III/IV B. TECH ECE (FOUR YEAR COURSE) &
III/IV B. TECH + M. TECH (SIX YEAR DUAL DEGREE COURSE)
(WITH EFFECT FORM 2020-2021 ADMITTED BATCH ONWARDS)
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	T	P				
EC-3101	PC	Linear ICs & Applications	3	0	0	30	70	100	3
EC-3102	PC	Digital Communications	3	0	0	30	70	100	3
EC-3103	PC	Pulse and Digital Circuits	3	0	0	30	70	100	3
EC-3104	PE	Professional Elective-I	3	0	0	30	70	100	3
EC-3105	OE	Open Elective-I	3	0	0	30	70	100	3
EC-3106	PC	Linear ICs & Pulse Circuits Lab	0	0	3	50	50	100	1.5
EC-3107	PC	Digital Communication Lab	0	0	3	50	50	100	1.5
EC-3108	SC	Object Oriented Programming through JAVA	1	0	2	50	50	100	2
EC-3109	INT	Internship-I				50	50	100	2
								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	T	P				
EC-3201	PC	Antennas and Wave Propagation	3	0	0	30	70	100	3
EC-3202	PC	Digital Signal Processing	3	0	0	30	70	100	3
EC-3203	PC	Microwave Engineering	3	0	0	30	70	100	3
EC-3204	PE	Professional Elective-II	3	0	0	30	70	100	3
EC-3205	OE	Open Elective-II	3	0	0	30	70	100	3
EC-3206	PC	Antenna Simulation Laboratory	0	0	3	50	50	100	1.5
EC-3207	PC	Digital Signal Processing Lab	0	0	3	50	50	100	1.5
EC-3208	PC	Microwave Engineering Lab	0	0	3	50	50	100	1.5
EC-3209	SC	Soft Skills	1	0	2	50	50	100	2
								Total Credits	**21.5**
Internship-II									

IV/IV B.TECH ECE (FOUR YEAR COURSE) &
IV/IV B.TECH + M.TECH (SIX YEAR DUAL DEGREE COURSE)
(WITH EFFECT FORM 2020-2021 ADMITTED BATCH ONWARDS)
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	T	P				
EC-4101	PE	Professional Elective-III	3	0	0	30	70	100	3
EC-4102	PE	Professional Elective-IV	3	0	0	30	70	100	3
EC-4103	PE	Professional Elective-V	3	0	0	30	70	100	3
EC-4104	OE	Open Elective-III	2	0	0	30	70	100	3
EC-4105	OE	Open Elective-IV	2	0	0	30	70	100	3
EC-4106	HSSE	HSS-Elective	3	0	0	30	70	100	3
EC-4107	SC	Internet of Things Lab	1	0	2	50	50	100	2
EC-4108	INT	Internship-II				50	50	100	2
								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
EC-4201	PROJ	Project work	100	100	200	14
					Total Credits	**14**

PROFESSIONAL ELECTIVES

1. Global Positioning System
2. Radar Engineering
3. Cellular Mobile Communication
4. Electronic Measurements and Instrumentation
5. Micro Electronics
6. EMI/EMC
7. Internet and Web Technology
8. Information Theory and Coding
9. Smart Antenna Systems
10. TV and Satellite Communication System
11. Transducers and Signal Conditioning
12. Low Power VLSI Design
13. Digital Image Processing
14. Fiber Optic Communication
15. Advanced Microprocessors

OPEN ELECTIVES

1. VLSI Design
2. Wireless Sensor Networks
3. Computer Networks
4. DSP Processors and Architectures
5. Embedded System Design
6. Bio-Medical Instrumentation
7. Mobile Communications
8. FPGA Design
9. Speech Processing
10. System on Chip Design
11. Internet of Things and Applications
12. Artificial Neural Networks

HSS ELECTIVES

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

EC-3101 LINEAR ICS & APPLICATIONS

Course Objectives: The objectives of this course are

- To understand & learn the measuring techniques of performance parameters of OP-AMP.
- To learn the linear and non-linear applications of operational amplifiers.
- To understand the analysis & design of different types of active filters using op-amps.
- To learn the internal structure, operation and applications of different analog ICs.
- To Acquire skills required for designing and testing integrated circuits.

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

- Outline the fundamental concepts of an operational amplifier.
- Make use of an op-amp to design linear and non-linear circuits.
- Analyze and design Signal Conditioning Circuits using op-amp.
- Analyze and design active filters using op-amp.
- Develop timers and PLL's by making use of 555 and 565 linear IC's.
- Differentiate various types of DAC's and ADC's using op-amp.

SYLLABUS

Operational Amplifiers: Design Aspects of Monolithic Op-Amps, Ideal Characteristics, AC and DC Characteristics, Data sheet Specifications, Offset Voltages and Currents, Frequency Compensation Techniques, Measurement of Op-Amp Parameters.

Applications of Op-Amps: Inverting and Non-inverting Amplifiers, Integrator, Differentiator, Comparator, Logarithmic Amplifiers, Instrumentation Amplifiers, Op-Amp Phase Shift, Wein-bridge and Quadrature Oscillator, Voltage Controlled Oscillators, Voltage to Current and Current to Voltage Converters., Analog Multiplexers.

Signal Conditioning Circuits: Rectifiers, Peak Detection and, Wave form Generators, Sample and Hold Circuits, Multivibrators, Square Wave Generators, Schmitt trigger.

Active Filters: LPF, HPF, BPF, BEF, All-pass Filters, Higher Order Filters and their Comparison, Switched Capacitance Filters.

Special ICs: 555 Timers, 556 Function Generator ICs and their Applications, Three Terminal IC Regulators, IC 1496 (Balanced Modulator), IC 565 PLL and its Applications, Function Generators, Voltage to Frequency and Frequency to Voltage Converters.

