search, Best First search, comparing search strategies in terms of complexity.

MODULE-II

Special Search Techniques: Heuristic Search, greedy best first search, A* search Problem Reduction, AO*Algorithm; Hill climbing search, Simulated Annealing search; Genetic Algorithm; Constraint Satisfaction Problems; Adversarial search, Games, Optimal decisions and strategies in games, Minimax search, Alpha, beta pruning.

Knowledge Representation: Procedural Vs Declarative Knowledge, Representations & Approaches to Knowledge Representation, Forward Vs Backward Reasoning, Matching Techniques, Partial Matching, Fuzzy Matching Algorithms and RETE Matching Algorithms.

MODULE-III

Symbolic Logic: Propositional Logic, First Order Predicate Logic: Representing Instance and is-a Relationships, Computable Functions and Predicates, Syntax & Semantics of FOPL, Normal Forms, Unification &Resolution, Representation Using Rules, Natural Deduction.

Structured Representations of Knowledge: Semantic Nets, Partitioned Semantic Nets, Frames, Conceptual Dependency, Conceptual Graphs, Scripts, CYC.

MODULE-IV

Reasoning under Uncertainty: Introduction to Non-Monotonic Reasoning, Truth Maintenance Systems, Logics for Non-Monotonic Reasoning, Model and Temporal Logics.

Statistical Reasoning: Bayes Theorem, Certainty Factors and Rule-Based Systems, Bayesian Probabilistic Inference, Bayesian Networks, Dempster-Shafer Theory.

Fuzzy Logic: Crisp Sets, Fuzzy Sets, Fuzzy Logic Control, Fuzzy Inferences & Fuzzy Systems.

MODULE-IV

Experts Systems: Overview of an Expert System, Structure of an Expert Systems, Different Types of Expert Systems- Rule Based, Model Based, Case Based and Hybrid Expert Systems, Knowledge Acquisition and Validation Techniques, Black Board Architecture, Knowledge Building System Tools, Expert System Shells, Fuzzy Expert systems.

Learning: Types of learning, general learning model, Learning by induction; generalization, specialization, example of inductive learner.

Text Book:

1. Artificial Intelligence, George F Luger, Pearson Education Publications
2. Artificial Intelligence, Elaine Rich and Knight, Mcgraw-Hill Publications

References:

1. Introduction To Artificial Intelligence & Expert Systems, Patterson, PHI
2. Multi Agent systems- a modern approach to Distributed Artificial intelligence, Weiss. G, MIT Press.
3. Artificial Intelligence: A modern Approach, Russell and Norvig, Printice Hall

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 – Low

CO/PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO2	PSO3
CO-1		3										2	2		
CO-2	3												2		
CO-3		3										2	2		
CO-4	3											2	2		

B.Tech III – V Sem **L T P C**
Subject Code: 21OE5CD01 **3 0 0 3**

Statistics for Data Science

Course Objective

1. The Number Theory basic concepts useful for cryptography etc
2. The theory of Probability, and probability distributions of single and multiple random variables 3. The sampling theory and testing of hypothesis and making inferences
4. Stochastic process and Markov chains.

Course Outcomes:

1. Apply the number theory concepts to cryptography domain
2. Apply the concepts of probability and distributions to some case studies
3. Correlate the material of one unit to the material in other units
4. Resolve the potential misconceptions and hazards in each topic of study.

Module I

Greatest Common Divisors and Prime Factorization: Greatest common divisors, The Euclidean algorithm, The fundamental theorem of arithmetic, Factorization of integers and the Fermat numbers
Congruences: Introduction to congruences, Linear congruences, The Chinese remainder theorem, Systems of linear congruences

Module II

Simple Linear Regression and Correlation: Introduction to Linear Regression, The Simple Linear Regression Model, Least Squares and the Fitted Model, Properties of the Least Squares Estimators, Inferences Concerning the Regression Coefficients, Prediction, Simple Linear Regression Case Study
Random Variables and Probability Distributions: Concept of a Random Variable, Discrete Probability Distributions, Continuous Probability Distributions, Statistical Independence. Discrete probability
Distributions: Binomial Distribution, Poisson distribution.

Module III

Continuous Probability Distributions: Normal Distribution, Areas under the Normal Curve, Applications of the Normal Distribution, Normal Approximation to the Binomial, Fundamental Sampling
Distributions: Random Sampling, Sampling Distributions, Sampling, Distribution of Means and the Central Limit Theorem, Sampling Distribution of S2, t–Distribution, F Distribution.

Module IV

Estimation & Tests of Hypotheses: Introduction, Statistical Inference, Classical Methods of Estimation. Estimating the Mean, Standard Error of a Point Estimate, Prediction Intervals, Tolerance Limits, Estimating the Variance, Estimating a Proportion for single mean, Difference between Two Means, between Two Proportions for Two Samples and Maximum Likelihood Estimation.

Module V

Stochastic Processes and Markov Chains: Introduction to Stochastic processes- Markov process. Transition Probability, Transition Probability Matrix, First order and Higher order Markov process, n step transition probabilities, Markov chain, Steady state condition, Markov analysis.

TEXT BOOKS:

1. Kenneth H. Rosen, Elementary number theory & its applications, sixth edition, Addison Wesley, ISBN 978 0-321-50031-1
2. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, Probability & Statistics for Engineers & Scientists, 9th Ed. Pearson Publishers.
3. S. D. Sharma, Operations Research, Kedarnath and Ramnath Publishers, Meerut, Delhi

REFERENCE BOOKS:

1. S C Gupta and V K Kapoor, Fundamentals of Mathematical statistics, Khanna publications 2. T.T. Soong, Fundamentals of Probability And Statistics For Engineers, John Wiley & Sons Ltd, 2004.
3. Sheldon M Ross, Probability and statistics for Engineers and scientists, Academic Press.

CO-PO &PSO Mapping:

Course Name - Course Outcomes / Program Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO 2	PSO 3
CO1	M	L			L										
CO2	M	L			L										
CO3	M	L			L										
CO4	M	L			L										

B. Tech III Year – V Sem	L	T	P	C
Subject Code: 21OE5CO01	3	0	0	3

FUNDAMENTALS OF IOT

PREREQUISITE: Basics of computers

COURSE OBJECTIVE:

1. The Internet is evolving to connect people to physical things and also physical things to other physical things all in real time.
2. The course enables student to understand the basics of Internet of things and protocols.
3. Introduces some of the application areas where Internet of Things can be applied.
4. Students will learn about the middleware for Internet of Things. To understand the concepts of Web of Things

COURSE OUTCOMES:

1. Interpret the concepts of IoT
2. Analyze the importance of Protocols in IoT
3. Understand the IoT architecture
4. Apply IoT concepts in Industry applications and IoT platforms

Module 1:

Introduction to IOT - IoT and its importance, Elements of an IoT ecosystem, Technology drivers, Business drivers, Trends and implications

Overview of Governance, Privacy and Security Issues.

Module II

IOT PROTOCOLS - Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – **Protocols** – IEEE802.15.4–BACNet Protocol– Modbus – KNX – Zigbee– Network layer – APS layer – Security

Module III

IOT ARCHITECTURE - IoT Open-source architecture (OIC)- OIC Architecture & Design principles- IoT Devices and deployment models

IoTivity : An Open source IoT stack - Overview- IoTivity stack architecture- Resource model and Abstraction.

Module IV

WEB OF THINGS - Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT

Unified Multitier WoT Architecture – WoT Portals and Business Intelligence.

Module V:

IOT APPLICATIONS – Qualitative study of sensors, IoT applications for industry: Future Factory Concepts, Smart Objects, Smart Applications.

Study of existing IoT platforms /middleware, IoT- A, Hydra etc.

TEXT & REFERENCES:

Text:

- Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press,2012.
- Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet ofThings", Springer, 2011.
- David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a HighlyConnected World", Cambridge University Press, 2010.
- Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applicationsand Protocols", Wiley, 2012.

References:

- Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)",1st Edition, VPT, 2014
- Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to ConnectingEverything", 1st Edition, Apress Publications, 2013
- CunoPfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493-9357-1

Course Outcomes (CO)	**CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low**													
	Program Outcomes (POs)												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3								2	2			1	
CO2	3	1			3				2	2			2	
CO3	3	1			2				2	2			2	
CO4	3	1	3		3				2	2			1	

B. Tech III Year–V Sem	**L**	**T**	**P**	**C**
Subject Code: 21OE5CC01	**3**	**1**	**-**	**4**

DATA SECURITY

Prerequisite(s): Nil

Course Objectives:

• To introduce different classical cryptographic techniques and its theoretical security analysis.
• To provide and demonstrate different cryptanalysis attacks against the cryptographic techniques, and their attack models.
• To show the impact of these ciphers on society during the time of their use.

Course Outcomes:

At the end of the course, students are able to:

CO1: Identify the basic language & terminologies of cryptography.
CO2: Demonstrate Encryption and Decryption methods using various ciphers of classical cryptography.
CO3: Perform cryptanalysis of classical cryptography.
CO4: Understand the concept of digital signatures.

Module 1:

Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks.
Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric keycryptography, steganography, key range and key size, possible types of attacks.

Module 2:

Symmetric key Ciphers: Algorithms Types, Algorithm Modes, Data Encryption Standards, International Data Encryption Algorithm (IDEA), RC4, RC5, Blowfish,
Case Study: Secure Multiparty Calculation.

Module 3:

Asymmetric key Ciphers - I: Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Comparison of symmetric and symmetric Key Cryptography.

Module 4:

Asymmetric key Ciphers - II: Digital signatures, Elgamal Digital Signature Scheme, Attacks on Digital Signature, Knapsack Algorithm, Problems with Public key Exchange.

Module 5:

Public – Key Infrastructure : Digital Certificates, private - Key management, The PKIX Model, Public Key Cryptography Standards(PKCS) , XML, PKI and security.

Text Books:

1. Padmanabhan T R, Shyamala C and Harini N, "Cryptography and Security", Wiley Publications 2011.
2. Josef Pieprzyk, Thomas Hardjono and Jenifer Seberry, "Fundamentals of Computer Security", Springer 2010.

