Dept. of Electronics & Communications Engineering

Andhra University College of Engineering

Visakhapatnam-530003

4 Years B.TECH

and

B.TECH+M.TECH (DOUBLE DEGREE COURSE)

Scheme of Instruction and Examination with effect from 2022-2023 admitted batch onwards

Under APSCHE Curriculum

SCHEME and Syllabus
(With effect from 2022-23 admitted Batch)
B.Tech & B.Tech+M.Tech
III Year - I Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
EC3101	PC	Control Systems	4	0	30	70	100	3
EC3102	PC	Digital Communications	4	0	30	70	100	3
EC3103	PC	Internet of Things	4	0	30	70	100	3
EC3104	PE	Professional Elective-I	4	0	30	70	100	3
EC3105	OE	Open Elective-I	4	0	30	70	100	3
EC3106	PC	Digital Communication Lab	0	3	50	50	100	1.5
EC3107	PC	Internet of ThingsLab	0	3	50	50	100	1.5
EC3108	SC	Object Oriented Programming through JAVA	1	2	50	50	100	2
EC3109	INT	Internship-I			50	50	100	2
Internship-I(2months) done after 2nd Year 2nd Semester to be evaluated during 3rd Year 1st Semester								
							Total Credits	**22**

B.Tech & B.Tech+M.Tech
III Year - II Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
EC3201	PC	Antennas and Wave Propagation	4	0	30	70	100	3
EC3202	PC	Digital Signal Processing	4	0	30	70	100	3
EC3203	PC	Microwave Engineering	4	0	30	70	100	3
EC3204	PE	Professional Elective-II	4	0	30	70	100	3
EC3205	OE	Open Elective-II	4	0	30	70	100	3
EC3206	PC	Antenna Simulation Lab	0	3	50	50	100	1.5
EC3207	PC	Digital Signal Processing Lab	0	3	50	50	100	1.5
EC3208	PC	Microwave Engineering Lab	0	3	50	50	100	1.5
EC3209	SC	Soft Skills	1	2	50	50	100	2
							Total Credits	**21.5**
Internship-II								

B.Tech & B.Tech+M.Tech
IV Year - I Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
EC4101	PE	Professional Elective-III	4	0	30	70	100	3
EC4102	PE	Professional Elective-IV	4	0	30	70	100	3
EC4103	PE	Professional Elective-V	4	0	30	70	100	3
EC4104	OE	Open Elective-III	4	0	30	70	100	3
EC4105	OE	Open Elective-IV	4	0	30	70	100	3
EC4106	HSSE	HSS-Elective	4	0	30	70	100	3
EC4107	SC	WEB Technologies	1	2	50	50	100	2
EC4108	INT	Internship-II			50	50	100	2
Internship-II (2months) done after 3rdYear 2nd Semester to be evaluated during 4th Year 1st Semester								
							Total Credits	**22**

B. Tech & B. Tech+M.Tech
IV Year - II Semester

Course code	Category	Course Title	Internal Marks	External Marks	Total Marks	Credits
EC4201	PROJ	Project work	100	100	200	14
					Total Credits	**14**

PROFESSIONAL ELECTIVES (PE)

1. Global Positioning System.
2. Radar Engineering.
3. Cellular Mobile Communication.
4. Electronic Measurements and Instrumentation.
5. Data Structures.
6. EMI/EMC.
7. Internet and Web Technology.
8. Speech Processing.
9. Computer Networks.
10. TV and Satellite Communication System.
11. Transducers and Signal Conditioning.
12. VLSI Design.
13. Digital Image Processing.
14. Fiber Optic Communication.
15. Advanced Microprocessors.

OPEN ELECTIVES (OE)

1. Low Power VLSI Design.
2. Wireless Sensor Networks.
3. Smart Antenna Systems.
4. Artificial Neural Networks.
5. Embedded System Design.
6. Bio-Medical Instrumentation.
7. FPGA Design.
8. DSP Processors and Architectures.
9. Information Theory and Coding.
10. Financial Management for Engineers.
11. Data Science.
12. Artificial Intelligence and Machine Learning.

HSS ELECTIVES (HSSE)

1. Industrial Management & Entrepreneurship.
2. Organizational Behavior.
3. Operations Research.

EC3101CONTROL SYSTEMS (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
EC 3101	**Control Systems**	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives: The main objectives of this course are given below

- To introduce the concepts of open loop and closed loop systems, mathematical models of mechanical and electrical systems, and concepts of feedback.
- To study the characteristics of the given system in terms of the transfer function and introducing various approaches to reduce the overall system for necessary analysis.
- To develop the acquaintance in analyzing the system response in time-domain and frequency domain in terms of various performance indices.
- To analyze the system in terms of absolute stability and relative stability by different approaches.

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

CO 1: Develop the transfer function using block diagram algebra and signal flow graph methods.

CO 2: Construct the mathematical model of the physical feedback control systems.

CO 3: Realize the Time Domain Analysis of Control Systems and analyze the Concepts and Necessary Conditions for Stability of control systems.

CO 4: Evaluate the stability of control systems using time and frequency response methods.

CO 5: Analyze system's absolute, relative, local stability using different frequency domain methods.

Syllabus

UNIT – I: Basic Structure of a Feedback Control System Introduction to Mathematical Modeling of Physical Systems – Equations of Electrical Networks – Modeling of Mechanical Systems – Equations of Mechanical Systems, Analogous Systems.

UNIT – II: Transfer Functions of Linear Systems – Impulse Response of Linear Systems – Block Diagrams of Control Systems – Signal Flow Graphs (Simple Problems) –

Reduction Techniques for Complex Block Diagrams and Signal Flow Graphs (Simple Examples).

UNIT – III: Time Domain Analysis of Control Systems – Time Response of First and Second Order Systems with Standard Input Signals – Steady State Error Constants – Effect of Derivative and Integral Control on Transient and Steady State Performance of Feedback Control Systems.

UNIT -IV: Concept of Stability and Necessary Conditions for Stability – Routh-Hurwitz Criterion, Relative Stability Analysis, the Concept and Construction of Root Loci, Analysis of Control Systems with Root Locus (Simple Problems to understand theory).

UNIT – V: Correlation between Time and Frequency Responses – Polar Plots – Bode Plots – Log Magnitude versus Phase Plots – All Pass and Minimum Phase Systems – Nyquist Stability Criterion – Assessment of Relative Stability – Constant M and N Circles.

Text Books:

1. Automatic Control Systems, Benjamin C. Kuo, PHI Publication (5th Edition).
2. Control Systems Engineering, I. J. Nagrath and M. Gopal, Wiley Eastern Ltd.

Reference Books:

1. Modern Control Engineering, Ogata, PHI.
2. Control Systems Principles and Design, M.Gopal, McGrawHill.

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EC3102 DIGITAL COMMUNICATIONS (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
EC 3102	Digital Communications	4			30	70	100	3hrs	3

Course Objectives:

- To understand different pulse digital modulation techniques and their comparison.
- To familiarize various digital modulation techniques and calculation of their error probabilities.
- To analyze error performance of a digital communication system in presence of noise and other interferences.
- To understand concept of spread spectrum communication system.

Course Outcomes:

CO 1: Differentiate the various types of pulse digital modulation techniques.

CO 2: Outline the band pass digital modulation and demodulation techniques.

CO 3: Evaluate the performance of digital communication system in the presence of noise.

CO 4: Analyze various receivers and determine the probability of error for various digital modulation techniques.

CO 5: Classify the different spread spectrum modulation techniques.

SYLLABUS

UNIT – I: Analog-to-Digital Conversion: Pulse modulation techniques, Sampling, Time Division Multiplexing, Pulse Amplitude Modulation, Pulse Width Modulation, Pulse Position Modulation, Digital Modulation Techniques: Pulse Code Modulation, Differential Pulse Code Modulation, Delta Modulation, Adaptive Delta Modulation, Continuously Variable Slope Delta Modulation, Companding, Noise in Pulse-Code and Delta-Modulation Systems.

UNIT – II: Bandpass Transmission: Binary Phase-Shift Keying, Differential Phase-Shift Keying, Differentially-Encoded PSK (DEPSK), Quadrature Phase-Shift Keying (QPSK), M-ary PSK, Quadrature Amplitude Shift Keying (QASK), Binary Frequency Shift-Keying,

Similarity of BFSK and BPSK, M-ary FSK, Minimum Shift Keying (MSK), Duo-binary Encoding.

UNIT – III: Mathematical Representation of Noise: Some Sources of Noise, Frequency-Domain Representation of Noise, The Effect of Filtering on the Probability Density of Gaussian Noise, Spectral Components of Noise Response of a Narrowband Filter to Noise, Effect of a Filter on the Power Spectral Density of Noise, Superposition of Noises, Mixing Involving Noise, Linear Filtering, Noise Bandwidth, Quadrature Components of Noise, Power Spectral Density of n(t) and n(t), Probability Density of n(t), n(t), and their Time Derivatives, Representation of Noise Using Orthonormal Coordinates, Irrelevant Noise Components.

UNIT – IV: Data Transmission: A Base-band Signal Receiver, Probability of Error, The Optimum Filter, White Noise: The Matched Filter, Probability of Error of the Matched Filter, Coherent Reception: Correlation, Phase-Shift Keying, Frequency-Shift Keying, Non-coherent Detection of FSK, Differential PSK, Four Phase PSK (QPSK), Error Probability for QPSK, Probability of Error of Minimum Shift Keying (MSK), Comparison of Modulation Systems.

UNIT – V: Spread Spectrum Modulation: Direct Sequence (DS) Spread Spectrum, Use of Spread Spectrum with Code Division, Multiple Access (CDMA), Ranging using DS Spread Spectrum, Frequency Hopping (FH) Spread Spectrum, Generation and Characteristics of PN Sequences, Acquisition (Coarse Synchronization) of a FH Signal, Tracking (Fine Synchronization) of a FH Signal, Acquisition (Coarse Synchronization) of a DS Signal, Tracking of a DS Signal.

Text Books:

1. Analog and Digital Communication Systems by Martin S. Roden, 3rd edition, Prentice Hall, 1994.
2. Principles of Communications by Taub and Schilling.

Reference Books:

1. Modern Analog and Digital Communications by B.P.Lathi, Oxford reprint, 3rd Edition, 2004.
2. Digital and Analog Communication systems by Samshanmugam, John Wiley, 2005.
3. Principles of Digital Communications- J.Das, SK.Mullick, P.K.Chatterjee.

EC3103 INTERNET OF THINGS (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
EC 3103	Internet of Things	4			30	70	100	3hrs	3

Course Objectives:

- Vision and Introduction to Internet of Things (IoT).
- Understand IoT Market perspective.
- Data and Knowledge Management and use of Devices in IoT Technology.
- Understand State of the Art – IoT Architecture.
- Understand Real World IoT Design Constraints, Industrial Automation and Commercial.

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

CO 1: Explain in a concise manner how the general Internet as well as Internet of Things work.

CO 2: Understand constraints and opportunities of wireless and mobile networks for Internet of Things.

CO 3: Use basic sensing and measurement and tools to determine the real-time performance of network of devices.

CO 4: Develop prototype models for various applications using IoT technology.

CO 5: To understand data acquisition and storage process in IOT applications.

SYLLABUS

UNIT – I: Internet of Things Overview: Introduction to Internet of things, IoT Conceptual Framework, IoT Architecture View, Technology Behind IoT, Sources of IoT, M2M Communication, Examples of IoT, IoT/M2M Systems layers and Desing Standardization, Communication Technologies, Data Enrichment, Data Consolidation and Device Management at Gateway.

UNIT – II: Design Principles for Web Connectivity: Introduction, Web Communication Protocols for Connected Devices, Message Communication Protocols for Connected Devices, Web Connectivity for Connected Devices Network using Gateway, SOAP, REST, HTTP RESTful and WebSocket, Internet Connectivity, Internet- Based Communication, IP Addressing in the IoT, Media Access Control, Application Layer Protocols: HTTP, HTTPS, FTP, Telnet.

UNIT – III: Data Processing and Analytics: Introduction, Data Acquiring and Storage, Organising the Data, Transactions, Business Processes, Integration and Enterprise Systems, Analytics, Knowledge Acquiring, Managing and Sorting Process, Cloud Computing Paradigm for Data Collection, Storage and Computing, Cloud Service Models, IoT Cloud -Based Services Using the Xively, Nimbits and Other Platforms.

UNIT – IV: Prototyping the Embedded Devices for IoT and M2M: Introduction, Embedded Computing Basics, Embedded Platforms for Prototyping: Arduino, Intel® Galileo, Intel® Edison, Raspberry Pi, BeagleBone, mBed boards and Computing Systems, Things Always Connected to the Internet/Cloud, Prototyping Embedded Device Software, Devices, Gateways, Internet and Web/Cloud Services Software-Development.

UNIT – V: Business Models and Processes Using IoT: Introduction, Business Models and Business Model Innovation, Value Creation Scenarios for Internet of Things, Business Model Scenarios for Internet of Things.

Text Books:

1. Internet of Things: Architecture, Design Principles and Applications, Rajkamal, McGraw Hill Higher Education.

2. Internet of Things, A.Bahgya and V.Madisetti, Univesity Press,2015.

Reference Books:

1. Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley.

2. Getting Started with the Internet of Things, Cuno Pfister, Oreilly.

EC3104 Program Elective-I

(Refer Annexure-I for Syllabus details)

EC3105 Open Elective-I

(Refer Annexure-II for Syllabus details)

EC3106 DIGITAL COMMUNICATION LAB (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
EC 3106	**Digital Communications Lab**			**3**	**50**	**50**	**100**	**3hrs**	**1.5**

Course Objectives:

- A/D and D/A Converters.
- Continuously Variable Slope Delta Modulation
- Phase Shift Keying (PSK) Modulator
- Frequency Shift Keying (PSK) Modulator.

Course Outcomes:

CO 1: Practically verifying A/D and D/A Converters.
CO 2: Practically Analyze Continuously Variable Slope Delta Modulation

CO 3: Practically know the concept of Phase Shift Keying (PSK) Modulator.

CO 4: Practically understand the concepts of Frequency Shift Keying (PSK) Modulator.

CO 5: Practically verify Encoding and Decoding schemes.

SYLLABUS

List of Experiments:

1. Sample the given input signal for different sampling rates and recover the signal by means of appropriate low – pass filter.
2. Study the Pulse – Width Modulation for both AC and DC Modulating Signals and obtain the corresponding waveforms.
3. Study the Pulse – Position Modulation for both AC and DC Modulating Signals and obtain the corresponding waveforms.
4. Study the functioning of a given Analog to Digital Converter.
5. Study the functioning of a given Digital to Analog Converter.

6. Encode the given 4-Bit Data Word into 16-Bit Orthogonal Encoded Word using Hadamard Code.

7. Decode the 16-Bit Orthogonal Encoded Word to 4-Bit Data Word.

8. Study the performance of the given Continuously Variable Slope Delta Modulation (CVSD).

9. Obtain the characteristics of the Phase Shift Keying (PSK) Modulator.

10. Obtain the characteristics of the Frequency Shift Keying (FSK) Modulator.

EC3107 INTERNET OF THINGS LAB (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
EC 3107	**Internet of Things Lab**			**3**	**50**	**50**	**100**	**3hrs**	**1.5**

Course Objectives:

- Interface Arduino to ZigBee module.
- Interface Arduino to GSM module.
- Interface sensors to Raspberry Pi module.
- Design an IoT system.

Course Outcomes:

CO 1: Interface Arduino to ZigBee module and GSM modules.