Digital to Analog and Analog to Digital Converters: DAC techniques, Weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, Different types of ADCs-parallel Comparator type ADC, Counter type ADC, Successive approximation ADC and dual type ADC, DAC and ADC specifications, Integrated ADC and DACs.

Text Books:

1. Op-Amps and Linear ICs- Ramakanth Gayakwad, PHI, 1987.
2. Linear Integrated Circuits- D. Roy Chowdhury, New Age International(p) Ltd,2nd Edition ,2003.

Reference Books:

1. Integrated Circuits- Botkar, Khanna Publications.
2. Applications of Linear ICs- Clayton.
3. Microelectronics-Jacob Millman.

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EC – 3102 DIGITAL COMMUNICATIONS

Course Objectives: The objectives of this course are

- 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: At the end of the course the student will be able to

- Differentiate the various types of pulse digital modulation techniques.
- Outline the band pass digital modulation and demodulation techniques.
- Evaluate the performance of digital communication system in the presence of noise.
- Analyze various receivers and determine the probability of error for various digital modulation techniques.
- Perform the time and frequency domain analysis of the signals in a digital communication system
- Classify the different spread spectrum modulation techniques.

SYLLABUS

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.

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.

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

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.

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.

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EC – 3103 PULSE AND DIGITAL CIRCUITS

Course Objectives: The objectives of this course are

- To understand the concept of wave shaping circuits, Switching Characteristics of diode and transistor.
- To study the design and analysis of various Multivibrators.
- To understand the functioning of different types of time-base Generators.
- To learn the working of logic families.

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

- Outline the response of linear wave shaping circuits for the standard inputs.
- Extend the applications of diodes and transistors to non-linear wave shaping.
- Understand the operation, analysis and design of Bistable multivibrators using BJTs.
- Make use of basic electronic components to design monostable and astable multivibrators.
- Categorize the operation of various time base generators.
- Realization of logic gates using different logic families.

SYLLABUS

Linear Wave Shaping: High pass and Low pass RC circuits, Response of High pass and Low pass RC circuits to sinusoidal, step, pulse, square, exponential and Ramp inputs, High pass RC circuit as a differentiator, Low pass RC circuit as an integrator. Attenuators and its application as CRO probe, RL and RLC Circuits and their response for step input, Ringing Circuit.

Nonlinear Wave Shaping: Diode clippers, Transistor Clippers, clipping at two independent levels, Comparator, Applications of voltage Comparators, Diode Comparator, Clamping Operation, Clamping Circuits using Diode with Different Inputs, Clamping Circuit Theorem, Practical Clamping circuits, Effect of diode Characteristics on Clamping Voltage.

Bistable Multivibrators: Transistor as a switch, switching times of a transistor, Design and Analysis of Fixed-bias and self-bias transistor binary, commutating capacitors, Triggering schemes of Binary, Transistor Schmitt trigger and its applications.

Monostable and Astable Multivibrators: Design and analysis of Collector coupled Monostable Multivibrator, Expression for the gate width and its waveforms. Design and analysis of Collector coupled Astable Multivibrator, expression for the Time period and its waveforms, The Astable Multivibrator as a voltage to frequency convertor.

Time Base Generators: General features of a time-base signal, Methods of Generating time base waveform, Exponential voltage sweep circuit, Basic principles of Miller and Bootstrap time base generators, transistor Miller sweep generator, transistor Bootstrap sweep generator, Current Sweep circuit, Linearity correction through adjustment of driving Waveform.

Synchronization And Frequency Division: Principles of Synchronization, Frequency division in sweep circuit, Synchronization of A stable Multivibrators, Synchronization of a sweep circuit with symmetrical signals, Sine wave frequency division with a sweep circuit.
LOGIC GATES: Realization of gates using diodes and Transistors, RTL, DTL.

Text Books:

1. Pulse Digital and Switching Waveforms, J. Millman and H. Taub, McGraw-Hill, 2nd Edition 1991.
2. Pulse switching and digital circuits – David A. Bell, PHI ,5thEdn., oxford university press.

References Books:

1. Pulse and Digital Circuits, K. VenkatRao, Pearson Education India, 2nd Edition, 2010.
2. Pulse and Digital Circuits, A. Anand Kumar, PHI, second edition, 2005.

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EC – 3104 Professional Elective-I

(Refer Annexure-I for Syllabus details)

EC – 3105 Open Elective-I

(Refer Annexure-II for Syllabus details)

EC-3106 LINEAR ICS & PULSE CIRCUITS LAB

Course Objectives: The objectives of this course are

- To apply operational amplifiers in linear and nonlinear applications.
- To acquire the basic knowledge of special function ICs.
- To Gain the practical hands-on experience on 555 Timer applications.
- To Gain the practical hands-on experience on 723 Voltage Regulator and Three terminal voltage regulators.

Course Outcomes:

- Design various linear & non-linear wave shaping circuits.
- Basic characteristics of op-amp parameters and its measurements, design compensating circuits.
- Develop applications using linear and nonlinear characterization of OPAMP.
- Understand the functionality of IC723 and determine the load and line regulations
- Design the Multivibrator circuits using IC555.

SYLLABUS

List of Experiments:

1. Linear wave shaping
2. Non-linear wave shaping
3. UJT as a Relaxation oscillator
4. Measurement of parameters of Op-amp
5. Schmitt trigger
6. Frequency response of Active filters
7. Op-amp as Wave form generator
8. IC-555 as an Astable Multi vibrator
9. Study of Instrumentation Amplifier
10. Voltage regulator using IC-723
11. Monostable Multi vibrator using IC-555.

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EC-3107 DIGITAL COMMUNICATIONS LAB

Course Objectives: The objectives of this course are

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

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

- A/D and D/A Converters.
- Continuously Variable Slope Delta Modulation
- Phase Shift Keying (PSK) Modulator
- Frequency Shift Keying (PSK) Modulator.
- Understand encoding and decoding techniques for digital communication systems

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.