Resources:

1. Douglas R Stinson, "Cryptography: Theory and Practice", CRC Press 2005.
2. Alfred J Menezes, Paul C Van Oorshot and Scott A. Vanstone, "Handbook of Applied Cryptography", CRC press 1996.

CO-PO/PSO Mapping:

CO-PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO2	PSO3
CO-1			2				3								
CO-2				2			1								
CO-3				3				1							
CO-4		1						3							

B.Tech III Year–II Sem	**L**	**T**	**P**	**C**
Subject Code: 21ES6CS03	**3**	**0**	**0**	**3**

PYTHON PROGRAMMING

Prerequisite: Programming for Problem solving Using C

Course Objectives:
1. Acquire programming skills in core Python.
2. Acquire Object-oriented programming skills in Python.
3. Develop the skill of designing graphical-user interfaces (GUI) in Python.
4. Develop the ability to write database applications in Python.

Course Outcomes: Upon completion of the course, the student should be able to
1. Understand operators, precedence of operators, associativity while evaluating expressions in program statements.
2. Visualize the capabilities of procedural as well as object-oriented programming in Python and demonstrate the same in real world scenario.
3. Demonstrate indexing and slicing mechanisms for extracting a portion of data in a sequence.
4. Extend the knowledge of Python programming to build successful career in software development.

Module I

Python Basics, Objects- Python Objects, Standard Types, Other Built-in Types, Internal Types, Standard Type Operators, Standard Type Built-in Functions, Categorizing the Standard Types, Unsupported Types
Numbers - Introduction to Numbers, Integers, Floating Point Real Numbers, Complex Numbers, Operators, Sequences - Strings, Lists, and Tuples, Mapping and Set Types

Module II

Conditional Statements : Selection/Conditional Branching Statements: if, if-else, nested if, if-elif-else statement(s),
Iterative Statements – while and for loop, Nested loops, break and continue statement, pass Statement, else Statement used with loops.

Module III
Functions: Communicating with functions, Variable Scope and lifetime, return statement, Types of arguments, Lambda functions, and Recursive functions
Classes and Objects – Defining Classes, Creating Objects, Data Abstraction and Hiding through Classes, Class Method and self-Argument, Class variables and Object variables, __init()__and del__() method.

Module IV

FILES: File Objects, File Built-in Function [open()], File Built-in Methods, File Built-in Attributes, Standard Files, Command-line Arguments.

Exceptions: Exceptions in Python, Detecting and Handling Exceptions, Context Management, , Raising Exceptions, Related Modules Regular Expressions: Introduction, Special Symbols and Characters, Res and Python

Module V

Multithreaded Programming: Introduction, Threads and Processes, Python, Threads, and the Global Interpreter Lock, Thread Module, Threading Module, Related Modules

GUI Programming: Introduction, Tkinter and Python Programming, Brief Tour of Other GUIs, Related Modules and Other GUIs

Text Books:

1. Python Programming - Using Problem Solving Approach, Reema Thareja, Oxford Press, 1st Edition, 2017.
2. Python 3 Object Oriented Programming, DuPhilips, PACKT Publishing, 2nd Edition, 2015.

Reference Books:

1. Let Us Python, Yashavant Kanetkar, Aditya Kanetkar, BPB Publications, 2nd Edition, 2019.
2. Python: The Complete Reference, Martin C. Brown, McGraw Hill, Indian Edition, 2018
3. Object Oriented Programming in Python, Michael H.Goldwasser, David Letscher, Prentice Hall, 1st Edition, 2007.
4. Python Programming – A Modular Approach, Taneja Sheetal, Kumar Naveen, Pearson, 1st Edition, 2017
5. Core Python Programming, R Nageswar Rao, Dreamtech Press, 2018.

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – High; 2 – Medium; 1 - Low

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes*	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	2	-	-	-	-	-	-	-	-	-	1	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-	1	-
CO3	-	-	-	-	2	-	-	-	-	-	-	-	1	-
CO4	-	-	-	-	2	-	-	-	-	-	-	-	1	-

B. Tech III Year – II Sem	**L**	**T**	**P**	**C**
Subject Code: 21PC6EC19	3	1	0	4

DIGITAL SIGNAL PROCESSING

Prerequisite: Signals and Systems

Course Objectives:

1. To provide background and fundamental material for the analysis and processing of digitalsignals.
2. To understand the fast computation of DFT and appreciate the FFT processing.
3. To study the designs and structures of digital (IIR and FIR) filters and analyze and synthesizefor a given specifications.
4. To acquaint in Multi-rate signal processing techniques and finite word length effects**.**

Course Outcomes: Upon completing this course, the student will be able to

1. Analyze the LTI system characteristics and Multi Rate signal processing.
2. Describe the inter-relationship between DFT and various transforms.
3. Design a digital filter for a given specification.
4. Analyze the significance of various filter structures and effects of round off errors.

Module-I

Introduction to Digital Signal Processing: Discrete Time Signals & Sequences,conversion of continuous to discrete signal, Normalized Frequency**,** Linear Shift Invariant Systems, Stability, and Causality, linear differential equation to difference equation**,** Linear Constant CoefficientDifference Equations, Frequency Domain Representation of Discrete Time Signals and Systems.

Multi rate Signal Processing:

Introduction, Down Sampling, Decimation, Up sampling, Interpolation, Sampling Rate Conversion.

Module – II

Discrete Fourier series: DFS Representation of Periodic Sequences, Properties of Discrete Fourier Series, Relation between DTFT, DFS, DFT and Z- Transform.

Discrete Fourier Transforms: Properties of DFT, Linear Convolution of Sequences using DFT, Computation of DFT: Over-Lap Add Method, Over-Lap Save Method and IDFT.

Module – III

Fast Fourier Transforms: Fast Fourier Transforms (FFT) – Direct computation of DFT, Divide and conquer approach to computation of DFT, Radix -2 FFT algorithms, Radix -4 algorithms, efficient computation of DFT of two real sequences, efficient computation of DFT of 2N-point real sequence.

FFT algorithms

Radix-2 Decimation-in-Time, Decimation-in-Frequency FFT Algorithms, differences and similarities between DIT and DIF algorithms, IDFT using FFT algorithms

Module – IV

IIR Digital Filters: Analog filter approximations (Order of filters I &II) – Butterworth and Chebyshev , Design of IIR Digital Filters from Analog Filters, Step and Impulse Invariant Techniques, Bilinear Transformation Method, Spectral Transformations.

FIR Digital Filters (Order of filters I &II): Characteristics of FIR Digital Filters, Frequency Response. Design of FIR Filters: Fourier Method, Digital Filters using Window Techniques, Frequency Sampling Technique, Comparison of IIR & FIR filters.

Module – V

Applications of Z – Transforms, Solution of Difference Equations of Digital Filters, System Function, Stability Criterion, Frequency Response of Stable Systems, Realization of Digital Filters – Direct, Canonic, Cascade and Parallel Forms.

Finite Word Length Effects: Limit cycles, Overflow Oscillations, Round-off Noise in IIR Digital Filters, Computational Output Round Off Noise, Methods to Prevent Overflow, Trade Off Between Round Off and Overflow Noise, Measurement of Coefficient Quantization Effects through Pole-Zero Movement, Dead Band Effects.

Text Books:

1. Discrete Time Signal Processing – A. V. Oppenheim and R.W. Schaffer, PHI, 2009
2. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G.Manolakis, Pearson Education / PHI, 2007.

Reference Books:

1. Digital Signal Processing – Fundamentals and Applications – Li Tan, Elsevier, 2008
2. Fundamentals of Digital Signal Processing using MATLAB – Robert J. Schilling, Sandra L.Harris, Thomson, 2007
3. Digital Signal Processing – S. Salivahanan, A. Vallavaraj and C. Gnanapriya, TMH, 2009
4. Digital Signal Processing - A Practical approach, Emmanuel C. Ifeachor and Barrie W. Jervis,2nd Edition, Pearson Education, 2009

Web Resources:

1. https://nptel.ac.in/courses/117102060
2. E Books: https://www.sciencedirect.com/book/9780128150719/digital-signal-processing
3. https://www.goodreads.com/book/show/12614923-web-based-supply-chain-management-and-digital-signal-processing

MOOC's Courses:

1. https://onlinecourses.nptel.ac.in/noc21_ee20/preview
2. https://www.coursera.org/learn/dsp1

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – High; 2 – Medium; 1 - Low

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes*	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	1	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	2	2	-	-	-	-	-	-	-	-	-	-	3
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	3

B. Tech III Year – II Sem	L	T	P	C
Subject Code: 21PC6EC20	3	0	0	3

VLSI Technology and Design

Prerequisite: EDC, DLD

Course Objectives: The objectives of the course are to:

1. Create models of moderately sized CMOS circuits that realize specified digital functions.
2. Apply CMOS technology-specific layout rules in the placement and routing of transistors and interconnect, and to verify the functionality, timing, power, and parasitic effects
3. Design static CMOS combinational and sequential logic at the transistor level, including mask layout.
4. Compare the trade-offs of sequencing elements including flip-flops and latches
5. Design functional units including adders, multipliers, ROMs, SRAMs, and PLAs.

Course Outcomes: Upon completing this course, the student will be able to

1. Acquire qualitative knowledge about the fabrication process of integrated circuit using MOS transistors.
2. Analysis of transfer characteristics of different logic gates using CMOS inverter
3. Draw the layout of any logic circuit which helps to estimate parasitic of any logic circuit
4. Design simple logic circuit using PLA, PAL, FPGA and CPLD

Module-I

Introduction : Introduction to IC Technology, MOS and related VLSI Technology, Basic MOS Transistors, Enhancement and Depletion modes of transistor action, IC production process, MOS and CMOS Fabrication processes, BiCMOS Technology, Comparison between CMOS and Bipolar technologies.

Basic Electrical Properties Of MOS and Bi-CMOS Circuits: Ids versus Vds Relationships, Aspects of MOS transistor Threshold Voltage, MOS transistor Trans, Output Conductance and Figure of Merit, The Pass transistor.

