23ECT07-ANALOG AND DIGITAL IC APPLICATIONS

Credits - 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives:

1. To introduce the classification of Integrated Circuits, internal blocks and characteristics of Op-Amp.
2. To analyse linear and non-linear applications of Op-Amp .
3. To gain knowledge on active filters, timers and phased locked loops.
4. To understand the working of Voltage Regulators and Converters.
5. To study about different types of Digital ICs and their applications.

Course Outcomes:

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

1. Understand the classification of Integrated Circuits, internal blocks and characteristics of Op-Amp.
2. Analyse linear and non-linear applications of Op-Amp.
3. Gain knowledge on active filters, timers and phased locked loops.
4. Understand the working of Voltage Regulators and Converters.
5. Know about different types of Digital ICs and their applications.

UNIT I
ICs and OP- AMPS

Integrated Circuits and Operational Amplifier: Introduction, Classification of IC's, IC chip size and circuit complexity, basic information of Op-Amp IC741 and its features, the ideal Operational amplifier, Op-Amp internal circuit, Op-Amp characteristics - DC and AC, Features of 741 Op-Amp.

UNIT II

Applications of OP- AMP

Linear Applications of Op-Amp: Inverting, non-inverting, Differential amplifiers, adder, subtractor, Instrumentation amplifier, AC amplifier, V to I and I to V converters, Integrator and differentiator.

Non-Linear Applications of Op-Amp: Sample and Hold circuit, Log and Antilog amplifier, multiplier and divider, Comparators, Schmitt trigger, monostable and astable Multivibrators, Triangular and Square waveform generators, RC Phase shift Oscillator.

UNIT III

Active Filters and other ICs

Active Filters: Introduction, Butterworth filters – 1st order, 2nd order low pass and high pass filters, band pass, band reject and all pass filters.

Timer and Phase Locked Loops: Introduction to IC 555 timer, description of functional diagram, monostable and astable operations and applications, Schmitt trigger, PLL - introduction, basic principle, phase detector/comparator, voltage controlled oscillator (IC 566), low pass filter, monolithic PLL and applications of PLL.

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UNIT IV
Voltage Regulators and Converters

Voltage Regulator: Introduction, Series Op-Amp regulator, IC Voltage Regulators, IC 723 general purpose regulators, Switching Regulator.

D to A and A to D Converters: Introduction, basic DAC techniques - weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A to D converters - parallel comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC Specifications.

UNIT V
Digital ICs

CMOS Logic: CMOS logic levels, MOS transistors, Basic CMOS Inverter, NAND and NOR gates, CMOS AND-OR-INVERT and OR-AND-INVERT gates, implementation of any function using CMOS logic.

Combinational Logic IC's: Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs - Code Converters, Decoders, Encoders, Priority Encoders, Multiplexers, Demultiplexers, Parallel Binary Adder/ Subtractor, Magnitude Comparators.

Sequential Logic IC's: Familiarity with commonly available 74XX & CMOS40XX Series ICs - All Types of Flip-flops, Synchronous Counters, Decade Counters, Shift Registers.

Textbooks:

1. D. Roy Choudhury, Shail B. Jain, —Linear Integrated Circuitl, 4th edition (2012), New Age International Pvt.Ltd., New Delhi, India
2. Floyd, Jain, —Digital Fundamentalsl, 8th edition (2009), Pearson Education, New Delhi.

References:

1. Ramakant A. Gayakwad, —OP-AMP and Linear Integrated Circuitsl, 4th edition (2012), Prentice Hall / Pearson Education, New Delhi.
2. Sergio Franco (1997), Design with operational amplifiers and analog integrated circuits, McGraw Hill, New Delhi.
3. Gray, Meyer (1995), Analysis and Design of Analog Integrated Circuits, Wiley International, New Delhi.

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SEMESTER III-I

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Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M					L	L			H			H	M	L
CO2		M	L	M	M	L				H		L	H	M	L
CO3		M	M			L				H		L	H	M	L
CO4			M	M					L	H			H	M	L
CO5	L			H							M		H	M	L

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23ECT08 - ANTENNAS AND WAVE PROPAGATION

Credits – 3 **Sessional Marks: 30**

L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives:

1. To learn the antennas basic terminology, radiation mechanism of antennas and dipole antennas.
2. To gain knowledge on HF, VHF & UHF antennas, their operation and applications.
3. Analyze the working and applications of Microwave antennas.
4. Understand different techniques involved in the design of antenna arrays and antenna parameter measurements.
5. To study the various types of radio wave propagation methods.

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

1. Understand the antennas basic terminology and radiation mechanism of antennas.
2. Gain knowledge on VHF and UHF antennas, their operation and applications.
3. Design and analyze the working and applications of Microwave antennas.
4. Analyze different techniques involved in the design of antenna arrays and antenna parameter measurements.
5. Gain a comprehensive knowledge about the types of radio wave propagation methods.

UNIT – I: Antenna Basics & Dipole Antennas

Definition of antenna, radiation mechanism using single wire, two wire, and dipoles, basic antenna parameters including radiation pattern, main lobe, side lobes, beam width, directivity, and gain, radiation from quarter-wave monopole and half-wave dipole, far-field region and concept of radiation resistance, and illustrative problems.

UNIT – II: HF, VHF, and UHF Antennas

Introduction to small loop antennas, comparison of far-field patterns of small loop and short dipole, basic structure and characteristics of Yagi-Uda antenna, folded dipole and its advantages, working principle of log-periodic antennas, types and applications of horn antennas.

UNIT – III: Microwave Antennas

Introduction to microstrip antennas, features and structure of rectangular patch antennas, basic parameters and characteristics of microstrip antennas, introduction to reflector antennas including geometry and working of parabolic reflectors, and basic concept and applications of dielectric lens antennas.

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UNIT – IV: Antenna Arrays and Measurements

Concept of point sources and radiation pattern, array of two isotropic sources with broadside and end-fire configurations, principle of pattern multiplication in uniform linear arrays, measurement of radiation pattern, and gain measurement using comparison method.

UNIT – V: Wave Propagation

Introduction to electromagnetic wave propagation and its classifications, ground wave propagation with plane earth reflections, space wave propagation including variation of field strength with distance and height, and basic effect of earth curvature, sky wave propagation covering structure of ionosphere, reflection and refraction of sky waves, critical frequency, maximum usable frequency (MUF), lowest usable frequency (LUF), virtual height, and skip distance.

TEXT BOOKS:

1. John D. Kraus, Ronald J. Marhefka and Ahmad S.Khan, —Antennas and wave propagationl, TMH, New Delhi, 4th Ed., 2010.
2. C.A. Balanis, —Antenna Theory- Analysis and Designl, John Wiley & Sons, 2nd Edn., 2001.
3. K.D. Prasad and SatyaPrakashan, —Antennas and Wave Propagationl, New Delhi, Tech. India Publications, 2001.

REFERENCES:

1. E.C. Jordan and K.G. Balmain, —Electromagnetic Waves and Radiating Systemsl, 2nd Edition, PHI, 2000.
2. G.S.N Raju, —Antenna and Wave Propagationl, Pearson Education India, 3rd Edition 2009.
3. R K Shevgaonkar,l Electromagnetic Wavesl. Tata McGraw-Hill, 2006

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO-POPSO) Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	L		M	L	L					L	H	L	M
CO2	H	M	L		M	L	L					L	H	M	M
CO3	H	H	H	M	H	L	L					M	H	H	H
CO4	H	H	M	H	H	L	L		M	M		M	H	H	H
	H	M	L		M	M	M					M	H	M	M

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23ECT09 - MICROPROCESSORS AND MICROCONTROLLERS

Credits - 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives:

1. To learn the fundamental architectural concepts of microprocessors.
2. To gain knowledge about assembly language programming concepts.
3. To get familiar about 8086 interfacing.
4. To understand the fundamentals of the 8051 Microcontroller.
5. To learn interfacing with the 8051 Microcontroller.

Course Outcomes:

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

1. Learn the fundamental architectural concepts of microprocessors.
2. Gain knowledge about assembly language programming concepts.
3. Understand the concepts of 8086 interfacing.
4. Learn the fundamentals of the 8051 Microcontroller.
5. Know the interfacing with the 8051 Microcontroller.

UNIT I 8086 Architecture: Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.

UNIT II 8086 Programming: Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.

UNIT III 8086 Interfacing: Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, need for 8259 programmable interrupt controllers.

UNIT IV Microcontroller : Overview of 8051 microcontroller. Architecture. I/O Ports. Memory organization, Pin description of 8051 microcontroller, Machine cycle. Addressing Modes, Instruction set of 8051: Data transfer instructions, Arithmetic instructions, Logical Instructions, Stack related instructions, Branching instructions. Simple programs, Interrupts, timer/ Counter and serial communication.

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UNIT V Interfacing Microcontroller :- Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Architecture of PIC, Architecture of AVR, Architectuure of ARM.

Textbooks:

1. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rdEdition,1994.
2. K M Bhurchandi, A K Ray, Advanced Microprocessors and Peripherals, 3rd edition, McGraw Hill Education, 2017.
3. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, 2nd edition, Pearson, 2012.

References:

1. Ramesh S Gaonkar, Microprocessor Architecture Programming and Applications with the 8085, 6th edition, Penram International Publishing, 2013.
2. Kenneth J. Ayala, The 8051 Microcontroller, 3rd edition, Cengage Learning, 2004.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	H	L										H		
CO2	H	M	L	L		M				L			H	M	L
CO3			L	H	H									L	L
CO4		L		M	M	L	L				M		H	L	L
CO5			M	M	M	L				M	M		H	L	L

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23CST38: COMPUTER ARCHITECTURE AND ORGANIZATION
Professional Elective – I for EEE III Year – I semester

Credits–3 **Sessional Marks: 30**
L:T:P::3:0:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following:

1. How Computer Systems work & the basic principles, Instruction Level Architecture and Instruction Execution, the data is represented and the operations are carried out in the computer
2. Perform memory system design
3. Access I/O devices and its principles.
4. Enhance the knowledge on Instruction Level Parallelism
5. Develop the skills on micro programming.
6. Apply the concepts of advanced pipelining techniques.

Course Outcomes

After successful completion of course, the student should be able to

CO1. Understand the building blocks of computer, instruction execution cycle, I/O transfers, interrupts, and memory organization.
CO2. Identify addressing modes, and data/instruction formats, advantage of the pipelining and parallel processors.
CO3. Perform the arithmetic operations using various algorithms and number systems and design memory in various ways.
CO4. Detect errors in the transmission.
CO5. Compare various cache memory mapping techniques.

UNIT – I

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU, registers, instruction execution cycle, RTL Interpretation of instructions, addressing modes, instruction set, instruction formats.

UNIT – II

Data representation: signed number representation, fixed and floating-point representations, character representation. Algorithms for arithmetic operations: Addition, Subtraction, multiplication (Booth's, Modified Booth's) - division (restoring and non-restoring)

UNIT – III

Memory Organization: Memory systems hierarchy-Main memory organization-Types of Main memory- memory interleaving and its characteristics and performance- Cache memories: address mapping-line size- replacement and write policies, Reliability of memory systems- error detecting and error correcting systems.

UNIT – IV

Peripheral devices and their characteristics: Input-output subsystems, I/O device Interface, I/O transfers–program controlled, interrupt driven and DMA.

UNIT – V

Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards
Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache

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Textbooks

1. William Stallings, —Computer Organization and Architecture: Designing for Performancel, Pearson Education, 10th Edition, 2016.
2. David A. Patterson and John L. Hennessy, —Computer Organization and Design: The Hardware/Software Interface, Morgan Kaufmann, Elsevier, 5th Edition, 2011.

Reference Books

1. Carl Hamacher, —Computer Organization and Embedded Systemsl, McGraw Hill HigherEducation, 6th Edition, 2011.
2. Vincent P. Heuring, Harry F. Jordan, and T.G. Venkatesh, —Computer System Design and Architecturel, Pearson Education, 2nd Edition, 2008.

Web References

1. https://nptel.ac.in/courses/106/106/106106166/
2. https://nptel.ac.in/courses/106/105/106105163/

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	-	L	-	M	-	-	-	-	-	-	-	H	-	-
CO2	-	H	-	M	-	L	-	-	-	-	-	-	H	-	-
CO3	-	H	M	L	-	-	-	L	-	-	-	-	H	-	-
CO4	L	M	-	H	-	-	-	-	-		-	-	H	-	-
CO5	M	L	-	H	-	-	-	-	-	-	-	-	H	-	L

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SEMESTER III-I

B.TECH(ECE)-R23

23ECT14 - INFORMATION THEORY AND CODING

Credits - 3
L: T: P:: 3:0:0

Sessional Marks: 30
University Exam Marks: 70

Course Objectives:

1. To provide an insight into the concept of information in the context of communication theory and communication receivers.
2. To implement various source coding algorithms and analyze their performance.
3. To gain knowledge about techniques for error detection and error correction.
4. To design linear block codes and cyclic codes.
5. To get familiar with various convolutional codes.

Course Outcomes:

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

1. Learn the concepts of information in the context of communication theory and communication receivers.
2. Implement various source coding algorithms and analyze their performance.
3. Gain knowledge about techniques for error detection and error correction.
4. Design linear block codes and cyclic codes.
5. Understand various convolutional codes.

UNIT I

Information Theory: Introduction, Definition of Entropy, Conditional Entropy, Relative Entropy, Basic Properties of Entropy, Mutual Information, Information Inequalities, Problem solving.

Block to Variable length Coding: Prefix-free Code, Coding a single Random Variable, Prefix, Free Code, Kraft Inequality, Bounds on optimal Code length, Coding a Single Random Variable, Rooted Tree with Probabilities, Shanon-Fano Coding, Free fix code, Coding an information Source, Huffman Coding, Example.

Variable to Block Length Coding: Proper message set, Assigning probabilities to K-ary rooted tree corresponding to a proper message set, Prefix free Coding of a proper message set, Tunstall message set, Tunstall coding.

UNIT II

Asymptotic Equi-partition Property, Chebyshev inequality, Weak law of large numbers, Typical Sequences, Block to Block Coding of DMS: Consequences of Asymptotic Equipartition Property, Problem solving.

Universal Source Coding: Lempel-Ziv Algorithm, LZ -77 Encoding and Decoding, Lempel-Ziv Welch (LZW) Algorithm, LZW Encoding, and Decoding.

Coding of Sources with memory, Channel Capacity, Noisy Channel Coding Theorem, Differential Entropy, Gaussian Channel, Rate Distortion Theory, Blahut-Arimoto Algorithm, problem solving.

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UNIT III

Error Control Coding: Introduction to Error Control Codes, Error Probability with Repetition in the Binary Symmetric Channel, Parity Check Bit Coding for Error Detection, Block Coding for Error Detection and Correction, The Hamming Distance, The upper bound of the Probability of Error with Coding, Soft Decision Decoding, Hard Decision Decoding.