CO 2: Interface Arduino Bluetooth modules.

CO 3: Make use of Cloud platform to upload and analyse any sensor data.

CO 4: Use of Devices, Gateways and Data Management in IoT.

CO 5: Use the knowledge and skills acquired during the course to build and test a complete working IoT system involving prototyping, programming and data analysis.

SYLLABUS

List of Experiments:

1. Introduction to Arduino platform and programming.
2. Interfacing Arduino to Zigbee module.
3. Interfacing Arduino to GSM module.
4. Interfacing Arduino to Bluetooth Module.
5. Introduction to Raspberry PI platform and python programming.
6. Interfacing sensors to Raspberry PI.
7. Communicate between Arduino and Raspberry PI using any wireless medium.
8. Setup a cloud platform to log the data.
9. Log Data using Raspberry PI and upload to the cloud platform.
10. Design an IOT based system.

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EC3108 OBJECT ORIENTED PROGRAMMING THROUGH JAVA (SC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
EC 3108	**Object Oriented Programming Through JAVA**	**1**		**2**	**50**	**50**	**100**	**3hrs**	**2**

Course Objectives:

- To write programs using abstract classes.
- To write programs for solving real world problems using java collection frame work.
- To write multithreaded programs.
- To write GUI programs using swing controls in Java.
- To introduce java compiler and eclipse platform.
- To impart hands on experience with java programming.

Course Outcomes:

CO 1: Able to write programs for solving real world problems using java collection frame work.

CO 2: Able to write programs using abstract classes.

CO 3: Able to write multithreaded programs.

CO 4: Able to write GUI programs using swing controls in Java.

CO 5: Apply validation techniques to build a reliable solution to a given problem.

SYLLABUS

List of Programs:

1. Use Eclipse or Net bean platform and acquaint with the various menus. Create a test project, add a test class, and run it. See how you can use auto suggestions, auto fill. Try code formatter and code refactoring like renaming variables, methods, and classes. Try debug step by step with a small program of about 10 to 15 lines which contains at least one if else condition and afor loop.
2. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions like divided by zero.
3. a) Develop an applet in Java that displays a simple message.

b) Develop an applet in Java that receives an integer in one text field, and computes its factorialValue and returns it in another text field, when the button named “Compute” is clicked.

4. Write a Java program that creates a user interface to perform integer divisions. The user enterstwo numbers in the text fields, Num1 and Num2. The division of Num1 and Num 2 is displayedin the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, theprogram would throw a Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception. Display the exception in a message dialog box.
5. Write a Java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print thevalue of cube of the number.
6. Write a Java program for the following:
    i) Create a doubly linked list of elements.
    ii) Delete a given element from the above list.
    iii) Display the contents of the list after deletion.
7. Write a Java program that simulates a traffic light. The program lets the user select one of threelights: red, yellow, or green with radio buttons. On selecting a button, an appropriate messagewith “Stop” or “Ready” or “Go” should appear above the buttons in selected color. Initially, thereis no message shown.
8. Write a Java program to create an abstract class named Shape that contains two integers andan empty method named print Area (). Provide three classes named Rectangle, Triangle, and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.
9. Suppose that a table named Table.txt is stored in a text file. The first line in the file is the header,and the remaining lines correspond to rows in the table. The elements are separated by commas. Write a java program to display the table using Labels in Grid Layout.
10. Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired (Use Adapter classes).

EC3201 ANTENNAS AND WAVE PROPAGATION (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
EC 3201	**Antennas and Wave Propagation**	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To understand the applications of the electromagnetic waves in free space.
- To introduce the working principles of various types of antennas.
- To discuss the major applications of antennas with an emphasis on how antennas are employed to meet electronic system requirements.
- To understand the concepts of radio wave propagation in the atmosphere.

Course Outcomes:

CO 1: Understand the radiation mechanism of an antenna and identify basic antenna parameters.

CO 2: Design and analyze various types of antenna Arrays.

CO 3: Construct and Analyze HF, VHF and UHF Antennas.

CO 4: Analyze Microwave antennas and summarize the antenna measurement techniques.

CO 5: Outline the characteristics of radio wave propagation.

SYLLABUS

UNIT – I: Radiation and Antennas: Antenna definition and Functions, Network theorems, Properties of antennas, Antenna parameters, Polarization, Basic antenna elements, Radiation mechanism, Radiation fields of alternating current element, Radiated power and radiation resistance of current element, Radiation, induction and electrostatic fields, Hertzian dipole, Different current distributions in linear antennas, Radiation from half-wave dipole, Radiation from quarter wave monopole, Radiation characteristics of dipoles.

UNIT – II: Analysis of Linear Arrays: Directional characteristics of dipole antennas, Radiation pattern of alternating current element, Radiation pattern expressions of centre-fed

vertical dipoles of finite length, Radiation patterns of centre-fed vertical dipoles, Radiation patterns of centre-fed horizontal dipoles, Radiation patterns of vertical dipoles, Two-element uniform array, Uniform linear arrays, Field strength of a uniform linear array, First sidelobe ratio (SLR), Broadside and End-fire arrays, Patterns of array of non-isotropic radiators, Multiplication of patterns, Generalized expression for principle of pattern multiplication, Radiation pattern characteristics, Binomial arrays, Effect of earth on vertical patterns, Effect of earth on radiation resistance, Methods of excitation, Impedance matching techniques, Transmission loss between transmitting and receiving antennas – FRIIS formula, Antenna temperature and signal-to-noise ratio.Array Synthesis, Synthesis methods, Fourier transform method, Linear array design by Woodward-Lawson method, Dolph-chebychev method (Tschebyscheff distribution), Taylor method, Laplace transform method, Standard amplitude distributions.

UNIT – III: HF, VHF and UHF Antennas: Introduction, Isotropic radiators, Directional antennas, Omni-directional antennas, Resonant antennas, Nonresonant antennas, LF antennas, Antennas for HF, VHF and UHF, Dipole arrays, Folded dipole, V-Antennas, Inverted V-antennas, Rhombic antenna, Yagi-Uda antenna, Log-periodic antennas, Loop antenna, Helical antenna, Whip antenna, Ferrite rod antenna, Turnstile antennas, Discone antennas, Notch antenna.

UNIT – IV: Microwave Antennas and Antenna Measurements: Introduction, Rod reflector, Plane reflector, Corner reflector, Parabolic reflector, Types of parabolic reflectors, Feed systems for parabolic reflectors, Shaped beam antennas, Horn antennas, Corrugated horns, Slot antennas, Impedance of a few typical dipoles, Slots in the walls of rectangular waveguides, Babinet's principle, Lens antennas, Microstrip antennas , Measurement ranges, Indoor and outdoor ranges, Antenna impedance measurements, Measurement of radiation resistance, Gain measurements, Measurement of antenna bandwidth, Directivity measurement, Measurement of sidelobe ratio, Measurement of radiation efficiency, Measurement of antenna aperture efficiency, Measurement of polarization of antenna, Phase measurement.

UNIT – V: Wave Propagation: Propagation characteristics of EM Waves, Factors involved in the propagation of radio waves, Ground wave propagation, Ground wave field strength by Maxwell's equations, Reflection of radio waves by the surface of the earth, Roughness of earth, Reflection factors of earth, Wave tilt of the ground wave, Tropospheric wave propagation, Atmospheric effects in space wave propagation, Duct propagation, Radio horizon,

Troposcatter, Fading of EM waves in Troposphere, Line of sight (LOS), Ionospheric propagation, Characteristics of ionosphere, Refractive index of ionosphere, Phase and group velocities, Mechanism of Ionospheric propagation, reflection and refraction, Characteristic parameters of Ionospheric propagation, Sky wave field strength, Fading and diversity techniques, Faraday's rotation, Effect of earth's magnetic field.

Text Book:

1. Antennas and Wave Propagation, G.S.N. Raju, Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2007.

Reference Books:

1. EM Waves and Radiation Systems, E. C. Jordan and K. G. Balmain, PHI – N. Delhi, 1997.
2. Antennas, J.D. Kraus, McGraw Hill, NY.
3. Antenna theory, C.A. Balanis, John Wiley & Sons, NY, 1982.

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EC3202 DIGITAL SIGNAL PROCESSING (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
EC 3202	Digital Signal Processing	4			30	70	100	3hrs	3

Course Objectives:

- To Analyze the Discrete Time Signals and Systems.
- To understand the various implementations of digital filter structures.
- To know the importance of FFT algorithm for computation of Discrete Fourier Transform.
- To learn the FIR and IIR Filter design procedures.
- To know the applications of DSP.

Course Outcomes:

CO 1: Apply the concepts of difference equations to Analyze the discrete time systems

CO 2: Make use of the FFT algorithm for solving the DFT of a given signal.

CO 3: Analyze the Digital IIR & FIR filter design for different specifications.

CO 4: Analyze the Digital FIR filter design for different specifications.

CO 5: Understand the signal Processing concepts in various applications.

SYLLABUS

UNIT – I: Discrete - Time Signals and Systems: Discrete - Time Signals – Sequences, Linear Shift – Invariant Systems, Stability and Causality, Linear Constants – Coefficient Difference Equations, Frequency Domain Representation of Discrete – Time Signals and Systems.

UNIT – II: Applications of Z – Transforms: System Functions H(z) of Digital Systems, Stability Analysis, Structure and Realization of Digital Filters, Finite Word Length Effects.

UNIT – III: Discrete Fourier Transform (DFT): Properties of the DFS, DFS Representation of Periodic Sequences, Properties of DFT, Convolution of Sequences. Fast – Fourier Transforms (FFT):

Radix – 2 Decimation – In – Time (DIT) and Decimation – In – Frequency (DIF), FFT Algorithms, Inverse FFT.

UNIT – IV: IIR Digital Filter Design Techniques: Design of IIR Filters from Analog Filters, Analog Filters Approximations (Butterworth and Chebyshev Approximations), Frequency Transformations, General Considerations in Digital Filter Design, Bilinear Transformation Method, Step and Impulse Invariance Technique.

UNIT – V: Design of FIR Filters: Fourier series Method, Window Function Techniques, Comparison of IIR and FIR Filters. Applications of FFT in Spectrum Analysis and Filtering, Application of DSP in Speech Processing.

Text Book:

1. Alan V. Oppenheim and Ronald W. Schafer: Digital Signal Processing, PHI.

Reference Books:

1. Sanjit K. Mitra, Digital Signal Processing "A – Computer Based Approach", Tata Mc Graw Hill.
2. Raddar and Rabiner, Application of Digital Signal Processing.
3. S. P. Eugene Xavier, Signals, Systems and Signal Processing, S. Chand and Co. Ltd.
4. Antonio, Analysis and Design of Digital Filters, Tata Mc Graw Hill.

EC3203 MICROWAVE ENGINEERING (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
EC 3203	Microwave Engineering	4			30	70	100	3hrs	3

Course Objectives:

- The microwave components.
- Microwave signal generators and amplifiers.
- Various microwave circuits and microwave integrated circuits.
- Various microwave parameter measurements.

Course Outcomes:

CO 1: Analyze the microwave components.

CO 2: Illustrate microwave signal generators and amplifiers.

CO 3: Understand the operation of various microwave circuits.

CO 4: Infer various microwave integrated circuits.

CO 5: Infer various microwave parameter measurements.

SYLLABUS

UNIT – I: Microwave Components: Introduction to Microwaves and their applications, Coaxial Line Components, Wave-guide Components, Directional Couplers, Hybrid Tee Junction, Magic Tee, Attenuators, Ferrite Devices, Isolators, Circulators, Cavity Resonators, Re-entrant Cavities, Wave-meters, Microwave Filters, Detectors, Mixers.

UNIT -II: Microwave Signal Generators and Amplifiers: Vacuum Tube Triodes, Resonant Cavity Devices, Reflex Klystron, two – Cavity Klystron, Multi – Cavity Klystron, Slow – Wave Devices, TWT, Crossed Field Devices, Magnetrons, Semiconductor Devices, Microwave BJTs, FETs, Tunnel Diodes, Gunn Diode, IMPATT, TRAPATT Diodes.

UNIT – III: Microwave Circuits: Scattering Matrix and its Properties, Scattering Matrix of directional coupler, circulator, E Plane Tee, H plane Tee and Magic Tee.

UNIT – IV: Microwave Integrated Circuits: Materials, Substrate, Conductor, Dielectric and Resistive Materials, MMIC Growth, Fabrication Techniques, MOSFET Fabrication, NMOS Growth and CMOS Development, Thin Film Formation.

UNIT – V: Microwave Measurements: VSWR, Frequency, Guide Wavelength, Coupling and Directivity measurements.

Text Books:

1. Microwave Engineering, G.S.N. Raju, IK International Publishers.
2. Microwave Communications – Components and Circuits, E. Hund, McGraw Hill.
3. Microwave Devices and Circuits, S. Y. Liao, PHI.
4. Microwave Engineering, R. Chatterjee, East – West Press Pvt. Ltd.

Reference Books:

1. Foundations For Microwave Engineering, R. R. Collin, McGraw Hill.

EC3204 Program Elective-II
(Refer Annexure-I for Syllabus details)

EC3205 Open Elective-II
(Refer Annexure-II for Syllabus details)

EC3206 ANTENNA SIMULATION LABORATORY (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
EC 3206	Antennas Simulation Lab			3	50	50	100	3hrs	1.5

Course Objectives:

- To understand the fundamental working principle of an antenna.
- To describe/explore the different antenna parameters like input impedance, far-field radiation patterns, reflection coefficient, etc.
- To apply the different feeding technique.
- To evaluate and perform the optimization to achieve a certain goal.
- To design the wire antennas, microstrip antennas, etc.

Course Outcomes:

CO 1: Understand different simulation software used for antenna design and analysis.
CO 2: Understand the design and analyzing basic antenna and its parameters experimentally.
CO 3: Design and understand wire antennas and microstrip antennas using HFSS.
CO 4: Understand the different feeding technique used for antenna design.
CO 5: Design wire antennas, Microstrip antennas, and Microstrip based filters using EM simulator.

SYLLABUS

List of Experiments:

1. Design of fundamental parameters of the antenna and an overview of HFSS to measure different antenna parameters.
2. Design of a half-wave dipole antenna.
3. Design of a quarter-wave monopole antenna.
4. Design and simulation of rectangular microstrip patch antenna with a particular operating frequency, dielectric constant and substrate thickness.
5. Design of microstrip patch antenna using a coaxial feeding technique.

6. Design and simulation of dual-band rectangular patch antenna using the inset feeding technique.
7. Design and simulation of rectangular microstrip patch antenna using CPW feeding with slot for bandwidth enhancement.
8. Design of aperture coupled rectangular microstrip patch antenna with two different substrates.
9. Design of proximity coupled rectangular microstrip patch antenna.
10. Design and simulation of Dielectric Resonator Antenna with a particular operating frequency, dielectric constant and substrate thickness.
11. Design and Simulation of MPA using MATLAB.
12. Design and Simulation of MPA using the CST Microwave Studio Suite 2020.

EC3207 DIGITAL SIGNAL PROCESSING LAB (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
EC 3207	**Digital Signal Processing Lab**			**3**	**50**	**50**	**100**	**3hrs**	**1.5**

Course Objectives:

- To make familiar with practical implementation of the digital signal processing.
- To develop DSP algorithms for convolution, correlation and DFT.
- To design digital filters.
- To have hands on experience in MATLAB and DSP processor.

Course Outcomes:

CO 1: Generation and Implementation of discrete time signals and systems using MATLAB

CO 2: Analyze the Frequency analysis of discrete signals and systems using MATLAB.