Module-II

NMOS Inverter, Pull-up to Pull-down Ratio for NMOS inverter driven by another NMOS inverter. Alternative forms of pull-up, The CMOS Inverter, MOS transistor circuit model, Bi-CMOS Inverter, Latch-up in CMOS circuits and BiCMOS Latch-up Susceptibility

MOS and Bi-CMOS Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2 μm CMOS Design rules for wires, Contacts and Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits

Module-III

Basic Circuit Concepts: Sheet Resistance for MOS transistors and Inverters, Area Capacitance of Layers, Standard unit of capacitance, The Delay Unit, Inverter Delays, Propagation Delays, Wiring Capacitances, Fan-in and fan-out characteristics, Choice of layers, Transistor switches

Realization of logic gates using NMOS, PMOS and CMOS technologies.

Scaling Of MOS Circuits: Scaling models, Scaling factors for device parameters, Limits due to sub threshold currents, current density limits on logic levels and supply voltage due to noise

Module-IV

Subsystem Design: Architectural issues, switch logic, Gate logic, clocked sequential circuits, system considerations, general considerations of subsystem design processes, an illustration of design processes

Design of Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Zero/One Detectors, Counters. **Array Subsystems:** SRAM, DRAM, ROM, Serial Access Memories.

Module-V

Programmable Logic Devices: PLAs, PAL, FPGAs, CPLDs, Standard Cells, Programmable Array Logic, Design Approach, Parameters influencing low power design. CMOS Testing: CMOS Testing, Need for testing, Test Principles, Design Strategies for test, Chip level Test Techniques.

VlSI Design Issues: VLSI Design issues and design trends, design process, design for testability, technology options, power calculations, package selection, clock mechanisms, mixed signal design, ASIC design flow, FPGA design flow, introduction to SoC design.

TEXT BOOKS:

1. Essentials of VLSI circuits and systems – Kamran Eshraghian, Eshraghian Dougles and A. Pucknell, 1st Edition, PHI, 2005

2. CMOS VLSI Design – A Circuits and Systems Perspective, Neil H. E Weste, David Harris, Ayan Banerjee, 3rd Edition , Pearson, 2009.

3. PLD Based Design with VHDL: RTL Design, Synthesis and Implementation, Vaibbhav Taraate, Springer, 2017.

REFERENCE BOOKS:

1. CMOS logic circuit Design - John .P. Uyemura, Springer, 2007.
2. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.

Web Resources:

1. http://www.vlsi-expert.com/
2. http://pages.hmc.edu/harris/cmosvlsi/4e/index.html

Mooc's Courses:

1. https://nptel.ac.in/courses/117106092
2. https://www.coursera.org/lecture/vlsi-cad-logic/welcome-and-introduction-CBOe2

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes ***	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	1	-	2	-	-	-		-	-	-	3	-
CO2	3	-	-	-	2	-	-	-	2	-	-	-	2	-
CO3	2	-	-	2	2	-	-	-	2	-	-	-	2	-
CO4	3	-	2	-		-	-	-	2	-	-	-	2	-

B. Tech III Year- II Sem	**L**	**T**	**P**	**C**
Subject Code: 21HS6MB02	**2**	**0**	**0**	**2**

Fundamentals of Engineering Management

Pre-requisite: Nil

Course Objective:

1. To understand the Management Concepts, applications of concepts in Practical aspects of business
2. To induce the development of Managerial Skills for Engineers.
3. To study the system and process of effective controlling in the organization.
4. To enable students to understand the key components of a successful project and to embed the necessary processes, components, and attributes into execution of their projects; allows practice of communication skills to organize project teams

Course Outcomes: Upon completion of the course, the student should be able to

1. Comprehend the concepts & principles of management in real life industry.
2. Describe the interaction of organizational designs and competitive strategies
3. Apply the concept of operations management in manufacturing and service sector and will be able to plan and implement production and service related decisions.
4. Demonstrate strong conceptual knowledge in the functional area of Human Resource Management, Marketing management and Project Management

Module I:

Introduction to Management: Evolution of Management, Nature & Scope-Functions of Management-Role of Manager-levels of Management-Managerial Skills - Challenges

Planning & Strategic Management: Planning - Planning Process - Types of Plans - MBO

Module II:

Organization Structure: Organization Design - Organizational Structure - Departmentation - Delegation - Centralization – Decentralization - Recentralization -Organizational Culture - Organizational climate - Organizational change

Human Resource Management-HR Planning - Recruitment & Selection - Training & Development-Performance appraisal - Job satisfaction-Stress Management Practices

Module III:

Operation Management: Introduction to Operations Management - Principles and Types of Plant Layout - Methods of production (Job Batch and Mass production) - Method study and Work Measurement

Quality Management – TQM - Six sigma - Deming's Contribution to Quality – Inventory Management – EOQ - ABC Analysis - JIT System-Business Process Re-engineering (BPR)

Module IV:

Marketing Management: Introduction to Marketing-Functions of Marketing-Marketing vs. Selling- Marketing Mix - Marketing Strategies - Product Life Cycle - Market Segmentation

Distribution Decisions, Promotion and Communication Strategies:

Types of Marketing - Direct Marketing - Network Marketing - Digital Marketing -Channels of Distribution - Supply Chain Management (SCM)

Module V:

ERP Introduction, Benefits, Origin, Evolution and Structure: Conceptual Model of ERP, the Evolution of ERP, the Structure of ERP.

ERP Marketplace Dynamics: Market Overview, Marketplace Dynamics, the Changing ERP Market. ERP- Functional Modules: Introduction, Functional Modules of ERP Software, Integration of ERP, Supply chain and Customer Relationship Applications.

Text Books:

1. Management Essentials, Andrew DuBrin, 9e, Cengage Learning, 2012.
2. Fundamentals of Management, Stephen P.Robbins, Pearson Education, 2009.

Reference Books:

1. Essentials of Management, Koontz Kleihrich, Tata Mc - Graw Hill.
2. , "ERP Demystified", Alexis Leon, Tata McGraw Hill
3. Management Fundamentals, Robert N Lussier, 5e, Cengage Learning, 2013.
4. Industrial Engineering and Management: Including Production Management, T.R.Banga, S.C Sharma , Khanna Publishers.

Web Resources

1. http://nptel.ac.in/courses/109105121/
2. http://nptel.ac.in/courses/122105021/

CO-PO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 – Low												
Course Outcomes (COs)	**Program Outcomes (POs)**											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	-	-	-	-	-	-	-	-	2	-	2	-
CO2	-	-	-	-	-	-	-	-	2	2	2	-
CO3	-	-	-	-	-	-	-	-	2	-	2	-
CO4	-	-	-	-	-	-	-	-	1	-	2	-

B. Tech III Year – II Sem	**L**	**T**	**P**	**C**
Subject Code:21PC6EC22	3	0	0	3

VLSI Design Laboratory

Prerequisite: Digital Logic Design

Course Objectives: This course will enable students to:

1. To learn Hardware Descriptive Languages (Verilog/VHDL).
2. To learn the fundamental principles of VLSI circuit design in both digital and analog domain.
3. To familiarise fusing of logical modules on FPGAs.
4. To provide hands on design experience with professional design (EDA) platforms.

Course Outcomes: Upon successful completion of the course, the student is able to

1. Write HDL code for basic as well as advanced digital integrated circuits.
2. Import the logic modules into FPGA Boards.
3. Synthesize, Place and Route the digital IPs.
4. Design, Simulate and Extract the layouts of Analog IC Blocks using EDA tools.

List of Experiments:

Note: Any SIX of the following experiments from each part are to be conducted (Total 12)

Part-I Layout, physical verification, placement & route for complex design, static timing analysis, IR drop analysis and crosstalk analysis using Microwind or any equivalent tool for the following:

1. Basic logic gates
2. NMOS and CMOS inverters
3. CMOS NOR and NAND gates
4. CMOS XOR and MUX gates
5. Static / Dynamic logic circuit (register cell)
6. Latch
7. Pass transistor
8. Layout of any combinational circuit (complex CMOS logic gate).

Part - II All the following experiments have to be implemented using XILINX Simulator/ Equivalent software

1. Realize all the logic gates
2. Design of 8-to-3 encoder (without and with priority) and 2-to-4 decoder
3. Design of 8-to-1 multiplexer and 1-to-8 demultiplexer
4. Design of 4 bit binary to gray code converter
5. Design of 4 bit comparator
6. Design of Full adder using two half adders
7. Design of flip flops: SR, D, JK, T
8. Design of 4-bit binary, BCD counters (synchronous/ asynchronous reset)
9. Design of any 4-bit sequence counter

Text Books:

1. Essentials of VLSI circuits and systems – Kamran Eshraghian, Eshraghian Dougles and A. Pucknell, PHI, 2005

2. CMOS VLSI Design – A Circuits and Systems Perspective, Neil H. E Weste, David Harris, Ayan Banerjee, 3rd Ed, Pearson, 2009.

Reference Books:

1. CMOS logic circuit Design - John .P. Uyemura, Springer, 2007.
2. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.

Web Resources:

1. http://www.vlsi-expert.com/
2. http://pages.hmc.edu/harris/cmosvlsi/4e/index.html

E Books:

1. http://www.freebookcentre.net/electronics-ebooks-download/Design-of-VLSI-Circuits.html
2. http://www.freebookcentre.net/electronics-ebooks-download/Introduction-to-VLSI-Circuits-Design.html

Mooc's Courses:

1. https://nptel.ac.in/courses/117106092
2. https://www.coursera.org/lecture/vlsi-cad-logic/welcome-and-introduction-CBOe2

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 – Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	-	-	3	-	-	-	-	-	-	-	1	-
CO2	3	2	-	-	3	-	-	-	-	-	-	-	2	-
CO3	3	2	-	-	3	-	-	-	-	-	-	-	2	-
CO4	3	2	2	-	3	-	-	-	-	-	-	-	2	-

B. Tech III Year–II Sem	**L**	**T**	**P**	**C**
Subject Code: 21ES6CS04	**0**	**0**	**3**	**1.5**

Python Programming Lab

Prerequisite: Basic Programming Skills.
Course Objectives: This course will enable students to:
1. Acquire programming skills in core Python.
2. Acquire Object-oriented programming skills in Python.
3. Develop the skill of designing graphical-user interfaces (GUI) in Python.
4. Develop the ability to write database applications in Python.