UNIT IV

Linear Block Codes: Introduction to Linear Block Codes, Syndrome and Error Detection, Encoding Block Codes, Decoding of Block Codes, Single Parity Check bit Code, Repeated Codes, Hadamard Code, Hamming Code, Cyclic Codes, Generator and Parity-Check Matrices of Cyclic Codes, Encoding and Decoding of Cyclic Codes, BCH codes, Reed-Solomon Code.

UNIT V

Convolutional Coding, Code Generation, Decoding Convolutional Code, the Code Tree, Decoding in the presence of Noise, State and Trellis Diagrams, The Viterbi Algorithm, Comparison of Error Rates in Coded and Uncoded Transmission, Turbo Codes, LDPC codes, Hard and Soft Decision Decoding.

Textbooks:

1. Thomas M.Cover, Joy A. Thomas, Elements of Information Theory, John Wiley & Sons,2nd Edition, 2006.
2. Herbert Taub, Donald L Shilling, Goutam Saha, Principles of Communication Systems, 4th Edition, McGraw Hill, 2017.

References:

1. Shu Lin, Daniel J. Costello Jr., Error Control Coding, Pearson, Second Edition, 2013.
2. Simon Haykin, Communication Systems, John Wiley, 4th Edition, 2010.

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	H	L										L	M	
CO2	H	L	H	M									M	H	
CO3	L	L	H	M									M	H	
CO4	M	M		L									L	M	H
CO5			H	M					L	M	L	M		M	H

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23ECT15 - DETECTION AND ESTIMATION THEORY

Credits - 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives:

1. To understand the impact of white Gaussian noise on the detection of signals.
2. To analyze the detection of deterministic signals and random signals.
3. To learn about the nonparametric detections.
4. To analyze estimation signal parameter and apply suitable estimation techniques.
5. To understand the signal estimation in Discrete-Time techniques.

Course Outcomes:

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

1. Understand the impact of white Gaussian noise on the detection of signals.
2. Analyze the detection of deterministic signals and random signals.
3. Learn about the nonparametric detections.
4. Analyze estimation signal parameter and apply suitable estim.ation techniques.
5. Understand the signal estimation in Discrete-Time techniques

UNIT 1

Statistical Decision Theory: Review of Gaussian variables and processes; problem formulation and objective of signal detection and signal parameter estimation in discrete-time domain. Bayesian, minimax, and Neyman-Pearson decision rules, likelihood ratio, receiver operating characteristics, composite hypothesis testing, locally optimum tests, detector comparison techniques, asymptotic relative efficiency.

UNIT 2

Detection of Deterministic Signals: Matched filter detector and its performance; generalized matched filter; detection of sinusoid with unknown amplitude, phase, frequency and arrival time, linear model.

Detection of Random Signals: Estimator-correlator, linear model, general Gaussian detection, detection of Gaussian random signal with unknown parameters, weak signal detection

UNIT 3

Nonparametric Detection: Detection in the absence of complete statistical description of observations, sign detector, Wilcoxon detector, detectors based on quantized observations, robustness of detectors.

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UNIT 4

Estimation of Signal Parameters: Minimum variance unbiased estimation, Fisher information matrix, Cramer-Rao bound, sufficient statistics, minimum statistics, complete statistics; linear models; best linear unbiased estimation; maximum likelihood estimation, invariance principle; estimation efficiency; Bayesian estimation: philosophy, nuisance parameters, risk functions, minimum mean square error estimation, maximum a posteriori estimation.

UNIT 5

Signal Estimation in Discrete-Time: Linear Bayesian estimation, Weiner filtering, dynamical signal model, discrete Kalman filtering.

Text books:

1. H. L. Van Trees, "Detection, Estimation and Modulation Theory: Part I, II, and III", John Wiley, NY, 1968.
2. H. V. Poor, "An Introduction to Signal Detection and Estimation", Springer, 2/e, 1998.

Reference books:

1. S. M. Kay, "Fundamentals of Statistical Signal Processing: Estimation Theory", Prentice Hall PTR, 1993.
2. S. M. Kay, "Fundamentals of Statistical Signal Processing: Detection Theory", Prentice Hall PTR, 1998.

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	SO2	SO3
CO1	H	M											H		
CO2	H	M											H		
CO3	H	M											H		
CO4	H	M	H										H	M	
CO5															H

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23MUP01: MUSIC - VOCAL

Credits-3
L:T:P::2:0:2

Sessional Marks: 30
University Marks:70

Course Objectives

To expose the students to the following:

1. To impart basic knowledge on Indian classical music
2. Description of basic systematic traditional training in Carnatic music.
3. Training of voice culture is necessary for a student to learn music properly.

Course Outcomes

After successful completion of course, the student should be able to

CO1. Enhance musical interest in students after completion
CO2. Perform sulabha kirtanas on the stage with the Systematic learning
CO3. Through music, students learn team work Focus, and improvisational skills. Music awakens new perceptions in students which help them learn and think in new ways.

LEVEL – 1
THEORY

UNIT – I: Basic knowledge of the following technical terms:

1. Sangita
2. Sruti
3. Vaggeyakara
4. Nada
5. Swarasthanas
6. Arohana
7. Avarohana
8. Sthayi
9. Dhatu
10. Matu
11. Avarta
12. Trikala
13. Tala
14. Raga
15. Sapta Talas
16. Jati
17. Murchana
18. Abhyasagana

UNIT – II: Rachana Lakshanas

1. Gita
2. Lakhana Gita

UNIT – III: Life histories and contribution of the following composers

1. Purandara Dasa
2. Paidala Gurumurthi Sastri

UNIT – IV: Tala

Sapta talas and Scheme of 35 Talas

UNIT – V: Raga Lakshanas

1. Mayamalavagaula
2. Malahari
3. Mohana

R.N.S. Sadeswan

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PRACTICAL

1. Saraliswaras.....	8
2. Jantaswaras.....	6
3. Datuswaras.....	2
4. HetchuSthayiswaras.....	1
5. TagguSthayiswaras.....	1
6. Alankaras.....	7
7. Gitas	
a. Sri Gananatha.....	Malahari
b. Varavina.....	Mohana
c. Annamayya Keerthana ...	1
d. Bhadrachala Ramadas Keerthana	1

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SEMESTER III-I

B.TECH(ECE)-R23

23ECP05 - ANALOG & DIGITAL IC APPLICATIONS LAB

Credits – 1.5
L: T: P:: 0:0:3

Sessional Marks: 30
University Exam Marks: 70

Course Objectives:

1. To design an Inverting and Non-inverting Amplifier using an Op Amp.
2. To demonstrate the Linear and Non-Linear Applications using IC 741.
3. To design Astable and Monostable Multivibrator using timer ICs.
4. To analyse the DAC and ADC converter.
5. To design Counters and Registers using digital ICs.

Course Outcomes:

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

1. Design an Inverting and Non-inverting Amplifier using an Op Amp.
2. Demonstrate the Linear and Non-Linear Applications using IC 741.
3. Design Astable and Monostable Multivibrator using timer ICs.
4. Analyse the DAC and ADC converter.
5. Design Counters and Registers using digital ICs.

List of Experiments: (At least 8 Linear and 4 Digital IC experiments shall be performed).

1. Design an Inverting and Non-inverting Amplifier using Op Amp and calculate gain.
2. Design Adder and Subtractor using Op Amp and verify addition and subtraction process.
3. Design a Comparator using Op Amp and draw the comparison results of A=B, A>B, A<B
4. Design a Integrator and Differentiator Circuits using IC741 and derive the required condition practically.
5. Design a Active LPF, HPF cutoff frequency of 2 KHZ and find the roll off of it.
6. Design a Circuit using IC741 to generate sine/square/triangular wave with period of 1KHZ and draw the output waveform.
7. Construct Mono-stable Multivibrator using IC555 and draw its output waveform.
8. Construct AstableMultivibrator using IC555 and draw its output waveform and also find its duty cycle.
9. Design a Schmitt Trigger Circuit and find its LTP and UTP.
10. Design Voltage Regulator usingIC723, IC 7805/7809/7912 and find its load regulation factor.
11. Design R-2R ladder DAC and find its resolution and write a truth table with respective voltages.
12. Design Parallel comparator type/ counter type/ successive approximation ADC and find its efficiency.
13. Design a 8x1 multiplexer using digital ICs.
14. Design a 4-bit Adder/Subtractor using digital ICs
15. Design a Decade counter and verify its truth table and draw respective waveforms.
16. Design a Up/down counter usingIC74163 and draw read/write waveforms.
17. Design a Universal shift register using IC 74194/195 and verify its shifting operation.
18. Design a 8x3 encoder/3x8 decoder and verify its truth table.

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C rse Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO- PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	M	M	L	H	M						L	H	H	H
CO2	M	M	M	L	H	M						M	H	H	H
CO3	L	M	H	H	H	M				L	L	H	M	M	H
CO4	H	H	M		H				M	H		M	H	M	L
CO5	L	H	L		H				M			H	H	M	

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23ECP06 - MICROPROCESSORS AND MICROCONTROLLERS LAB

Credits – 1.5 **Sessional Marks: 30**
L: T: P:: 0:0:3 **University Exam Marks: 70**

Course Objectives:

1. To become skilled in 8086 Assembly Language programming.
2. To understand the detailed software and hardware structure of the microprocessor.
3. Train their practical knowledge through laboratory experiments.
4. To understand and learn 8051 Microcontroller.
5. To acquire knowledge on microprocessors and microcontrollers, interfacing various peripherals, and configuring.

Course Outcomes:

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

1. Formulate a program and implement algorithms using Assembly language.
2. Describe an Assembly language program for the 8086 Microprocessor.
3. Develop programs for different applications in the 8086 Microprocessor.
4. Interface peripheral devices with 8086 and 8051.
5. Use an Assembly/Embedded C programming approach for solving real-world problems.

List of Experiments: (Any TEN of the experiments are to be conducted)

1. **Programs for 16 Bit Arithmetic Operations** (Using various addressing modes)
   a) Write an ALP to Perform Addition and Subtraction of Multi precision numbers.
   b) Write an ALP to Perform Multiplication and division of signed and unsigned Hexadecimal numbers.
   c) Write an ALP to find square, cube and factorial of a given number.

2. **Programs Involving Bit Manipulation Instructions**
   a) Write an ALP to find the given data is positive or negative.
   b) Write an ALP to find the given data is odd or even.
   c) Write an ALP to find Logical ones and zeros in a given data.

3. **Programs on Arrays for 8086**
   a) Write an ALP to find Addition/subtraction of N no_s.
   b) Write an ALP for finding largest/smallest no.
   c) Write an ALP to sort given array in Ascending/descending order.
4. **Programs on String Manipulations for 8086**
   a) Write an ALP to find String length.
   b) Write an ALP for Displaying the given String.
   c) Write an ALP for Comparing two Strings.
   d) Write an ALP to reverse String and Checking for palindrome.

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5. **Programs for Digital Clock Design Using 8086**
   a) Write an ALP for Designing clock using INT 21H Interrupt.
   b) Write an ALP for Designing clock using DOS Interrupt Functions.
   c) Write an ALP for Designing clock by reading system time.

6. **Interfacing Stepper Motor with 8086**
   a) Write an ALP to 8086 processor to Interface a stepper motor and operate it in clockwise by choosing variable step-size.
   b) Write an ALP to 8086 processor to Interface a stepper motor and operate it in Anti-clockwise by choosing variable step-size.

7. **Interfacing ADC/DAC with 8086**
   a) Write an ALP to 8086 processor to Interface ADC.
   b) Write an ALP to 8086 processor to Interface DAC and generate Square Wave/Triangular Wave/Stepsignal.

8. **Communication between Two Microprocessors**
   a) Write an ALP to have Parallel communication between two microprocessors using 8255
   b) Write an ALP to have Serial communication between two microprocessor kits using 8251.

9. **Programs using Arithmetic and Logical Instructions for 8051**
   a) Write an ALP to 8051 Microcontroller to perform Arithmetic operations like addition, subtraction,
   b) Multiplication and Division.
   c) Write an ALP to 8051 Microcontroller to perform Logical operations like AND, OR and XOR.
   d) Programs related to Register Banks.

10. **Programs to Verify Timers/Counters of 8051**
    a) Write a program to create a delay of 25msec using Timer0 in mode 1 and blink all the Pins of P0.
    b) Write a program to create a delay of 50 μsec using Timer1 in mode 0 and blink all the Pins of P2.
    c) Write a program to create a delay of 75msec using counter0 in mode 2 and blink all the Pins of P1.
    d) Write a program to create a delay of 80 μsec using counter1 in mode 1 and blink all the Pins of P3.

11. **UART Operation in 8051**
    a) Write a program to transfer a character serially with a baud rate of 9600 using UART.
    b) Write a program to transfer a character serially with a baud rate of 4800 using UART.
    c) Write a program to transfer a character serially with a baud rate of 2400 using UART.

12. **Interfacing LCD with 8051**
    a) Develop and execute the program to interface16*2 LCD to 8051.
    b) Develop and execute the program to interface LCD to 8051 in 4-bit or 8-bit mode.

Reference Books:

1. Kenneth.J.Ayala. The 8051 microcontroller, 3rd edition, Cengage learning,2010.
2. Advanced microprocessors and peripherals-A.K ray and K.M.Bhurchandani, TMH, 2nd edition2006.

The 8051 Microcontroller and Embedded Systems: Using Assembly and C by Muhammad AliMazidi, Janice GillispieMazidi, Second Edition.

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Course Outcomes – Program Outcomes – ProgramSpecific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	H	L										L	L	
CO2	L	L	L	L		L				L			M		L
CO3			L	L	L									L	
CO4		L		M	M	L	L				L		H	L	L
CO5			M	M	M	L				M	M		H	L	L

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23ECS01 - PCB DESIGN AND PROTOTYPE DEVELOPMENT

Credits – 2 **Sessional Marks: 30**
L: T: P:: 0:1:2 **University Exam Marks: 70**

Course Objectives:

1. Identifying Electronic Components Symbols & Footprints.
2. To analyze the capability to produce PCBs of their circuit.
3. To effectively use the design rules & interfacing between schematic & PCB.
4. To analyze the concepts of Analog and Digital Circuits.
5. To fabricate a single-sided PCB using components.

Course Outcomes:

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

1. Students can design a schematic of their circuit.
2. Students can design PCB layout of their design.
3. Detailed description and practical of PCB designing.
4. Understand the basic concepts of Analog Circuits and Digital Circuits.
5. Students should identify the components and assemble them on PCB.

UNIT I

Fundamental of basic electronics: Component identification, Component symbols & their footprints, understand schematic, Creating new PCB, Browsing footprints libraries, Setting up the PCB layers, Design rule checking, Track width selection, Component selection, Routing and completion of the design

UNIT II

Introduction to PCB: Definition and Need/Relevance of PCB, Background and History of PCB, Types of PCB, Classes of PCB Design, Terminology in PCB Design, Different Electronic design automation (EDA)tools and comparison.