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EC-3108 OBJECT ORIENTED PROGRAMMING THROUGH JAVA

Course Objectives: The objectives of this course are

- 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: At the end of the course the student will be able to

- Able to write programs for solving real world problems using java collection framework.
- Able to write programs using abstract classes.
- Able to write multithreaded programs.
- Able to write GUI programs using swing controls in Java.

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).

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EC-3201 ANTENNAS AND WAVE PROPAGATION

Course Objectives: The objectives of this course are

- 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: At the end of the course the student will be able to

- Understand the radiation mechanism of an antenna.
- Identify basic antenna parameters.
- Design and Analyze various types of antenna Arrays.
- Construct and Analyze HF, VHF and UHF Antennas.
- Analyze Microwave antennas and summarize the antenna measurement techniques.
- Outline the characteristics of radio wave propagation.

SYLLABUS

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.

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: Introduction, 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.

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.

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.

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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EC- 3202 DIGITAL SIGNAL PROCESSING

Course Objectives: The objectives of this course are

- 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: At the end of the course the student will be able to

- Apply the concepts of difference equations to Analyze the discrete time systems
- Realize the Digital filters along with its structures and finite word length effects.
- Make use of the FFT algorithm for solving the DFT of a given signal.
- Analyze the Digital IIR & FIR filter design for different specifications.
- Analyze the Digital FIR filter design for different specifications.
- Understand the signal Processing concepts in various applications.

SYLLABUS

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.

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

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.

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.

Design of FIR Filters: Fourier series Method, Window Function Techniques, Comparison of IIR and FIR Filters.

Applications: 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.

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EC- 3203 MICROWAVE ENGINEERING

Course Objectives: The objectives of this course are

- To understand about the microwave components
- To understand Microwave signal generators and amplifiers
- To analyze Various microwave circuits and microwave integrated circuits.
- To analyze Various microwave parameter measurements

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

- Analyze the microwave components.
- Illustrate microwave signal generators and amplifiers.
- Infer various microwave circuits and microwave integrated circuits.
- Infer various microwave parameter measurements.

SYLLABUS

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.

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.

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

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

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.

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EC – 3204 Professinal Elective-II
(Refer Annexure-I for Syllabus details)

EC – 3205 Open Elective-II
(Refer Annexure-II for Syllabus details)

EC – 3206 ANTENNA SIMULATION LABORATORY

Course Objectives: The objectives of this course are

- 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: At the end of the course the student will be able to

- Understand the working principle of different antennas
- Design wire antennas and microstrip antennas using HFSS.
- Understand the different feeding technique
- 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.

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EC – 3207 DIGITAL SIGNAL PROCESSING LAB

Course Objectives: The objectives of this course are

- 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: At the end of the course the student will be able to

- Generation and Implementation of discrete time signals and systems using MATLAB
- Analyze the Frequency analysis of discrete signals and systems using MATLAB.
- Design and simulate FIR and IIR filters with different techniques using MATLAB.
- Verification of Linear and Circular Convolution using DSP Processor.
- Implementation of FIR and IIR filters with different techniques using DSP Processor.

SYLLABUS

List of Experiments:

MATLAB Experiments:

1. Generation of discrete –time sequences
2. Implementation of Discrete time systems
   a) Linear Convolution of two sequences
   b) Circular Convolution of two sequences
3. Frequency analysis of discrete time sequences
4. Frequency analysis of discrete time systems
5. Design of IIR digital filter
   a) Butterworth b) Chebyshev
6. Design of FIR digital filter
   a) Hamming window
   b) rectangular window

Hardware Experiments:

1. Verification of Linear Convolution using DSP Processor kit
2. Verification of Circular Convolution using DSP Processor kit
3. Implementation of IIR Filters on DSP Processor
4. Implementation of FIR Filters using Window Techniques on DSP Processor

EC – 3208 MICROWAVE ENGINEERING LAB

Course Objectives: The objectives of this course are to determine

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

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

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

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.

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EC-3209 SOFT SKILLS

Course Objectives: The objectives of this course are

- 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: At the end of the course the student will be able to

- Make use of techniques for self-awareness and self-development.
- Apply the conceptual understanding of communication into everyday practice.
- Understand the importance of teamwork and group discussions skills.
- Develop time management and stress management.

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.

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EC-4101 Profesional Elective-III
(Note: Refer Annexure-I for Syllabus details)

EC-4102 Professional Elective-IV
(Note: Refer Annexure-I for Syllabus details)

EC-4103 Professional Elective-V
(Note: Refer Annexure-I for Syllabus details)

EC-4104 Open Elective-III
(Note: Refer Annexure-II for Syllabus details)

EC-4105 Open Elective-IV
(Note: Refer Annexure-II for Syllabus details)

EC-4106 HSS-Elective
(Note: Refer Annexure-III for Syllabus details)

EC-4107 INTERNET OF THINGS LAB

Course Objectives: The objectives of this course are

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

Course Outcomes:

- Interface Arduino to ZigBee module and GSM modules
- Interface Arduino Bluetooth modules
- Make use of Cloud platform to upload and analyse any sensor data
- Use of Devices, Gateways and Data Management in IoT.
- 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 CO1
2. Interfacing Arduino to Zigbee module CO1, CO3
3. Interfacing Arduino to GSM module CO1, CO3
4. Interfacing Arduino to Bluetooth Module CO1, CO3
5. Introduction to Raspberry PI platform and python programming CO2
6. Interfacing sensors to Raspberry PI CO2
7. Communicate between Arduino and Raspberry PI using any wireless medium CO1, CO2, CO3
8. Setup a cloud platform to log the data CO4
9. Log Data using Raspberry PI and upload to the cloud platform CO5
10. Design an IOT based system CO6/

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ANNEXURE-I

PROGRAM ELECTIVES

1. Global Positioning System
2. Radar Engineering
3. Cellular Mobile Communication
4. Electronic Measurements and Instrumentation
5. Micro Electronics
6. EMI/EMC
7. Internet and Web Technology
8. Information Theory and Coding
9. Smart Antenna Systems
10. TV and Satellite Communication System
11. Transducers and Signal Conditioning
12. Low Power VLSI Design
13. Digital Image Processing
14. Fiber Optic Communication
15. Advanced Microprocessors

GLOBAL POSITIONING SYSTEM

Course Objectives: To provide an insight into the basic concepts of

- 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: At the end of the course the student will be able to

- Understand the basic concepts of Global Position System with GPS working principle
- Understand the basic concepts of other global satellite constellations
- Analyze GPS satellite constellation and signals
- Examine using different coordinate systems

SYLLABUS

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.