Course Outcomes: Upon completion of the course, the student should be able to
1. Acquire programming skills in core Python.
2. Acquire Object-oriented programming skills in Python.
3. Develop the skill of designing graphical-user interfaces (GUI) in Python.
4. Develop the ability to write database applications in Python.

List of Experiments:

Experiment – 1: OPERATORS
a. Read a list of numbers and write a program to check whether a particular element is present or not using membership operators.
b. Read your name and age and write a program to display the year in which you will turn 100 years old.

Experiment – 2: CONTROL STRUCTURES
a. Read your email id and write a program to display the no of vowels, consonants, digits and white spaces in it using if…elif…else statement.
b. Write a Program to find the sum of a Series 1/1! + 2/2! + 3/3! + 4/4! +…….+ n/n!. (Input :n = 5, Output : 2.70833)

Experiment – 3: LIST
a. Read a list of numbers and print the numbers divisible by x but not by y (Assume x = 4 and y = 5).
b. Read a list of numbers and print the sum of odd integers and even integers from the list.(Ex: [23, 10, 15, 14, 63], odd numbers sum = 101, even numbers sum = 24)

Experiment – 4: TUPLE
a. Given a list of tuples. Write a program to find tuples which have all elements divisible by K from a list of tuples. test_list = [(6, 24, 12), (60, 12, 6), (12, 18, 21)], K = 6, Output : [(6, 24, 12), (60, 12, 6)]
b. Given a list of tuples. Write a program to filter all uppercase characters tuples from given list of tuples. (Input: test_list = [(“GFG”, “IS”, “BEST”), (“GFg”, “AVERAGE”), (“GfG”,), (“Gfg”, “CS”)], Output : [(‘GFG’, ‘IS’, ‘BEST’)]).

Experiment – 5: SET
a. Write a program to generate and print a dictionary that contains a number (between 1 and n) in the form (x, x*x).
b. Write a program to perform union, intersection and difference using Set A and Set B.

Experiment – 6: DICTIONARY

a. Write a program to do the following operations:
i. Create a empty dictionary with dict() method
ii. Add elements one at a time
iii. Update existing key's value
iv. Access an element using a key and also get() method
v. Deleting a key value using del() method
b. Write a program to create a dictionary and apply the following methods:
i. pop() method
ii. popitem() method
iii. clear() method

Experiment – 7: STRINGS

a. Given a string, write a program to check if the string is symmetrical and palindrome or not. A string is said to be symmetrical if both the halves of the string are the same and a string is said to be a palindrome string if one half of the string is the reverse of the other half or if a string appears same when read forward or backward.
b. Write a program to read a string and count the number of vowel letters and print all letters except 'e' and 's'.

Experiment – 8: USER DEFINED FUNCTIONS

a. Write a function merge_dict(dict1, dict2) to merge two Python dictionaries.
b. Given a list of n elements, write a linear_search() function to search a given element x in a list.

Experiment – 9: BUILT-IN FUNCTIONS

a. Write a program to demonstrate the working of built-in statistical functions mean(), mode(), median() by importing statistics library.
b. Write a program to demonstrate the working of built-in trignometric functions sin(), cos(), tan(), hypot(), degrees(), radians() by importing math module.

Experiment – 10: **CLASS AND OBJECTS**

a. Write a program to create a BankAccount class. Your class should support the following methods for
i) Deposit
ii) Withdraw
iii) GetBalanace
iv) PinChange
b. Write a program to create an employee class and store the employee name, id, age, and salary using the constructor. Display the employee details by invoking employee_info () method and also using dictionary (_dict_).

Text Books:

1. Michael H Goldwasser, David Letscher, "Object Oriented Programming in Python", Prentice Hall, 1st Edition, 2007.
2. Yashavant Kanetkar, Aditya Kanetkar, "Let us Python", BPB publication, 1st Edition, 2019.

Reference Books:

1. Ashok Kamthane, Amit Kamthane, "Programming and Problem Solving with Python", McGraw Hill Education (India) Private Limited, 2018.
2. Taneja Sheetal, Kumar Naveen, "Python Programming – A modular approach", Pearson, 2017.
3. R Nageswara Rao, "Core Python Programming", Dreamtech press, 2017.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	-	-	1	-	-	-	-	-	-	-	-	-	1	-
CO2	-	1	-	-	-	-	-	-	-	-	-	-	1	-
CO3	-	-	-	-	2	-	-	-	-	-	-	-	1	-
CO4	-	-	-	-	2	-	-	-	-	-	-	-	1	-

B. Tech III Year – II Sem	**L**	**T**	**P**	**C**
Subject Code:21PC6EC21	0	0	2	1

Digital Signal Processing Laboratory

Prerequisite: Signals and Systems

Course Objectives: This course will enable students to:

1. To implement Linear and Circular Convolution
2. To implement FIR and IIR filters
3. To study the architecture of DSP processor.
4. To demonstrate Finite word length effect.

Course Outcomes: Upon successful completion of the course, the student is able to

1. Examine the frequency response and impulse response of discrete-time LTI systems
2. Interpret discrete-time signals using DFT.
3. Apply FFT algorithms for various signal processing operations.
4. Analyze IIR and FIR digital filters.

List of Experiments: (Twelve experiments to be done):

1. Generation of Sinusoidal Waveform / Signal based on Recursive Difference Equations
2. Histogram of White Gaussian Noise and Uniformly Distributed Noise.
3. To find DFT / IDFT of given DT Signal
4. To find Frequency Response of a given System given in Transfer Function/ Differential equation form.
5. Obtain Fourier series coefficients by formula and using FET and compare for half sine wave.
6. Implementation of FFT of given Sequence
7. Determination of Power Spectrum of a given Signal(s).
8. Implementation of LP FIR Filter for a given Sequence/Signal.
9. Implementation of HP IIR Filter for a given Sequence/Signal
10. Generation of Narrow Band Signal through Filtering
11. Generation of DTMF Signals
12. Implementation of Decimation Process
13. Implementation of Interpolation Process
14. Implementation of I/D Sampling Rate Converters
15. Impulse Response of First order and Second Order Systems.

Text books:

1. Discrete Time Signal Processing – A. V. Oppenheim and R.W. Schaffer, PHI, 2009
2. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G. Manolakis, Pearson Education / PHI, 2013.

Reference Books:

1. Digital Signal Processing – Fundamentals and Applications – Li Tan, Elsevier, 2008
2. Fundamentals of Digital Signal Processing using MATLAB – Robert J. Schilling, Sandra L. Harris, Thomson, 2007
3. Digital Signal Processing – S. Salivahanan, A. Vallavaraj and C. Gnanapriya, TMH, 2009
4. Digital Signal Processing - A Practical approach, Emmanuel C. Ifeachor and Barrie W. Jervis, 2 nd Edition, Pearson Education, 2009

Web Resources:

1. https://nptel.ac.in/courses/117102060
2. https://nptel.ac.in/courses/108108185
3. https://nptel.ac.in/courses/108106151

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 – Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	2	3	2	-	-	2	2	3	-	2	-	3
CO2	2	3	3	2	3	-	-	2	2	2	-	2	-	3
CO3	3	2	2	3	3	-	-	3	3	2	-	2	-	3
CO4	3	2	3	2	2	-	-	2	2	3	-	2	2	3

B. Tech III Year- II Sem **L T P C**
Subject Code: 21MC6HS04 **2 0 0 0**

QUANITATIVE APTITUDE
(Common to CSE/EEE/ECE/CSM/CSD/CSC/CSO/ME)

Course Overview
This course provides the basic skills required in solving the problems of Aptitude required by various companies for Campus Recruitment and competitive tests. The contents of course include solving problems on different concepts such as Permutations and Combinations, Averages, Percentages and Logarithms etc.

Course Pre/co-requisites
No prior knowledge is required.

Course Objectives: This course will enable students to:
1. To categorize, apply and use thought process to distinguish between concepts of Quantitative methods.
2. To prepare and explain the fundamentals related to various possibilities and probabilities related to quantitative aptitude.
3. To critically evaluate numerous possibilities related to puzzles.

Course Outcomes: Upon completion of the course, the student should be able to
1. Apply the concepts of ratios, proportions and percentages to solve problems.
2. Solve problems on Logarithms, permutations, combinations, clocks, and calendars.
3. Able to recall and use the concepts to solve problems numerical estimation with respect to company specific and competitive tests
4. Interpret data using graphs and charts.

Module I:
Arithmetic ability:-Algebraic operations- BODMAS – Fractions – Number system - Divisibility rules LCM&GCD (HCF), Simplification
Ratio and Proportion: Ratio, Proportion, Variations, Problems on Ages

Module II:
Percentages, Simple Interest (SI) and Compound Interest (CI): Fundamentals of Percentage, Percentage change, SI and CI, Relation between SI and CI.
Profit and Loss, Partnerships: Basic terminology in profit and loss, Types of partnership, Problems related to partnership

Module III:
Time and Work, Pipe and Cistern, Speed, Time and Distance, Problems on trains & boats, Calendar problems, Clock problems. Average, Mixtures and Alligation: Averages, Weighted average, Difference between mixture and alligation, Problems on Mixtures and alligation

Module IV:
Data Interpretation: Introduction, Tabulation, Bar Graph, Pie Charts, Line Graphs, Combined Graphs, Geometry: Lines and Angles, Triangle, Trigonometry, Circle, Height and Distance, Quadrilateral and Polygon

Module V:
Permutations and Combinations: Fundamentals counting principle, Definition of Permutation, Seating arrangement, Problems related to alphabets, Rank of the word, Problems related to numbers, Circular permutation, Combination. Logarithms: Fundamental formulae of logarithms and problems, finding number of terms on expanding a given number.