UNIT III

PCB Design Process: PCB Design Flow, Placement and routing, Steps involved in layout design, Artwork generation Methods - manual and CAD, General design factors for digital and analogue circuits, Layout and Artwork making for Single-side, double-side and Multilayer Boards, Design for manufacturability, Design-specification standards

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Practice Exercises: Any twelve experiments are to be done

1. Practice following PCB Design steps
   - Schematic Design: Familiarization of the Schematic Editor, Schematiccreation, Annotation, Netlist generation.
   - Layout Design: Familiarization of Footprint Editor, Mapping of components, Creation of PCB layout Schematic.
   - Create new schematic components.
   - Create new component footprint

Regulator circuit using 7805

2. Inverting Amplifier or Summing Amplifier using op-amp
3. Full-wave Rectifier
4. Astable multivibrator using IC555
5. Monostable multivibrator using IC555
6. RCPhase-shifter oscillator using transistor.
7. Wein-bridge Oscillator using op- amp
8. Full-Adder using half-adders.
9. 4-bit binary /MOD N counter using D-Flip flops.
10. One open-ended (analog/ digital/mixed circuit) experiments of similar nature and magnitude to the above are to be assigned by the teacher

    (Student is expected to solve and execute/simulate independently).
11. Design an 8051 Development board having Power section consisting of IC7805, capacitor, resistor, headers, LED.
12. Design an 8051 Development board having Serial communication section consisting of MAX 232, Capacitors, DB9connector,Jumper, LEDs
13. Design an 8051 Development board having Reset & Input/output sections consisting of 89C51 Microcontroller, Electrolytic Capacitor, Resistor, Jumper, Crystal Oscillator, Capacitors
14. Fabricate a single-sided PCB, mount the components and assemble them in a cabinet for any one of the circuits mentioned in the above exercises.

References:

1. Jon Varteresian, Fabricating Printed Circuit Boards, z, 2002
2. R. Tummala, Fundamentals of Microsystems Packaging, McGraw-Hill 2001
3. C. Robertson. PCB Designer's Reference. Prentice Hall, 2003
4. Open-source EDA Tool KiCad Tutorial: http://kicad-pcb.org/help/tutorials/ 13. PCB Fabrication user guide page:

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http://www.wikihow.com/Create-Printed-Circuit-Boards

http://www.siongboon.com/projects/2005-09-07_home_pcb_fabrication/

http://reprap.org/wiki/MakePCBInstructions#Making_PCBs_yourself

PCB Fabrication at home(video): https://www.youtube.com/watch?v=mv7Y0A9YeUc, https://www.youtube.com/watch?v=imQTCW1yWkg

Course outcomes-Program outcomes- Control Specific Outcomes (CO-PO-PSO)Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	M	M	L	H	M						L	H	H	H
CO2	M	M	M	L	H	M						M	H	H	H
CO3	L	M	H	H	H	M				L	L	H	M	M	H
CO4	H	H	M		H				M	H		M	H	M	L
CO5	L	H	L		H				M			H	H	M	

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SEMESTER III-I B.TECH(ECE)-R23

23BSP07 - TINKERING LAB

Credits – 1 **Sessional Marks: 30**
L: T: P:: 0:0:2 **University Exam Marks: 70**

The aim of tinkering lab for engineering students is to provide a hands-on learning environment where students can explore, experiment, and innovate by building and testing prototypes. These labs are designed to demonstrate practical skills that complement theoretical knowledge.

Course Objectives

1. Encourage Innovation and Creativity
2. Provide Hands-on Learning and Impart Skill Development
3. Foster Collaboration and Teamwork
4. Enable Interdisciplinary Learning, Prepare for Industry and Entrepreneurship
5. Impart Problem-Solving mind-set

Course Outcomes (COs)

By the end of this course, students will be able to:

1. Identify and analyze real-life problems that can be addressed through innovative solutions.
2. Apply fundamental scientific and engineering concepts to design creative models or prototypes.
3. Use laboratory tools, equipment, and software to build and test functional prototypes.
4. Collaborate effectively in teams to plan, design, and execute project-based activities.
5. Evaluate prototype performance, troubleshoot issues, and refine designs through iterative experiment.

These labs bridge the gap between academia and industry, providing students with the practical experience. Some students may also develop entrepreneurial skills, potentially leading to start- ups or innovation-driven careers. Tinkering labs aim to cultivate the next generation of engineers by giving them the tools, space, and mind-set to experiment, innovate, and solve real-world challenges.

List of experiments:

1) Make your own parallel and series circuits using breadboard for any application of your choice.
2) Demonstrate a traffic light circuit using breadboard.
3) Build and demonstrate automatic Street Light using LDR.
4) Simulate the Arduino LED blinking activity in Tinkercad.
5) Build and demonstrate an Arduino LED blinking activity using Arduino IDE.
6) Interfacing IR Sensor and Servo Motor with Arduino.
7) Blink LED using ESP32.
8) LDR Interfacing with ESP32.
9) Control an LED using Mobile App.

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10) Design and 3D print a Walking Robot
11) Design and 3D Print a Rocket.
12) Build a live soil moisture monitoring project, and monitor soil moisture levels of a remote plan in your computer dashboard.
13) Demonstrate all the steps in design thinking to redesign a motor bike.
14) Temperature and Humidity monitoring system (DHT11 + LCD)
15) Smart dustbin using ultrasonic sensor
16) Fire detection and alarm system
17) RFID based attendance system
18) Portable water quality tester
19) Smart Helmet for accident detection
20) AI based smart Irrigation
21) Facial recognition dustbin

Note: A minimum of 8 to 10 experiments must be completed by the students.
Students need to refer to the following links:

1) https://aim.gov.in/pdf/equipment-manual-pdf.pdf
2) https://atl.aim.gov.in/ATL-Equipment-Manual/
3) https://aim.gov.in/pdf/Level-1.pdf
4) https://aim.gov.in/pdf/Level-2.pdf
5) https://aim.gov.in/pdf/Level-3.pdf

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	L	L	L	H	L						H	H	L	H
CO2	H	M	H	M	H	L	L					M	H	H	H
CO3	H	M	H	M	H	L	L		H	M		M	H	H	H
CO4	H	M	H	M	H	L	M		H	M		M	H	H	H
CO5	H	M	H	M	H	M	H	L	M	M	M	H	H	H	H

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23ECI01 - EVALUATION OF SUMMER INTERNSHIP

Credits-2 **Sessional Marks: 50**

Course Objectives

By the end of the internship, students will be able to:

1. Apply theoretical knowledge to real-world tasks in a professional setting.
2. Develop essential workplace skills including communication, teamwork, and time management.
3. Gain insight into industry-specific practices and professional environments.
4. Exhibit professionalism, ethical behavior, and responsibility in the workplace.
5. Reflect on personal growth and career goals based on internship experiences.

Course Outcomes

Upon successful completion, students will be able to:

1. Integrate academic learning with practical experience in a relevant field.
2. Communicate effectively with supervisors, colleagues, and clients.
3. Solve workplace problems using critical thinking and creativity.
4. Demonstrate professional conduct and adherence to organizational norms.
5. Analyze and document internship experiences in a structured report or presentation.

Category	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)	Unsatisfactory (1)
Work Ethic	Highly motivated, always on time, meets all deadlines	Usually motivated, on time, meets most deadlines	Adequate motivation, occasional tardiness, meets basic expectations	Needs frequent reminders, often late or misses deadlines	Lacks motivation, consistently late, deadlines often missed
Professionalism	Always respectful, communicates clearly, well-groomed	Usually respectful, communicates effectively	Sometimes lacks professionalism, minor communication issues	Inconsistent behavior, lacks polish in communication	Unprofessional conduct, poor communication
Initiative & Problem Solving	Frequently takes initiative, solves problems independently	Often takes initiative, usually offers solutions	Sometimes takes initiative, needs guidance for problem solving	Rarely takes initiative, depends on others for solutions	Avoids responsibility, unwilling to solve problems
Teamwork & Collaboration	Works exceptionally well with others, promotes collaboration	Works well with team, contributes ideas	Gets along with others, but rarely contributes ideas	Struggles with teamwork, reluctant to cooperate	Does not participate or causes conflict
Learning & Adaptability	Actively learns new skills, adapts	Willing to learn, adapts with support	Accepts learning tasks, adapts slowly	Resists new tasks or changes	Unwilling to learn or change

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Category	Excellent (5) quickly	Good (4)	Satisfactory (3)	Needs Improvement (2)	Unsatisfactory (1)
Quality of Work	Consistently delivers high-quality, error-free work	Work is mostly high-quality with minor errors	Satisfactory quality, some errors	Work frequently contains errors	Poor quality, frequent and serious errors
Technical/Job-Specific Skills	Demonstrates strong skills, often exceeds expectations	Shows solid skills, meets expectations	Basic understanding of required skills	Limited skill application, needs development	Lacks required skills, does not meet expectations

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M	H	M	M	-	L	-	M	M	H	H	H	H	M
CO2	-	-	-	-	-	M	-	M	H	M	M	M	M	M	
CO3	H	H	H	M	H	-	M	-	M	H	M	H	H	H	H
CO4	-	-	-	-	M	M	H	M	M	M	M	-	M	-	-
CO5	M	M	M	M	M	-	-	-	M	H	M	H	M	M	M

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23ECT10 - DIGITAL SIGNAL PROCESSING

Credits - 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives:

1. To get familiar with the properties of discrete time signals, systems and z-transform.
2. To learn the importance of FFT algorithm for computation of Discrete Fourier Transform and Fast Fourier Transform with decimations.
3. To understand the implementations of digital filter structures.
4. To analyse the FIR filter design using Fourier series and windowing methods.
5. To gain the knowledge on Programmable DSP Devices.

Course Outcomes:

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

1. Familiar with the properties of discrete time signals, systems and z-transform.
2. Learn the importance of FFT algorithm for computation of Discrete Fourier Transform and Fast Fourier Transform with decimations.
3. Understand the implementations of digital filter structures.
4. Analyse the FIR filter design using Fourier series and windowing methods.
5. Gain the knowledge on Programmable DSP Devices.

UNIT I

Introduction to discrete time signals and systems: Introduction to digital signal processing,

Review of discrete-time signals and systems, Analysis of discrete-time linear time invariant systems, frequency domain representation of discrete time signals and systems

Z–Transform: Definition, ROC, Properties, Poles and Zeros in Z-plane, the inverse Z-Transform, System analysis, Transfer function, BIBO stability, System Response to standard signals, Solution of difference equations with initial conditions, Illustrative Problems, analysis of linear time-invariant systems in the z-domain, pole-zero stability.

UNIT II

Discrete Fourier Transform : Introduction, Discrete Fourier Series, properties of DFS, Discrete Fourier Transform, Inverse DFT, properties of DFT, Linear and Circular convolution, convolution using DFT, sampling, Quantization effects.

Fast Fourier Transform: Introduction, Fast Fourier Transform, Radix-2 Decimation in time and Decimation in frequency FFT, Inverse FFT (Radix-2).

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UNIT III

IIR Filters: Introduction to digital filters, Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital filters from analog filters by Impulse invariant and bilinear transformation methods, Frequency transformations, Basic structures of IIR Filters - Direct form-I, Direct form-II, Cascade form and Parallel form realizations.

UNIT IV

FIR Filters: Introduction, Characteristics of FIR filters with linear phase, Frequency response of linear phase FIR filters, Design of FIR filters using Fourier series and windowing methods (Rectangular, Triangular, Raised Cosine, Hanging, Hamming, Blackman), Comparison of IIR & FIR filters, Basic structures of FIR Filters – Direct form, Cascade form, Linear phase realizations.

UNIT V

Architectures for Programmable DSP Devices: Architecture of TMS320C5X: Introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Register ALU, Index Register, Block Move Address Register, Parallel Logic Unit, Memory mapped registers, program controller, some flags in the status registers, On- chip memory, On-chip peripherals.

Textbooks:

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

References:

1. S.K.Mitra, Digital Signal Processing – A practical approach , 2nd Edition, Pearson Education, New Delhi, 2004.
2. MH Hayes, Digital Signal Processing, Schaum's Outline series, TATA Mc-Graw Hill, 2007.
3. Robert J. Schilling, Sandra L. Harris, Fundamentals of Digital Signal Processing using Matlab, Thomson, 2007.

Course Outcomes-Program Outcomes – Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	L	M	M	M		L			M		M	H		
CO2	L	M	M	H	L	L				L			H	M	L
CO3	L	M	H	M	M	H		M		L				H	M
CO4	M		M	M	L	M	L	L	L	M		L	H	L	L
CO5		H	M	L	H	L			M	L	L	L	M	H	L

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23ECT11 - MICROWAVE AND OPTICAL COMMUNICATIONS

Credits - 3 **Sessional Marks: 30**

L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives:

1. To analyse different modes of operation in rectangular wave guides, circular wave guides and resonators.
2. To study and analyse various microwave components and microwave sources.
3. To gain knowledge on different microwave semiconductor devices and microwave measurements procedures.
4. To analyse different optical fiber modes and to study different types of distortions and losses in optical communication.
5. To study various optical sources, optical detectors and to analyze various optical links.

Course outcomes.

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

1. Analyze different modes of operation in rectangular wave guides, circular wave guides and resonators.
2. Understand andanalyze various microwave components and microwave sources.
3. Gain knowledge on different microwave semiconductor devices and microwave measurements procedures.
4. Analyze different optical fiber modes and to study different types of distortions and losses in optical communication.
5. Understand study various optical sources, optical detectors and to analyze various optical links.

UNIT I

Waveguides: Introduction, Rectangular waveguides, Field expressions for TE and TM modes, Wave propagation in the guide, Phase and group velocities, Power transmission and attenuation, Waveguide current and mode excitation, Circular waveguide – TE and TM modes(**Qualitative treatment only**), Wave propagation, Cavity resonators (**Qualitative treatment only**).

UNIT II

Passive Microwave Devices: Introduction to scattering parameters and their properties, Terminations, Variable short circuit, Attenuators, Phase shifters, Hybrid Tees (H-plane, E-plane, Magic Tees), Directional Couplers – Bethe hole and Two hole Couplers, Deriving Scattering matrix for Microwave passive devices. Microwave propagation in Ferrites, Gyrator, Isolator, Circulator.

Microwave Amplifiers and Oscillators: Microwave Tubes: Linear Beam Tubes – Two cavity Klystron amplifier -velocity modulation, bunching process, output power, Reflex Klystron oscillator, power output and efficiency, Travelling Wave Tube (TWT) – Bunching process and amplification process (**Qualitative treatment only**). Crossed Field Tubes – Magnetron oscillator, pi-mode operation, power output and efficiency, Hartree Condition.

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UNIT III

Microwave Semiconductor Devices: Gunn Oscillator – Principle of operation, Characteristics, Two valley model, IMPATT, TRAPATT diodes.

Microwave Measurements: Description of Microwave bench-different blocks and their features, errors and precautions, Microwave power measurements, Measurement of attenuation, frequency, VSWR (low, medium, high), Measurement of _Q' of a cavity, Impedance measurements.