CO 3: Design and simulate FIR and IIR filters with different techniques using MATLAB.

CO 4: Verification of Linear and Circular Convolution using DSP Processor.

CO 5: Implementation of FIR and IIR filters with different techniques using DSP Processor.

SYLLABUS

List of Experiments:

1). Sampling theorem, illustration of up sampling in time and frequency domain.

2). Sampling theorem, illustration down sampling in time and frequency domain.

3) Implement: -

a) Linear Convolution of Two Sequences.

b) Circular Convolution of Two Sequences.

c) Cross-Correlation and Auto-Correlation.

4) FFT of a given (8 point and 16 point) N-point Sequence using: -

a) DIF-FFT b) DIT-FFT.

5) System Response of Discrete Time Sequences: -

a) Impulse b) Step

6) Spectral Analysis of given Waveforms. And Plot Spectrogram (Frequency v/s Time): -

a) Sine b) Square c) Audio file.

7) Study of Architecture of DSP Chip-TMS320C6711.

8) Design following IIR Digital Filters using i) Butterworth and ii) Chebyshev designs:

(a) LPF (b) HPF (c) BPF (d) BSF

9) Design FIR Digital Filters using a) Rectangular window b) Hamming window:

(a) LPF (b) HPF (c) BPF (d) BSF.

10) Addition of White Gaussian Noise to an Audio file and recover the Signal using Butterworth filters.

11) Perform various operations on Digital Images.

(a) Cropping (b) rotation (c) histogram (d) binary image

(e) B to G conversion (f) water marking (g) Adding noise to the image.

EC3208 MICROWAVE ENGINEERING LAB (PC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
EC 3208	Microwave Engineering Lab			3	50	50	100	3hrs	1.5

Course Objectives:

- VSWR.
- V-I Characteristics of GUNN Diode.
- Coupling Factor and Directivity of a 4-Port directional coupler.
- Microwave frequency

Course Outcomes:

CO 1: Measurement of VSWR.

CO 2: Experimentally analyze V-I Characteristics of GUNN Diode.

CO 3: Measure Coupling Factor and Directivity of a 4-Port directional coupler practically.

CO 4: Practically experimenting and understand radiation pattern of Horn Antenna.

CO 5: Practically analyze analog and digital fiber optic links.

SYLLABUS

List of Experiments:

1. Measurement of VSWR.
2. V-I Characteristics of GUNN Diode.
3. Measurement of Coupling Factor and Directivity of a 4-Port directional coupler.
4. Measurement of Microwave frequency.
5. Reflex Klystron Characteristics.
6. Radiation Pattern of Horn Antenna.
7. Fiber Optic Analog Link.
8. Fiber Optic Digital Link.
9. Other four experiments from the choice either from Microwave Engineering or from Antenna Theory.

EC3209 SOFT SKILLS (SC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
EC 3209	Soft Skills	1		2	50	50	100	3hrs	2

Course Objectives:

- To develop skills to communicate clearly.
- To aid students in building interpersonal skills.
- To enhance team building and time management skills.
- To inculcate active listening and responding skills.

Course Outcomes:

CO 1: Make use of techniques for self-awareness and self-development.

CO 2: Apply the conceptual understanding of communication into everyday practice.

CO 3: Understand the importance of teamwork and group discussions skills.

CO 4: Develop time management and stress management.

CO 5: Preparation of resume and interviews.

SYLLABUS

Introduction to Soft Skills: Communication – Verbal and Non-Verbal Communication - Personal grooming (Etiquette, Attitude, Body Language), Posture, Gestures, Facial Expressions, Eye Contact, Space Distancing, Presentation Skills, Public Speaking, just a Minute (JAM) sessions, Adaptability.

Goal Setting and Time Management: Immediate, Short term, Long term, Smart Goals, Strategies to Achieve goals, Types of Time, Identifying Time Wasters, Time Management Skills, Stress Busters.

Leadership and Team Management: Qualities of a Good Leader, Team Dynamics, Leadership Styles, Decision Making, Problem Solving, Negotiation Skills.

Group Discussions: Purpose (Intellectual ability, Creativity, Approach to a problem, Tolerance), Group Behaviour, Analysing Performance.

Job Interviews: Identifying job openings, Covering Letter and CVs / Resumes, Interview (Opening, Body-Answer Q, Close-Ask Q), Telephone Interviews, Types of Questions.

Reference Books:

1. Krannich, Caryl, and Krannich, Ronald L. Nail the Resume! Great Tips for Creating Dynamite Resumes. United States, Impact Publications, 2005.
2. Hasson, Gill. Brilliant Communication Skills. Great Britain: Pearson Education, 2012
3. Prasad, H. M. How to Prepare for Group Discussion and Interview. New Delhi: Tata McGraw-Hill Education, 2001.
4. Pease, Allan. Body Language. Delhi: Sudha Publications, 1998.
5. Rizvi, Ashraf M. Effective Technical Communication: India, McGraw-Hill Education. 2010
6. Thorpe, Edgar &Showick Thorpe. Winning at Interviews. 2nd Edition. Delhi: Dorling Kindersley, 2006.

EC-4101 Program Elective-III

(Note: Refer Annexure-I for Syllabus details)

EC4102 Program Elective-IV

(Note: Refer Annexure-I for Syllabus details)

EC4103 Program Elective-V

(Note: Refer Annexure-I for Syllabus details)

EC4104 Open Elective-III

(Note: Refer Annexure-II for Syllabus details)

EC4105 Open Elective-IV

(Note: Refer Annexure-II for Syllabus details)

EC4106 HSS Elective

(Note: Refer Annexure-III for Syllabus details)

EC4107 WEB TECHNOLOGIES (SC)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
EC 4107	WEB Technologies	1		2	50	50	100	3hrs	2

Course Objectives:

- To develop an ability to design and implement static and dynamic website.
- Create conforming web pages.
- Understand, analyze and create XML documents and XML Schema.
- Understand, analyze and build web applications using PHP.
- Handling Cookies and Sessions using PHP, SERVLETS and JSP.

Course Outcomes:

CO 1: Design and implement dynamic websites with good aesthetic sense of designingand latest technical know-how's.

CO 2: Create web pages using HTML and Cascading Styles sheets.

CO 3: Analyze a web page and identify its elements and attributes.

CO 4: Create dynamic web pages using JavaScript.

CO 5: Build web applications using PHP.

SYLLABUS

List of Programs:

1. Design the following static web pages required for an online book storeweb site.

   i) HOME PAGE: The static home page must contain three frames.
   ii) LOGIN PAGE
   iii) CATOLOGUE PAGE: The catalogue page should contain thedetails of all the books available in the web site in a table.
   iv) REGISTRATION PAGE

2. Write a JavaScript to validate the following fields of the Registrationpage.

i) First Name (Name should contains alphabets and the lengthshould not be less than 6 characters).

ii) Password (Password should not be less than 6 characters length).

iii) E-mail id (should not contain any invalid and must follow thestandard pattern name@domain.com)

iv) Mobile Number (Phone number should contain 10 digits only).

v) Last Name and Address (should not be Empty).

3. Develop and demonstrate the usage of inline, internal and externalstyle sheet using CSS.

4. Develop and demonstrate JavaScript with POP-UP boxes andfunctions for the following problems:

   i) Input: Click on Display Date button using onclick () function.
   Output: Display date in the textbox.

   ii) Input: A number n obtained using prompt.
   Output: Factorial of n number using alert.

   iii) Input: A number n obtained using prompt.
   Output: A multiplication table of numbers from 1 to 10 of n using alert.

   iv) Input: A number n obtained using prompt and add another numberusing confirm.
   Output: Sum of the entire n numbers using alert.

5. Write an HTML page that contains a selection box with a list of 5 countries. When the user selects a country, its capital should be printed next in the list. Add CSS to customize the properties of the font of the capital (color, bold and font size).

6. Write an HTML page including any required JavaScript that takes a number from text field in the range of 0 to 999 and shows it in words. It should not accept four and above digits, alphabets and special characters.

7. Develop and demonstrate PHP Script for the following problems:

   i) Write a PHP Script to find out the Sum of the Individual Digits.

   ii) Write a PHP Script to check whether the given number isPalindrome or not.

8. Implement the web applications with Database using PHP.

9. Modify the above PHP program to use an xml instead of database.

10. Write a program to design a simple calculator using (i) JavaScript (ii)PHP**.**

EC4201 PROJECT WORK

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
EC 4201	Project Work			28	100	100	200		14

Course Objectives:

- To give the real-life exposure on modelling, development and implementation of hardware and embedded systems.
- To give exposure in the relevant field of specialization.
- To focus on research problems and analysis, solutions, research methodology, publishing/patenting research work.

Course Outcomes:

CO 1: Apply critical and creative thinking in the design of engineering projects, plan and manage your time effectively as a team.

CO 2: Consider the business context and commercial positioning of designed devices or systems and apply knowledge of the real-world situations that a professional engineer can encounter.

CO 3: Use fundamental knowledge and skills in engineering and apply it effectively on a project and design and develop a functional product prototype while working in a team.

CO 4: Undertake an engineering project under mentorship and timely reflect on your own and peer's technical and non- technical learning.

CO 5: Orally present and demonstrate your product to peers, academics, generally and industry community and manage any disputes and conflicts within and outside your team.

ANNEXURE -I

PROFESSIONAL ELECTIVES (PE)

1. Global Positioning System.
2. Radar Engineering.
3. Cellular Mobile Communication.
4. Electronic Measurements and Instrumentation.
5. Data Structures.
6. EMI/EMC.
7. Internet and Web Technology.
8. Speech Processing.
9. Computer Networks.
10. TV and Satellite Communication System.
11. Transducers and Signal Conditioning.
12. VLSI Design.
13. Digital Image Processing.
14. Fiber Optic Communication.
15. Advanced Microprocessors.

GLOBAL POSITIONING SYSTEM (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	Global Positioning System	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- Global Position System with GPS working principle.
- Other global satellite constellations.
- GPS satellite constellation and signals.
- Block diagrams of Synthetic Aperture Radar (SAR), Phased array Radars and others.
- different coordinate systems

Course Outcomes:

CO 1: Understand the basic concepts of Global Position System with GPS working principle.

CO 2: Understand the basic concepts of other global satellite constellations.

CO 3: Analyze various GPS Errors.

CO 4: Analyze GPS satellite constellation and signals.

CO 5: Examine using different coordinate systems.

SYLLABUS

UNIT – I: Introduction to GPS: Global Position System, the History of GPS, the Evolution of GPS, Development of NAVSTAR GPS, Block I, Block II satellites, Block IIA, Block IIR and Block II R-M satellites.

UNIT – II: GPS Working: Principal Trilateration, Determination of where the satellites are, Determination of how far the satellites are, Determining the receiver position in 2D or X-Y Plane, Determining the receiver position in 3D or X-Y-Z Plane, basic equations for finding user position, user position determination with least squares estimator.

UNIT – III: Other Global Satellite Constellation: GLONASS, GALILEO, Comparison of 3GNSS (GPS, GALILEO, GLONASS) in terms of constellation and services provided.

UNIT – IV: GPS Satellite constellation and Signal Structure: GPS system segments, Space segment, Control segment, User segment, GPS Signals, Pseudorandom noise (PRN) code, C/A code, P code Navigation data, Signal structure of GPS.

UNIT – V: Coordinate Systems: Geoid, Ellipsoid, Coordinate Systems, Geodetic and Geo centric coordinate systems, ECEF coordinates, world geodetic 1984 system, Conversion between Cartesian and geodetic coordinate frame.

Text Books:

1. G S RAO, Global Navigation Satellite Systems, McGraw-Hill Publications, New Delhi, 2010.
2. Pratap Mishra, Global positioning system: signals, measurements, and performance, Ganga-Jamuna Press, 2006.

Reference Books:

1. Scott Gleason and Demoz Gebre-Egziabher, GNSS Applications and Methods, Artech House, 685 Canton Street, Norwood, MA 02062, 2009.
2. James Ba – Yen Tsui, 'Fundamentals of GPS receivers – A software approach', John Wiley & Sons (2001).
3. B.Hoffmann- Wellenhof, GPS theory and practice, 5th Edition, Springer 2001.

RADAR ENGINEERING (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	Radar Engineering	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To study the principles of operation of various blocks of Radar systems and Radar Range equation in detail.
- To study the functions of various blocks of CW Radar, FM-CW Radar, MTI and Pulse Doppler Radars, Tracking radar and their limitations and applications.
- To study the functions of various blocks of Radar receivers and detection of Radar signals in noise in detail.
- To study the principles and working of phased array antennas and their application to radar systems.

Course Outcomes:

CO 1: Understand the basic concepts of Radar, equation and factors influencing radar range equation.

CO 2: Knowledge of different types of radars and understand the detection criteria for different parameters.

CO 3: Distinguish the fixed and moving targets using different types of radar systems. Analyze Tracking Radar.

CO 4: Examine block diagrams of Synthetic Aperture Radar (SAR), Phased array Radars and others.

CO 5: Knowledge about different radar transmitters and receivers and identify the different types of display devices & duplexers used in radar receivers.

SYLLABUS

UNIT – I: Introduction to RADAR: Radar Equation, Radar Block Diagram and Operation, Prediction of Range, Minimum Detectable Signal, Receiver Noise, Probability Density Functions, S/N, Integration of Radar Pulses, Radar Cross-section, Transmitter Power, PRF and Range Ambiguities, Radar Antenna Parameters, System Losses and Propagation Effects.

UNIT - II: MTI and Pulse Doppler RADAR: Introduction, Delay line Cancellers, Moving target Detector, Limitation to MTI performance, MTI from moving platform, Pulse Doppler Radar.

UNIT – III: Tracking RADARS: Sequential Lobing, Conical Scan, Monopulse tracking Radar, Low angle tracking, Pulse compression, Block Diagrams of Synthetic Aperture Radar (SAR), Phased array Radars, MST Radar, ECM, ECCM.

UNIT – IV: Detection of Signals in Noise: Matched Filter Receiver, Detection Criteria, Constant False Alarm Rate Receivers. Information From RADAR Signals: Basic Radar Measurements, Pulse Compression, Target Recognition.

UNIT – V: RADAR Transmitters and Receivers: Magnetron, Solid State RF Power Source, Other Aspects of Radar Transmitters, Radar Receiver, Superheterodyne Receiver, Duplexers and Receivers Protectors, Radar Displays.

Text Book:

1. Radar Engineering and Fundamentals of Navigational Aids, G S N Raju, IK International Publishers, 2008.

Reference Book:

1. Introduction to Radar Systems, Skolnik, McGraw Hill, 2007.

CELLULAR AND MOBILE COMMUNICATION (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	Cellular and Mobile Communication	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To know the evolution of Mobile communication and cell concept to improve capacity of the system.
- Understand the basic cellular concepts like frequency reuse, cell splitting, cell sectoring etc., and various cellular systems.
- Understand the frequency management, channel assignment, various propagation effects in cellular environment and the concepts of handoff and types of handoffs.
- Understand the architectures of GSM and 3G cellular systems.

Course Outcomes:

CO 1: Explain the fundamentals of cellular radio system design and its basic elements.

CO 2: Analyze the concepts of different co-channel, non-co-channel interference and cellular coverage on signal & traffic of a designed system.

CO 3: Identify the various types of multiplexing and modulation techniques suitable for mobile communications.

CO 4: Analyze mobile radio propagation models.

CO 5: Summarize the different types of second-generation system architectures such as GSM, TDMA and CDMA for mobile communication systems.