Text Book:
1. Quantitative Aptitude for competitive examinations, . R.S Aggarwal, S.Chand, 2017.

Reference Books
1. Quantitative Aptitude for competitive examinations, Abhijit Guha, 6th Edition, McGraw Hill Education.
2. Dinesh Khattar, The Pearson guide to Quantitative Aptitude for Competitive Examinations, 3rd Edition, Pearson Education.

Web resources:
1. www.m4maths.com
2. www.Indiabix.com

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	-	-	-	-	-	2	-	-	-	-	2	3	-	-
CO2	-	-	-	-	-	2	-	-	-	-	2	3	-	-
CO3	-	-	-	-	-	2	-	-	-	-	2	3	-	-
CO4	-	-	-	-	-	2	-	-	-	-	2	3	-	-

B. Tech III Year – II Sem	L	T	P	C
Subject Code: 21PE6EC21	3	0	0	3

ARM Microprocessor and Interfacing
(Professional Elective-II)

Pre-requisite: Microcontrollers and Applications.

Course Objectives:

This course will enable students to:

1. Understand the architectural features and instruction set of 32 bit microcontroller ARM Cortex M3
2. Program ARM Cortex M using the various instructions and C language for different applications.
3. Understand the basic hardware components and their selection method based on the characteristics and attributes depends on applications
4. Understand the communication interface to TM4C123 microcontroller

Course Outcomes: Upon completion of the course, the student should be able to

1. Interpret the evolution of ARM processors, architectural advances and classificationof ARM processors.
2. Demonstrate programming proficiency using the addressing modes and instructionsof the arm microcontroller.
3. Develop programs to interface various peripherals with microcontrollers.
4. Analyze real time communication modules using ARM microcontroller

Module I

ARM Architecture:

Introduction to Cortex M microcontroller, ARM instruction set architecture, register set, processor operating modes, Interrupts and processor reset sequence, pipelined architecture and data path

Module II

ARM Assembly language programming:

Addressing modes, Data processing instructions, data transfer instructions, control flow instructions, multiple register transfer instructions, co-processor Instructions, break point instructions, and memory faults. Co-processor Instructions, break point instructions, memory faults, ARM instruction Set, Cortex-M Assembly Programming Basics

Module III

Fundamentals of I/O configuration & Interfacing: Configuring ARM pins as GPIO's, clock and bus configuration, mode control configuration, pad control configuration, Data control configuration, configure keil tools for hardware design, Interfacing of LED and switch, interfacing seven-segment display, keypad interfacing, interfacing LCD module, Methods for Input and output synchronization

Module IV

Serial Communication Interfaces: UART interface-Connection, communication protocol details, RS232 Standard Serial Interface, I2C interface- Bus protocol, connectivity, SPI- Modes of Operation, Signal Timing, CAN Interface- Network, Frames, Bus Arbitration, Bit Timing, Error Handling and Confinement, UART Details TM4C123 Microcontroller, I2C Details on TM4C123 Microcontroller,

Module V

Analog Interfacing: Need for Analog Interfacing, Digital Representation of Analog Signals, ADC Types – Parallel Design, DAC based ADC designs, Integrator Based ADC Designs, Sigma-Delta ADC, SPI Details on TM4C123 Microcontroller, CAN Details on TM4C123 Microcontroller,

Text Books:

1. ARM Microprocessor Systems – Cortex – M Architecture, Programming, and Interfacing Muhammad Tahir and Kashif Javed, CRC Press, 2017.
2. ARM System-on-chip Architecture by, Steve Furber , 2nd Edition., Pearson,2009.

Reference Books:

1. Embedded Systems Fundamentals with ARM Cortex-M based Microcontrollers: A Practical Approach, Dr. Alexander G. Dean, Published by Arm Education Media, 2017
2. Cortex -M3 Technical Reference Manual
3. The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors, Joseph Yiu, 3rd edition, Newnes, 2013.

Web Resources:

1. https://nptel.ac.in/courses/117/106/117106111/
2. https://onlinecourses.nptel.ac.in/noc20_cs15/preview

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	-	-	-	-	-	-	-	-	-	-	-	1	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	1	2
CO3	2	-	-	-	-	-	-	-	2	2	-	-	2	2
CO4	-	3	-	-	-	-	-	-	3	3	-	-	2	2

B. Tech III Year – II Sem	**L**	**T**	**P**	**C**
Subject Code: 21PE6EC22	3	0	0	3

Digital System Design
(Professional Elective-II)

Pre-requisite: Basic knowledge on Digital logic Design

Course Objectives: This course will enable students to:

1. To provide extended knowledge of digital logic circuits in the form of state model approach.
2. To provide an overview of system design approach using programmable logic devices.
3. To provide and understand of fault models and test methods.
4. To Provide and understands test pattern generation techniques for fault detection

Course Outcomes: Upon completion of the course, the student should be able to

1. Illustrate the minimization of Finite state machine.
2. Design ROM, PAL and PLA using logic gates.
3. Explain the operation of synchronous sequential and asynchronous sequential circuits
4. Analyze test pattern generation techniques for fault detection and fault diagnosis in sequential circuits.

Module I: Fault Modelling & Test Pattern Generation:

Logic Fault model – Fault detection & Redundancy- Fault equivalence and fault location – Fault dominance – Single stuck at fault model – Multiple stuck at fault models –Bridging fault model

Fault diagnosis of combinational circuits by conventional methods – Path sensitization techniques, Boolean Difference method – Kohavi algorithm – Test algorithms – D algorithm, PODEM, Random testing, Transition count testing, Signature analysis and test bridging faults.

Module II: Fault Diagnosis in Sequential Circuits:

Circuit Test Approach, Transition Check Approach – State identification and fault detection experiment, Machine identification, Design of fault detection experiment.

Analysis of Asynchronous Sequential Circuits- Flow table reduction races-state assignment, transition table and problems in transition table.

Module III: Minimization and Transformation of Sequential Machines:

The Finite State Model: Capabilities and limitations of FSM – State equivalence and machine minimization – Simplification of incompletely specified machines.

Fundamental mode model – Flow table – State reduction – Minimal closed covers – Races, Cycles and Hazards.

Module IV: Digital Design:

Digital Design Using ROMs, PALs and PLAs, BCD Adder, 32 – bit adder, State graphs for control circuits, Scoreboard and Controller, A shift and add multiplier, Array multiplier, Keypad Scanner, Binary divider.

Module V: SM Charts:
State machine charts, Derivation of SM Charts, Realization of SM Chart, Implementation of Binary Multiplier, dice game controller.

Text Books:
1. Fundamentals of Logic Design – Charles H. Roth, 5th ed., Cengage Learning, 2013.
2. Digital Design – Morris Mano, M.D.Ciletti, 4th Edition, Pearson, 2016.

Reference Books:
1. Switching and Finite Automata Theory – Z. Kohavi , McGraw Hill, 2nd ed., 2001.
2. Digital Systems Testing and Testable Design – Miron Abramovici, Melvin A. Breuer and Arthur D. Friedman- John Wiley & Sons Inc, Wiley-IEEE Press, 1st edition, 1994.

Webresources:
1. https://digitalsystemdesign.in/digital-system-design-basics/
2. https://dvikan.no/ntnu-studentserver/kompendier/digital-systems-design.pdf
3. https://www.fer.unizg.hr/en/course/dsd_a

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	1	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	1	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	1	-

B. Tech III Year – II Sem	**L**	**T**	**P**	**C**
Subject Code: 21PE6EC23	3	0	0	3

OPTICAL COMMUNICATION
(Professional Elective-II)

Prerequisite: Basic Physics

Course objectives: This course will enable students to:
1. To study optical fiber modes, configuration and transmission characteristics in optical communication
2. To learn various sources, detectors and transmission techniques available for optical communication
3. To explore different optical amplifiers and coupling techniques
4. To know optical communication systems and networks

Course outcomes: Upon completion of the course, the student should be able to:
1. Explain basic components of optical fibers, different modes and configurations.
2. Illustrate the transmission characteristics associated with attenuation, dispersion and polarization.
3. Classify sources and detectors of optical communication system.
4. Describe fiber optical networks and coupling techniques based on their different applications.

Module I
Introduction to Optical Fibers : Fundamental laws of optics: Ray theory; classification of optical fibers: Step-Index and Graded Index Fibers, Single Mode and Multimode Fibers, Fiber materials, Snell's Law
Modes in Optical Fiber: Modes in planar wave guide, modes in cylindrical optical fiber: traverse or guided, cladding, leaky; transverse electric and magnetic modes.

Module II
Transmission Characteristic of Optical Fiber:Attenuation in optical fiber: absorption loss, scattering loss, bending loss, core-cladding loss.
Dispersion: Intra model dispersion: material dispersion, waveguide dispersion, profile dispersion, polarization mode dispersion; Intermodal Dispersion in a Multimode Graded-Index Fiber, dispersion optimization of single mode fiber.

Module III
Optical Sources: LED for optical fiber communication, LED structures: homo junction and hetero junction, surface emitting LED, Edge emitting LED, super luminescent LED, Laser sources: semiconductor laser diode
Optical Detectors: Characteristics of a photo detector, Types of photodetectors: PIN, Schottky barrier, Metal semiconductor metal, Avalanche photo diodes, Phototransistors

Module IV
Optical Amplifiers: Optical amplifier, semiconductor laser amplifier, fiber amplifier, Raman and Brillouin fiber amplifiers.
Coupling: Fiber to fiber coupling, types of slices: fiber splices, fusion splices, mechanical splices; types of connectors: Fiber, ST, SC, LC, and FC.

Module V

Optical Link Design and Networks: System design consideration: system requirements, link margin; Link power budget, rise-time budget. Elements of optical networks, SONET/SDH Optical Interfaces, SONET/SDH Rings and Networks, Optical ETHERNET.