UNIT IV

Introduction to Optical Fibers and Transmission Characteristics - The propagation of light in optical waveguides – Classification of optical fibers – Numerical aperture, Step index and Graded index fiber – Modes in cylindrical fiber – Linearly polarized modes, Attenuation: Absorption, Scattering, Bending losses. Modal dispersion and chromatic dispersion – Single mode fiber - waveguide dispersion– MFD – PMD

UNIT V

Optical Transmitters and Receivers: Optical Sources: - Light source materials – LED homo and hetero structures – surface and edge emitters – Quantum efficiency – Injection Laser Diode – Modes and threshold condition – Structures and Radiation Pattern. Optical detectors: – Physical principles – PIN and APD diodes – Photo detector noise

Optical Link Design: Point- to- point links – System considerations – Link Power budget – Rise time budget.

Textbooks:

1. David M. Pozar,l Microwave Engineeringl John Wiley & Sons, Inc. 4th edition, 2012
2. Samuel Y. Liao, —Microwave Devices and Circuitsl, PHI publications, Third Edition, 1997.
3. Gerd Keiser, —Optical Fiber Communicationsl, McGraw Hill, Third Edition, 2000.

References:

1. R. E. Collin, —Foundations for Microwave Engineeringl, Wiley Student Edition, Second Edition, 2009.
2. Om. P. Gandhi, —Microwave: Engineering and Applicationsl, Kai Fa Book Company, 1981.
3. Reich H. J., et al, —Microwave Principlesl, MIT Press, 1972.
4. F E Terman, —Electronic and Radio Engineeringl, McGraw Hill, 4th Edition, 1984

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Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H	M	M	M					L		M	H	M	
CO2	H	H	M	M	H					L		M	H	H	
CO3	H	H	M	H	H					L		M	H	H	
CO4	H	H	M	H	M					L		M	H	H	
CO5	H	H	M	H	H					L		M	H	H	

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23ECT12 - VLSI DESIGN

Credits - 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives:

1. To understand the steps involved in fabrication of ICs using MOS transistor technology.
2. To learn about the VLSI design processes, Stick diagrams and Layouts.
3. To gain knowledge on the Gate Level Design concepts.
4. To learn the design of various subsystems with different VLSI Design styles.
5. To get familiar with CMOS testing techniques.

Course Outcomes:

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

1. Understand the steps involved in fabrication of ICs using MOS transistor technology.
2. Learn about the VLSI design processes, Stick diagrams and Layouts.
3. Gain knowledge on the Gate Level Design concepts.
4. Learn the design of various subsystems with different VLSI Design styles.
5. Familiar with CMOS testing techniques.

UNIT I

Introduction: Brief Introduction to IC technology MOS, PMOS, NMOS, CMOS & BiCMOS Technologies. Basic Electrical Properties of MOS and BiCMOS Circuits: I_{DS} - V_{DS} relationships, MOS transistor Threshold Voltage, figure of merit, Transconductance, Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

UNIT II

VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, Lambda(λ)-based design rules for wires, contacts and Transistors, Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling.

UNIT III

Gate level Design: Logic gates and other complex gates, Switch logic, Alternate gate circuits. Basic Circuit Concepts: Sheet Resistance Rs and its concepts to MOS, Area Capacitances calculations, Inverter Delays, Driving large Capacitive Loads, Wiring Capacitances, Fan-in and fan-out

UNIT IV

Subsystem Design: Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Counters. VLSI Design styles: Full-custom, Standard Cells, Gate-arrays, FPGAs, CPLDs and Design Approach for Full-custom and Semi-custom devices, parameters influencing low power design.

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UNIT V

CMOS Testing: Need for testing, Design for testability - built in self-test (BIST) – testing combinational logic –testing sequential logic – practical design for test guide lines – scan design techniques.

Textbooks:

1. Essentials of VLSI Circuits and Systems, Kamran Eshraghian, EshraghianDougles, A. Pucknell, 2005, PHI.
2. Modern VLSI Design – Wayne Wolf, 3 Ed., 1997, Pearson Education.

References:

1. CMOS VLSI Design-A Circuits and Systems Perspective, Neil H.E Weste, David Harris, Ayan Banerjee, 3rd Edn, Pearson, 2009.
2. BehzadRazavi , —Design of Analog CMOS Integrated Circuitsl, McGraw Hill, 2003.
3. Jan M. Rabaey, —Digital Integrated Circuitsl, AnanthaChandrakasan and Borivoje Nikolic, Prentice-Hall of India Pvt.Ltd, 2nd edition, 2009.

Course Outcomes-Program Outcomes -Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	L											H		
CO2		H	H	M	M								M	H	
CO3	H	L		L										M	L
CO4		L	H	M										L	M
CO5		M	H	L										M	H

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23ECT16 - ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

Credits - 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives:

1. To know about the performance characteristics of instruments and measurement of electrical quantities.
2. To understand the construction, working and applications of different types of CRO's.
3. To analyze the working of different types of bridges.
4. To study the working of signal & function generators and analyzers.
5. To analyze the working of sensors and transducers in measuring physical parameters.

Course Outcomes:

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

1. Learn about the performance characteristics of instruments and measurement of electrical quantities.
2. Understand the construction, working and applications of different types of CRO's.
3. Compare the working of different types of bridges.
4. Know the working of signal & function generators and analyzers.
5. Grasp the working of sensors and transducers in measuring physical parameters.

UNIT-I

Performance characteristics of Instruments: Static characteristics, Accuracy, Precision, Resolution, Sensitivity, static and dynamic calibration, Errors in Measurement, and their statistical analysis, dynamic characteristics-speed of Response, fidelity, Lag and dynamic error. DC ammeters, DC voltmeters-multirange, range extension/solid state and differential voltmeters, AC voltmeters–multirange, range extension. Thermocouple type RF ammeter, ohm meters, series type, shunt type, multimeter for voltage, current and resistance measurements.

UNIT-II

Oscilloscopes: Introduction, Basic Principle, Standard specifications of CRO,CRT features, vertical and horizontal amplifiers, horizontal and vertical deflection systems, sweep trigger pulse, delay line, sync selector circuits, probes for CRO – active, passive, and attenuator type, triggered sweep CRO, and Delayed sweep, dual trace/beam CRO, Measurement of amplitude, frequency and phase (Lissajous method). Principles of sampling oscilloscope, storage oscilloscope, and digital storage oscilloscope, Digital frequency counters, time & Period measurements.

UNIT-III

Bridges: DC Bridges for Measurement of resistance: Wheat stone bridge, Kelvin's Bridge, AC Bridges for Measurement of inductance- Maxwell's bridge, Hay's Bridge, Anderson bridge. Measurement of capacitance- Schearing Bridge, Wien Bridge. Errors and precautions in using bridges.

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UNIT-IV

Signal Generators: Signal generator-fixed and variable, AF oscillators, function generators, pulse, random noise, sweep, and arbitrary waveform generators, their standards, specifications and principles of working (Block diagram approach).Wave analyzers, Harmonic distortion analyzers, Spectrum analyzers, and Logic analyzers.

UNIT-V

Sensors and Transducers - Active and passive transducers: Measurement of displacement (Resistance, capacitance, inductance; LVDT) Force (strain gauges) Pressure (piezoelectric transducers) Temperature (resistance thermometers, thermocouples and thermistors), Velocity, Acceleration, Vibration, pH measurement Signal Conditioning Circuits.

TEXT BOOKS:

1. A.D. Helfrick and W.D. Cooper, —Modern Electronic Instrumentation and Measurement Techniquesl, 5th Edition, PHI, 2002.
2. H.S.Kalsi, —Electronic Instrumentationl, 2nd edition, Tata McGraw Hill, 2004.

REFERENCES:

1. David A. Bell, —Electronic Instrumentation & Measurementsl, 2nd Edition, PHI, 2003.
2. K. Lal Kishore, —Electronic Measurements & Instrumentationsl, Pearson Education, 2009.

Course Outcomes – Program Outcomes – ProgramSpecific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	L		L	M						L	L	H		L
CO2	M	L			L					L	L	L	M	L	
CO3	H	L		L	M								H	M	M
CO4	M				L		L				M	L	H	H	L
CO5	M	L	M		L	L				M		M	L	H	L

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23ECT17 - EMBEDDED SYSTEMS

Credits - 3
L: T: P:: 3:0:0

Sessional Marks: 30
University Exam Marks: 70

Course Objectives:

1. To understand the history, classification, and design process of embedded systems.
2. To explore the core components of embedded systems, including processors, memory, and I/O components.
3. To introduce onboard and external communication interfaces used in embedded systems.
4. To explain different firmware design approaches and programming techniques for embedded systems.
5. To provide an understanding of real-time operating systems and task management in embedded systems.

Course Outcomes:

After completing the course, the student will be able to,

1. Classify embedded systems based on their purpose, generation, and complexity.
2. Identify and select appropriate hardware components for an embedded system design.
3. Differentiate and implement various communication protocols like I2C, SPI, and CAN.
4. Develop firmware using assembly and high-level programming languages.
5. Analyze and apply RTOS-based task scheduling and synchronization techniques.

UNIT I
Introduction to Embedded Systems

History of embedded systems, Classification of embedded systems based on generation and complexity, Purpose of embedded systems, The embedded system design process-requirements, specification, architecture design, designing hardware and software, components, system integration, Applications of embedded systems, and characteristics of embedded systems.

UNIT II
Typical Embedded System

Core of the embedded system-general purpose and domain specific processors, ASICs, PLDs, COTs; Memory-ROM, RAM, memory according to the type of interface, memory shadowing, memory selection for embedded systems, Sensors, actuators, I/O components: seven segment LED, relay, piezo buzzer, push button switch, other sub-systems: reset circuit, brownout protection circuit, oscillator circuit real time clock, watch dog timer.

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UNIT III

Communication Interface

Onboard communication interfaces-I2C, SPI, CAN, parallel interface; External communication interfaces-RS232 and RS485, USB, infrared, Bluetooth, Wi-Fi, ZigBee, GPRS, GSM.

UNIT IV

Embedded Firmware Design and Development

Embedded firmware design approaches-super loop based approach, operating system based approach; embedded firmware development languages-assembly language based development, high level language based development.

UNIT V

RTOS based Embedded System Design

Operating system basics, types of operating systems, tasks, process and threads, multiprocessing and multitasking, task scheduling: non-pre-emptive and pre-emptive scheduling; task communication-shared memory, message passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/ Synchronization Issues, Task Synchronization Techniques

Textbooks:

1. Introduction to Embedded Systems - Shibu KV, Mc Graw Hill Education.
2. Computers as Components –Wayne Wolf, Morgan Kaufmann (second edition).

References:

1. Embedded System Design -Frank Vahid, Tony Grivargis, john Wiley.
2. Embedded Systems- An integrated approach - Lyla b das, Pearson education 2012.
3. Embedded Systems – Raj Kamal, TMH

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		L				M						H		
CO2	L	M	H	M	L					L				M	H
CO3				M	H		L		L	M	L		L	M	H
CO4		L	M	H				L	M		M	L		L	H
CO5			M	L		H	L	M	L	L	M	M	L	H	M

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23MET33: INTRODUCTION TO INDUSTRIAL ROBOTICS

Credits - 3 | **Sessional Marks: 30**

L: T: P:: 3:0:0 | **University Exam Marks:70**

To expose the students to the following

Course objectives:

1. Discuss various applications and components of industrial robot systems
2. Learn about the types of actuators used in robotics
3. Calculate the forward kinematics and inverse kinematics.
4. Learn about programming principles and languages for a robot control system
5. Discuss the applications of image processing and machine vision in robotics.

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

CO1 : Discuss various applications and components of industrial robot systems

CO2: Learn about the types of actuators used in robotics

CO3: Calculate the forward kinematics and inverse kinematics.

CO4: Learn about programming principles and languages for a robot control system

CO5: Discuss the applications of image processing and machine vision in robotics

UNIT – 1

INTRODUCTION: Automation and Robotics, CAD/CAM and Robotics – An overview of Robotics –present and future applications – classification by coordinate system and control system.

COMPONENTS OF THE INDUSTRIAL ROBOTICS:

Robot anatomy, work volume, components, number of degrees of freedom - robot drive systems, function line diagram representation of robot arms, common types of arms -- requirements and challenges of end effectors, determination of the end effectors.

UNIT – 2

ROBOT ACTUATORS AND FEED BACK COMPONENTS:

Actuators: Pneumatic, Hydraulic actuators, electric& stepper motors. Comparison of Electric, Hydraulic and Pneumatic types of actuation devices. Feedback components: position sensors–potentiometers, resolvers, encoders–Velocity sensors.

UNIT – 3

MOTION ANANALYSIS: Homogeneous transformations as applicable to rotation and translation –problems.

MANIPULATOR KINEMATICS: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics–problems.

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UNIT – 4

GENERAL CONSIDERATIONS IN PATH DESCRIPTION AND GENERATION: Trajectory planning and avoidance of obstacles. path planning. Skew motion. joint integrated motion –straight line motion–Robot programming. languages and software packages-description of paths with a robot programming language.

UNIT – 5

IMAGE PROCESSING AND MACHINE VISION: Introduction to Machine Vision. Sensing and Digitizing function in Machine Vision. Training and Vision System. Robotic Applications.

TEXTBOOKS:

1. Industrial Robotics/GrooverMP/Pearson Edu.
2. Robotics and Control /MittalR K &Nagrathi J /TMH.

REFERENCES:

1. Robotics/Fu KS/ McGraw Hill.
2. Robotic Engineering /Richard D. Klafter, PrenticeHall
3. Robot Analysis and Control/ H. Asada and J.J.E. Slotine/BSP Books Pvt.Ltd
4. Introduction to Robotics/John J Craig/PearsonEdu.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO)Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H				M					M			M	M	M
CO2	M	H												M	
CO3		M	H							M			M	M	L
CO4	M	H								M					
			H							M					M

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23BST13: TECHNICAL PAPER WRITING & IPR

Credits – 3 **Sessional Marks: 30**
L:T:P:C::2:0:0:0 **University Exam Marks: 70**

Course Objectives:

1. To enable the students to practice the basic skills of research paper writing
2. To make the students understand the importance of IP and to educate them on the basic concepts of Intellectual Property Rights.
3. To practice the basic skills of performing quality literature review
4. To help them in knowing the significance of real life practice and procedure of Patents.
5. To enable them learn the procedure of obtaining Patents, Copyrights, & Trade Marks

Course Outcomes: On successful completion of this course, the students will be able to:

COURSE OUTCOMES: At the end of the course, students will be able to		**Blooms Level**
CO1	Identify key secondary literature related to their proposed technical paper writing	L1, L2
CO2	Explain various principles and styles in technical writing	L1, L2
CO3	Use the acquired knowledge in writing a research/technical paper	L3
CO4	Analyse rights and responsibilities of holder of Patent, Copyright, Trademark, International Trademark etc.	L4
CO5	Evaluate different forms of IPR available at national & international level	L5
CO6	Develop skill of making search of various forms of IPR by using modern tools and techniques.	L3, L6

UNIT – I:

Principles of Technical Writing: styles in technical writing; clarity, precision, coherence and logical sequence in writing-avoiding ambiguity- repetition, and vague language -highlighting your findings discussing your limitations -hedging and criticizing -plagiarism and paraphrasing.