SYLLABUS

UNIT – I: Introduction: Evolution of Mobile Communications, Mobile Radio Systems around the world, First, Second, Third Generation Wireless Networks, Wireless Local Loop (WLL), Wireless LANs, Bluetooth, Personal Area Networks (PANs), Examples of Wireless Communication Systems, A Simplified Reference Model, Applications.

UNIT – II: Wireless Transmission Techniques: Frequencies for radio transmission, Signals, Antennas, Signal Propagation, Multiplexing, Modulation Techniques: ASK, PSK, FSK,

Advanced ASK, Advanced PSK, Multicarrier, Spead Spectrum: Direct sequence and Frequency hopping, Medium Access control- SDMA, FDMA, TDMA, CDMA, Comparison of S/F/T/CDMA.

UNIT – III: The Cellular Concept: Introduction, Frequency reuse, Handoff strategies, Interference and System Capacity: Co- Channel Interference, Channel Planning, Adjacent Channel Interference, Power control for reducing interference, Trunking and Grade of Service, Cell Splitting, Sectoring, Repeaters for Range extension, A microcell zone concept.

UNIT – IV: Mobile Radio Propagation: Introduction, Free space propagation model, The three basic propagation models-Reflection, Diffraction and Scattering, Two-ray model, Outdoor propagation models, Indoor propagation models, Signal Penetration into building, Small scale multipath Propagation, Parameters of Mobile multipath channels, Types of small scale fading.

UNIT -V: Telecommunication Systems: GSM: Mobile Services, System Architecture, Radio interface, Protocols, Localization and Calling, Handover, Security, New data services, UMTS and IMT-2000: Releases and Standardization, System Architecture, Radio interface, UTRAN, Handover.

Text Books:

1. Mobile Cellular Communication by Gottapu Sasibhushana Rao, PEARSON International, 2012.

Reference Books:

1. Mobile Communications-Jochen Schiller, Pearson education, 2nd Edn, 2004.
2. Wireless Communications: Principles and Practice-Theodore. S. Rapport, Pearson education, 2nd Edn, 2002.
3. Mobile Cellular Telecommunications-W.C.Y. Lee, Tata McGraw Hill, 2nd Edn, 2006.
4. Wireless and Mobile Communications-Lee, McGraw Hill, 3rd Edition, 2006.
5. Wireless Communications and Networks-William Stallings, Pearson Education, 2004.

ELECTRONIC MEASUREMENTS & INSTRUMENTATION (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	Electronic Measurement and Instrumentation	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To introduce the fundamentals of Electronics Instruments and Measurement
- To provide an in-depth understanding of Measurement errors.
- To address the underlying concepts and methods behind Electronics measurements.
- To understand operation of different instruments.
- To know the principles of various types of transducers and sensors.

Course Outcomes:

CO 1: Understand the different characteristics of electronic measuring instruments.

CO 2: Make use of Signal generators to analyze a signal.

CO 3: Understand the design and functioning of Oscilloscopes.

CO 4: Utilize AC bridges for measurement of inductance and distinguish active transducers from passive transducers.

CO 5: Develop the ability to use instruments for measurement of physical parameters.

SYLLABUS

UNIT – I: Basic Measurement Concepts: Measurement systems – Static and dynamic characteristics – error analysis – moving coil meters – DC ammeters, DC voltmeters, Series type ohmmeter, Shunt type ohmmeter, multimeter - moving iron meters – Bridge measurements – Wheatstone, Kelvin, Guarded Wheatstone, Maxwell, Hay, Schering, Anderson and Wein bridge.

UNIT – II: Basic Electronic Measurements: AC voltmeters using rectifiers, True RMS responding voltmeter, Electronic multimeter – Comparison of analog and digital techniques – digital voltmeter - Ramp, Stair case ramp, Integrating, Continuous balance, Successive approximation.

UNIT -III: Digital Instruments: Frequency counters – measurement of frequency and time interval – extension of frequency range – measurement errors - Cathode ray oscilloscopes –

block schematic – applications – special oscilloscopes – Storage and sampling oscilloscopes – wave analyzer - distortion analyzer - spectrum analyzer – Q meters.

UNIT -IV: Transducers: Introduction, Classification of transducers, Analog transducers, Resistive transducers, Potentiometers, Strain gauges, Types of strain gauges, Resistance strain gauges, Semiconductor strain gauges, Resistance thermometers, Thermometers, Application of Thermistors, Thermo-couple construction, Measurement of thermocouple output, Compensating circuits, Advantages and disadvantages of thermocouples.

UNIT – V: Displacement Transducers: Variable inductance type transducer, Variation of self-inductance, Variation of mutual inductance, Linear variable differential transformer, Rotary variable differential transformer, Capacitive transducers, Piezo-electric transducers, Digital transducers, Shaft Encoder.

Text Books:

1. Albert D. Helfrick and William D. Cooper – Modern Electronic Instrumentation and Measurement Techniques, Prentice Hall of India, 2003.
2. A K Sawahney, Electrical and Electronics Measurement and Instrumentation, Dhanpat Rai,2000

Reference Books:

1. H S Kalsi, Electronic instrumentation, TMH, 1995.
2. Ernest O. Doebelin, Measurement Systems- Application and Design-Tata McGraw-Hill-2004.
3. Oliver B.M. & Cage – Electronic Measurements & Instrumentation -Tata McGraw Hill
4. K Padma Raju,Y J Reddy, Instrumentation and Control Systems, McGraw Hill Education,2016.

DATA STRUCTURES (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	Data Structures	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course objectives:

- Assess how the choice of data structures and algorithm design methods impacts the performance of programs.
- Choose the appropriate data structure and algorithm design method for a specified application.
- Solve problems using data structures such as linear lists, stacks, queues, binary trees, heaps binary search trees, and graphs and writing programs for these solutions.

Course outcomes:

CO 1: Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithm.

CO 2: Demonstrate different methods for traversing trees.

CO 3: Compare alternative implementations of data structures with respect to performance.

CO 4: Discuss the computational efficiency of the principal algorithms for sorting and searching.

CO 5: Understand the concepts of Topological Ordering of nodes, Graph Traversal.

Syllabus

UNIT – I: Introduction to Data Structures: Review of C Programming, Recursive Definition and Processes, Recursion in C, Simulation of Recursion, Efficiency of Recursion, Abstract Data Types, Meaning and Definition of Data Structures, Arrays.

UNIT – II: Stacks: Stack as an Abstract Data Type, Primitive Operations, Implementing Stack Operations using Arrays, Infix, Postfix and Prefix: Definitions, Evaluation and Conversions. Queues: Queue as an Abstract Data Type, Sequential Representation, Types of Queues, Operations, Implementation using Arrays. Linked List: Operations, Implementation of Stacks, Queues and priority Queues using Linked Lists+, Circular Lists: Insertion, Deletion and Concatenation Operations, Stacks and Queues as Circular Lists, Doubly Linked Lists.

UNIT – III: Trees: Binary Trees - Definitions and Operations, Binary Tree Representation: Node Representation, Implicit array Representation, Binary Tree Traversal, Threaded Binary Trees and their Traversal, Trees and their Applications; Tree Searching: Insertion and Deletion of a node from a Binary Search Tree, Efficiency of Binary Search Tree operations.

UNIT - IV: Searching: Basic Searching Techniques: Dictionary as an Abstract Data Type, Algorithmic Notation, Sequential Searching and its Efficiency, Binary Search, Interpolation Search. Sorting: General Background: Efficiency, Asymptotic Notations, Efficiency of Sorting, Bubble Sort and Quick Sort and their Efficiency, Selection Sorting, Binary Tree Sort, Heap Sort, Insertion Sorts, Shell Sort, Address calculation Sort, Merge and Radix Sorts.

UNIT – V: Graphs and Their Application: Definition of Graphs, Representation of Graphs, Transitive closure, Linked Representation of Graphs, Topological Ordering of nodes, Graph Traversal and Spanning Forests, Undirected Graphs and their Traversals, Applications of Graphs, Minimal Spanning Trees.

Textbooks:

1. Data Structures Using C and C++ Yddish Langsam, Moshe J. Augenstein and Aaron M. Tanenbaum, Prentice Hall of India (2nd Edition)

2. Data Structures, Algorithms and Applications with C++, Sahani Mc-Graw Hill

EMI/EMC (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	EMI/EMC	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To familiarize with the fundamentals that are essential for electronics industry in the field of EMI / EMC
- To understand EMI sources and its measurements
- To understand the various techniques for electromagnetic compatibility.
- Acquire broad knowledge of various EM radiation measurement techniques.
- Model a given electromagnetic environment/system so as to comply with the standards.

Course Outcomes:

CO 1: Understand the EMI sources, EMC regulations and methods of eliminating interferences.

CO 2: Identifying of EMI hotspot and various techniques like Grounding, Shielding, Cabling.

CO 3: Analyze the effect of EM noise in system environment and its sources.

CO 4: Summarize the EMC design constraints and make appropriate trade-offs that meets all requirements.

CO 5: Differentiate various EMI measurement techniques.

SYLLABUS

UNIT – I: Introduction to EMI/EMC: EMI Sources, EMI Coupling, Noise Path, Models of Noise Coupling, EMC Regulations, Designing for EMC, Compliance Tests, Elimination of EMI, EMI Testing, Compliance Test and Engineering Tests.

UNIT – II: Grounding Techniques: Grounding Techniques, Shielding Techniques, Cabling Techniques.

UNIT – III: Conducted EMI/EMC: Origin of Conducted EMI, Common and Normal mode Noise, Noise from Power Electronic Systems, Spectra of Pulse Noise Sources, Modeling of EMI Noise Sources, Transient Disturbance Simulation Signals, EMI Filters for Mains Noise.

UNIT -IV: Choice of Passive Components: EMC Design Components

UNIT -V: EMI Measurement Technology: EMI Measuring Instruments, Pitfalls of EMI Measurements, Test Instrumentation Accessories and their Characteristics, Measurement of Pulsed EMF, EMI Patterns from Different List Objects, EMI Immunity Test System, Software in EMI/EMC Measurements, Recent Trends in Susceptibility Measurement, Cost Effective EMI/EMC Measurements, Setup and its Maintenance.

Text Books:

1. IMPACT Learning Material Series Modules 1 – 9, IIT New Delhi, Published by RSTE.
2. Electromagnetic Compatibility, R. C. Paul.

INTERNET & WEB TECHNOLOGY (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	Internet & WEB Technology	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To understand best technologies for solving web client/server problems.
- To analyze and design real time web applications.
- To use Java script for dynamic effects and to validate form input entry.
- To Analyze to Use appropriate client-side or Server-side applications.

Course Outcomes:

CO 1: Understand the concepts of HTML, Java scripts and Cascading Style Sheets

CO 2: Generate XML documents and Schemas and summarize Java Beans.

CO 3: Develop and deploy real time web applications in web servers and Servlets.

CO 4: Build JSP tools that assist in automating data transfer over the Internet.

CO 5: Accessing a Database from Servlets & JSP Page.

SYLLABUS

UNIT – I: HTML Common tags- List, Tables, images, forms, Frames; Cascading Style sheets; Java Script: - Introduction to Java Scripts, Objects in Java Script**,** Dynamic HTML with Java Script. XML, Document type definition, XML Schemas, Document Object model, Presenting XML, Using XML Processors: DOM and SAX.

UNIT – II: Java Beans: Introduction to Java Beans, Advantages of Java Beans, BDK, Introspection, Using Bound properties, Bean Info Interface, Constrained properties Persistence, Customizes, Java Beans API, Introduction to EJB's

UNIT -III: Web Servers and Servlets: Tomcat web server, Introduction to Servlets: Lifecycle of a Server let, The Servlet API, The javax.servelet Package, Reading Servlet parameters, and Reading Initialization parameters. The javax.servelet HTTP package, Handling Http Request & Responses, Using Cookies-Session Tracking, Security Issues

UNIT – IV: JSP Application Development: Generating Dynamic Content, Using Scripting Elements Implicit JSP Objects, Conditional Processing – Displaying Values Using an Expression to Set an Attribute, Declaring Variables and Methods Error Handling and Debugging Sharing Data between JSP pages, Requests, and Users Passing Control and Date between Pages – Sharing Session and Application Data – Memory Usage Considerations

UNIT – V: Database Access: Database Programming using JDBC, Studying Javax.sql. *Package, accessing a Database from Servlets & JSP Page, Application – Specific Database Actions, Deploying JAVA Beans in a JSP Page, Introduction to struts framework.

Text Books:

1. Internet and World Wide Web – How to program by Dietel and Nieto
PHI/Pearson Education Asia.
2. Advanced Java™ 2 Platform How to Program, Deitel/Deitel/Santry 3. Java Server Pages – Hans Bergsten, SPD O'Reilly

Reference Books:

1. HTML Black Book: The Programmer's Complete HTML Reference Book-by Steven Holzner
2. Core Servelets and Java Server Pages Volume2: Core Technologies by Marty Hall and Larry Brown, Pearson Education.

SPEECH PROCESSING (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	Speech Processing	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To understand the basic principles of sound and speech production and perception.
- To understand basic principles of speech recognition, synthesis and dialogue systems
- To obtain an introductory overview in the field.

Course Outcomes:

CO 1: Model an electrical equivalent of Speech Production system.

CO 2: Convey details of a range of commonly used speech feature extraction techniques.

CO 3: Provide a basic understanding of multidimensional techniques for speech representation and classification methods.

CO 4: Familiarize you with the practical aspects of speech processing, including robustness, and applications of speech processing, including speech enhancement, speaker recognition and speech recognition.

CO 5: Design a Homomorphic Vocoder for coding and decoding of speech

SYLLABUS

UNIT – I: Fundamentals of Digital Speech Processing: Anatomy & Physiology of Speech Organs, The process of Speech Production, Acoustic Phonetics, Articulatory Phonetics, The Acoustic Theory of Speech Production- Uniform lossless tube model, effect of losses in vocal tract, effect of radiation at lips, Digital models for speech signals.

UNIT – II: Time Domain Models for Speech Processing: Introduction- Window considerations, Short time energy and average magnitude Short time average zero crossing rate, Speech Vs Silence discrimination using energy and zero crossing, Pitch period estimation using a parallel processing approach, The short time autocorrelation function, The short time

average magnitude difference function, Pitch period estimation using the autocorrelation function.

UNIT – III: Linear Predictive Coding (LPC) Analysis: Basic principles of Linear Predictive Analysis: The Autocorrelation Method, The Covariance Method, Solution of LPC Equations: Cholesky Decomposition Solution for Covariance Method, Durbin's Recursive Solution for the Autocorrelation Equations, Comparison between the Methods of Solution of the LPC Analysis Equations, Applications of LPC Parameters: Pitch Detection using LPC Parameters, Formant Analysis using LPC Parameters.

UNIT -IV: Homomorphic Speech Processing: Introduction, Homomorphic Systems for Convolution: Properties of the Complex Cepstrum, Computational Considerations, The Complex Cepstrum of Speech, Pitch Detection, Formant Estimation, The Homomorphic Vocoder. Speech Enhancement: Nature of interfering sounds, Speech enhancement techniques: Single Microphone Approach: spectral subtraction, Enhancement by re-synthesis, Comb filter, Wiener filter, Multi microphone Approach.

UNIT - V: Automatic Speech & Speaker Recognition: Basic pattern recognition approaches, Parametric representation of speech, Evaluating the similarity of speech patterns, Isolated digit Recognition System, Continuous digit Recognition System. Hidden Markov Model (HMM) for Speech: Hidden Markov Model (HMM) for speech recognition, Viterbi algorithm, Training and testing using HMMS. Speaker Recognition: Recognition techniques, Features that distinguish speakers, Speaker Recognition Systems: Speaker Verification System, Speaker Identification System.