Telecommunication Applications: Introduction, Optical fiber LAN link for Industry and power plants, Optical networking technology in enterprise, Description of 8Mb/s Optical fiber, Description of 2.5 Gb/s Optical fiber, Power budget

Text books:

1. "Optical Fiber Communication", P Chakrabarti, McGraw Hill Education (India) Private Limited, 2016
2. "Optical Fiber Communication",Gred Keiser, McGraw Hill Education (India) Private Limited. Fifth Edition, Reprint 2013.
3. Optical fiber communication and its Applications- S.C. Gupta, 3rd edition, PHI Learning Private Limited, 2018

Reference books:

1. Optical fiber communication, John M.Senior, ― Pearson Education, second edition.2007.
2. Fiber-Optic Communication Systems, Govind P. Agrawal, fifth edition, John Wiley & Sons, 2021
3. Optical Networks, Rajiv Ramaswami, Second Edition, Elsevier , 2004.
4. Fiber-optic communication systems, Govind P. Agrawal, third edition, John Wiley & sons, 2004.

MOOC'S Course:

NPTEL lecture on "Optical Communication"-IIT Bombay

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	2
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	2
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	2
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	2

B. Tech III Year – I Sem	L	T	P	C
Subject Code: 21PE6EC24	3	0	0	3

Artificial Neural Networks
(Professional Elective –II)

Course Objectives: This course will enable students to:

1. Understand the basics of ANN and comparison with Human brain.
2. Acquire knowledge on Generalization and function approximation of various ANN architectures.
3. Understand reinforcement learning using neural networks
4. Acquire knowledge of unsupervised learning using neural networks.

Course Outcomes: Upon completion of the course, the student should be able to

1. Explain the role of neural networks in engineering, artificial intelligence, and cognitive modelling.
2. Describe the concepts and techniques of neural networks through the study of the most important neural network models.
3. Evaluate whether neural networks are appropriate to a particular application.
4. Apply neural networks to particular application, and to know what steps to take to improve performance.

MODULE - I

Introduction: A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks

Learning Process: Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process

MODULE - II

Single Layer Perceptrons: Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Techniques, Perceptron –Convergence Theorem, Relation Between Perceptron and Bayes Classifier for a Gaussian Environment

Multilayer Perceptron: Back Propagation Algorithm XOR Problem, Heuristics, Output Representation and Decision Rule, Computer Experiment, Feature Detection

MODULE - III

Back Propagation: Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques, Virtues and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning, Unsupervised Learning

MODULE - IV

Self-Organization Maps (SOM): Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Patter Classification

MODULE - V

Neuro Dynamics: Dynamical Systems, Stability of Equilibrium States, Attractors, Neuro Dynamical Models, Manipulation of Attractors as a Recurrent Network Paradigm

Hopfield Models – Hopfield Models, Computer Experiment.

TEXT BOOKS:

1. Neural Networks a Comprehensive Foundations, Simon Haykin, PHI edition.

REFERENCE BOOKS:

1. Artificial Neural Networks - B. Vegnanarayana Prentice Hall of India P Ltd 2005
2. Neural Networks in Computer Inteligance, Li Min Fu MC GRAW HILL EDUCATION 2003
3. Neural Networks -James A Freeman David M S Kapura Pearson Education 2004.
4. Introduction to Artificial Neural Systems Jacek M. Zurada, JAICO Publishing House Ed. 2006.

CO-PO mapping:

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	-	-	2	-	-	-	-	-	-	-	-	-	-
CO2	2	1	-	2	-	-	-	-	-	-	-	-	-	-
CO3	1	2	-	2	1	-	-	-	-	-	-	-	-	1
CO4	2	-	-	2	1	-	-	-	-	-	-	-	-	1

HR 21

	L	T	P	C
B.Tech III Year – VI Sem				
Subject Code: 21OE6CS09	**3**	**0**	**0**	**3**

Object Oriented Programming Using Java

Prerequisites: Programming in C

Course Objectives:
1. Understand fundamental concepts and object oriented concepts in Java
2. Implementing the concept of packages and exception handling in Java.
3. Implement the concept of multithreading and inter process communication in Java.
4. Develop GUI applications.

Course Outcomes:
1. Solve the given problem using OOPS technique.
2. Explain the concept of Package and Exception Handling.
3. Implement Multi threading and Inter process communication in java
4. Develop GUI based applications using applet, AWT , Event handling and swing.

Module - I
History and Evolution of java: Java's lineage, Java and internet, Byte code, Java buzzwords, Evolution of java.
Object oriented programming - data, types, variables, Arrays,operators, control statements, type conversion and casting, Introduction to classes, objects, methods, constructor, this and static keywords , garbage collection, overloading methods, parameter passing, access control, command line arguments,exploring String class
Inheritance: member access and inheritance, Multilevel Inheritance, super and final keywords, method overriding, dynamic method dispatch, abstract classes and methods.

Module- II
Packages and Interfaces: Defining, Creating and Accessing a Package, understanding CLASSPATH, importing packages, Differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces.
Exception handling: Concepts of exception handling and its benefits, usage of try, catch, throw, throws and finally, built in exceptions, creating own exceptions.

Module -III
Multithreading: Differences between multi-threading and multi programming, thread life cycle, creating threads using thread class and Run able interface, thread priorities, synchronization , inter thread communication.
I/O Streams: Stream classes, Byte and character streams, File class, reading and writing files,reading and writing from console, serialization.

Module -IV
Applets: Concepts of Applets, differences between applets and applications, life cycle of an applet, creating applets, passing parameters to applets.

AWT: class hierarchy, user interface components- labels, buttons, scrollbars, text components, checkbox, checkbox groups, choices, lists panels – scroll pane, dialogs, menu bar, Layout Managers- Flow Layout, Border Layout, Grid Layout, Card Layout, Grid Bag Layout.
Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes.

Module- V

Swings: Introduction, limitations of AWT, MVC architecture, components, containers, exploring swing- J Applet, J Frame and J Component, Image Icon, J Label, J Text field, J Button, J Checkbox, J List, J Radio button, J Combo Box, J Tabbed Pane, J Scroll Pane.
The Collections Framework (java.util)- Collections overview, Collection Interfaces, Generics The Collection classes- Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array De-queue. Accessing a Collection via an iterator, Using an Iterator, The For-Each alternative, Map Interfaces and Classes, Comparators, Collection algorithms, Arrays, The Legacy Classes and Interfaces- Dictionary, Hash table, Properties, Stack, Vector More Utility classes, String Tokenizer, Date, Calendar, Random, Scanner

Text Books:
1. The Complete Reference JAVA 2, Author: Herbert Schield , ninth edition Publishers: TataMec-Hill
2. Understanding Object-Oriented Programming with Java, updated edition, T. Budd, PearsonEducation.

Reference Books:
1. An Introduction to JAVA Programming (Chapter 6) Author: Y.Daniel Liang , Publishers:Tata Mec-Hill.
2. Programming with JAVA (2nd Edition) Author: E. Balagurusamy Publishers: Tata Mec-Hill.
3. Internet and Java Programming, R.Krishna Murthu and S.Prabhu, New Age Publishers

CO-PO/PSO Mapping:

Course Outcomes(COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***		
	PO 1	**PO 2**	**PO 3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO3**
CO1	**2**														**1**
CO2	**2**														**1**
CO3	**2**														**1**
CO4	**3**	**1**	**1**	**1**	**3**										**3**

B. Tech III Year – VI Sem	**L**	**T**	**P**	**C**
Subject Code:21OE6EC02	3	0	0	3

Fundamentals of Digital Electronics

(Open Elective)

Prerequisite: Basic knowledge on computers

Course Objectives:

This course provides in-depth knowledge of Digital logic techniques of digital circuits, which is the basis for design of any digital circuit.

1. To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
2. To impart the concepts of combinational, sequential logic circuits.
3. To learn the concepts of sequential circuits, enabling them to analyse sequential systems in terms of state machines.

Course Outcomes: Upon completion of the course, the student should be able to

1. Explain the numerical information in different forms and Boolean Algebra theorems
2. Solve Boolean expressions using Boolean Theorems-maps
3. Design and analyze combinational and sequential circuits
4. Implement logic families and realization of logic gates

Module I: Number Systems & Boolean Algebra:

Number Systems: Number base conversions: Binary, Octal, Decimal, Hexa-decimal, Complements of Numbers, Codes- Weighted and Non-weighted codes and its Properties, Parity check code and Hamming code.
Boolean algebra: Basic Theorems and Properties, Switching Functions- Canonical and Standard Form, Algebraic Simplification, Digital Logic Gates, EX-OR gates, Universal Gates. The Karnaugh Map Method, don't care map entries, Prime and Essential Implicants.

Module II: Combinational Logic Circuits:
Basic Arithmetic Circuits- Half adder, Full adder, Half subtractor, Full subtractor, 4-bit parallel adder/subtractor. BCD Adder
Combinational logic circuits: 2-bit comparator, Multiplexers, Implementation of Boolean functions using Multiplexers, Decoders, Implementation of Boolean functions using Decoder, Demultiplexers, Encoder, Priority Encoder, Code converters.

Module III: Sequential Circuits Fundamentals:
Introduction to Sequential Circuits: Basic Architectural Distinctions between Combinational and Sequential circuits, SR Latch, Flip Flops: SR, JK, JK Master Slave, D and T Type Flip Flops,
Flip flop Conversions: Excitation Table of all Flip Flops, Timing and Triggering Consideration, Conversion from one type of Flip-Flop to another.

Module IV: Sequential Logic Applications:

Sequential Logic Applications: Registers and Counters: Shift Registers – Left, Right and Bidirectional Shift Registers, Universal shift register, Applications of Shift Registers

Design of Counters: Design and Operation of Ring and Twisted Ring Counter, Operation of Asynchronous and Synchronous Counters.

Module V: Design and Analysis of Sequential Machines: Introduction to Finite State Machines- Mealy Machine and Moore Machine, State diagram, State Assignment and minimization, Design Procedure and Realization using Flip-Flops.

Introduction to CMOS Technology: CMOS technology, Working states of CMOS, Types of CMOS, AND, OR and NOT Gates using CMOS.