UNIT – II:

Technical Research Paper Writing: Abstract- Objectives-Limitations-Review of Literature-Problems and Framing Research Questions- Synopsis

UNIT – III:

Process of research: publication mechanism: types of journals- indexing-seminars conferences- proof reading –plagiarism style; seminar & conference paper writing; Methodology-discussion-results citation rules

UNIT – IV:

Introduction to Intellectual property: Introduction, types of intellectual property, International organizations, agencies and treaties, importance of intellectual property rights

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

UNIT – V:

Law of copy rights: Fundamentals of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer. Patent law, intellectual property audits.

Textbooks:

1. Deborah. E. Bouchoux, *Intellectual Property Rights*, Cengage Learning India, 2013
2. Meenakshi Raman, Sangeeta Sharma. *Technical Communication:Principles and practices.*Oxford.

Reference Books:

1. R.Myneni, *Law of Intellectual Property*, 9th Ed, Asia law House, 2019.
2. Prabuddha Ganguli,*Intellectual Property Rights* Tata Mcgraw Hill, 2001
3. P.Naryan,*Intellectual Property Law*, 3rd Ed ,Eastern Law House, 2007.
4. Adrian Wallwork. *English for Writing Research Papers*Second Edition. Springer Cham Heidelberg New York ,2016
5. Dan Jones, Sam Dragga, *Technical Writing Style*

Online Resources:

1. **https://theconceptwriters.com.pk/principles-of-technical-writing/**
2. **https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting.html**

3. https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting.html
4. https://www.manuscriptedit.com/scholar-hangout/process-publishing-research-paper-journal/
5. https://www.icsi.edu/media/website/IntellectualPropertyRightLaws&Practice.pdf
6. https://lawbhoomi.com/intellectual-property-rights-notes/
7. https://www.extension.purdue.edu/extmedia/ec/ec-723.pdf

Course Outcomes – Program Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	L	M	M	L	–	M	L	H	–	M
CO2	M	M	L	M	L	–	–	M	M	H	–	M
CO3	H	M	M	H	M	L	–	M	M	H	L	H
CO4	M	M	L	M	M	H	M	H	L	M	M	H
CO5	M	M	–	M	M	H	M	H	L	M	M	H
CO6	M	M	L	H	H	M	-	-	-	-	-	-

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23MUP02: DANCE - BHARATANATYAM

Credits-3
L:T:P::2:0:2

Sessional Marks: 30
University Marks:70

Course Objectives

To expose the students to the following:

1. To inculcate basic knowledge on Indian classical dance (Bharatanatyam)
2. Description of South and North Indian Classical Dances
3. To make the students have an introduction to the basics of theory in dance as regards technique
4. To introduce & understand the basic body movements of dance
5. Explanation of technical terms in dance
6. Learning the importance of dance technique items and develop an understanding through the descriptions of the items learnt in the dance practical

Course Outcomes

After successful completion of course, the student should be able to

CO1. Learn advanced lessons classical dance after the course

CO2. Demonstrate small dance items on stage with the strength from the course designed

CO3. Through dance, students learn team work & Focus, and improvisational skills. Dance awakens new perceptions in students which help them to learn and think in new ways

1.1 Theory:

1. Origin of Dance as per Bharata's Natya Sastra
2. Various forms of Indian Classical Dances and their places of origin
3. Definition of the following Technical Terms:
    a. Nritta
    b. Nritya
    c. Natya
4. Asamyutha Hastas and Samyutha Hastas as per Abhinaya Darpana

1.2 Practical: (Practicum Fundamental)

1. Warm ups: Body flexibility exercises & Namaskaram
2. Demonstration of the bellow mentioned Adavus (steps) in all 3 speeds:
    a. Thattadavu: Tei ya tei (6)
    b. Nattadavu: Tei yum tat ta (6)
    c. Paraval Adavu: Taa tei tei taa;di tei tei taa (2)
    d. Jaaradavu: Tei yaa – Tei hi (2)
    e. Tattakuditta mettadavu: Tat tei;-taaha (2)
    f. Kuditta mettadavu: Tei hat tei hi (2)
    g. Teermana Adavu: Gin na tom (2)
    h. Tattimettu: (Chaturasra) (2)
3. Slokaabhinayam - 2
4. Annamayya Keertanam - 1

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23ECP07 - MICROWAVE AND OPTICAL COMMUNICATIONS LAB

Credits – 1.5 **Sessional Marks: 30**
L: T: P:: 0:0:3 **University Exam Marks: 70**

Course Objectives:

1. To understand the working of microwave bench set up and characteristics of microwave sources.
2. To understand scattering matrix and its properties.
3. To know the Microwave measurement procedures for measuring attenuation and VSWR.
4. To verify the characteristics of various microwave components and to draw the radiation pattern of antennas.
5. To verify the characteristics of optical sources & detectors and to study about losses in optical fiber.

Course Outcomes:

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

1. Understand the working of microwave bench set up and characteristics of microwave sources.
2. Verify the scattering parameters of Directional coupler and Magic Tee.
3. Analyze the Microwave measurement procedures.
4. Verify the characteristics of various microwave components and to draw the radiation pattern of antennas.
5. Verify the characteristics of optical sources & detectors and to study about losses in optical fiber.

PART-A: Microwave Lab - Any Seven (7) Experiments

1. Reflex Klystron Characteristics
2. Gunn Diode Characteristics
3. Attenuation Measurement
4. Directional Coupler Characteristics
5. VSWR Measurement
6. Impedance Measurements
7. Frequency and Wavelength measurement
8. Scattering Parameters of Directional coupler
9. Scattering Parameters of Magic TEE
10. Radiation pattern measurement of an Antenna
11. Antenna gain measurement

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Part B: Optical Fiber Lab - Any five (5) Experiments

1. Characterization of LED
2. Characterization of Laser Diode
3. Intensity Modulation of Laser output through Optical fiber
4. Measurement of data rate for digital Optical link
5. Measurement of Numerical Aperture.
6. Measurement of Losses for Analog optical link

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO- PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	M	M	H					L		M	H	M	
CO2	L								L			M	L		
CO3	M	L	M									L	M	L	L
CO4	H	H	M	H	H				L	M		M	H	H	
CO5	H	H	M	H	H		L			L		M	H	H	

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23ECP08 - VLSI DESIGN LAB

Credits – 1.5 **Sessional Marks: 30**
L: T: P:: 0:0:3 **University Exam Marks: 70**

Course Outcomes:

1. The objective of this laboratory is to design and analyze digital circuits using 180 nm technology.
2. To design a logic circuit using CMOS transistor using 180 nm technology in terms of schematic, symbol, test bench, DC and AC analysis.
3. To evaluate different schematics &output responses for AOI logic by using different software tools.
4. To design CMOS circuits using Full & Semi custom IC designs for analysis.
5. To design different layouts using different software tools for analog circuits.

Course Objectives:

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

1. Ability to design and analyze digital circuits using CMOS transistor in 180 nm technology.
2. Design a logic circuit using CMOS transistor using 180 nm technology in terms of schematic, symbol, test bench, DC and AC analysis.
3. Evaluate different schematics &output responses for AOI logic by using different software tools.
4. Design CMOS circuits using Full & Semi custom IC designs for analysis.
5. Design different layouts using different software tools for analog circuits.

List of Experiments: (Any TEN of the experiments are to be conducted)

1. **Design and analysis of CMOS Inverter**
   a) Implement CMOS inverter schematic using 180 nm technology and design its symbol.
   b) Implement test bench for CMOS Inverter and check its output response.
   c) Perform DC and AC analysis for CMOS inverter.
   d) Check the performance of CMOS inverter using parametric sweep.

2. **Design and analysis of NAND and NOR Logic gates**
   a) Implement NAND/NOR schematic using 180 nm technology and design its symbol.
   b) Implement test bench for NAND/NOR and check its output response.
   c) Perform DC and AC analysis for NAND/NOR.
   d) Check the performance of NAND/NOR using parametric sweep.

3. **Design and analysis of XOR and XNOR Logic gates**
   a) Implement XOR/XNOR schematic using 180 nm technology and design its symbol.
   b) Implement test bench for XOR/XNOR and check its output response.
   c) Perform DC and AC analysis for XOR/XNOR.
   d) Check the performance of XOR/XNOR using parametric sweep.

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4. **Design of AOI logic**
   a) Design Schematic for AB+C_D and check its output response.
   b) Design Schematic for AB_+C_D and check its output response.
   c) Design Schematic for (A+B_)(C+D) and check its output response.
   d) Design Schematic for (A+B_)(C_+D) and check its output response.

5. **Design and analysis of Full adder**
   a) Design full adder using Full custom IC design.
   b) Design full adder using Semi custom IC design.

6. **Analysis of NMOS and PMOS characteristics**
   a) Implement test bench for NMOS/PMOS transistor.
   b) Perform DC and AC analysis for NMOS/PMOS transistor
   c) Check the performance of NMOS/PMOS transistor using parametric sweep.

7. **Design and analysis of Common source amplifier**
   a) Implement CS amplifier schematic using 180 nm technology and design its symbol.
   b) Implement test bench for CS amplifier and check its output response.
   c) Perform DC and AC analysis for CS amplifier.
   d) Check the performance of CS amplifier using parametric sweep.

8. **Design and analysis of Common drain amplifier**
   a) Implement CD amplifier schematic using 180 nm technology and design its symbol.
   b) Implement test bench for CD amplifier and check its output response.
   c) Perform DC and AC analysis for CD amplifier.
   d) Check the performance of CD amplifier using parametric sweep.

9. **Design of MOS differential amplifier**
   a) Design differential amplifier schematic using 180 nm technology and its symbol.
   b) Implement test bench for differential amplifier and check its output response.
   c) Perform DC and AC analysis for differential amplifier.
   d) Check the performance of differential amplifier using parametric sweep.

10. **Design of differential amplifier using FET/BJT**
    e) Design differential amplifier using FET/BJT schematic using 180 nm technology and its symbol.
    f) Implement test bench for two stage differential amplifier and check its output response.
    g) Perform DC and AC analysis for differential amplifier.
    h) Check the performance of differential amplifier using parametric sweep.

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11. Design of Inverter Layout

a. Design and implement inverter schematic.
b. Design the layout for inverter using 180 nm tech file.
c. Perform LVS for schematic and layout
d. Check and remove all DRC violations.
e. Extract parasitic R and C in layout.

12. Design of NAND/NOR Layout

a. Design and implement NAND/NOR schematic.
b. Design the layout for inverter using 180 nm tech file.
c. Perform LVS for schematic and layout
d. Check and remove all DRC violations.
e. Extract parasitic R and C in layout

The students are required to design the schematic diagrams using CMOS logic and to draw the layout diagrams to perform the experiments with the Industry standard EDA Tools.

Software Required: i. Mentor Graphics/ Synopsis/ Cadence / Equivalent Industry Standard Software. ii. Personal computer system with necessary software to run the programs and to implement.

Course Outcomes-Program Outcomes -Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	H	L										L	M	
CO2	H	L	H	M									M	H	
CO3	L	L	H	M									M	H	
CO4	M	M		L									L	M	H
CO5			H	M					L	M	L	M		M	H

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23ECS02 - AI AND SIGNAL PROCESSING

Credits – 2 **Sessional Marks: 30**
L: T: P:: 0:1:2 **University Exam Marks: 70**

Course Objectives:

1. To teach the methods of implementing algorithms using artificial intelligence techniques.
2. To illustrate search algorithms.
3. To demonstrate the building of intelligent agents.
4. To simulate the basic signal processing operations like convolution and correlation.
5. To simulate the DSP operations like DFT, FFT & implement IIR and FIR filters using simulation software and verify their frequency responses.

Course Outcomes:

After completion of the course, students will be able to

1. Implement search algorithms.
2. Solve Artificial intelligence problems.
3. Design chatbot and virtual assistant.
4. Simulate the basic signal processing operations like convolution and correlation.
5. Simulate the DSP operations like DFT, FFT & implement IIR and FIR filters using simulation software and verify their frequency responses.

UNIT I: Introduction AI: Definition and scope of AI, challenges in AI, Applications of AI, Problem solving in AI, Basics of Python programming, Implement search algorithms.

UNIT II: Fundamentals of signals and systems: Basic Continuous and discrete time signals, time domain analysis (convolution, correlation).
Basics of Digital signal processing: Discrete Fourier transform, fast Fourier transform, IIR Filter design using Butterworth and Chebyshev methods, FIR filter design using window techniques, Decimation and Interpolation, Applications of signal processing.

ARTIFICIAL INTELLIGENCE (Implement any six concepts)

1. Write a program to implement DFS and BFS.
2. Write a Program to find the solution for traveling salesman Problem.
3. Write a program to implement Simulated Annealing Algorithm.
4. Write a program to find the solution for the wumpus world problem.
5. Write a program to implement 8 puzzle problems.
6. Write a program to implement Towers of Hanoi problem.
7. Write a program to implement A* Algorithm.
8. Write a program to implement Hill Climbing Algorithm.
9. Build a Chatbot using AWS Lex, Pandora bots.
10. Build a bot that provides all the information related to your college.
11. Build a virtual assistant for Wikipedia using Wolfram Alpha and Python.

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DIGITAL SIGNAL PROCESSING (Implement any eight concepts)

1. Generate the following standard discrete time signals.
   i) Unit Impulse ii) Unit step iii) Ramp iv) Exponential v) Sawtooth
2. Generate sum of two sinusoidal signals and find the frequency response (magnitude and phase).
3. Implement and verify linear and circular convolution between two given signals.
4. Implement and verify autocorrelation for the given sequence and cross correlation between two given signals.
5. Compute and implement the N-point DFT of a given sequence and compute the power density spectrum of the sequence.
6. Implement and verify N-point DIT-FFT of a given sequence and find the frequency response (magnitude and phase).
7. Implement and verify N-point IFFT of a given sequence.
8. Design IIR Butterworth filter and compare their performances with different orders (Low Pass Filter /High Pass Filter)
9. Design IIR Chebyshev filter and compare their performances with different orders (Low Pass Filter /High Pass Filter).
10. Design FIR filter (Low Pass Filter /High Pass Filter) using windowing technique. i. Using Rectangular window, ii. Using hamming window, iii. Using Kaiser window..
11. Design and verify Filter (IIR and FIR) frequency response by using Filter design and Analysis Tool.
12. Compute the Decimation and Interpolation for the given signal.
13. Real time implementation of an audio signal using a digital signal processor.