Text Books:

1. L.R. Rabiner and S. W. Schafer, "Digital Processing of Speech Signals", Pearson Education.
2. Douglas O'Shaughnessy, "Speech Communications: Human & Machine", 2nd Ed., Wiley India, 2000.
3. L.R Rabinar and R W Jhaung, "Digital Processing of Speech Signals", 1978, Pearson Education.

Reference Books:

1. Thomas F. Quateri, “Discrete Time Speech Signal Processing: Principles and Practice”, 1st Edition., PE.
2. Ben Gold & Nelson Morgan, “Speech & Audio Signal Processing”, 1st Edition, Wiley.

COMPUTER NETWORKS (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	Computer Networks	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To describe how computer networks are organized with the concept of layered approach.
- To implement a simple LAN with hubs, bridges and switches.
- To analyze the contents in a given Data Link layer packet, based on the layer concept.
- To design logical sub-address blocks with a given address block.
- To describe how routing protocols work.

Course Outcomes:

CO 1: Understand the concepts of Network Topologies, structures, layers, physical layer Guided Transmission media and Multiplexing concepts.

CO 2: Understand how the Media Access control problem solved in a network using multiple access protocols.

CO 3: Detect and analyze the Datalink layer Framing, Error control Techniques and protocols in a network.

CO 4: Make use of the Network Layer routing algorithms, congestion control algorithms to perform better network communication.

CO 5: Analyze the internet Transport layer protocols and application layer services.

SYLLABUS

UNIT – I: Introduction: Uses of Computer Networks, Network Structure, Architectures, Services, Standardization, Functions of Various Network Layers, Network examples. Physical layer -Theoretical Basis for Data Communication, Transmission Media, Analog and Digital Transmission, Transmission and Switching ISDN.

UNIT – II: Medium Access Sub-layer: LAN, MAN, Protocol, ALOHA, IEEE Standard for 802 for LANs, Fiber Optic Networks, Satellite Networks.

UNIT – III: Data Link layer: Design Issues, Error Detection and Correction, Protocols and their Performance, Specifications and Examples.

UNIT -IV: Network layers: Design Considerations, Difference between Gateway, Ethernet Switch, Router, Hub, Repeater, Functions of Router, Congestion Control Internetworking and Examples, Details of IP addressing schemes, TCP/IP Protocol details.

UNIT – V: The Transport Layer: The Transport Service, Elements of Transport Protocols, The Internet Transport Protocols; UDP, The Internet Transport Protocols; TCP. The Application Layer -The Domain Name System, Electronic Mail, The World Wide Web.

Text Books:

1. Data Communications and Networking by Behrouz A. Forouzan, 2nd Edition, Tata McGraw Hill.

Reference Books:

1. Computer Networks, A. S. Tannenbaum, PHI – New Delhi.
2. Computer Networking Terminology Products and Standards, R. P. Suri and J. K. Jain, Tata McGraw Hill.

TV AND SATELLITE COMMUNICATION (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	TV and Satellite Communication	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- basic television system.
- With examples of Signal Transmission and Channel Bandwidth
- Television Receiver and Colour Television
- various concepts of satellite communication.

Course Outcomes:

CO 1: Analyze the concepts of basic television system.

CO 2: Illustrate examples of Signal Transmission and Channel Bandwidth.

CO 3: Understand the different television camera principles and receiver circuits.

CO 4: Infer Television Receiver and Colour Television.

CO 5: Infer various concepts of satellite communication.

SYLLABUS

UNIT – I: Basic Television System: Sound and Picture Transmission, the Scanning Process, Interlaced Scanning, Number of Scanning Lines, Vertical and Horizontal Resolution, Bandwidth of the Baseband Picture Signal. Composite - Video Signal, Video signal levels, Need for Synchronization, Details of Horizontal and Vertical Sync Pulses, Equalizing Pulses.

UNIT – II: Signal Transmission and Channel Bandwidth: AM and FM Channel Bandwidth, VSB Transmission, Complete Channel Bandwidth, Reception of Vestigial Sideband Transmission, Television Standards, Block Schematic study of a typical TV Transmitter.

UNIT -III: The TV Picture Tube: Monochrome Picture Tube, Picture Tube Characteristics and Picture Tube Control Circuits, Gamma Correction. Television Cameras: Principle of working and constructional details of Image Orthicon, Vidicon, Plumbicon and Silicon diode array Vidicon and Solid-state Image Scanners. Television Receiver: Block Schematic and Functional Requirements, VSB Correction. Vertical and Horizontal Deflection Circuits, E.H.T. Generation, Study of Video IF Amplifier Video Detector, Sound Channel Separation, Sync Separation Circuits.

UNIT – IV: Colour Television: Principles of Additive and Subtractive Colour Mixing, Chromaticity Diagram, Compatibility and Reverse Compatibility of Colour and Monochrome TV Requirements, Colour Signal Transmission, Bandwidth for Colour Signal Transmission, Sub-carrier Modulation of Chroma Signals, NTSC Encoding (Y, I, Q signals), PAL Encoding (Y, U, V signals), NTSC and PAL Decoders, Types of Colour TV Picture Tubes (Delta-gun, PIL and Trinitron Picture Tubes), Convergence Techniques.

UNIT – V: Satellite Communication: Orbital Aspects, Tracking and Control of Communication Satellites, Launch Vehicles, Propagation Characteristics: Attenuation and Noise, Frequency Bands, Satellite Transponders, Earth Station: Configuration, High Power Amplifiers, Antennas, LNA, Link Design, Multiple Access: FDMA, TDMA, CDMA, SPADE, INTELSATs, INSAT.

Text Books:

1. Global Navigation Satellite Systems with Essentials of Satellite Communications authored by G S Rao, Mc-Graw Hill Publication, New Delhi 2010
2. Monochrome and Colour Television, R. R. Gulati, Wiley Eastern.

Reference Books:

1. Television Engineering, A. M. Dhake, Tata - McGraw Hill.
2. Satellite Communication, D. C. Agarwal, Khanna Publishers.
3. Satellite Communication, T. Pratt and S. W. Bostian, John Wiley and Sons.

TRANSDUCERS AND SIGNAL CONDITIONERS (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	Transducers and Signal Conditioning	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To understand the necessity and advantages of transducer.
- To learn the operation and applications of various transducer.
- To design and construct different transducers.
- To measure several parameters using transducers.

Course Outcomes:

- Understand study about the concepts of measurement, error and uncertainty, transducer classification, terminology, static and dynamic characteristics of transducers.
- Gain knowledge on working principle construction, operation, characteristics and features of different transducers.
- Understand the concepts of signal conversion and signal conditioning methods for different transducers.
- Understand the selection criteria of transducer for particular application and use the same for developing the applications.
- Design and understand the signal conditioning circuits.

SYLLABUS

UNIT – I: Introduction: Measurement systems, Basic electronic measuring system, Transduction principles, Classification of transducers, General transducers characteristics, Criteria for transducer selection.

UNIT – II: Resistive Transducers: Principles of operation, construction, theory, advantages and disadvantages, applications of Potentiometers, strain gauges, (metallic and semi-conductor type), Resistance Thermometer, Thermistors. Inductive Transducers: Types of Inductive transducer, Principles of operation, construction, Advantages & disadvantages and applications. Various variable Inductive Transducers, LVDT (Linear variable differential

transformer). Capacitive Transducers: Types of capacitive transducer, Principles of operation, construction, theory, advantages and disadvantages and applications, of capacitive transducers based upon familiar equation of capacitance.

UNIT – III: Active Transducers: Principle of operation, construction, theory, advantages and disadvantages and applications of following transducers: Thermocouple, Piezo-electric transducer, Magneto-strictive transducer, Hall effect transducer, Photo-voltaic transducer and electrochemical transducer.

UNIT - IV: Other Transducers: Optical transducers: photo-emissive, photo-conductive and Photovoltaic cells, Digital Transducers: Optical encoder, Shaft encoder. Feedback fundamentals, introduction to Inverse transducer. Elastic Transducers: Spring bellows, diaphragm, bourdon tube – their special features and application.

UNIT – V: Signal Conditioning: Concept of signal conditioning, Applications of AC/DC Bridges, Application of Op-amp circuits used in instrumentation, Instrumentation amplifiers, Interference, grounding, and shielding.

Text Books:

1. Murty DVS, “Transducers & Instrumentation”, Prentice Hall of India
2. Sawhney AK, “Electrical and Electronics Measurements and Instrumentation,” Dhanpat Rai and Sons
3. Kalsi HS, “Electronic Instrumentation,” Tata McGraw Hill

4. Patranabis D, “Sensors and Transducers,” Prentice Hall of India 5. Doebelin EO, “Measurement Systems: Application and Design,” Tata McGraw Hill

Reference Books:

1. H.K.P. Neubert Instrument Transducers Oxford University Press: (Second edition).

VLSI DESIGN (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	VLSI Design	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- VLSI technology
- circuit design processes with stick diagrams and layout diagrams.
- VLSI circuit
- scaling of MOS circuits with sub system design and layout

Course Outcomes:

CO 1: Describe the basic concepts of VLSI technology.

CO 2: Demonstrate circuit design processes with stick diagrams and layout diagrams.

CO 3: Understand the aspects of design tools, testability and practical design for guidelines.

CO 4: Demonstrate basic circuit concepts.

CO 5: Summarize scaling of MOS circuits with sub system design and layout.

SYLLABUS

UNIT - I: Review of microelectronics and an introduction to MOS technology: Introduction to IC technology, MOS and related VLSI technology, NMOS, CMOS, BiCMOS Technologies, Thermal aspects of processing, Production of E beam marks.

UNIT – II: MOS and BiCMOS circuit design processes: MOS layers, Stick diagrams, Design rules, and layout, 2 & 1.2 micro meter CMOS rules, Layout diagrams, Symbolic diagram. Basic Circuit concepts - Sheet resistance, Area capacitances of layers, Delay unit, Wiring Capacitances, Choice of layers. Scaling of MOS Circuits -Scaling models, Scaling function for device parameters, Limitations of scaling.

UNIT – III: Sub system design and Layout: Architectural issues, Switch logic, Examples of Structural design (Combinational logic). Sub system design process Design of ALU subsystem,

some commonly used storage elements, Aspects of design tools, Design for testability, Practical design for test guidelines, Built in self-test, CMOS project-an incrementor / decrementer, a comparator for two n-bit numbers. Ultra-fast systems, Technology development, MOSFET based design.

UNIT – IV: Introduction to Embedded Systems: Embedded Systems, Processor Embedded into a System, Embedded Hardware Units and Devices in a System, Embedded Software in a System, Examples of Embedded Systems, Embedded Systems on Chip, Complex Systems Design and Processors, Design Process in Embedded System, Formalization of System Design, Design Process and Design Examples, Classification of Embedded Systems, Skills required for an Embedded System Designer.

UNIT – V: Embedded Software Development Process and Tools: Introduction to Embedded Software Development Process and Tools, Host and Target Machines, Linking and Locating Software, Getting Embedded Software into the Target System, Issues in Hardware-Software Design and Co-design

Text books:

1. Basic VLSI Design by Douglas A, Pucknell, Kamran Eshraghian, Prentice-Hall, l996, 3rd Edition.
2. Embedded Systems Architecture, Programming and Design, second edition by Raj Kamal, Tata McGraw Hill Publication (Chapter 1, Chapter 13)

Reference Books:

1. Mead, C.A and Conway, LA, “Introduction to VLSI Systems”, Addison-Wesley, Reading, Massachusetts, l980.

DIGITAL IMAGE PROCESSING (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	Digital Image Processing	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To familiarize with basic concepts of digital image processing and different image transforms
- To learn various image processing techniques like image enhancement, restoration, segmentation and compression
- To understand color fundamentals and different color models.
- To understand wavelets and morphological image processing.

Course Outcomes:

CO 1: Illustrate the fundamental concepts of Digital Image Processing and different image transforms.

CO 2: Analyze the effect of spatial and frequency domain filtering of images.

CO 3: Evaluate the methodologies for image restoration and reconstruction.

CO 4: Compare the different color image processing techniques.

CO 5: Categorize different image segmentation techniques and morphological image operations.

SYLLABUS

UNIT – I: Introduction: Origins of digital image processing, uses digital image processing, fundamental steps in digital image processing, components of an image processing system, digital image fundamentals, Elements of visual perception, light and electromagnetic spectrum, imaging sensing and acquisition, image sampling and quantization. Some basic relationships between pixels, and introduction to the mathematical tools used in digital image processing.

UNIT – II: Image Transforms: Need for image transforms, Spatial Frequencies in image processing, introduction to Fourier transform, discrete Fourier transform, fast Fourier transform and its algorithm, properties of Fourier transform. Discrete sine transforms. Walsh Transform. Hadamard transform, Haar Transform. Slant transforms, SVD and KL Transforms or Hotelling Transform

UNIT -III: Intensity Transformations and Spatial Filtering: Background, some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters, combining spatial enhancement methods, using fuzzy techniques for intensity transformations and spatial filtering. Filtering in the frequency domain, Preliminary concepts, Sampling and the Fourier transform of sampled functions, the discrete Fourier transform (DFT) of one variable, Extension to functions of two variables, some properties of the 2-D Discrete Fourier transform. The Basic of filtering in the frequency domain, image smoothing using frequency domain filters, Selective filtering, Implementation.

UNIT – IV: Image restoration and Reconstruction: A model of the image degradation /Restoration process, Noise models, restoration in the presence of noise only-Spatial Filtering, Periodic Noise Reduction by frequency domain filtering, Linear, Position –Invariant Degradations, Estimation the degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering, constrained least squares filtering, geometric mean filtering, image reconstruction from projections. Image compression: Fundamentals, various compression methods-coding techniques, digital image water marking. Image segmentation: Fundamentals, point, line, edge detection thresholding, region –based segmentation, segmentation using Morphological watersheds, the use of motion in segmentation. Color image processing, Color fundamentals, color models, pseudo color image processing, basic of full color image processing, color transformations, smoothing and sharpening. Image segmentation based on color, noise in color images, color image compression.

UNIT – V: Wavelets and Multi-resolution Processing: image pyramids, sub band coding & Haar transforms multi resolution expressions, wavelet transforms in one dimension. The fast wavelets transform, wavelet transforms in two dimensions, wavelet packets. Morphological image processing: preliminaries Erosion and dilation, opening and closing, the Hit-or-miss transformation, some Basic Morphological algorithms, grey –scale morphology

Text Books:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd edition, Prentice Hall, 2008.
2. R. C. Gonzalez, R. E. Woods and Steven L. Eddins, Digital Image Processing Using MATLAB, 2rd edition, Prentice Hall, 2009.
3. Anil K.Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 9th Edition, Indian Reprint, 2002.
4. Jayaraman, S. Esakkirajan, and T. Veerakumar, Digital Image Processing, Tata McGraw-Hill Education.

FIBER-OPTIC COMMUNICATIONS (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	Fiber Optic Communication	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To realize the significance of optical fibre communications.
- To understand the construction and characteristics of optical fibre cable.
- To develop the knowledge of optical signal sources and power launching.
- To identify and understand the operation of various optical detectors.
- To understand the design of optical systems and WDM.

Course Outcomes:

CO 1: Understand and analyze the constructional parameters of optical fibres.