Text Books:

1. Switching and Finite Automata Theory - Zvi Kohavi & Niraj K. Jha, 3rd Edition, Cambridge, 2010.
2. Modern Digital Electronics – R. P. Jain, 3rd Edition, Tata McGraw-Hill, 2007.

Reference Books:

1. Digital Design- Morris Mano, PHI, 4th Edition,2006
2. Introduction to Switching Theory and Logic Design – Fredriac J. Hill, Gerald R. Peterson, 3rd Ed, John Wiley & Sons Inc.
3. Fundamentals of Logic Design- Charles H. Roth, Cengage Learning, 5th, Edition, 2004.
4. Switching Theory and Logic Design – A Anand Kumar, PHI, 2013

Web Resources:

1. http://blog.digitalelectronics.co.in/
2. www.nesoacademy.org/electronics-engineering/digital-electronics/digital
3. https://www.slideshare.net/JournalsPubwwwjourna/international-journal-of-digital-electronics-vol-2-issue-2
2. https://lecturenotes.in/subject/203/switching-theory-and-logic-design-stld
3. http://www.infocobuild.com/education/audio-video-courses/electronics/DigitalCircuitsSystems
4. https://nptel.ac.in/courses/117105080/

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**3**	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	**3**	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	**3**	**3**	**3**	-	-	-	-	-	-	-	-	-	-	-
CO4	**3**	-	-	-	-	-	-	-	-	-	-	-	-	-

B. Tech III Year–VI Sem	**L**	**T**	**P**	**C**
Subject Code: 21OE6ME02	**3**	**0**	**0**	**3**

TOTAL QUALITY MANAGEMENT & SIX SIGMA APPLICATIONS

Pre-requisite: Management Science &Production Technology, Machine Tools

Course Objectives:

1. To understand the quality concepts and tools
2. To discuss about techniques relating to total quality management.
3. To understand the Principles and Practices of TQM
4. To understand the implementation of ISO 9000 AND Six sigma in a system

Module I

Introduction: The concept of TQM, Quality and Business performance, attitude, and involvement of top management, communication, culture and management systems.
Management of Process Quality: Definition of quality, Quality Control, a brief history, Product Inspection vs. Process Control, Statistical Quality Control.

Management of Process Quality: Definition of quality, Quality Control, a brief history, Product Inspection vs. Process Control, Statistical Quality Control, Control Charts and Acceptance Sampling.

Module II

Customer Focus and Satisfaction: Process vs. Customer, internal customer conflict, quality focus, Customer Satisfaction, role of Marketing and Sales, Buyer – Supplier relationships.

Bench Marking: Evolution of Bench Marking, meaning of bench marking, benefits of bench marketing, the bench marking procedure.

Module III

Organizing for TQM**:** The systems approach, organizing for quality implementation, making the transition from a traditional to a TQM organization, Quality Circles, seven Tools

Seven Tools of TQM: Stratification, check sheet, Scatter diagram, lshikawa diagram, pane to diagram, Kepner& Tregoe Methodology.

Module IV

The Cost of Quality: Definition of the Cost of Quality, Quality Costs, Measuring Quality Costs, use of Quality Cost information, Accounting Systems and Quality Management.

Use of Quality Cost information, Accounting Systems and Quality Management.

Module V

ISO9000: Universal Standards of Quality: ISO around the world, The ISO9000 ANSI/ASQC Q- 90. Series Standards, benefits of ISO9000 certification, the third party audit.

Documentation ISO9000 and services, the cost of certification implementing the system.

Six sigma and applications of sixsigma.

Text Books:

1. Total Quality Management / Joel E. Ross/Taylor and Franscis Limited.
2. Total Quality Management/P. N. Mukherjee/PHI
3. "Lean Six Sigma: Combining Six Sigma with Lean Speed" by Michael L. George, David Rowlands, and Bill Kastle, published by McGraw-Hill Education
4.

Reference Books:

1. Beyond TQM / Robert L.Flood
2. Statistical Quality Control / E.L. Grant.
3. Total Quality Management:A Practical Approach/H. Lal
4.

Course Outcomes: At the end of the course, the students will be able to

1) Understand the fundamental principles of Total Quality Management.
2) Analyze the different quality approaches
3) Evaluate the different tools in Total Quality Management
4) Describe the importance and implementing of ISO9000 in the system and Six sigma

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2						1	2	2	2	2	2	
CO2	3	2	2					1	2	2	2	2	2	
CO3	3	2	2					1	2	2	2	2	2	
CO4	3	2	2					1	2	2	2	2	2	

** If more PSOs are there in a particular branch, required no of columns can be added.*

B.Tech III Year – VI Sem

Subject Code: 21OE6EE02

L	T	P	C
3	0	0	3

FUNDAMENTALS OF INDUSTRIAL ELECTRONICS
OPEN ELECTIVE II
ALL BRANCHES EXCEPT EEE

Pre-requisite: Basic Electrical and Electronics Engineering or Analog and Digital Circuits

Course Objectives:

1) To Design/develop suitable power converter for efficient control or conversion of power in drive applications.
2) To Design / develop suitable power converter for efficient transmission and utilization of power in Industrial applications.

Course Outcomes: At the end of course student will be able to do

1) CO1 – Understand the differences between signal level and power level devices.
2) CO2 – Analyze controlled rectifier circuits.
3) CO3 – Analyze the operation of DC-DC choppers.
4) CO4 – Analyze the operation of voltage source inverters.

Module I:Power Switching Devices and Protection Circuits

Power Switching Devices:

Types of power converters; Power semiconductor switches and their V-I characteristics - Power Diodes, Power BJT, Power MOSFET, Power IGBT. SCR VI Characteristics, Switching characteristics.

Thyristor voltage and current ratings and protection using Snubber Circuit.

Module II:Triggering and Commutation

Triggering Circuits: R, RC and UJT triggering circuits

Commutation Circuits: Types of Commutation circuits (Class A, B,C,D,E,F)

Module III:Rectifiers

Single Phase Rectifier: Principles of single-phase half-controlled converter with R, RL and RLE load. Principles of single-phase fully-controlled converter with RLE load. Problems on Single phase Rectifiers.

Three Phase Rectifier: Principles of three-phase fully-controlled converter operation with RLE load. Problems on Three phase Rectifiers.

Module IV:Choppers, AC Voltage Converters and Cycloconverters

DC-DC Converters (Choppers)
Introduction of Choppers, Control strategies in Choppers, Time Ratio Control, Step down and Step Up Choppers with problems.

AC Voltage Converters and Cycloconverters
Phase Controller (AC Voltage Regulator)-Introduction, principle of operation of single-phase voltage controllers for R, R-L loads.

Cyclo-converter- Principle of operation of single phase cyclo-converters: Mid Tap and Bridge type, relevant waveforms.

Module V:Inverters and Applications

DC-AC Converters (Inverters)
Introduction, principle of operation, performance parameters, single phase half and full bridge inverters with R, RL loads. Problems on single phase inverters.
Applications: UPS, SMPS, Battery Charger.

TEXT BOOKS:

1. Dr.P.S.Bimbhra, "Power Electronics", Khanna Publishers, New Delhi.
2. M. H. Rashid, "Power electronics: circuits, devices, and applications", Pearson Education India, 2009.

Reference Books:

1.N. Mohan and T. M. Undeland, "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 2007.
2. MD Singh and KB Kanchandhani, " Power Electronics", Tata Mc Graw Hill Publishing Company Limited, New Delhi.

Web Resources: www.mathworks .com

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	1											1	2
CO2	2	2	3		2								2	2
CO3	1	2	3		2								2	2
CO4	1	2	3		2								2	2

B. Tech III Year–VI Sem	L	T	P	C
Subject Code: 21OE6CM06	3	0	0	3

Expert Systems

Prerequisite:

1. Artificial Intelligence

Course Objectives:

1. Understand Expert Systems and their applications.
2. Illustrate Fuzzy Logic Concepts with an example.
3. Understand the Genetic Algorithm and its applications.
4. Explain the components of Expert System building and its tools.

Module-I

Overview of Expert Systems:

Introduction to Expert System: Characteristics of Expert System, Advantages and Disadvantages of Expert Systems, Different types of Expert Systems: Rule-based Expert Systems, Knowledge-based Expert Systems, Model-based, Case-based, and Hybrid Expert Systems, Working Architecture of Expert Systems, Components of Expert Systems, Applications of Expert Systems, Techniques for extracting the knowledge from Domain Experts.

Module – II

Knowledge Representation:

Representations and Mapping: General goal of Knowledge Representation, Approaches to Knowledge Representation: Simple Relational Knowledge, Inheritable Knowledge, Inferential Knowledge, Procedural Knowledge or Operational Knowledge, Classification of Knowledge Representation Systems: Logics (Predicate Logic, Description Logic, Nonmonotonic Logic); Procedural Schemas (Production rules), Structural Schemas (Weak slot-and-filler structures, Strong slot-and-filler structures), Knowledge-Based Systems.

Module - III

Fuzzy Logic:

Introduction to Fuzzy Logic, Fuzzy set theory, Fuzzy sets: Operation on Fuzzy sets, Scalar cardinality, fuzzy cardinality, union and intersection, complement, equilibrium points, aggregation, projection, composition, decomposition, cylindrical extension, fuzzy relation, Fuzzy membership functions, Fuzzy Expert Systems, Fuzzy Decision Making, Applications of Fuzzy System, De-fuzzification.

Module – IV

Genetic Algorithms:

Introduction to Genetic Algorithms (GA), Representation, Operators in GA, Fitness function, population, building block hypothesis and schema theorem; Genetic algorithms operators-methods of selection, crossover and mutation, Simple GA(SGA), Different types of GA, generation gap, steady state GA, Applications of GA.

Module – V

Development of Expert System:

Nature of Expert System tools, Types of tools available for expert system building, Stages in the development of expert system tools. Building an Expert system, Stages of Expert system development, Tasks in building the Expert System.