References:

1. Artificial Intelligence, 2nd Edition,
2. E.Rich and K.Knight, TMH. 6. Artificial Intelligence and Expert Systems, Patterson, PHI.
3. Digital Signal Processing: Alon V. Oppenhelm, PHI.
4. Digital Signal processing (II-Edition): S.K. Mitra, TMH.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	M	L	L	H		L					M	L	L	L
CO2	L	L	L	L	H		L					L	M	M	M
CO3	L	M	L	L	H		L					L	M	L	M
CO4	H	H	L	L	M		L					L	H	M	L
CO5	H	H	L	M	L		L					M	H	M	M

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23ECT13 - CELLULAR & MOBILE COMMUNICATIONS

Credits – 3
L: T: P:: 3:0:0

Sessional Marks: 30
University Exam Marks: 70

Course Objectives:

1. To explain the basic cellular system and its working.
2. To understand the impact of multipath fading channels and techniques to mitigate fading effects in cellular communication.
3. To explore frequency management, channel assignment strategies, and different types of handoffs in cellular networks.
4. To analyze the performance of mobile antennas, interference issues, and cellular system design principles.
5. To evaluate system performance metrics such as dropped call rates, handoff strategies, and spectrum efficiency.

Course Outcomes:

After completing the course, the student will be able to,

1. Understand the basic cellular system and its working.
2. Explain the impairments caused by multipath fading and methods to mitigate fading effects in mobile communication.
3. Apply concepts of cellular communication to solve problems related to mobile antennas and system design.
4. Analyze co-channel and non-co-channel interferences, different types of handoffs, and dropped call rates.
5. Evaluate the performance of cellular systems, including signal reception, handoff efficiency, and spectrum utilization.

UNIT I

Cellular Mobile Radio Systems: Introduction to Cellular Mobile system, basic cellular system, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, Hexagonal shaped cells, Analog and Digital Cellular systems.

UNIT II

Elements of Cellular Radio System Design: General description of the problem, concept of frequency channels, Co-channel Interference Reduction Factor, desired C/I from a normal case in a Omni directional Antenna system, Cell splitting, consideration of the components of cellular system.

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Interference: Introduction to Co-channel interference, real time co-channel interference, Co-channel measurement, design of Antenna system, Antenna parameters and their effects, diversity receiver, non-co-channel interference-different types.

UNIT III

Cell Coverage for Signal and Traffic: Signal reflections in flat and hilly terrain, effect of human made structures, phase difference between direct and reflected paths, constant standard deviation, straight line path loss slope, general formula for mobile propagation over water and flat open area, near and long-distance propagation antenna height gain, form of a point-to-point model.

UNIT IV

Cell Site and Mobile Antennas: Sum and difference patterns and their synthesis, Omni directional antennas, directional antennas for interference reduction, space diversity antennas, umbrella pattern antennas, minimum separation of cell site antennas, high gain antennas.

Frequency Management and Channel Assignment: Numbering and grouping, setup access and paging channels channel assignments to cell sites and mobile units, channel sharing and borrowing, sectorization, overlaid cells, non fixed channel assignment.

UNIT V

Handoff: Handoff, dropped calls and cell splitting, types of handoffs, handoff invitation, delaying handoff, forced handoff, mobile assigned handoff. Intersystem handoff, cell splitting, micro cells, vehicle locating methods, dropped call rates and their evaluation.

System Evaluations: Performance evaluation, Signal evaluation, Measurement of average received level and level crossings, Spectrum efficiency evaluation.

TEXT BOOKS:

1. W .C. Y. Lee, —Mobile cellular telecommunicationsl, Tata Mc-Graw Hill, 2nd Edition, 2006.
2. Theodore. S. Rapport, —Wireless communicationsl, Pearson Education, 2ndEdn., 2002.

REFERENCES:

1. Gordon L. Stuber, —Principles of Mobile communicationsl, Springer International 2nd Edition, 2007.
2. Lee , —Wireless and Mobile Communicationsl, Mc Graw Hills, 3rd Edition, 2006.
3. Jon W.Mark and WeihuaZhqung, —Wireless communications and Networkingl, PHI, 2005.
4. R.Blake, —Wireless communication Technologyl, Thompson Asia Pvt.Ltd., 2004.

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Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M					L	L			H			H	M	L
CO2		M	L	M	M	L				H		L	H	M	L
CO3		M	M			L				H		L	H	M	L
CO4			M	M					L	H			H	M	L
CO5	L			H							M		H	M	L

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23HMT04 - HUMAN RESOURSES MANAGEMENT

Credits – 2 | **Sessional Marks: 30**

L: T: P:: 2:0:0 | **University Exam Marks: 70**

OBJECTIVES:

1. To develop Human Resource Management skills of management students
2. To orient them towards Human Resource Planning and proper utilization of human resource for the smooth functioning of the business.

COURSE OUTCOMES:

After the successful completion of the course, students will be able to:

1. Understand the concept, functions, strategic role, and challenges of HRM along with current HR trends.
2. Apply human resource planning and forecasting methods for manpower demand, supply, and career development.
3. Perform job analysis, recruitment, selection, induction, and training for new employees.
4. Assess employee performance using appraisal methods, performance management, and ethical practices.
5. Design and evaluate training and development programs to support HRD objectives and organizational growth.

Unit - I

Human Resource Management – Concept – Nature – Significance – objectives and functions, Process- Strategic role of HRM – Environmental forces and challenges –Organization of HRM functions – Contemporary HR trends.

Unit - II

Human Resource planning- Significance of Human Resource Planning – Process –Forecasting – Human Resource demands & Supply forecasting methods - Career Planning and development.

Unit - III

Employee Acquisition – Job analysis -Job description and job specification – Recruitment – Sources of Recruitment – selection process and tests. Placement & Induction - Training for new employees.

Unit - IV

Performance appraisal - Objectives – Importance – Methods of Performance appraisal. – Managing performance –performance management and employee development- Ethics in performance management.

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Unit - V

Human Resource Development (HRD) – Objectives – Determining training needs, - Methods of Training & Development – Designing, Organizing and evaluating T&D programs.

REFERENCE BOOKS:

1.Venkata Ratnam C. S. & Srivatsava B. K.,PERSONNEL MANAGEMENT AND HUMAN RESOURCES, *Tata Mc-Graw Hill, NewDelhi,,*
2. Aswathappa, HUMAN RESOURCE MANGEMENT, *Tata McGraw Hill, NewDelhi, 2010*
3. Garry Dessler &Varkkey, HUMAN RESOURCE MANAGEMENT, *Pearson, New Delhi, 2009*
4. Alan Price, HUMAN RESOURCE MANAGEMENT, *Cengage Learning, NewDelhi, 2007*
5. Pravin Durai, HUMAN RESOURCE MANGEMENT, *Pearson, New Delhi,2010*
6. Snell, Bohlander & Vohra, HUMAN RESOURCES MANAGEMENT, *Cengage, NewDelhi, 2010*

Course Outcomes - Program Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	–	M	–	M	M	M	–	M	–	M
CO2	H	H	M	M	–	M	M	–	M	M	M	H
CO3	H	H	H	M	M	M	–	M	M	H	M	H
CO4	M	H	M	M	–	M	–	H	M	H	M	H
CO5	H	H	H	M	M	M	–	M	H	H	H	H

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23ECT18 - LOW POWER VLSI DESIGN

Credits – 3 | **Sessional Marks: 30**

L: T: P:: 3:0:0 | **University Exam Marks: 70**

Course Objectives:

1. To understand the need for low-power circuit design and analyze different power dissipation mechanisms in VLSI circuits.
2. To explore various low-power design approaches at the system, circuit, and mask levels.
3. To study low-power adder architectures and their role in power-efficient computing.
4. To examine different low-power multiplier architectures and their impact on digital design.
5. To gain knowledge of low-power memory technologies and their future developments.

Course Outcomes:

After completing the course, the student will be able to,

1. Understand the need for low-power circuit design and analyze different power dissipation mechanisms in VLSI circuits.
2. Learn various low-power design approaches at the system, circuit, and mask levels.
3. Gain knowledge on low-power adder architectures and their role in power-efficient computing.
4. Examine different low-power multiplier architectures and their impact on digital design.
5. Grasp knowledge of low-power memory technologies and their future developments.

UNIT I

Fundamentals: Need for Low Power Circuit Design, Sources of Power Dissipation – Static and Dynamic Power Dissipation, Short Circuit Power Dissipation, Glitching Power Dissipation, Short Channel Effects –Drain Induced Barrier Lowering and Punch Through, Surface Scattering, Velocity Saturation, Impact Ionization, Hot Electron Effect.

UNIT II

Low-Power Design Approaches: Low-Power Design through Voltage Scaling – VTCMOS circuits, MTCMOS circuits, Architectural Level Approach –Pipelining and Parallel Processing Approaches. Switched Capacitance Minimization Approaches: System Level Measures, Circuit Level Measures, Mask level Measures.

UNIT III

Low-Voltage Low-Power Adders: Introduction, Standard Adder Cells, CMOS Adder's Architectures – Ripple Carry Adders, Carry Look Ahead Adders, Carry Select Adders, Carry Save Adders, Low-Voltage Low-Power Design Techniques – Trends of Technology and Power Supply Voltage, Low-Voltage Low-Power Logic Styles.

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UNIT IV

Low-Voltage Low-Power Multipliers: Introduction, Overview of Multiplication, Types of Multiplier Architectures, Braun Multiplier, Baugh Wooley Multiplier, Booth Multiplier, Introduction to Wallace Tree Multiplier.

UNIT V

Low-Voltage Low-Power Memories: Basics of ROM, Low-Power ROM Technology, Future Trend and Development of ROMs, Basics of SRAM, Memory Cell, Precharge and Equalization Circuit, Low-Power SRAM Technologies, Basics of DRAM, Self-Refresh Circuit, Future Trend and Development of DRAM.

Textbooks:

1. CMOS Digital Integrated Circuits – Analysis and Design – Sung-Mo Kang, Yusuf Leblebici, TMH, 2011.
2. Low-Voltage, Low-Power VLSI Subsystems – Kiat-Seng Yeo, Kaushik Roy, TMH Professional Engineering.

References:

1. Introduction to VLSI Systems: A Logic, Circuit and System Perspective – Ming-BO Lin, CRC
Press, 2011.
2. Low Power CMOS Design – AnanthaChandrakasan, IEEE Press/Wiley International, 1998.
3. Low Power CMOS VLSI Circuit Design – Kaushik Roy, Sharat C. Prasad, John Wiley & Sons,2000.

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Course Outcomes-Program Outcomes -Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H	L		H							M	H	M	H
CO2	H	H	H	M	H	L	M			L	L	M	H	H	H
CO3	H	H	M	M	H					L	L	M	M	H	
CO4	H	H	H	M	H		L			L			H	M	H
CO5	H	M	M	M	H		M			L	L		H	M	H

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23ECT19 - RADAR ENGINEERING

Credits – 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives:

1. To understand the basic working principle of Radar and target detection procedure.
2. To learn about the working and applications of CW and Frequency modulated Radar.
3. To comprehend the working and applications of MTI and Pulse Doppler Radar
4. To understand different methods of tracking a target and their limitations.
5. To analyze the effect of noise at the receiver and uses of phased array antennas and navigational aids.

Course Outcomes:

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

1. Learn the basic working principle of Radar and target detection procedure.
2. Know the working and applications of CW and Frequency modulated Radar.
3. Gain the knowledge of about MTI and Pulse Doppler Radar.
4. Understand different methods of tracking a target and their limitations.
5. Analyze the effect of noise at the receiver and uses of phased array antennas and navigational aids.

UNIT I

Basics of Radar: Introduction, Maximum Unambiguous Range, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications, Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Modified Radar Range Equation, Illustrative Problems. Radar Equation: SNR, Envelope Detector, False Alarm Time and Probability, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets - sphere, cone-sphere), Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Display types, Illustrative Problems.

UNIT II

CW and Frequency Modulated Radar: Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar, Illustrative Problems.FM-CW Radar, Range and Doppler Measurement, Block Diagram and Characteristics (Approaching/ Receding Targets), FM-CW altimeter, Multiple Frequency CW Radar.

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UNIT III

MTI and Pulse Doppler Radar: Introduction, Principle, MTI Radar with - Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, And Staggered PRFs. Range Gated Doppler Filters, MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler radar.

UNIT IV

Tracking Radar: Tracking with Radar, Sequential Lobing, Conical Scan, Monopulse Tracking Radar – Amplitude Comparison Monopulse (one- and two-coordinates), Phase Comparison Monopulse, Tracking in Range, Acquisition and Scanning Patterns, Comparison of Trackers.

UNIT V

Detection of Radar Signals in Noise: Introduction, Noise Figure and Noise Temperature, Matched Filter Receiver – Response Characteristics and Derivation, Correlation detection, Detection criteria, Detector Characteristics, Automatic Detection, Constant False Alarm Rate Receiver. Introduction to Software Defined Radio, Introduction to Stealth technology.

Radar Receivers: Introduction to Phased Array Antennas- Basic Concepts, Electronically Steered Phased Array Antennas, Phase Shifters, Frequency – scan Arrays, Radiation for Phased Array, Architecture for Phased Arrays. Radiation Pattern. Beam Steering and Beam Width changes. Navigational Aids : Direction Finder, VOR,ILS and Loran.

TEXT BOOKS:

1. Merrill I. Skolnik, —Introduction to Radar Systemsl, 2nd Edition, TMH Special Indian Edition, 2007.
2. Byron Edde, —Radar Principals, Technology, Applicationsl, Pearson Education, 1992.

REFERENCES:

1. Peebles, —Radar Principlesl, Wiley, New York, 1998.
2. G.S.N.Raju, —Radar Engineering and Fundamentals of Navigational Aidsl, I. K. International Pvt. Ltd.
3. G. SasiBhushan Rao, — Microwave and Radar Engineeringl, Pearson Education, 2014

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	L											H	M	
CO2	H	L	L										M	H	
CO3	M	L	L										M	H	
CO4	M	H	L										L	M	H
CO5									L	M	L	M		M	H

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23ECT20 - DIGITAL IMAGE PROCESSING

Credits – 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives:

1. To learn the fundamentals of Image Processing with different Transforms.
2. To understand functions of Intensity Transformations and working fundamentals of Spatial Filters
3. To implement various models of Restoring and Reconstruction of Images from filtering projections.
4. To study the concepts of image compression using different coding & Wavelets and Multiresolution Processes.
5. To design image processing systems using Segmentation techniques for Morphological & Color Images.

Course Outcomes:

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

1. Learn the fundamentals of Image Processing with different Transforms.
2. Uunderstand the functions of Intensity Transformations and working fundamentals of Spatial Filters
3. Implement various models of Restoring and Reconstruction of Images from filtering projections.
4. Grasp the concepts of image compression using different coding &Wavelets and Multiresolution Processes.
5. Design the image processing systems using Segmentation techniques for Morphological & Color Images.