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.

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

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.

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.

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RADAR ENGINEERING

Course Objectives: To provide an insight into the basic concepts of

- RADAR engineering.
- MTI and Pulse Doppler Radar.
- Tracking Radar.
- block diagrams of Synthetic Aperture Radar (SAR), Phased array Radars and others.
- different radar receiver principles of direction finders

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

- Understand the basic concepts of RADAR engineering
- Understand the basic concepts of MTI and Pulse Doppler Radar
- Analyze Tracking Radar
- Examine block diagrams of Synthetic Aperture Radar (SAR), Phased array Radars and others.
- Examine different radar receiver principles of direction finders.

SYLLABUS

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.

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

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.

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.

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.

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CELLULAR AND MOBILE COMMUNICATION

Course Objectives: The objectives of this course are

- 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: At the end of the course the student will be able to

- Explain the fundamentals of cellular radio system design and its basic elements.
- Analyze the concepts of different co-channel, non-co-channel interference and cellular coverage on signal & traffic of a designed system.
- Identify the various types of multiplexing and modulation techniques suitable for mobile communications.
- Distinguish the number of radio channels, channel assignment and frequency management used in mobile communications and analyze the different hand off & cell splitting techniques and dropped call rate at cell site area
- Analyze small scale fading
- Summarize the different types of second-generation system architectures such as GSM, TDMA and CDMA for mobile communication systems.

SYLLABUS

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.

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.

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.

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.

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.

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ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

Course Objectives: The objectives of this course are

- 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: At the end of the course the student will be able to

- Understand the different characteristics of electronic measuring instruments.
- Make use of Signal generators to analyze a signal.
- Understand the design and functioning of Oscilloscopes.
- Utilize AC bridges for measurement of inductance.
- Distinguish active transducers from passive transducers.
- Develop the ability to use instruments for measurement of physical parameters.

SYLLABUS

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.

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.

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.

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, 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.

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MICROELECTRONICS

Course Objectives: The objectives of this course are

- To explain and apply basic concepts of semiconductor physics relevant to devices.
- To describe, explain, and analyse the operation of important semiconductor devices in terms of their physical structure.
- To realize the combinational and sequential circuits using semiconductors.
- To design - confront integrated device and/or circuit design problems, identify the design issues, and develop solutions.

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

- Understanding the fabrication process of BJT, FET and MOS technologies.
- Analyze the basic digital circuits.
- Make use of combinational circuits to implement combinational logic functions.
- Develop different types of counters and registers using flip-flops.

SYLLABUS

Integrated- Circuit Fabrication: Monolithic Integrated - Circuit (microelectronics) technology- The planar processes - Bipolar Transistor Fabrication - Fabrication of FETs - CMOS Technology - Monolithic Diodes - The Metal – Semiconductor Contact - IC Resistor - IC Capacitors - IC Packaging - Characteristics of IC Components – Microelectronic circuit layout.

Basic Digital circuits: MOS Technology - NMOS, CMOS, Inverters, Logic gates - ECL circuits.

Combinational Circuits: Arithmetic functions - Comparators - Multiplexers - Demultiplexers - Memory - Memory applications – PAL - PLAs.

Sequential Circuits: A1 - Bit memory - The circuits properties of biastable latch - The clocked SR Flip-Flop - J-K, T, and D-type Flip-flops. Shift-registers - Ripple Counters - synchronous counters - Applications of counters.

Text Book:

1. Microelectronic by JocobMilliman, ArbinGrabel second edition, TMH.

Reference Books:

1. Part 2 of Integrated Circuits, Design Principles and Fabrications by editors, Warner and Fordemwalt, 1965, Motorola Series, McGraw Hill.
2. MOS LSI Design and Applications by Dr. William N. Carr and Dr. Jack P. Mize, McGraw Hill, 1972.
3. Microelectronic circuits and devices second edition Horenstien, PHI.

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EMI/EMC

Course Objectives: The objectives of this course are

- 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: At the end of the course the student will be able to

- Understand the EMI sources, EMC regulations and methods of eliminating interferences.
- Identifying of EMI hotspot and various techniques like Grounding, Shielding, Cabling.
- Analyze the effect of EM noise in system environment and its sources.
- Summarize the EMC design constraints and make appropriate trade-offs that meets all requirements.
- Designing electronic systems that function without errors or problems related to electromagnetic compatibility.
- Differentiate various EMI measurement techniques.

SYLLABUS

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.

Grounding Techniques: Grounding Techniques, Shielding Techniques, Cabling Techniques.

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.

Choice of Passive Components: EMC Design Components

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.

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INTERNET & WEB TECHNOLOGY

Course Objectives: The objectives of this course are

- 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: At the end of the course the student will be able to

- Understand the concepts of HTML, Java scripts and Cascading Style Sheets
- Generate XML documents and Schemas and summarize Java Beans.
- Develop and deploy real time web applications in web servers and Servlets.
- Build JSP tools that assist in automating data transfer over the Internet.
- Accessing a Database from Servlets & JSP Page.

SYLLABUS

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.

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

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

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

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.