Text Books:

1. Principles of Expert Systems by Peter, J.F. Lucas & Linda C. van der Gaag, 2014.
2. Foundations of Neural Networks, Fuzzy Systems, and Knowledge Engineering by Nikola K. Kasabov, 1998.
3. Introduction to Genetic Algorithms by S. N. Sivanandam and S. N. Deepa 2008.

Reference Text Books:

1. David Goldberg. V Genetic Algorithms in Search, Optimization, and Machine Learning, Pearson Education, 2009.
2. Zimmermann. H.J, "Fuzzy set theory-and its Applications"- Springer international edition, 2011.

Web Resources & E-Books:

1. https://www.geeksforgeeks.org/
2. https://www.sciencedirect.com/journal/expert-systems-with-applications/

MOOC's Courses:

1. NPTEL Course on "Introduction to Fuzzy Set Theory, Arithmetic and Logic".
2. NPTEL Course on "Fundamentals Of Artificial Intelligence"

Course Outcomes:

Upon completing this course, the student will be able to

1. Describe the Expert Systems and their applications.
2. Use Knowledge Representation to solve the problem.
3. Illustrate the Fuzzy Logic and Genetic Algorithms with an example.
4. Discuss the Expert System building and its tools.

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – High; 2 – Medium; 1 - Low

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes*		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2														
CO2	3	2													2
CO3	3	2													2
CO4	2														

B.Tech III – VI Sem	L	T	P	C
Subject Code: 21OE6CD02	3	0	0	3

Data Mining and Data Analytics

Course Objective

1. Understand the concepts of Data Mining
2. Familiarize with association rule mining
3. Familiarize various classification algorithms
4. Understand the concepts of Cluster analysis
5. Implement the Data mining concepts with various domains

Course Outcomes:

1. Discuss varies Data Mining Principles.
2. Analyze the impact of data analytics for business decisions and strategy.
3. Apply the Association, Clustering rules for mining the data.
4. Design various classification techniques.

Module I

Introduction to Data warehouse, Difference between operational database systems and data warehouses. Data warehouse Characteristics, Data warehouse Architecture.
Introduction: What is Data Mining, Definition, KDD, Challenges, Data Mining Tasks, Data Preprocessing, Data Cleaning, Missing data, Dimensionality Reduction, Feature Subset Selection, Discretization and Binarization, Data Transformation; Measures of Similarity and Dissimilarity – Basics.

Module II

Data Analytics: Introduction to Analytics, Introduction to Tools and Environment, Application of Modeling in Business, Databases & Types of Data and variables. Data Modeling Techniques, Missing Imputations etc. Need for Business Modeling.

Module III

Regression – Concepts, Blue property assumptions, Least Square Estimation, Variable Rationalization, and Model Building etc.
Logistic Regression: Model Theory, Model fit Statistics, Model Construction, Analytics applications to various Business Domains etc.

Module IV

Association Rule Mining & Classification: Mining Frequent Patterns–Associations and correlations – Mining Methods–Mining Various kinds of Association Rules– Correlation Analysis.
Classification: Classification and Prediction – Basic concepts–Decision tree induction– Bayesian classification, Lazy learner.

Module V

Clustering and Applications: Cluster analysis–Types of Data in Cluster Analysis– Categorization of Major Clustering Methods– Partitioning Methods.
Hierarchical Methods– Density–Based Methods, Grid–Based Methods, Outlier Analysis.

TEXT BOOKS:

1. Data Mining – Concepts and Techniques – Jiawei Han & Micheline Kamber, 3rd Edition Elsevier.
2. Data Mining Techniques – ArunKPujari

REFERENCE BOOKS

1. Introduction to Data Mining, Tan, Steinbach and Kumar, Addision Wisley, 2006.
2. Data Mining Analysis and Concepts, M. Zaki and W. Meira

CO-PO &PSO Mapping:

Course Name - Course Outcomes / Program Outcomes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	M												M		
CO2	M	H											H		
CO3	H		M											M	
CO4	M													H	

B.Tech III Year – VI Sem	L	T	P	C
Subject Code: 21OE6CO05	3	0	0	3

SENSORS AND DEVICES

Prerequisite: IoT, ADE

Course Objectives:

- To introduce the terminology, technology and its applications
- To introduce the concept of M2M (machine to machine) with necessary protocols
- To introduce the Python Scripting Language which is used in many IoT devices
- To introduce the Raspberry PI platform, that is widely used in IoT applications
- To introduce the implementation of web-based services on IoT devices

Course Outcomes:

- Understand the IoT value chain structure (device, data cloud), application areas and technologies involved.
- Analyse IoT sensors and technological challenges faced by IoT devices, with a focus on wireless, energy, power, and sensing modules
- Market forecast for IoT devices with a focus on sensors
- Explore Internet of Things with the help of preparing projects designed for Raspberry Pi

MODULE-I:

Introduction to Internet of Things- Definition and Characteristics of IoT, Sensors, Physical Design of IoT – IoT Protocols, IoT communication models, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Embedded Systems

Types: Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry.

MODULE-II:

IoT - Software defined networks, network function virtualization, difference between SDN and NFV for IoT

M2M Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER

MODULE-III:

IoT Physical Devices and Endpoints- Introduction to Arduino and Raspberry Pi

Programming – Interfaces (serial, SPI, I2C), Python program with Raspberry PI with focus on interfacing external gadgets, controlling output, reading input from pins.

MODULE-IV:

Controlling Hardware- Connecting LED, Buzzer, Switching High Power devices with transistors, speed control of DC Motor, unipolar and bipolar Stepper motors

Sensors- Light sensor, temperature sensor with thermistor, voltage sensor, ADC and DAC, Temperature and Humidity Sensor DHT11, Motion Detection Sensors, Wireless Bluetooth Sensors, Level Sensors, USB Sensors

MODULE-V:

IoT Physical Servers and Cloud Offerings– Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT

Course project on IoT Application

TEXT BOOKS:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn W allace, O'Reilly (SPD), 2014, ISBN: 9789350239759
3. Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016, ISBN 7989352133895

REFERENCE BOOKS:

1. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015 3. Editors Ovidiu Vermesan
2. Peter Friess,'Internet of Things – From Research and Innovation to Market Deployment', River Publishers, 2014
3. N. Ida, Sensors, Actuators and Their Interfaces, SciTech Publishers, 2014.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 - Low														
Program Outcomes (POs)													**Program Specific Outcomes***	
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO-1	3												1	
CO-2	3	1											2	
CO-3	3	1											2	
CO-4	3	1											1	

B. Tech III Year–VI Sem	L	T	P	C
Subject Code: 21OE6CC02	3	0	0	3

COMPUTER HARDWARE AND SYSTEM ESSENTIALS

Prerequisites: Nil

Course Objectives:

• Computer hardware essentials is designed to introduce students to a basic understanding of the different types of computing devices, computer components (CPU, memory, power supplies, etc.), and operating systems.
• It also introduces building a fully functional Linux and Installing applications.
• Understand the basic of circuit building.

Course Outcomes:

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

CO1: Understanding the working principles of different computing devices (desktop computers, laptops, etc.).
CO2: Understand connection interfaces between peripheral devices, storage devices, displays.
CO3: Understand the procedure for Installation of OS - Linux and supporting, upgrading and new applications.
CO4: Understand the concepts of number system and circuit building.

Module 1:

Components of Computer System: Computer Memory: Secondary storage device types, Basic Principles of operation: Sequential Access device, Direct Access device -Magnetic disks,Optical disks, memory storage devices, Ports: Serial and Parallel Ports, Specialized Expansion Ports: SCSI, USB, MIDI, Expansion Slots and Boards, PC Cards, Plug and Play, HDMI ports, networking ports. System software: bootstrap module, configuration.

Module 2:

OS loading: typical Linux virtual machine. Installing a Linux virtual machine. Using package manager to install/update software. Understanding disk partitions and obtaining partition information using system tools. Obtaining essential system resource utilization and information using system tools and proc file system: disk utilization, memory utilization, process information, CPU utilization.

Module 3:

Operating System: Introduction, Objectives, classification and functions of Operating System, Basics of popular operating system (LINUX, WINDOWS). Kernel prompt, Shell commands.

The User Interface: Task Bar, Icons, Menu, Running an Application. Operating System Simple Setting: Changing System Date and Time, Changing Display Properties, To Add or

Remove a Windows Component, Changing Mouse Properties, Adding and removing Printers. File and Directory Management: Creating and renaming of files and directories, Common utilities. Interrupts statements in various OS and its uses.

Module 4:

Number systems - Signed and Unsigned numbers arithmetic, Binary, Decimal, Octal, Hex, BCD etc. Introduction to logic circuits: Variables and functions, Inversion- Truth tables – Logic Gates and Networks - Boolean algebra - Synthesis using gates - Design examples – Optimized implementation of logic functions: Karnaugh map - Strategy for minimization – Minimization of product of sums forms - Incompletely specified functions - Multiple output circuits – Tabular method for minimization.

Module 5:

Combinational circuit building blocks: Multiplexers - Decoders - Encoders, Sequential circuit building blocks: Flipflops-SR, JK, D and T- Registers - Counters
- A simple sequential circuit design example from state diagram.

Textbook:

1. Brookshear JG. Computer science: an overview. Eleventh Edition, Addison-Wesley Publishing Company; 2011.
2. Givone DD. Digital Principles and Design.Tata McGraw Hill Publishing Company Limited; 2003.
3. Mano MM, Ciletti MD. Digital Design with Introduction to the Verilog HDL.Fifth Edition, Pearson Education; 2015.

References:

1. Norton, Peter. Introduction to computers. Sixth edition, Tata McGraw-HILL; 2008.
2. Wakerly JF. Digital Design Principles and Practices. Fourth Edition, Pearson Education; 2008.
3. Sinha, Pradeep K., and Priti Sinha. Computer fundamentals. BPB publications; 2010.

CO-PO/PSO Mapping:

CO-PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO2	PSO3
CO-1			2				3								
CO-2				2											
CO-3					2	2									
CO-4		1						3							