UNIT I

Introduction: Introduction to Image Processing, Fundamental steps in digital image processing, components of an image processing system, image sensing and acquisition, image sampling and quantization, some basic relationships between pixels, an introduction to the mathematical tools used in digital image processing. Image Transforms: Need for image transforms, Discrete Fourier transform (DFT) of one variable, Extension to functions of two variables, some properties of the 2-D Discrete Fourier transform, Importance of Phase, Walsh Transform. Hadamard transform, Haar Transform, Slant transform, Discrete Cosine transform, KL Transform, SVD and Radon Transform, Comparison of different image transforms.

UNIT II

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 Filtering in the Frequency Domain: Preliminary concepts, The Basics of filtering in the frequency domain, image smoothing using frequency domain filters, Image Sharpening using frequency domain filters, Selective filtering.

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UNIT III

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, Estimating the degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering, constrained least squares filtering, geometric mean filter ,image reconstruction from projections.

UNIT IV

Image compression: Fundamentals, Basic compression methods: Huffman coding, Golomb coding, Arithmetic coding, LZW coding, Run-Length coding, Symbol-Based coding, Bit-Plane coding, Block Transform coding, Predictive coding Wavelets and Multiresolution Processing: Image pyramids, subband coding, Multiresolution expansions, wavelet transforms in one dimensions & two dimensions, Wavelet coding.

UNIT V

Image segmentation: Fundamentals, point, line, edge detection, thresholding, region –based segmentation. Morphological Image Processing: Preliminaries, Erosion and dilation, opening and closing, basic morphological algorithms for boundary extraction, thinning, gray-scale morphology, Segmentation using morphological watersheds.

Color image processing: color fundamentals, color models, pseudo color image processing, basics of full color image processing, color transformations, smoothing and sharpening. Image segmentation based on color, noise in color images, color image compression.

Textbooks:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd edition, Prentice Hall, 2008.
2. Jayaraman, S. Esakkirajan, and T. Veerakumar,l Digital Image Processingl, Tata McGraw-Hill Education, 2011.

Reference Books:

1. Anil K.Jain, —Fundamentals of Digital Image Processingl, Prentice Hall of India, 9th Edition, Indian Reprint, 2002.
2. B.Chanda, D.DuttaMajumder, —Digital Image Processing and Analysisl, PHI, 2009

Online Learning Resources:

https://nptel.ac.in/courses/117105079

https://nptel.ac.in/courses/117105135

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Course outcomes-Program outcomes- Control Specific Outcomes (CO-PO-PSO)Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	L	M	M	M		L			M		M	H		
CO2	L	M	M	H	L	L				L			H	M	L
CO3	L	M	H	M	M	H		M		L				H	M
CO4	M		M	M	L	M	L	L	L	M		L	H	L	L
CO5		H	M	L	H	L			M	L	L	L	M	H	L

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23ECT21 - 5G COMMUNICATIONS

Credits – 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives:

1. To introduce the fundamental concepts of 5G spectrum, radio access technologies, and system requirements.
2. To understand the architecture and physical layer aspects of 5G networks, including MIMO and beamforming.
3. To explore advanced 5G radio-access technologies and their role in multi-user communication.
4. To study network slicing, SDN, NFV, and their applications in vehicular communications.
5. To analyze mobility management, interference control, and dynamic network reconfiguration in 5G.

Course Outcomes:

After completing the course, the student will be able to,

1. Understand the 5G radio spectrum and channel models, including spectrum sharing and propagation challenges.
2. Analyze the 5G network architecture, including the core network, RAN, and physical layer procedures.
3. Evaluate different 5G radio-access technologies, including new waveforms and non-orthogonal multiple access schemes.
4. Apply network slicing concepts and vehicular communication techniques for efficient 5G network deployment.
5. Develop strategies for mobility and handoff management to optimize network performance and minimize interference.

UNIT I

5G Radio Spectrum: 5G spectrum landscape and requirements, Spectrum access modes and sharing scenarios, 5G spectrum technologies.

5G Channel Model: The 5G wireless Propagation Channels: Channel modeling requirements, propagation scenarios and challenges in the 5G modeling.

5G Use Cases and System Concept: Use cases and requirements, 5G system concept

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UNIT II

Radio Interface Architecture: 5G architecture options, core network architecture, RAN architecture. 5G PHYSICAL LAYER: Physical channels and signals, 5G frame structure, physical layer procedures (MIMO, Power control, link adaptation, beam forming).

UNIT III

5G Radio-Access Technologies: Access design principles for multi-user communications, multi-carrier with filtering: a new waveform, non-orthogonal schemes for efficient multiple access

UNIT IV

Introduction to 5G Network Slicing: Network Slicing, E2E Slicing, SDN and NFV Slicing

Vehicular Communications: From V2V to AV2X, key standards, VC architectures, V2X Use cases

UNIT V

Mobility and Handoff Management in 5G: Network deployment types, Interference management in 5G, Mobility management in 5G, Dynamic network reconfiguration in 5G.

Textbooks:

1. Afif Osseiran, Jose F Monserrat, Patrick Marsch, —5G Mobile and Wireless Communications
Technologyl, Cambridge University Press, 2016
2. Saad Z. Asif, —5G Mobile Communications Concepts and Technologiesl, CRC Press, Taylor
& Francis Group, First Edition, 2018
3. HarriHolma, Antti Toskala, Takehiro Nakamura, —5G Technology 3GPP NEW RADIOl, John Wiley & Sons First Edition,2020

References:

1. Gordon L. Stuber, —Principles of Mobile Communicationl, KLUWER ACADEMIC PUBLISHERS, 2nd Edition, 2002
2. Joseph C. Liberti, Theodore S. Rappaport, —Smart Antennas for Wireless Communicationsl,
Prentice Hall PTR, 1999
3. Ying Zhang, —Network Function Virtualization Concepts and Applicability in 5G Networksl, John Wiley & Sons, 2018.

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Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

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CO1	H	M	L										M		
CO2	M	L						L				H	M		H
CO3	H	M										L	M	H	L
CO4		H	L								L		M	H	
CO5															

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23ECT22 – SENSORS AND ACTUATORS

Credits – 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives:

1. To provide exposure to various kinds of sensors and actuators and their engineering applications.
2. To impart knowledge on the basic laws and phenomenon behind the working of sensors and actuators
3. To explain the operating principles of various sensors and actuators
4. To educate the fabrication of sensors
5. To explain the required sensor and actuator for interdisciplinary application

Course Outcomes

After completing the course, the student will be able to,

1. Classify different types of Sensors and Actuators along with their characteristics
2. Summarize various types of Temperature and Mechanical sensors
3. Illustrates various types of optical and mechanical sensors
4. Analyze various types of Optical and Acoustic Sensors
5. Interpret the importance of smart materials in various devices

UNIT I
Introduction to Sensors and Actuators

Sensors: Types of sensors: temperature, pressure, strain, active and passive sensors, General characteristics of sensors (Principles only), Deposition: Chemical Vapor Deposition, Pattern: photolithography and Etching: Dry and Wet Etching.

Actuators: Functional diagram of actuators, Types of actuators and their basic principle of working: Pneumatic, Electromagnetic, Piezo-electric and Piezo-resistive actuators, Applications of Actuators.

UNIT II
Temperature and Mechanical Sensors

Temperature Sensors: Types of temperature sensors and their basic principle of working: Thermo-resistive sensors: Thermistors, Thermo-electric sensors: Thermocouples, PN junction temperature sensors

Mechanical Sensors: Types of Mechanical sensors and their basic principle of working: Force sensors: Strain gauges, Tactile sensors, Pressure sensors: Piezoresistive, Variable Reluctance Sensor (VRP).

UNIT III
Optical and Acoustic Sensors

Optical Sensors: Basic principle and working of: Photodiodes, Phototransistors and Photo resistors based sensors, Photomultipliers, Infrared sensors: thermal, Passive Infra-Red, Fiber based sensors and Thermopiles

Acoustic Sensors: Principle and working of Ultrasonic sensors, Piezo-electric resonators, Microphones

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UNIT IV
Magnetic and Electromagnetic Sensors

Motors as actuators (linear, rotational, stepping motors), magnetic valves, inductive sensors (LVDT, RVDT, and Proximity), Hall Effect sensors, Magneto-resistive sensors, Magnetostrictive sensors and actuators.

UNIT V
Chemical and Radiation Sensors

Chemical Sensors: Principle and working of Electro-chemical, Thermo-chemical, Gas, pH, Humidity and moisture sensors.

Radiation Sensors: Principle and working of Ionization detectors, Scintillation detectors, Semiconductor radiation detectors and Microwave sensors (resonant, reflection, transmission)

Textbooks:

1. Sensors and Actuators – Clarence W. de Silva, CRC Press, 2nd Edition, 2015
2. Sensors and Actuators, D.A.Hall and C.E.Millar, CRC Press, 1999

Reference Books:

1. Sensors and Transducers- D.Patranabhis, Prentice Hall of India (Pvt) Ltd. 2003
2. Measurement, Instrumentation, and Sensors Handbook-John G.Webster, CRC press 1999
3. Sensors – A Comprehensive Sensors- Henry Bolte, John Wiley.
4. Handbook of modern sensors, Springer, Stefan Johann Rupitsch.

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	H	L										H	M	
CO2	M	L	H	M									M	H	
CO3	M	L	H	M									M	H	
CO4	M	M		L									L	M	H
CO5			H	M					L	M	L	M		M	H

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23ECT23 - WIRELESS SENSOR NETWORKS

Credits – 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives:

1. To introduce the fundamental concepts and architecture of wireless sensor networks.
2. To explore various network architectures, optimization techniques, and design principles for wireless sensor networks.
3. To study MAC protocols, routing techniques, and addressing mechanisms for efficient sensor network communication.
4. To understand the infrastructure establishment of sensor networks, including topology control and synchronization.
5. To provide knowledge on sensor network platforms, programming challenges, and simulation tools.

Course Outcomes:

After completing the course, the student will be able to,

1. Learn the fundamental concepts and architecture of wireless sensor networks.
2. Explore various network architectures, optimization techniques, and design principles for wireless sensor networks.
3. Gain knowledge of MAC protocols, routing techniques, and addressing mechanisms for efficient sensor network communication.
4. Understand the infrastructure establishment of sensor networks, including topology control and synchronization.
5. Grasp the knowledge on sensor network platforms, programming challenges, and simulation tools.

UNIT I

Overview of Wireless Sensor Networks: Single-Node Architecture - Hardware Components- Network Characteristics- unique constraints and challenges, Enabling Technologies for Wireless Sensor Networks- Types of wireless sensor networks.

UNIT II

Architectures: Network Architecture- Sensor Networks-Scenarios- Design Principle, Physical Layer and Transceiver Design Considerations, Optimization Goals and Figures of Merit, Gateway Concepts.

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UNIT III

Networking Sensors: MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wakeup Concepts - SMAC, - B-MAC Protocol, IEEE 802.15.4 standard and ZigBee, the Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols Energy-Efficient Routing, Geographic Routing.

UNIT IV

Infrastructure Establishment: Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

UNIT V

Sensor Network Platforms and Tools: Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node level Simulators, State-centric programming.

Textbooks:

1. Holger Karl & Andreas Willig, "Protocols and Architectures for Wireless Sensor Networksl, John Wiley, 2005.
2. Feng Zhao & Leonidas J.Guibas, —Wireless Sensor Networks-An Information Processing Approach", Elsevier, 2007

Reference Books:

1. WaltenegusDargie , Christian Poellabauer, —Fundamentals Of Wireless Sensor Networks Theory And Practicel, By John Wiley & Sons Publications, 2011
2. KazemSohraby, Daniel Minoli, &TaiebZnati, —Wireless Sensor Networks-Technology, Protocols, and Applicationsl, John Wiley, 2007.
3. Anna Hac, —Wireless Sensor Network Designsl, John Wiley, 2003

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO11	PO12	PSO1	PSO2	PS O3
CO1	H	M	L	L	L		L					M	H	L	L
CO2	H	L	H	L	L		M					M	H	M	L
CO3	H	M	L	L	H		L					L	H	L	M
CO4	H	L	H	M	M		L					L	H	M	L
CO5	H	L	L	M	H		L					M	H	L	M

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23ECT24 - SPEECH PROCESSING

Credits – 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives:

1. To impart knowledge on anatomy and physiology of speech organs and the process of Speech Production.
2. To understand the methods for extracting of speech using Time domain parameters.
3. To learn the Frequency Domain Methods for Speech Processing.
4. To interpret and analyze LPC Parameters for Speech Processing.
5. To introduce the concepts of homomorphic Speech Processing.

Course Outcomes:

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

1. Gain knowledge on anatomy and physiology of speech organs and the process of Speech Production.
2. Understand the methods for extracting of speech using Time domain parameters.
3. Learn the Frequency Domain Methods for Speech Processing.
4. Interpret and analyze LPC Parameters for Speech Processing.
5. Grasp the concepts of homomorphic Speech Processing.

UNIT I

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

UNIT II

Time Domain Methods for Speech Processing: Time domain parameters of speech, methods for extracting the parameters: Zero crossings, Auto-correlation function, pitch estimation.

UNIT III

Frequency Domain Methods for Speech Processing: Short time Fourier analysis, Filter bank analysis, Spectrographic analysis, Formant extraction, Pitch extraction.

UNIT IV

Linear predictive Coding (LPC) for Speech: Formulation of linear prediction problem in time domain, solution of normal equations, Interpretation of linear prediction in auto correlation and spectral domains, Method of Solution of the LPC Parameters: Pitch Detection using LPC Parameters, Formant Analysis using LPC Parameters.

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UNIT V

Homomorphic Speech Processing: Introduction Homomorphic Systems for Convolution: Properties of the Complex Cepstrum, Computational Considerations, The Complex Cepstrum of Speech, pitch Detection and Formant Estimation; Applications of speech processing – Speech Enhancement, Speech recognition, Speech synthesis and Speaker Verification.

Textbooks:

1. L.R. Rabiner and S. W. Schafer, Digital Processing of Speech Signals, Pearson Education.
2. Douglas O' Shaughnessy, Speech Communications: Human &Machine, 2nd Ed., Wiley-IEEE Press.

References:

1. Thomas F. Quatieri, Discrete Time Speech Signal Processing: Principles and Practice, 1st Ed., Pearson Education.
2. Ben Gold & Nelson Morgan, Speech and Audio Signal Processing: Processing and Perception of Speech and Music ,1st Ed., Wiley.

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H	L		M								H	M	
CO2	H	H	M	M	H		L					M	M	H	M
CO3	H	H	H	H	H							M	H	H	H
CO4	M	H	M	H	H		L						H	M	M
CO5	H	H	H	M	H					L	L	M	H	M	L

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23ECT25 – INTERNET OF THINGS & APPLICATIONS

Credits – 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives:

1. Understand the basics of Internet of Things and protocols.
2. Discuss the requirement of IoT technology
3. Introduce some of the application areas where IoT can be applied.
4. Understand the vision of IoT from a global perspective, understand its applications, determine its market perspective using gateways, devices and data management.
5. To analyze IoT solutions using sensors, actuators and Devices.