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INFORMATION THEORY AND CODING

Course Objectives: To provide an insight into the basic concepts of

- The concept of Error control coding
- Linear Block Codes for Error Correction.
- Convolution coding to improve the reliability of the system
- Sequential Decoding of Convolution codes

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

- Understand the concept of Error control coding
- Apply Linear Block Codes for Error Correction
- Apply Convolution coding to improve the reliability of the system
- Sequential Decoding of Convolution codes

SYLLABUS

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.

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.

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

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 ofDigital 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
2) Coding by J Das, S.K. Mullick, P.K.Chatterjee, New Age Int. Ltd.
3) Principles of Communication Systems, Taub &Schilling, 2/e, TMH Publisher.

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SMART ANTENNAS SYSTEMS

Course Objectives: The objectives of this course are

- 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: By the end of the course the student will be able to

- Understand antenna theory and application of signa processing in it.
- Learn techniques of developing MIMO antennas, beam forming.
- Design practical antennas for Radar applications.
- Determine the capacity and data rate in MIMO system

Syllabus

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.

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.

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

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.

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.

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TV AND SATELLITE COMMUNICATION

Course Objectives: To provide an insight into the basic concepts of

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

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

- Analyze the concepts of basic television system.
- Illustrate examples of Signal Transmission and Channel Bandwidth.
- Infer Television Receiver and Colour Television.
- Infer various concepts of satellite communication.

SYLLABUS

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.

Television Cameras: Principle of working and constructional details of Image Orthicon, Vidicon, Plumbicon and Silicon diode array Vidicon and Solid-state Image Scanners.

Composite - Video Signal: Video signal levels, Need for Synchronization, Details of Horizontal and Vertical Sync Pulses, Equalizing Pulses.

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.

The TV Picture Tube: Monochrome Picture Tube, Picture Tube Characteristics and Picture Tube Control Circuits, Gamma Correction. **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.

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.

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.

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TRANSDUCERS AND SIGNAL CONDITIONING

Course Objectives: The objectives of this course are

- 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: At the end of the course the student will be able to

- 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.

SYLLABUS

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

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.

Elastic Transducers: Spring bellows, diaphragm, bourdon tube – their special features and application.

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.

Other Transducers: Optical transducers: photo-emissive, photo-conductive and Photovoltaic cells, Digital Transducers: Optical encoder, Shaft encoder. Feedback fundamentals, introduction to Inverse transducer.

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).

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LOW POWER VLSI DESIGN

Course Objectives: The objectives of this course are

- 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
- To understand the concepts of Low Power Latches and Flip Flops

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

- Capability to recognize advanced issues in VLSI systems, specific to the deep-submicron silicon technologies.
- Students able to understand deep submicron CMOS technology and digital CMOS design styles.
- To design chips used for battery-powered systems and highperformance circuits
- Explain the equations, approximations and techniques available for deriving a device model with specified properties
- Explore and improvise on the latest techniques used for designing power-efficient logic gates, latches, and flip-flops

SYLLABUS

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

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.

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.

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

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.

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DIGITAL IMAGE PROCESSING

Course Objectives: The objectives of this course are

- 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: At the end of the course the student will be able to

- Illustrate the fundamental concepts of Digital Image Processing and different image transforms.
- Analyze the effect of spatial and frequency domain filtering of images.
- Evaluate the methodologies for image restoration and reconstruction.
- Compare the different color image processing techniques.
- Elucidate the mathematical modelling of image Multi-resolution processing and apply different image compression techniques.
- Categorize different image segmentation techniques and morphological image operations.

SYLLABUS

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.

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

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.

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.

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.

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.

Image compression: Fundamentals, various compression methods-coding techniques, digital image water marking.

Morphological image processing: preliminaries Erosion and dilation, opening and closing, the Hit-or-miss transformation, some Basic Morphological algorithms, grey –scale morphology

Image segmentation: Fundamentals, point, line, edge detection thresholding, region –based segmentation, segmentation using Morphological watersheds, the use of motion in segmentation**.**

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.

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FIBER-OPTIC COMMUNICATIONS

Course Objectives: The objectives of this course are

- 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: At the end of the course the student will be able to

- Understand and analyze the constructional parameters of optical fibres.
- Be able to design an optical system.
- Estimate the losses due to attenuation, absorption, scattering and bending.
- Compare various optical detectors and choose suitable one for different applications.

SYLLABUS

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.

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.

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

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.

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.

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ADVANCED MICROPROCESSORS

Course Objectives: The objectives of this course are

- 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: At the end of the course the student will be able to

- understand the functionality of 80186,80286,80386 and 80486 architecture to design advanced microprocessors systems
- Analyze the Performance of RISC and CISC architectures.
- Interface the advanced processors with Memory.
- Summarize the interfacing rules of different peripherals with advanced microprocessor.

SYLLABUS

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.

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.

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 -

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

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.

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ANNEXURE-II

OPEN ELECTIVES

1. VLSI Design
2. Wireless Sensor Networks
3. Computer Networks
4. DSP Processors and Architectures
5. Embedded System Design
6. Bio-Medical Instrumentation
7. Mobile Communications
8. FPGA Design
9. Speech Processing
10. System on Chip Design
11. Internet of Things and Applications
12. Artificial Neural Networks

VLSI DESIGN

Course Objectives: To provide an insight into the basic concepts of

- 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: At the end of the course the student will be able to

- Describe the basic concepts of VLSI technology.
- Demonstrate circuit design processes with stick diagrams and layout diagrams
- Demonstrate basic circuit concepts.
- Summarize scaling of MOS circuits with sub system design and layout.

SYLLABUS

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.

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.

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 incrementer / decrementer, a comparator for two n-bit numbers. Ultra fast systems, Technology development, MOSFET based design.

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.

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.

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WIRELESS SENSORS & NETWORKS

Course Objectives: The objectives of this course are

- 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: At the end of the course the student will be able to

- Understand the fundamental Concepts, applications and architectures of wireless sensor networks
- Categorize the various network topologies.
- Realize the MAC Protocols for Wireless Sensor Networks.
- Describe routing protocols for ad hoc wireless networks with respect to TCP design issues.
- Outline the transport layer and security protocols for WSN.
- Differentiate various sensor network platforms and tools.