CO 2: Estimate the losses due to attenuation, absorption, scattering and bending.

CO 3: Compare various optical detectors and choose suitable one for different applications.

CO 4: Understand different optical sources and detectors.

CO 5: Be able to design an optical system.

SYLLABUS

UNIT – I: Overview of Optical Fiber Communication: - Historical development, The general system, Advantages of Optical Fiber Communications, Optical Fiber Wave Guides- Introduction, Ray Theory Transmission, Total Internal Reflection, Acceptance Angle, Numerical Aperture, Skew Rays, Cylindrical Fibers- Modes, V number, Mode Coupling, Step Index Fibers, Graded Index Fibers. Single Mode Fibers- Cut Off Wavelength, Mode Field Diameter, Effective Refractive Index, Fiber Materials Glass, Halide, Active Glass, Chalgenide Glass, Plastic Optical Fibers.

UNIT – II: Signal Distortion in Optical Fibers: Attenuation, Absorption, Scattering and Bending Losses, Core and Cladding Losses, Information Capacity Determination, Group Delay, Types of Dispersion - Material Dispersion, Wave-Guide Dispersion, Polarization Mode

Dispersion, Intermodal Dispersion, Pulse Broadening, Optical Fiber Connectors- Connector Types, Single Mode Fiber Connectors, Connector Return Loss.

UNIT – III: Fiber Splicing: Splicing Techniques, Splicing Single Mode Fibers, Fiber Alignment and Joint Loss- Multimode Fiber Joints, Single Mode Fiber Joints. Optical Sources- LEDs, Structures, Materials, Quantum Efficiency, Power, Modulation, Power Bandwidth Product, Injection Laser Diodes- Modes, Threshold Conditions, External Quantum Efficiency, Laser Diode Rate Equations, Resonant Frequencies, Reliability of LED & ILD.

Source to Fiber Power Launching: - Output Patterns, Power Coupling, Power Launching, Equilibrium Numerical Aperture, Laser Diode to Fiber Coupling

UNIT -IV: Optical Detectors: Physical Principles of PIN and APD, Detector Response Time, Temperature Effect on Avalanche Gain, Comparison of Photo Detectors, Optical Receiver Operation- Fundamental Receiver Operation, Digital Signal Transmission, Error Sources, Receiver Configuration, Digital Receiver Performance, Probability of Error, Quantum Limit, Analog Receivers.

UNIT – V: Optical System Design: Considerations, Component Choice, Multiplexing, Point-to- Point Links, System Considerations, Link Power Budget with Examples, Overall Fiber Dispersion in Multi-Mode and Single Mode Fibers, Rise Time Budget with Examples. Transmission Distance, Line Coding in Optical Links, WDM, Necessity, Principles, Types of WDM, Measurement of Attenuation and Dispersion, Eye Pattern.

Text Books:

1. Optical Fiber Communications – Gerd Keiser, MC GRAW HILL EDUCATION, 4th Edition, 2008.

2. Optical Fiber Communications – John M. Senior, Pearson Education, 3rd Edition, 2009.

Reference Books:

1. Fiber Optic Communications – D.K. Mynbaev , S.C. Gupta and Lowell L. Scheiner, Pearson Education, 2005.

2. Text Book on Optical Fibre Communication and its Applications – S.C.Gupta, PHI, 2005.
3. Fiber Optic Communication Systems – Govind P. Agarwal, John Wiley, 3rd Ediition, 2004.
4. Introduction to Fiber Optics by Donald J.Sterling Jr. – Cengage learning, 2004.

ADVANCED MICROPROCESSORS (PE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	Advanced Microprocessor	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To describe the function of the microprocessor and detail its basic operation.
- To understand the concepts of advanced architecture in the microprocessors.
- To describe the function and purpose of each program-visible registers in microprocessor.
- To interface memory devices with 80186,80286,80386 and 80486.

Course Outcomes:

CO 1: Understand the functionality of 80186,80286,80386 and 80486 architecture to design advanced microprocessors systems

CO 2: Analyze the Performance of RISC and CISC architectures.

CO 3: Interface the advanced processors with Memory.

CO 4: Understand timing and instruction cycle timings.

CO 5: Summarize the interfacing rules of different peripherals with advanced microprocessor.

SYLLABUS

UNIT – I: 80386 Architecture: Instruction set - Addressing modes - Real mode - Protected mode - 80386 Architecture - Address segmentation - Paging - Segment registers. Basic 486 Architecture - 486 memory system and memory management - Features of Pentium memory and I/O systems - Pentium memory management - Introduction to Pentium Pro features.

UNIT -II: High Performance CISC Architecture – Pentium: CPU Architecture- Bus Operations – Pipelining – Brach predication – floating point unit- Operating Modes –Paging – Multitasking – Exception and Interrupts – Instruction set – addressing modes – Programming

the Pentium processor.

UNIT – III: High Performancerisc RISC Architecture – ARM Arcon RISC Machine – Architectural Inheritance – Core & Architectures - Registers – Pipeline - Interrupts – ARM organization - ARM processor family – Co-processors - ARM instruction set- Thumb Instruction set.

UNIT – IV: Instruction cycle timings: The ARM Programmer's model – ARM Development tools – ARM Assembly Language Programming – Optimizing ARM Assembly Code – Optimized Primitives.

UNIT-V: Memory Interface: Memory Devices, Address Decoding, 8086, 80186,80286,80386SX Memory Interface, 80286DX and 80486 Memory Interface, Pentium through core2 Memory Interface

Reference Books:

1. The Intel Microprocessors 8086 / 8088, 80186, 80188, 80286, 80386, 80486, Pentium and Pentium – Pro Processor Architecture, Programming and Interface by Barray B. Berry, 4th Edition, PHI.
2. Microprocessors Principles and Applications by Gilmore, 2nd Edition, TMH.
3. Microprocessors and Interfacing Programming and Applications by Douglas V. Hall, Mc Graw Hill.
4. Microprocessors / Microcomputers Architecture, Software and Systems by A.J. Khambata, John Wiely & Sons.
5. Advanced Microprocessors by Daniel Tabak, Mc Graw Hill, 1995.

ANNEXURE -II

OPEN ELECTIVES (OE)

1. Low Power VLSI Design
2. Wireless Sensor Networks
3. Smart Antenna Systems
4. Artificial Neural Networks
5. Embedded System Design
6. Bio-Medical Instrumentation
7. FPGA Design
8. DSP Processors and Architectures
9. Information Theory and Coding
10. Financial Management for Engineers
11. Data Science
12. Artificial Intelligence and Machine Learning

LOW POWER VLSI DESIGN (OE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	Low Power VLSI Design	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- This course addresses a profound analysis on the development of the CMOS & Bi-CMOS digital circuits for a low voltage low power environment
- To study the concepts of device behavior and modeling
- To study the concepts of low voltage, low power logic circuits

Course Outcomes:

CO 1: Capability to recognize advanced issues in VLSI systems, specific to the deep-submicron silicon technologies.

CO 2: Students able to understand deep submicron CMOS technology and digital CMOS design styles.

CO 3: To design chips used for battery-powered systems and high-performance circuits

CO 4: Explain the equations, approximations and techniques available for deriving a device model with specified properties

CO 5: Explore and improvise on the latest techniques used for designing power-efficient logic gates, latches, and flip-flops.

SYLLABUS

UNIT – I: Low Power Design, An Over View: Introduction to low- voltage low power design, limitations, Silicon-on-Insulator.

UNIT – II: MOS/ Bi CMOS PROCESSES: Bi CMOS processes, Integration and Isolation considerations, Integrated Analog/Digital CMOS Process. Deep submicron processes, SOI CMOS, lateral BJT on SOI, future trends and directions of CMOS/ Bi CMOS processes.

UNIT – III: Device Behavior and Modeling: Advanced MOSFET models, limitations of MOSFET models, bipolar models. Analytical and Experimental characterization of sub-half

micron MOS devices, MOSFET in a Hybrid mode environment.

UNIT – IV: CMOS and Bi-CMOS Logic Gates: Conventional CMOS and Bi CMOS logic gates. Performance evaluation.

UNIT – V: Low- Voltage Low Power Logic Circuits: Comparison of advanced BiCMOS Digital circuits. ESD-free Bi CMOS, Digital circuit operation and comparative Evaluation. Low Power Latches and Flip Flops, Evolution of Latches and Flip flops-quality measures for latches and Flip flops, Design perspective.

Text Books:

1. CMOS/Bi CMOS ULSI low voltage, low power by Yeo Rofail / Gohl (3 Authors)-Pearson Education Asia 1st Indian reprint,2002

Reference Books:

1. Digital Integrated circuits, J.Rabaey PH. N.J 1996
2. CMOS Digital ICs sung-moKang and yusufleblebici 3rd edition TMH2003 (chapter 11)
3. VLSI DSP systems, Parhi, John Wiley & sons, 2003 (chapter 17)
4. IEEE Trans Electron Devices, IEEE J.Solid State Circuits, and other National and International Conferences and Symposia.

WIRELESS SENSORS & NETWORKS (OE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	Wireless Sensors & Networks	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To understand the WSN node Architecture and Network Architecture.
- To identify the Wireless Sensor Network Platforms.
- To design and develop wireless sensor node.
- To learn the concepts of layered protocols for WSN.

Course Outcomes:

CO 1: Understand the fundamental Concepts, applications and architectures of wireless sensor networks

CO 2: Categorize the various network topologies.

CO 3: Realize the MAC Protocols for Wireless Sensor Networks.

CO 4: Describe routing protocols for ad hoc wireless networks with respect to TCP design issues.

CO 5: Outline the transport layer and security protocols for WSN and differentiate various sensor network platforms and tools.

SYLLABUS

UNIT – I: Overview of Wireless Sensor Networks: Key definitions of sensor networks, Advantages of sensor Networks, Unique constraints a challenge, Driving Applications, Enabling Technologies for Wireless Sensor Networks. Architectures - Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture -Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

UNIT – II: Networking Technologies: Physical Layer and Transceiver Design Considerations, Personal area networks (PANs), hidden node and exposed node problem,

Topologies of PANs, MANETs, WANETs.MAC Protocols for Wireless Sensor Networks - Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad-Hoc Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols, Contention – Based Protocols with reservation Mechanisms, Contention – Based MAC Protocols with Scheduling Mechanisms, MAC Protocols that use Directional Antennas, Other MAC Protocols.

UNIT – III: Routing Protocols: Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table –Driven Routing Protocols, On – Demand Routing Protocols, Hybrid Routing Protocols, Routing Protocols with Efficient Flooding Mechanisms, Hierarchical Routing Protocols, Power – Aware Routing Protocols, Proactive Routing.

UNIT – IV: Transport Layer and Security Protocols: Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks, Other Transport Layer Protocol for Ad Hoc Wireless Networks.

UNIT – V: Security in WSNs: Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks. Sensor Network Platforms and Tools - Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node level Simulators, State-centric programming. Applications of WSN -Ultra-wide band radio communication, Wireless fidelity systems. Future directions, home automation, smart metering Applications.

Text Books:

1. Ad Hoc Wireless Networks: Architectures and Protocols - C. Siva Ram Murthy and B.S.Manoj, 2004, PHI
2. Wireless Ad- hoc and Sensor Networks: Protocols, Performance and Control – Jagannathan Sarangapani, CRC Press
3. Holger Karl & Andreas Willig, “Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2005.

Reference Books:

a. Kazem Sohraby, Daniel Minoli, &Taieb Znati, “Wireless Sensor Networks- Technology, Protocols, and Applications”, John Wiley, 2007.
2. Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.
3. Ad- Hoc Mobile Wireless Networks: Protocols & Systems, C.K. Toh ,1 ed. Pearson Education.
4. Wireless Sensor Networks - C. S. Raghavendra, Krishna M. Sivalingam, 2004, Springer.
5. Wireless Sensor Networks – S Anandamurugan, Lakshmi Publications.

SMART ANTENNAS SYSTEMS (OE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	Smart Antenna Systems	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To know the basic concepts on antenna.
- To know the performance of an antenna array.
- Learning self-adaptive procedure to extract the desired signal.
- Design of smart antenna system.

Course Outcomes:

CO 1: Understand antenna theory and application of signal processing in smart antennas.

CO 2: Analyze DOA estimation methods.

CO 3: Learn techniques of developing MIMO antennas.

CO 4: Understand different beam forming techniques.

CO 5: Analyze space time processing techniques.

Syllabus

UNIT – I: Smart Antennas: Introduction, Need for Smart Antennas, Overview, Smart Antenna Configurations, Switched-Beam Antennas, Adaptive Antenna Approach, Space Division Multiple Access (SDMA), Architecture of a Smart Antenna System, Receiver, Transmitter, Benefits and Drawbacks, Basic Principles, Mutual Coupling Effects.

UNIT – II: DOA Estimation Fundamentals: Introduction, Array Response Vector, Received Signal Model, Subspace-Based Data Model, Signal Autocovariance, Conventional DOA Estimation Methods, Conventional Beamforming Method, Capon's Minimum Variance Method, Subspace Approach to DOA Estimation, MUSIC Algorithm, ESPRIT Algorithm, Uniqueness of DOA Estimates.

UNIT – III: Beam Forming Fundamentals: Classical Beam former, Statistically Optimum Beamforming Weight Vectors, Maximum SNR Beam former, Multiple Sidelobe Canceller and Maximum, SINR Beam former, Minimum Mean Square Error (MMSE), Direct Matrix

Inversion (DMI), Linearly Constrained Minimum Variance (LCMV), Adaptive Algorithms for Beamforming

UNIT – IV: Integration and Simulation of Smart Antennas: Overview, Antenna Design, Mutual Coupling, Adaptive Signal Processing Algorithms, DOA, Adaptive Beam forming, Beam forming and Diversity Combining for Rayleigh-Fading, Channel, Trellis-Coded Modulation (TCM) for Adaptive Arrays, Smart Antenna Systems for Mobile Adhoc Networks (MANETs), Protocol, Simulations, Discussion.

UNIT – V: Space–Time Processing: Introduction, Discrete Space–Time Channel and Signal Models, Space– Time Beamforming, Inter symbol and Co-Channel Suppression, Space–Time Processing for DSCDMA, Capacity, and Data Rates in MIMO Systems, Discussion.

Text Books:

1. Constantine A. Balanis & Panayiotis I. Ioannides, "Introduction to Smart Antennas", Morgan & Claypool Publishers' series-2007
2. Joseph C. Liberti Jr., Theodore S Rappaport, "Smart Antennas for Wireless CommunicationsIS-95 and Third Generation CDMA Applications", PTR – PH publishers, 1st Edition, 1989.

Reference Books:

1. T.S Rappaport, "Smart Antennas Adaptive Arrays Algorithms and Wireless Position Location", IEEE press 1998, PTR – PH publishers 1999.
2. Lal Chand Godara, "Smart Antennas", CRC Press, LLC-20.

ARTIFICIAL NEURAL NETWORKS (OE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	Artificial Neural Networks	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To provide an insight into the basic concepts.
- To understand the artificial intelligence as representation and search and its applications representation and inference.
- Situations and machine learning.
- Convolution Neural networks and Recursive Neural networks.
- Different neural and synaptic dynamics.

Course Outcomes:

CO 1: Understand the concepts Neural Networks based on learning methods.

CO 2: Apply knowledge on Rosenblatt's perceptron.

CO 3: Understand radical basis function networks and Hopfield networks.

CO 4: Analyze CNN and recursive neural networks.

CO 5: Evaluate the concepts of Reinforcement learning.

SYLLABUS

UNIT – I: Introduction to Neural Networks: Architecture based classification of Neural Networks. Classification of Neural Networks based on learning methods. Activation functions and Loss functions. Factors to be considered for choice of type of Neural Network. Introduction to hardware requirements for implementation of Neural Networks.

UNIT – II: Rosenblatt's perceptron model: Rosenblatt's perceptron convergence theorem. Back Propagation Method. Back propagation learning algorithm for multilayer feed forward Neural Network. Factors affecting back propagation-based training of a Neural Network.

UNIT – III: Radial basis function networks: Generalized regularization theory. Neural Network models with Hebbian learning. Introduction to Hopfield networks. Recurrent Neural Network models. Universal approximation theorem. Backpropagation through time. Real time recurrent learning. Long short-term memory.

UNIT -IV: Convolutional Neural Networks: Variants of the basic convolution function. Convolution algorithms. Recursive Neural Networks. Greedy layer-wise pretraining. Transfer learning. Structured probabilistic models for deep learning. Convolutional Boltzmann machines.

UNIT -V: Model based calculation of reward in Reinforcement learning: Markov decision process. Bellman's optimality criteria. Policy iteration. Value iteration. Q-learning. Model free Reinforcement learning. Deep reinforcement learning. Generative adversarial networks.

Text Books:

1. S. O. Haykin. Neural Networks & Learning Machines. 3rd Ed. Pearson. 2019

Reference Books:

1. S. J. Russell and P. Norvig. Artificial Intelligence: A Modern Approach. 3rd Ed. Pearson. 2016.

2. Charu C. Aggarwal. Neural Networks and Deep Learning: A Textbook. Springer. 2018.

3. I. Goodfellow, Y. Bengio, A. Courville, F. Bach. Deep Learning (Adaptive Computation and Machine Learning series). MIT Press. 2016

4. S. O. Haykin. Neural Networks: A comprehensive foundation. 2nd Ed. Pearson. 1997

EMBEDDED SYSTEM DESIGN (OE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	Embedded System Design	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To introduce the Building Blocks of Embedded System and Educate in Various Embedded Development Strategies.
- To Introduce Bus Communication in processors, Input/output interfacing and to impart knowledge in various processor scheduling algorithms.
- To introduce Basics of Real time operating system and example tutorials to discuss on real time operating system tool
- To provide clear understanding about the role of firmware, operating systems in correlation with hardware systems.

Course Outcomes:

CO 1: Acquire a basic knowledge about fundamentals of microcontroller and knowledge about programming and system control to perform a specific task.

CO 2: Acquire knowledge about devices and buses used in embedded networking, and develop programming skills in embedded systems for various applications.

CO 3: Understand the concepts of memory interface, onboard external communication interfaces and design Procedure for Embedded Firmware.

CO 4: Expected to visualize the role of Real time Operating Systems in Embedded Systems.

CO 5: Expected to evaluate the Correlation between task synchronization and latency issue.

SYLLABUS

UNIT – I: Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems. Typical Embedded System - Core of the Embedded System: General

Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS).

UNIT -II: Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT – III: Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

UNIT -IV: RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multi-processing and Multitasking, Task Scheduling.

UNIT – V: Task Communication: Shared Memory, Message Passing, Remote Procedure Calland Sockets, Task Synchronization: Task Communication / Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

Text Books:

1. Introduction to Embedded Systems-Shibu K.V, McGrawHill.

Reference Books:

1. Embedded Systems-RajKamal, MCGRAWHILLEDUCATION.
2. Embedded System Design-Frank Vahid, Tony Givargis, John Wiley.
3. Embedded Systems–Lyla, Pearson, 2013
4. An Embedded Software Primer- David E.Simon, Pearson Education.

BIO MEDICAL INSTRUMENTATION (OE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	Bio Medical Instrumentation	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To know the sources of Bio-electric potentials and Electrodes.
- To analyze the cardiovascular &Respiratory systems and its related measurements.
- To understand the various techniques for electromagnetic compatibility.
- To acquire knowledge of electronics in clinical laboratory and therapeutic area.

Course Outcomes:

CO 1: Understand the origin of bio-potentials and role of its electrodes.

CO 2: Elucidate the cardiovascular system and its measurements.

CO 3: Develop a thorough understanding on principles of Patient Care Monitory and Measurements in Respiratory System.

CO 4: Outline the concepts of Bio telemetry and Instrumentation for the clinical laboratory.

CO 5: Summarize the application of Electronics in diagnostics and therapeutic area.

SYLLABUS

UNIT – I: Sources of Bioelectric potentials: Sources of Bioelectric potentials and Electrodes Resisting and Action Potentials, Propagation of Action Potentials, The Bioelectric Potentials Electrode theory, Bio Potential Electrodes, Biochemical Transducers.

UNIT – II: The Cardiovascular System: The Cardiovascular System and Cardiovascular Measurements, The Heart and Cardiovascular System, The Heart, Blood Pressure, Characteristics of Blood Flow, Heart Sounds Electrocardiography, Measurement of Blood Pressure, Measurement of Blood Flow and Cardiac output, Plethysmography, Measurement of Heart Sounds,

UNIT – III: Patient Care and Monitoring: Patient Care & Monitory and Measurements in Respiratory System The elements of Intensive Care Monitory, Diagnosis, Calibration and repairability of Patient Monitoring equipment, other instrumentation for monitoring patients, pace makers,

defibrillators The Physiology of respiratory system, tests and instrumentation for mechanics of breathing, respiratory theory equipment.

UNIT – IV: Biotelemetry: Bio telemetry and Instrumentation for the clinical laboratory Introduction to biotelemetry, physiological parameters adaptable to biotelemetry, the components of biotelemetry system, implantable units, applications of telemetry in patient care the blood, tests on blood cells, chemical test, automation of chemical tests

UNIT – V: X-Ray and Radioisotope Instrumentation: X – ray and radioisotope instrumentation and electrical safety of medical equipment. Generation of Ionizing radiation, instrumentation for diagnostic X – rays, special techniques, instrumentation for the medical use of radioisotopes, radiation therapy. Physiological effects of electrical current, shock Hazards from electrical equipment, Methods of accident prevention

Text Book:

1. Biomedical Instrumentation and Measurements – C. Cromwell, F.J. Weibell, E.A. Pfeiffer Pearson education.

FPGA DESIGN (OE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	FPGA Design	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To prepare the student to be an entry-level industrial standard FPGA designer.
- To give the student an understanding of issues and tools related to FPGA design and implementation.
- To give the student an understanding of basics of System on Chip and Platform based design.
- To learn and use design flow for using FPGA and using FPGA programming to design practical circuits.

Course Outcomes:

CO 1: Be able to completely understand FPGA design flow and the building blocks of commercially available FPGA/CPLDs.

CO 2: Be able to create circuits that realize specified digital functions and to identify logic and technology-specific parameters to control the functionality, timing, power, and parasitic effects.

CO 3: Develop VHDL/Verilog models and synthesize targeting for Vertex, Spartan FPGAs.

CO 4: Develop parameterized library cells and implement system designs using parameterized cells.

CO 5 Understand the concepts of routing in FPGA and analyze different routing strategies and designing of a system having a set of objective criteria & design constraints.

SYLLABUS

UNIT – I: Introduction to FPGAs: Evolution of programmable devices, FPGA Design flow, Applications of FPGA.

UNIT – II: Design Examples Using PLDs: Design of Universal block, Memory, Floating point multiplier, Barrel shifter.

UNIT – III: FPGAs/CPLDs: Programming Technologies, commercially available FPGAs, Xilinx's Vertex and Spartan, Actel's FPGA, Altera's FPGA/CPLD.

UNIT -IV: Building blocks of FPGAs/CPLDs: Configurable Logic block functionality, Routing structures, Input/output Block, Impact of logic block functionality on FPGA performance, Model for measuring delay.

UNIT - V: Routing Architectures: Routing terminology, general strategy for routing in FPGAs, routing for row – based FPGAs, introduction to segmented channel routing, routing for symmetrical FPGAs, example of routing in a symmetrical FPGA, general approach to routing in symmetrical FPGAs, independence from FPGA routing architectures, FPGA routing structures. FPGA architectural assumptions, the logic block, the connection block, connection block topology, the switch block, switch block topology, architectural assumptions for the FPGA

Text Books:

1. John V. Old Field, Richrad C. Dorf, Field Programmable Gate Arrays, Wiley, 2008.

2. Data sheets of Artix-7, Kintex-7, Virtex-7.

3. Stephen D. Brown, Robert J. Francis, Jonathan Rose, Zvonko G. Vranesic, Field Programmable Gate Arrays, 2nd Edition, Springer, 1992.

DSP PROCESSORS & ARCHITECTURES (OE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	DSP Processor & Architecture	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To learn the architecture, addressing modes of DSP processors.
- To interface the serial converters to a DSP device
- To give an exposure to the various fixed point & a floating point DSP architectures and to develop applications using these processors.
- To know different basic DSP algorithms.

Course Outcomes:

CO 1: Understand the concepts of DSP and numeric representations.

CO 2: Able to illustrate the architectural features of DSP devices.

CO 3: Knowledge about various addressing modes of DSP TMS320C54XX and determine various addressing modes and instructions of DSP processor.

CO 4: Understand the concepts of basic DSP algorithms and develops the skills for DSP programming.

CO 5: Analyzes the interfacing of serial and parallel communication devices to a DSP device.

SYLLABUS

UNIT – I: Introduction to Digital Signal Processing: Introduction, A Digital signal-processing system, the sampling process, Discrete time sequences Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear time-invariant systems, Digital filters, Decimation and interpolation, Analysis and Design tool for DSP Systems MATLAB, DSP using MATLAB. Computational Accuracy in DSP Implementations -Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter.

UNIT – II: Architectures for Programmable DSP Devices and Execution: Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External interfacing, Hardware looping, Interrupts, Stacks, Relative Branch support, Pipelining and Performance, Pipeline Depth, Interlocking, Branching effects, Interrupt effects, Pipeline Programming models

UNIT – III: Programmable Digital Signal Processors: Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C54XX processors, Pipeline Operation of TMS320C54XX Processors.

UNIT – IV: Implementations of Basic DSP Algorithms and FFT Algorithms: The Q-notation, FIR Filters, IIR Filters, Interpolation Filters, Decimation Filters, PID Controller, Adaptive Filters, 2-D Signal Processing, An FFT Algorithm for DFT Computation, A Butterfly Computation, Overflow and scaling, Bit-Reversed index generation, An 8-Point FFT implementation on the TMS320C54XX, Computation of the signal spectrum.

UNIT -V: Interfacing Memory And I/O Peripherals to Programmable DSP Devices: Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA). A Multichannel buffered serial port (McBSP), McBSP Programming, a CODEC interface circuit, CODEC programming, A CODEC-DSP interface example.

Text Books:

1. Digital Signal Processing – Avtar Singh and S. Srinivasan, Thomson Publications, 2004.
2. DSP Processor Fundamentals, Architectures & Features – Lapsley et al. S. Chand & Co, 2000.

Reference Books:

1. Digital Signal Processors, Architecture, Programming and Applications – B. Venkata Ramani and M.Bhaskar, TMH, 2004.
2. Digital Signal Processing – Jonatham Stein, John Wiley, 2005.

INFORMATION THEORY AND CODING (OE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	Information Theory and Coding	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- To provide an insight into the concept of information in the context of communication theory and its significance in the design of communication receivers.
- To explore in detail, the calculations of channel capacity to support error-free transmission and also, the most commonly used source coding and channel coding algorithms.
- Introduction to error-correcting codes. Types of error correcting codes and its applications
- To encourage and train to design coding schemes for data compression and error correction.

Course Outcomes:

CO 1: Overview of Probability Theory, significance of "Information" with respect to Information Theory. Derive equations for entropy, mutual information and channel capacity for all kinds of channels.

CO 2: Implement the various types of source coding algorithms and analyse their performance.

CO 3: Explain various methods of generating and detecting different types of error correcting codes.

CO 4: Understand the fundamentals of Field Theory and polynomial arithmetic, and design linear block codes and cyclic codes (encoding and decoding).

CO 5: Implement and decode a sequence at the receiver using Trellis decoder and Viterbi decoder.

SYLLABUS

UNIT – I: Information Theory: Information measure, Entropy and Information rate, Coding for a discrete memory less source, Predictive coding for sources with memory, Information transmission on discrete channels, Mutual information.

UNIT – II: Information Channels: Discrete channel capacity, coding for the binary symmetric channel, Continuous channels and system comparisons, continuous information, continuous channel capacity, Ideal communication system, system comparisons.

UNIT – III: Error Controlling Coding: Introduction, Examples of Error control coding, methods of Controlling Errors, Types of Errors, types of Codes, Linear Block Codes: matrix description of Linear Block Codes, Error detection & Correction capabilities of Linear Block Codes, Single error correction Hamming code, Table lookup Decoding using Standard Array.

UNIT – IV: Binary Cyclic Codes: Algebraic Structure of Cyclic Codes, Encoding using an (n-k) Bit Shift register, Syndrome Calculation, Error Detection and Correction

UNIT – V: Convolution Coding: Practical Convolution Encoder, Time Domain Approach, Transform Domain Approach, The Code Tree, Code Trellis, State Diagram, Decoding Methods of Convolution Codes, Sequential Decoding, Burst Error Detection and Correction Codes, Concatenated Block Codes, Turbo Codes.

Text Books:

1) Communication Systems,3/e, by A.B. Carlson, Mc. Graw Hill Publishers (for topic1)
2) Digital Communications by Simon Haykin, John Wiley & Sons (for topic 2).
3) Principles of Digital Communication, J. Das, S.K.Mullick, P. K. Chatterjee, Wiley, 1986- Technology &Engineering.
4) Information Theory and Coding, HariBhat, Ganesh Rao, Cengage, 2017.

Reference Books:

1) Principles of Digital Communications, Signal representation, Detection, Estimation &Information Coding by J Das, S.K. Mullick, P.K.Chatterjee, New Age Int. Ltd.
2) Principles of Communication Systems, Taub &Schilling, 2/e, TMH Publisher.

FINANCIAL MANAGEMENT FOR ENGINEERS (OE)

Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	Financial Management for Engineers	**4**			**30**	**70**	**100**	**3hrs**	**3**

Objectives of this Course:

- To provide awareness and understanding of the ways finance helps in reaching business objectives.
- To familiarize with the form, content and analysis of financial statements and the accounting principles and techniques.
- To Identify signals pointing to deterioration in financial condition and analyze the reasons for variances between the actual and budgeted results
- To facilitate in the improvement of organizations' performance by pointing out the importance of cost control, breakeven and variance analysis.
- To equip with the ability to communicate comfortably with Financial Executives and discuss the financial performance of the organization effectively.

Outcomes of the Course:

CO 1: Ability to analyze financial statements.

CO 2: Understanding costs and methods to reduce them.

CO 3: Taking decisions regarding the price of the products services, or both.

CO 4: Understanding of capital budgeting and various capital budgeting techniques.

CO 5: Skill to practice different Budgeting Systems in organizations.

SYLLABUS

UNIT-I: Accounting concepts and systems - Elements of Financial Statements - trading, profit & loss Statement- Cash Flow Statements - Notes to Accounts - Profits vs. Cash Flows.

UNIT-II: Analysis of Financial Statements - Financial Analysis-Financial Ratios and their Interpretations covering: Profitability Ratios; Liquidity Ratios; Return on Capital Ratios; - Management of Working Capital: Capital and Its Components - Working Capital Cycle - Working Capital Financing.