SYLLABUS

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.

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.

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.

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.

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. KazemSohraby, Daniel Minoli, &TaiebZnati, “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.

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COMPUTER NETWORKS

Course Objectives: The objectives of this course are

- 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: At the end of the course the student will be able to

- Understand the concepts of Network Topologies, structures and layers.
- Illustrate Physical layer Guided Transmission media and Multiplexing concepts.
- Understand how the Media Access control problem solved in a network using multiple access protocols.
- Detect and analyze the Datalink layer Framing, Error control Techniques and protocols in a network.
- Make use of the Network Layer routing algorithms, congestion control algorithms to perform better network communication.
- Analyze the internet Transport layer protocols and application layer services.

SYLLABUS

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.

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

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

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.

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.

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DSP PROCESSORS & ARCHITECTURES

Course Objectives: The objectives of this course are

- 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: At the end of the course the student will be able to

- Understand the concepts of DSP and numeric representations.
- Illustrate the architectural features of DSP devices.
- Determine various addressing modes and instructions of DSP processor.
- Analyze the concepts of basic DSP algorithms.
- Analyze the interfacing serial converters to a DSP device.

SYLLABUS

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.

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

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.

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.

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.

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EMBEDDED SYSTEM DESIGN

Course Objectives: The objectives of this course are

- To provide an overview of Design Principles of Embedded System.
- To provide clear understanding about the role of firmware, operating systems incorrelation with hardware systems.
- To understand the principles of sensors and actuators
- To understand parallel processing for multitasking systems

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

- Expected to understand the selection procedure of Processors in the embedded domain.
- Design Procedure for Embedded Firmware.
- Expected to visualize the role of Real time Operating Systems in Embedded Systems.
- Expected to evaluate the Correlation between task synchronization and latency issue

SYLLABUS

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). **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.

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

RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

Task Communication: Shared Memory, Message Passing, Remote Procedure Call and 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, Mc Graw Hill.

Reference Books:

1. Embedded Systems - Raj Kamal, MC GRAW HILL EDUCATION.
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.

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BIO MEDICAL INSTRUMENTATION

Course Objectives: The objectives of this course are

- To know the sources of Bioelectric 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: At the end of the course the student will be able to

- Understand the origin of biopotentials and role of its electrodes.
- Elucidate the cardiovascular system and its measurements.
- Develop a thorough understanding on principles of Patient Care Monitory and Measurements in Respiratory System.
- Outline the concepts of Bio telemetry and Instrumentation for the clinical laboratory.
- Summarize the application of Electronics in diagnostics and therapeutic area.

SYLLABUS

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

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,

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.

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

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.

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MOBILE COMMUNICATIONS

Course Objectives: The objectives of this course are

- Understanding the basic principles of mobile communication systems.
- An analysis of mobile communications with the interpretation of the call prints.
- Understand the basic principles of the modern mobile and wireless communication systems.
- Understand the operation of mobile communications systems and their generation divisions.

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

- Able to think and develop new mobile application.
- Able to take any new technical issue related to this new paradigm and come up with a solution(s).
- Able to develop new ad hoc network applications and/or algorithms/protocols.
- Able to understand & develop any existing or new protocol related to mobile environment.

SYLLABUS

Introduction: Mobile Communications, Mobile Computing – Paradigm, Promises/Novel Applications and Impediments and Architecture; Mobile and Handheld Devices, Limitations of Mobile and Handheld Devices. GSM – Services, System Architecture, Radio Interfaces, Protocols, Localization, Calling, Handover, Security, New Data Services, GPRS.

Wireless Medium Access Control (MAC): Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA, Wireless LAN/ (IEEE 802.11)

Mobile Network Layer: IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunnelling and Encapsulation, Route Optimization, DHCP.

Mobile Transport Layer: Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP, Other Transport Layer Protocols for Mobile Networks.

Database Issues: Database Hoarding & Caching Techniques, Client-Server Computing & Adaptation, Transactional Models, Query processing, Data Recovery Process &QoS Issues.

Data Dissemination and Synchronization: Communications Asymmetry, Classification of Data Delivery Mechanisms, Data Dissemination, Broadcast Models, Selective Tuning and Indexing Methods, Data Synchronization – Introduction, Software, and Protocols.

Mobile Ad hoc Networks (MANETs): Introduction, Applications & Challenges of a MANET, Routing, Classification of Routing Algorithms, Algorithms such as DSR, AODV,DSDV, etc., Mobile Agents, Service Discovery.

Text Books:

1. Jochen Schiller, "Mobile Communications", Addison-Wesley, Second Edition,2009.
2. Raj Kamal, "Mobile Computing", Oxford University Press, 2007, ISBN: 0195686772

Reference Books:

1. ASOKE K TALUKDER, HASAN AHMED, ROOPA R YAVAGAL, "Mobile Computing,Technology Applications and Service Creation" Second Edition, Mc Graw Hill.
2. UWE Hansmann, LotherMerk, Martin S. Nocklous, Thomas Stober, "Principles of Mobile Computing," Second Edition, Springer.

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FPGA DESIGN

Course Objectives: The objectives of this course are

- 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 desig n and implementation.
- To give the student an understanding of basics of System on Chip and Platform based design.
- To give the student the idea of FPGA routing structures

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

- Understand FPGA design flow.
- Identify the building blocks of commercially available FPGA/CPLDs.
- Develop VHDL/Verilog models and synthesize targeting for Vertex, Spartan FPGAs.
- Develop parameterized library cells and implement system designs using parameterized cells.

SYLLABUS

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

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

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

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.

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.

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SPEECH PROCESSING

Course Objectives: The objectives of this course are

- 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.
- To Evaluate the speech pattern similarities.

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

- Model an electrical equivalent of Speech Production system.
- Convey details of a range of commonly used speech feature extraction techniques.
- Provide a basic understanding of multidimensional techniques for speech representation and classification methods.
- Familiarize you with the practical aspects of speech processing, including robustness, and applications of speech processing, including speech enhancement, speaker recognition and speech recognition.
- Design a Homomorphic Vocoder for coding and decoding of speech

SYLLABUS

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.

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.

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.

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.

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:

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

Reference Books:

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

SYSTEM ON CHIP DESIGN

Course Objectives: The objectives of this course are

- To introduce the architectural features of system on chip.
- To imbibe the knowledge of customization using case studies.
- To Design Memory for SOC
- To Understand the Interconnect Architectures

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

- Expected to understand SOC Architectural features.
- To acquire the knowledge on processor selection criteria and limitations
- To acquires the knowledge of memory architectures on SOC.
- To understands the interconnection strategies and their customization on SOC.

SYLLABUS

Introduction to the System Approach: System Architecture, Components of the system, Hardware & Software, Processor Architectures, Memory and Addressing. System level interconnection, An approach for SOC Design, System Architecture and Complexity.

Processors: Introduction, Processor Selection for SOC, Basic concepts in Processor Architecture, Basic concepts in Processor Micro Architecture, Basic elements in Instruction handling. Buffers: minimizing Pipeline Delays, Branches, More Robust Processors, Vector Processors and Vector Instructions extensions, VLIW Processors, Superscalar Processors.

Memory Design for SOC: Overview of SOC external memory, Internal Memory, Size, Scratchpads and Cache memory, Cache Organization, Cache data, Write Policies, Strategies for line replacement at miss time, Types of Cache, Split – I, and D – Caches, Multilevel Caches, Virtual to real translation, SOC Memory System, Models of Simple Processor – memory interaction.

Interconnect Customization: Inter Connect Architectures, Bus: Basic Architectures, SOC Standard Buses, Analytic Bus Models, Using the Bus model, Effects of Bus transactions and contention time. SOC Customization:

Configuration: An overview, Customizing Instruction Processor, Reconfiguration Technologies, Mapping design onto Reconfigurable devices, Instance- Specific design, Customizable Soft Processor, Reconfiguration – overhead analysis and trade-off analysis on reconfigurable Parallelism.

Text Books:

1. Computer System Design System-on-Chip by Michael J. Flynn and Wayne Luk, Wiely India Pvt. Ltd. ARM System on Chip Architecture – Steve Furber –2nd Eed., 2000, Addison Wesley Professional.

Reference Books:

1 . Design of System on a Chip: Devices and Components – Ricardo Reis, 1st Ed., 2004, Springer

2 . Co-Verification of Hardware and Software for ARM System on Chip Design (Embedded Technology) – Jason Andrews – Newnes, BK and CDROM

3 . System on Chip Verification – Methodologies and Techniques –Prakash Rashinkar, Peter Paterson and Leena Singh L, 2001, Kluwer Academic Publishers.

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INTERNET OF THINGS AND APPLICATIONS

Course Objectives: The objectives of this course are

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

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

- Able to understand the application areas of IOT
- Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
- Able to understand building blocks of Internet of Things and characteristics.
- Able to design and implement IOT based systems

SYLLABUS

Introduction to Internet of Things: Definition and Characteristics of IoT, Sensors, Actuators, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry.

IoT and M2M: Software defined networks, network function virtualization, difference between SDN and NFV for IoT. Basics of IoT System Management with NETCOZF, YANG-NETCONF, YANG, SNMP NETOPEER.

Introduction to Python: Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling. Python packages - JSON, XML, HTTP Lib, URL Lib, SMTP Lib.

IoT Physical Devices and Endpoints: Introduction to Raspberry PI - Interfaces (serial, SPI, I2C). Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.

Controlling Hardware: Connecting LED, Buzzer, Switching High Power devices with transistors, Controlling AC Power devices with Relays, Controlling servo motor, speed

control of DC Motor, unipolar and bipolar Stepper motors. Sensors- Light sensor, temperature sensor with thermistor, voltage sensor, ADC and DAC, Temperature and Humidity Sensor DHT11, Motion Detection Sensors, Wireless Bluetooth Sensors, Level Sensors, USB Sensors, Embedded Sensors, Distance Measurement with ultrasound sensor.

IoT Physical Servers and Cloud Offerings: Introduction to Cloud Storage models and communication APIs. Webserver – Web server for IoT, Cloud for IoT, Python web application framework. Designing a RESTful web API.

Text Books:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti,Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759.

Reference Books:

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

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ARTIFICIAL NEURAL NETWORKS

Course Objectives: To provide an insight into the basic concepts of

- To understand the artificial intelligence as representation and search and its applications representation and inference.
- situations and machine learning.
- neural networks and fuzzy systems
- different neural and synaptic dynamics

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

- Understand the artificial intelligence as representation and search and its applications
- Apply knowledge representation and inference
- Understand situations and machine learning
- Examine neural networks and fuzzy systems
- Examine different neural and synaptic dynamics

SYLLABUS

Artificial Intelligence as Representation and Search: Introduction to AI, Roots and Scope of AI, Definition, Turing Test, Application Areas of AI, Predicate Calculus, Structures and Strategies for State Space Search, Heuristic Search, Control and Implementation of State Space Search.

Representation and Inference: Knowledge Representation, Strong Methods for Problem Solving, Reasoning in Uncertain

Situations, Machine Learning: Symbol-Based: Framework for Symbol – Based Learning, Version Space Search, ID3 Algorithm, Un-supervised learning, Reinforcement Learning, Connectionist: Perceptron Learning, Backpropagation Learning, Competitive Learning, Hebbian Coincidence Learning, Attractor Networks

Neural Networks and Fuzzy Systems: Neural and Fuzzy machine intelligence, fuzziness as multivalence, the dynamical-systems approach to machine intelligence, intelligent behaviour as adaptive model-free estimation.