UNIT-III: Management Decision Making: Cost concepts and its application in Decision Making - Types of cost – Direct& Indirect, Fixed& Variable - Cost Sheet - Cost Volume Profit Analysis - Understanding Cost behavior – Cost concepts and its application in Decision

Making - Relevance of Activity Based Costing - Marginal Costing - Make or Buy - Shut down or continue - Sell or process further - Domestic vs. Export Sales.

UNIT-IV: Budgets and Budgetary Control: Different types of Budgets (Departmental, Function based, Cash, Master) - Budgeting systems (ABC / ZBB / Rolling/ Incremental / Planning) - Variance Analysis - Capital Budgeting and Investment Appraisals - Meaning of Capital Budgeting - Relevance of Capital Budgeting - Techniques of Capital Budgeting - Payback Period - Accounting Rate of Return - Net Present Value - Internal Rate of Return - Discounted Payback Period.

UNIT-V: Means of Finance: Financial Instruments - Shares, Debentures, Derivatives - Share Capital Vs. Term Loans - Leasing - Financial Markets - Capital Markets - Stock Exchanges**.**

Suggested Books:

1. Finance for Non-Finance People by Sandeep Goal (2017), Publisher: Taylor and Francis.
2. Finance for Non-Finance Managers by B.K. Chatterjee (1988), Jaico Publishing House, Sold by Amazon.
3. Finance for Nonfinancial Managers: Finance for Small Business, Basic Finance Concepts (Accounts and Finance) by Murugesan Ramaswamy (2021), Repro Books-On-Demand.

DATA SCIENCE (OE)

Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	Data Science	**4**			**30**	**70**	**100**	**3hrs**	**3**

COURSE OBJECTIVES: From the course the student will learn

- Knowledge and expertise to become a data scientist.
- Essential concepts of statistics and machine learning that are vital for data science;
- Significance of exploratory data analysis (EDA) in data science.
- Critically evaluate data visualizations presented on the dashboards.
- Suitability and limitations of tools and techniques related to data science process.

COURSE OUTCOMES: At the end of the course, student will be able to

CO 1: Analyze the fundamental concepts of data science, distinguish between various data science methods, algorithms and models used in business applications.

CO 2: Describe the steps involved in Data Science process and the technologies needed for a data scientist.

CO 3: Identify suitable ML techniques for data modeling and apply them for decision support and handle large datasets with distributed storage and processing system.

CO 4: Gives the concepts of appropriate tools for data collection, EDA and model building for specific types of data, Integrate functions, modules and packages to develop algorithms using built-in libraries and frameworks.

CO 5: Design and create eco-friendly applications using object-oriented programming concepts, and allows building a prototype application of Data Science as a case study.

SYLLABUS

UNIT I: Introduction to Data science, benefits and uses, facets of data, data science process in brief, big data ecosystem and data science. Data Science process: Overview, defining goals and creating project charter, retrieving data, cleansing, integrating and transforming data, exploratory analysis, model building, presenting findings and building applications on top of them.

Unit II: Applications of machine learning in Data science, role of ML in DS, Python tools like sklearn, modelling process for feature engineering, model selection, validation and prediction, types of ML, semi-supervised learning.Handling large data: problems and general techniques for handling large data, programming tips for dealing large data, case studies on DS projects for predicting malicious URLs, for building recommender systems.

UNIT III: NoSQL movement for handling Bigdata: Distributing data storage and processing with Hadoop framework, case study on risk assessment for loan sanctioning, ACID principle of relational databases, CAP theorem, base principle of NoSQL databases, types of NoSQL databases, case study on disease diagnosis and profiling.

UNIT IV: Tools and Applications of Data Science: Introducing Neo4j for dealing with graph databases, graph query language Cypher, Applications graph databases, Python libraries like nltk and SQLite for handling Text mining and analytics, case study on classifying Reddit posts.

UNIT V: Data Visualization and Prototype Application Development: Data Visualization options, crossfilter, the JavaScript Map Reduce library, creating an interactive dashboard with dc.js, Dashboard development tools, applying the DS process for respective engineering problem solving scenarios as a detailed case study.

Textbook:

1) Davy Cielen, Arno D.B.Meysman, and Mohamed Ali, "Introducing to Data Science using Python tools", Manning Publications Co, Dreamtech press, 2016.

2) Prateek Gupta, "Data Science with Jupyter" BPB publishers, 2019 for basics.

Reference Books:

1) Joel Grus, "Data Science from Scratch", OReilly, 2019.

2)Doing Data Science: Straight Talk from The Frontline, 1 st Edition, Cathy O'Neil and Rachel Schutt, O'Reilly, 2013.

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (OE)

Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	Artificial Intelligence and Machine Learning	**4**			**30**	**70**	**100**	**3hrs**	**3**

COURSE OBJECTIVES: From the course the student will learn

- Know user interfaces to improve human and AI interaction and decision making.
- Allows the students to develop AI skills.
- Introduce the concepts of expert systems and machine learning.
- To be able to apply machine learning algorithms to solve problems of moderate complexity.

COURSE OUTCOMES: At the end of the course, student will be able to

CO 1: Understanding Artificial Intelligence and different branches of Artificial Intelligence and demonstrate awareness of informed search and exploration methods.

CO 2: Explain the concepts of Knowledge representation and basic Predicate Representations, Scripts and Schematic Network.

CO 3: Design and development of expert systems and its applications and apply structured thinking to unstructured problems

CO 4: Learn algorithmic topics of machine learning and mathematically deep enough to introduce the required theory

CO 5: Learning different clustering systems and understanding the concepts of different supervised learning methods and Artificial Neural Networks.

SYLLABUS

UNIT – I: Introduction to Artificial Intelligence: Definitions of Artificial Intelligence, Artificial Intelligence Problems, Topics of Artificial Intelligence, Timelines of Artificial Intelligence, Production Systems, State Space Representation, Branches of Artificial Intelligence, Applications of Artificial Intelligence. Heuristic Search Techniques-generate-and-test, Hill climbing, Search techniques, Problem Reduction, Constraints Satisfaction, Means-ends Analysis.

UNIT – II: Knowledge Representation Structures: First- order Logic- Basic Predicate Representations, Conversion of WFF to Clause Form, Resolution, resolution Examples, issues with Resolution, Frames, Conceptual Dependency, Scripts, and Semantic Network.

UNIT -III: Reasoning: Types of Reasoning, Non- monotonic Inference Methods, Non-monotonic Reasoning, Truth Maintenance Systems, Reasoning with Fuzzy Logic, Rule- based Reasoning, Diagnosis Reasoning. Expert Systems-Characteristics of Expert System, Components of an Expert System, Expert System Development, Knowledge Engineering, Applications of Expert System, Case studies.

UNIT -IV: Learning: Types of Learning, Machine Learning, Intelligent Agents**.** Clustering-k-Means clustering, Fuzzy Clustering, Hierarchical Clustering, Cluster Similarity, Case Studies.

UNIT -V: Supervised Learning: Support Vector Machines, case-based Reasoning, Decision Trees- C4.5 Algorithm, ID3 Algorithm, Random Forest, ensemble Classifiers, and nearest neighborhood. Artificial Neural Nets – ANN Basics, ANN- Learning Process, Types of Networks, perceptron, RBF Networks, ANN Summary, Case Studies.

Text Book:

1. Artificial Intelligence and Machine Learning, by Vinod Chandra S.S and Anand Hareendran S, PHI publishers.

Reference books:

1. Artificial Intelligence by Elaine Rich, Kevin Knight, McGraw-Hill publishers.
2. Machine Learning: The Art and Science of Algorithms that Make Sense of Data by Peter Flach, Cambridge University Press.

ANNEXURE – III

HSS ELECTIVES

1. Industrial Management & Entrepreneurship.
2. Organizational Behavior.
3. Operations Research.

INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP (HSSE)

Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	Industrial Management and Entrepreneurship	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives :

- To familiarize the students with the concepts of Management.
- To relate the concepts of Management with industrial organizations.
- To explain the factors affecting productivity and how productivity can be increased in an Industrial undertaking.
- To set forth a basic framework for understanding Entrepreneurship.

Course Outcomes:

CO 1: Understand the roles, skills and functions of management and distinguish the different types of business organizations.

CO 2: Identify the factors involved in Production Operations Management.

CO 3: Diagnose organizational problems and take suitable decisions.

CO 4: Establish good Human Resource Management practices.

CO 5: Acquire necessary knowledge and skills required for organizing and carrying out entrepreneurial activities.

SYLLABUS

UNIT – I: Basic Concepts of Management: Management: Definition, Nature and Importance; Functions of the Management; Levels of Management; F.W Taylor's Scientific Management; Henry Fayol's Principles of Management.

UNIT – II: Forms of Business Organizations: Introduction, Types of Business organizations: Private Sector- Individual Ownership, Partnership, Joint stock companies and Co-Operative organizations; Public sector- Departmental Organizations, Public Corporations and Government Companies; The Joint sector Management.

UNIT -III: Production and operations Management: Plant location- Factors to be considered in the selection of Plant location; Break - even analysis- Significance and

managerial applications; Importance of Production Planning and Control and its Functions; Human Resource Management and Functions of Human Resource Manager (in brief); Functions of Marketing; Methods of Raising Finance.

UNIT – IV: Entrepreneurship: Definition, Characteristics and Skills, Types of Entrepreneurs, Entrepreneur vs. Professional Managers, Growth of Entrepreneurs, Nature and Importance of Entrepreneurs, Women Entrepreneurs, Problems of Entrepreneurship.

UNIT – V: Entrepreneurial Development and Project Management: Institutions in aid of Entrepreneurship Development, Idea generation: Sources and Techniques, Stages in Project formulation; Steps for starting a small enterprise - Incentives for Small Scale Industries by Government.

Text Books:

1. Sharma, S.C, and Banga, T.R., Industrial Organization & Engineering Economics, Khanna Publishers, Delhi, 2000.
2. Vasant Desai, The Dynamics of Entrepreneurial Development and Management (Planning for future Sustainable growth), Himalayan Publishing House, 2018.

Reference Books:

1. Aryasri, A.R., Management Science, McGraw Hill Education (India Private Limited New Delhi 2014.
2. Sheela, P. and Jagadeswara Rao, K., Entrepreneurship, Shree Publishing House, Guntur, Andhra Pradesh, 2017.

ORGANIZATIONAL BEHAVIOUR (HSSE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	Organizational Behaviour	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives :

- To understand the basic concepts of organizational behaviour, its foundations and importance.
- To enable students to have a basic perspective of Motivation and Motivation theories.
- To acquaint the students about group behavior in organizations, including communication, leadership conflicts and organizational change and how these are linked to, and impact organizational performance.

Course Outcomes :

CO 1: Identifying fundamental aspects of organizational dynamics.

CO 2: Evaluate main theories of motivation and formulating suitable motivational strategies.

CO 3: Analyze the behavior of individuals and groups in organizations.

CO 4: Understanding of Leadership theories and Leadership behavior.

CO 5: Apply relevant theories, concepts to address important Organizational Behavior questions.

SYLLABUS

UNIT – I : Organizational Beaviour : Concept of Organisation- Concept of Organisational Behaviour - Nature of Organisational Beaviour - Role of Organisational Beaviour - Disciplines contributing to Organisational Beaviour.

UNIT – II : Motivation : Definition - Nature of Motivation - Role of Motivation - Theories of Motivation :Maslow's Need Hierarchy Theory, Herzberg's Motivation Hygiene Theory and Mc Gregor's Theory X and Theory Y.

UNIT - III: Group Dynamics: Meaning - Concept of Group - Types of groups -Formal and Informal groups - Group development - Group cohesiveness and factors affecting group cohesiveness. Leadership -Concept of Leadership - Difference between Leadership and Management - Importance of Leadership - Leadership styles: Autocratic leadership, Participative leadership and Free Rein leadership.

UNIT – IV : Communication : Manning - Communication Process - Forms of communication : Oral, Written and Non- Verbal communication - Direction of communication : Downward, Upward and Horizontal communication.

UNIT – V : Organisational conflicts : Concept of conflict - Reasons for conflict - Types of Conflict: Intrapersonal conflict, Interpersonal conflict, Intragroup conflict, Intergroup conflict, Inter organisational conflict - Conflict management. Organisational Change -Nature - Factors in Organisational change -Planned change : Process of planned change - Resistance to change: Factors in resistance to change - Overcoming resistance to change.

Text Books.

1. L.M.Prasad: Organisational Beaviour, Sultan Chand & Sons, New Delhi -110002.
2. K. Aswathappa: Organisational Behaviour, Himalaya Publishing House, New Delhi

Reference Books.

1. Stephen Robbins: Organizational Behaviour, Pearsons Education, New Delhi.

OPERATIONS RESEARCH (HSSE)

(Effective from Admitted Batch of 2022-23)

Code	Title	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
					Ses.	Ext.			
	Operations Research	**4**			**30**	**70**	**100**	**3hrs**	**3**

Course Objectives:

- Formulate a real-world problem as a mathematical programming model.
- Provide knowledge of optimization techniques and approaches.
- Understand and study inventory problems.
- Know the network models.
- Put on knowledge in solving replacement problems and different queueing models.

Course Outcomes:

CO 1: Learned to translate a real-world problem into a mathematical formulation.

CO 2: Convert the problem into a mathematical model.

CO 3: Formulate and Solve Transportation, Assignment and sequencing problems.

CO 4: Able to solve maximum flow and shortest path problems.

CO 5: Capable to solve replacement problems and analyze inventory models.

SYLLABUS

UNIT - I: Introduction to Optimization: Engineering Applications of Optimization, Statement of Problem, Classification of Optimization Problem Techniques.

UNIT – II: Linear Programming: Introduction, Requirements for a LP Problem, Examples on The Application of LP, Graphical Solution of 2-Variable LP Problems, Some Exceptional Cases, General Mathematical Formulation For LPP, Canonical and Standard Forms of LP Problem, Simplex Method, Examples on The Application of Simplex Techniques. Artificial Variable Techniques - Big-M Method and Two-Phase Techniques.

UNIT – III: Transportation Problem: Matrix Terminology, Definition and Mathematical Representation of Transportation Model, Formulation and Solution of Transportation Models (Basic Feasible Solution by North-West Corner Method, Inspection Method. Vogell's Approximation Method). Assignment Problem - Matrix Terminology, Definition of

Assignment Model, Comparison with Transportation Model, Mathematical Representation of Assignment Model, Formulation and Solution of Assignment Models.

UNIT – IV: Pert Network Introduction, Phases of Project Scheduling, Network Logic, Numbering the Events (Fulkerson's Rule), Measure of Activity. Pert Network Computations-Forward Pass and Backward Pass Computations, Slack Critical Path, and Probability of Meeting the Scheduled Dates.

UNIT – V: Inventory Models: Introduction, Necessity for Maintaining Inventory, Classification of Inventory Models, Inventory Models with Deterministic Demand, Demand Rate Uniform Production Rate Infinite, Demand Rate Non-Uniform Production Rate Finite, Demand Rate Uniform-Production Rate Finite. Game Theory: Useful Terminology, Rules for Game Theory, Saddle Point, Pure Strategy, Reduce Game by Dominance, Mixed Strategies, 2x2 Games Without Saddle Point.

Text Books:

1. "Operations Research-An Introduction' By H.Taha, Prentice Hall Of India Pvt. Ltd.

2. "Engineering Optimization-Theory & Practice" By S.S. Rao, New Age International (P) Ltd.

Reference Books:

1."Operations Research – An Introduction" By P.K.Gupta& D.S.Hira, S. Chand & Co. Ltd