Neural Dynamics: I. Activations and signals: Neurous as functions, signal monotonicity, biological activations and signals, neuron fields, neuronal dynamical systems, common signal functions, pulse-coded signal functions.

Neuronal dynamics II : Activation Models : neuronal dynamical systems, additive neuronal dynamics, additive neuronal feedback, additive bivalent models, BAM Connection matrices, additive dynamic and the noise-saturation dilemma, general neuronal activations : Cohen-grossberg and multiplicative models

Synaptic Dynamics: I. Unsupervised Learning: Learning as encoding, change, and quantization, four unsupervised learning laws, probability spaces and random processes, stochastic unsupervised learning and stochastic equilibrium, signal hebbian learning, competitive learning, differential hebbian learning, differential competitive learning. Synaptic Dynamics II: Supervised learning : Supervised function estimation, supervised learning as operant conditioning, supervised learning as stochastic pattern learning with known class memberships, supervised learning as stochastic approximation, the back propagation algorithm.

Text Books:

1. **"**Artificial Intelligence – Structures and Strategies for Complex Problem Solving**"**, George F. Luger, Th 4 Edition, Pearson Education , 2003.
2. Neural Networks & Fuzzy Systems, Bark Kosko, PHI Published in 1994.

Reference Books:

1. Artificial Intelligence, Knight, Tata McGraw Hill

2. Artificial Intelligence **'**a Modern Approach, Russell &Norvig, second edition, Pearson Education, 2003.

3. Fundamentals of Artificial Neural Networks, Mohamad H Hassoum, PHI
4. Neural Network Design, Hagan, Demuth and Beale, Vikas Publishing House.

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ANNEXURE-III

HSS Electives

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

INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP

Course Objectives : The objectives of this course are

- 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: At the end of the course the student will be able to

- Understand the roles, skills and functions of management.
- Distinguish the different types of business organizations.
- Identify the factors involved in Production Operations Management.
- Diagnose organizational problems and take suitable decisions
- Establish good Human Resource Management practices.
- Acquire necessary knowledge and skills required for organizing and carrying out entrepreneurial activities.

SYLLABUS

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.

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.

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.

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.

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.

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ORGANIZATIONAL BEHAVIOUR

Course Objectives: The objectives of this course are

- 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 behaviour in organizations, including communication, leadership conflicts and organizational change and how these are linked to and impact organizational performance.

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

- Identifying fundamental aspects of organizational dynamics.
- Evaluate main theories of motivation and formulating suitable motivational strategies.
- Analyze the behaviour of individuals and groups in organizations.
- Understanding of Leadership theories and Leadership behaviour.
- Apply relevant theories, concepts to address important Organizational Behaviour questions.

SYLLABUS

Organizational Behaviour : Concept of Organisation - Concept of Organisational Behaviour - Nature of Organisational Behaviour - Role of Organisational behaviour - Disciplines contributing to Organisational Behaviour.

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.

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.

Communication: Meaning - Communication Process - Forms of communication: Oral, Written and Non- Verbal communication - Direction of communication : Downward, Upward and Horizontal communication.

Organisational conflicts: Concept of conflict - Reasons for conflict - Types of Conflict: Intrapersonal conflict, Interpersonal conflict, Intragroup conflict, Intergroup conflict, Interorganisational 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.

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OPERATIONS RESEARCH

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:

- Learned to translate a real-world problem into a mathematical formulation.
- Formulate and Solve Transportation, Assignment and sequencing problems.
- Resolve inventory problems.
- Able to solve maximum flow and shortest path problems.
- Capable to solve replacement problems and analyze queueing models.

SYLLABUS

Introduction: Definitions of Operations Research; Phases of Operations Research; Types of Operations Research models; applications, merits and demerits of Operations Research.

Allocation: Linear Programming problem formulation; Basic assumptions; Graphical solution; Simplex method; Artificial variable technique; Two phase method; Big M method; Duality principle; Primal and Dual relation.

Transportation: Formulation; Solution methods; Unbalanced transportation problems - North west corner rule; Least cost entry method; Vogel's approximation method; Optimal solution; degeneracy.

Assignment: Formulation; Variations in Assignment problem; Travelling salesman problem.

Sequencing: Sequencing of - *n* jobs through two machines; *n* jobs through three machines; *n* jobs through *m* machines; 2 jobs through *m* machines.

Inventory Control: Introduction; Types of Inventory; Inventory costs; Deterministic models - Economic order quantity (EOQ) and Economic Production Quantity (EPQ) with and without shortages; Quantity discounts; P system; Q system; Inventory control Techniques.

Network Analysis: Network definitions; Time estimates in network analysis; Labeling using Fulkerson's rule; Forward pass computations; Backward pass computations; Project management using Critical Path Method(CPM) and Programme Evaluation and Review Technique(PERT).

Replacement: Introduction, Replacement of items that deteriorate with time - Value of money unchanging and changing, Replacement of items that fail completely.

Queueing models: Introduction; Single channel poisson arrivals; Exponential service times; Unrestricted queuewith infinite population and finite population models; Multi channel poisson arrivals; Exponential service times with infinite population and restricted queue.

Text Books:

1. Hamdy A Taha, "Operations Research- An Introduction" by TAHA , Prentice Hall, 2009.
2. F.S. Hiller, G.J. Liberman,B. Nag and P.Basu "Introduction To Operations Research, Mc Graw Hill Education(India), 2012.
3. S.D.Sharma, "Operations Research", Kedarnadh Ramnadh & Co.,2017

Reference Books:

1. R. Pannerselvam, "Operations Research", PHI..
2. Richard Bronson, Schaum's Series," Operations Research", Mc Graw Hill
3. N.V.S.Raju, "Operations Research- Theory and Practice" BS publications.
4. V.K. Kapoor, "Operations Research" Sultan Chand & Sons.