Course Outcomes:

After completion of the course, students will be able to

1. Understand general concepts of Internet of Things.
2. Apply design concept to IoT solutions
3. Analyze various M2M and IoT architectures
4. Evaluate design issues in IoT applications
5. Create IoT solutions using sensors, actuators and Devices

UNIT I
Introduction to IoT

Definition and Characteristics of IoT, physical design of IoT, IoT protocols, IoT communication models, IoT Communication APIs, Communication protocols, Embedded Systems, IoT Levels and Templates

UNIT II
Prototyping IoT Objects using Microprocessor/Microcontroller

Working principles of sensors and actuators, setting up the board – Programming for IoT, Reading from Sensors, Communication: communication through Bluetooth, Wi-Fi.

UNIT III
IoT Architecture and Protocols

Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, Protocols- 6LowPAN, RPL, CoAP, MQTT, IoT frameworks- Thing Speak.

UNIT IV
Device Discovery and Cloud Services for IoT

Device discovery capabilities- Registering a device, Deregister a device, Introduction to Cloud Storage models and communication APIs Web-Server, Web server for IoT.

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UNIT V

UAV IoT

Introduction toUnmanned Aerial Vehicles/Drones, Drone Types, Applications: Defense, Civil, Environmental Monitoring; UAV elements and sensors- Arms, motors, Electronic Speed Controller(ESC), GPS, IMU, Ultra sonic sensors; UAV Software –Arudpilot, Mission Planner, Internet of Drones(IoD)- Case study FlytBase.

Textbooks:

1. Vijay Madisetti and ArshdeepBahga, Internet of Things (A Hands-on-Approach), 1st Edition, VPT, 2014.
2. Handbook of unmanned aerial vehicles, K Valavanis;George J Vachtsevanos, New York, Springer, Boston, Massachusetts : Credo Reference, 2014. 2016.

Reference Books:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligencel, 1st Edition, Academic Press, 2014.
2. ArshdeepBahga, Vijay Madisetti - Internet of Things: A Hands-On Approach, Universities Press, 2014.
3. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.
4. Francis daCosta, - Rethinking the Internet of Things: A Scalable Approach to Connecting Everythingl, 1st Edition, Apress Publications, 2013
5. Cuno Pfister, Getting Started with the Internet of Things, O Reilly Media, 2011, ISBN: 9781-4493- 9357-1
6. DGCA RPAS Guidance Manual, Revision 3 – 2020
7. Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs, John Baichtal

Course outcomes-Program outcomes- Control Specific Outcomes (CO-PO-PSO)Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		M	L	M									H	M	
CO2	M	H	L	L									H	M	
CO3	M	L	L										H		
CO4	L	H	M										H	M	L
CO5		M	L	H									L	L	H

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23BST15 - Gender Sensitization

(Common to All Branches of Engineering)

Credits : 3	**Sessional Marks :30**
L:T:P :: 2 :0:0:0	**University Marks:70**

Course Objectives:

- To enable students to understand the gender related issues, vulnerability of women and men
- To familiarize them about constitutional safeguard for gender equality
- To expose the students to debates on the politics and economics of work
- To help students reflect critically on gender violence
- To make them understand that gender identities and gender relations are part of culture as they shape the way daily life is lived in the family as well as wider community and the workplace.

Course Outcomes (CO):

CO1 Understand the basic concepts of gender and its related terminology

CO2 Identify the biological, sociological, psychological and legal aspects of gender.

CO3 Use the knowledge in understanding how gender discrimination works in our society and how to counter it.

CO4 Analyzethe gendered division of labour and its relation to politics and economics.

CO5 Appraise how gender-role beliefs and sharing behaviour are associated with more well-being in all culture and gender groups .

CO6 Develop students' sensibility with regard to issues of gender in contemporary India

SYLLABUS

Unit-1UNDERSTANDING GENDER

Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring

Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male. First lessons in Caste.

Unit-2 GENDER ROLES AND RELATIONS

Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles- Gender Roles and Relationships Matrix-Missing Women-Sex Selection and its Consequences- Declining Sex Ratio- Demographic Consequences-Gender Spectrum -

Unit-3 GENDER AND LABOUR

Division and Valuation of Labour-Housework: The Invisible Labor- —My Mother doesn't Work.‖ —Share the Load.‖-Work: Its Politics and Economics -Fact and Fiction- Unrecognized *B.Tech* - and Unaccounted work -Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming

Unit-4 GENDER-BASED VIOLENCE

The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment - Domestic Violence - Different forms of violence against women - Causes of violence, impact of violence against women - Consequences of gender-based violence

Unit-5 GENDER AND CULTURE

Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature- Gender Development Issues-Gender Issues-Gender Sensitive Language Just Relationships

Prescribed Books

1. A.Suneetha, Uma Bhrugubanda, et al. *Towards a World of Equals: A Bilingual Textbook on Gender*‖, Telugu Akademi, Telangana, 2015.

2. Butler, Judith. *Gender Trouble: Feminism and the Subversion of Identity.* UK Paperback Edn. March 1990

Reference Books

1. Wtatt, Robin and Massood, Nazia, *Broken Mirrors: The dowry Problems in India*,London : Sage Publications, 2011

2. Datt, R. and Kornberg, J.(eds), *Women in Developing Countries, Assessing Strategies for Empowerment*, London: Lynne Rienner Publishers, 2002

3. Brush, Lisa D., *Gender and Governance*, New Delhi, Rawat Publication, 2007

4. Singh, Direeti, *Women and Politics World Wide*, New Delhi, Axis Publications, 2010

5. Raj Pal Singh, Anupama Sihag, *Gender Sensitization: Issues and Challenges* (English, Hardcover), Raj Publications, 2019

6. A.Revathy& Murali, Nandini, *A Life in Trans Activism*(Lakshmi Narayan Tripathi). The University of Chicago Press, 2016

Online Resources:

1. Understanding Gender

chrome extension://kdpelmjpfafjppnhbloffcjpeomlnpah/https://www.arvindguptatoys.com/arvindgupta/kamla-gender1.pdf

https://onlinecourses.swayam2.ac.in/nou24_hs53/preview

2. Gender Roles and Relations*B.Tech - CSE*

R23 Regulation

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https://www.plannedparenthood.org/learn/gender-identity/sex-gender-identity/what-are gender-roles-and-stereotypes

https://www.verywellmind.com/understanding-gender-roles-and-their-effect-on-our relationships-7499408

https://onlinecourses.swayam2.ac.in/cec23_hs29/preview

3. Gender and Labour

https://www.economicsobservatory.com/what-explains-the-gender-division-of-labour-and how-can-it-be-redressed

https://onlinecourses.nptel.ac.in/noc23_mg67/preview

4. GENDER-BASED VIOLENCE

https://eige.europa.eu/gender-based-violence/what-is-gender-based violence?language_content_entity=en

https://www.worldbank.org/en/topic/socialsustainability/brief/violence-against-women-and girls

https://onlinecourses.swayam2.ac in/nou25_ge38/preview

5. GENDER AND CULTURE

https://gender.study/psychology-of-gender/culture-impact-gender-roles-identities/

https://sociology.iresearchnet.com/sociology-of-culture/gender-and-culture/

https://archive.nptel.ac.in/courses/109/106/109106136/

Abdulali Sohaila. —I Fought For My Life...and Won.‖Available online

(at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

Course Outcomes – Program Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓					✓						
CO2	✓	✓		✓		✓						
CO3	✓	✓				✓						
CO4	✓			✓		✓						

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20ECS03 - ADVANCED EMBEDDED SYSTEM

Credits - 2 **Sessional Marks: 30**

L: T: P:0:1:2 **University Exam Marks: 70**

Course Objectives:

1. Apply the design concepts for development of a process and interpret data.
2. Demonstrate knowledge of programming environment, compiling, debugging, linking and executing variety of programs.
3. Demonstrate documentation and presentation of the algorithms / flowcharts / programs in a record form.
4. Validate the process using known input-output parameters.
5. Employ analytical and logical skills to solve real world problem and demonstrate oral communication skills.

Course Outcomes:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, andengineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for thepublic health and safety, and the cultural, societal, and environmental considerations.
4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information toprovide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with anunderstanding of the limitations.

LIST OF PROGRAMS

1. Write a program to toggle all the led to port and with some time delay using ARM7
2. Write a program to interface LCD with ARM7
3. Write a program to interface 4*4 matrix keypad with ARM7
4. Write a program for interfacing LED and PWM and to verify the output in the ARM7
5. Write a program to interface Stepper motor with ARM7
6. Write a program for interfacing of DC motor with ARM7
7. Write a program to study and characteristics of the programmable gain amplifier (PGA)
8. Write a Program realization of low pass, high pass and band pass filters and their characteristics

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9. Write a program to interface ADC and DAC with PSOC
10. Write a program for digital function implementation using digital blocks
    A. Counter for blinking LED B. PWM C. Digital buffer and digital inverter
11. Write a program to verify Timer operation in different modes
12. Write a Program to interface stepper motor with PSOC
13. Mini Project

*Minimum of 9 experiments to be completed including mini project

Reference Books:

1. Michael J. Pont, "Embedded C", Pearson Education, 2nd Edition, 2008.
2. NigelGardner, "The Microchip PIC in CCS C". Ccs Inc, 2nd Revision Edition.

Course outcomes-Program outcomes- Control Specific Outcomes (CO-PO-PSO)Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	L	M									H	M	
CO2	H	H	L	L									H	M	
CO3	H	H	L										H		
CO4	H	H	M										H	M	L
CO5	H	M	L	H									L	L	H

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23ECI02 - EVALUATION OF INDUSTRY INTERNSHIP

Credits-2 **Sessional Marks: 50**

Course Objectives

By the end of the internship, students will be able to:

1. Apply theoretical knowledge to real-world tasks in a professional setting.
2. Develop essential workplace skills including communication, teamwork, and time management.
3. Gain insight into industry-specific practices and professional environments.
4. Exhibit professionalism, ethical behavior, and responsibility in the workplace.
5. Reflect on personal growth and career goals based on internship experiences.

Course Outcomes

Upon successful completion, students will be able to:

1. Integrate academic learning with practical experience in a relevant field.
2. Communicate effectively with supervisors, colleagues, and clients.
3. Solve workplace problems using critical thinking and creativity.
4. Demonstrate professional conduct and adherence to organizational norms.
5. Analyze and document internship experiences in a structured report or presentation.

Category	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)	Unsatisfactory (1)
Work Ethic	Highly motivated, always on time, meets all deadlines	Usually motivated, on time, meets most deadlines	Adequate motivation, occasional tardiness, meets basic expectations	Needs frequent reminders, often late or misses deadlines	Lacks motivation, consistently late, deadlines often missed
Professionalism	Always respectful, communicates clearly, well-groomed	Usually respectful, communicates effectively	Sometimes lacks professionalism, minor communication issues	Inconsistent behavior, lacks polish in communication	Unprofessional conduct, poor communication
Initiative & Problem Solving	Frequently takes initiative, solves problems independently	Often takes initiative, usually offers solutions	Sometimes takes initiative, needs guidance for problem solving	Rarely takes initiative, depends on others for solutions	Avoids responsibility, unwilling to solve problems
Teamwork & Collaboration	Works exceptionally well with others, promotes collaboration	Works well with team, contributes ideas	Gets along with others, but rarely contributes ideas	Struggles with teamwork, reluctant to cooperate	Does not participate or causes conflict

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Learning & Adaptability	Actively learns new skills, adapts quickly	Willing to learn, adapts with support	Accepts learning tasks, adapts slowly	Resists new tasks or changes	Unwilling to learn or change
Quality of Work	Consistently delivers high-quality, error-free work	Work is mostly high-quality with minor errors	Satisfactory quality, some errors	Work frequently contains errors	Poor quality, frequent and serious errors
Technical/Job-Specific Skills	Demonstrates strong skills, often exceeds expectations	Shows solid skills, meets expectations	Basic understanding of required skills	Limited skill application, needs development	Lacks required skills, does not meet expectations

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M	H	M	M	-	L	-	M	M	H	H	H	H	M
CO2	-	-	-	-	-	M	-	M	H	M	M	M	M	M	
CO3	H	H	H	M	H	-	M	-	M	H	M	H	H	H	H
CO4	-	-	-	-	M	M	H	M	M	M	M	-	M	-	-
CO5	M	M	M	M	M	-	-	-	M	H	M	H	M	M	M

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23ECJ01: INTERNSHIP AND PROJECT

Credits – 12
L:T:P:: 0:0:24

Sessional Marks: 60
University Marks: 140

Course Objectives

1. Enable students to conduct independent and original research on a topic relevant to their field of study, utilizing advanced methodologies and technologies.
2. Deepen students' understanding and expertise in a specific area of technology, enhancing their skills in specialized domains.
3. Train students to effectively communicate complex research findings through a well-structured dissertation and oral presentations.
4. Instill a strong sense of ethics and responsibility in conducting and reporting research.
5. Encourage innovation and creative problem solving through challenging research questions that contribute to technological advancements.

Course Outcomes

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

1. Students will be proficient in designing, executing, and managing a substantial research project that contributes new knowledge or understanding to the field of technology.
2. Students will demonstrate deep knowledge and expert understanding in their chosen research area, applying complex concepts to solve specific problems.
3. Students will be able to communicate their research effectively, both in written format and orally, to a scholarly audience.
4. Students will conduct all aspects of their research according to strict ethical standards and demonstrate integrity in their scientific inquiry.
5. Students will develop innovative solutions or enhancements in their specific area of research, demonstrating creativity and the ability to overcome significant challenges

Rubrics for Evaluation:

1.Research Quality	**40%**	**Originality & Innovation (20%)**	A	Significant originality and innovation; introduces new methods, ideas, or approaches.
			B	Some original elements and attempts at innovation.
			C	Follows existing models with little new input; minor novel aspects.
			D	Lacks originality; largely derivative of existing work.
		Depth & Scope of Research (20%)	A	Comprehensive, detailed; explores subject deeply with broad implications.
			B	Adequate depth and scope; covers necessary aspects.
			C	Meets minimum criteria; lacks depth; limited scope.
			D	Superficial; key aspects missing or poorly covered.

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2. Methodology	20%	Appropriateness & Execution (20%)	A	Perfectly suited to research questions; flawlessly executed.
			B	Appropriate; minor execution flaws.
			C	Mostly appropriate; errors affect results.
			D	Poorly chosen or executed; major flaws.
3. Analysis & Interpretation	20%	Clarity & Depth of Analysis (10%)	A	Exceptionally clear and insightful; deep understanding.
			B	Clear with some insightful observations.
			C	Adequate; lacks depth or insight.
			D	Unclear or incorrect; lacks depth.
		Interpretation & Conclusions (10%)	A	Well-founded, insightful, clearly data-derived.
			B	Logical but lacks some insight or clear link to data.
			C	Some conclusions logical; others unsupported.
			D	Not supported by data; illogical.
4.Writing Quality & Presentation	10%	Coherence & Organization (5%)	A	Exceptionally well-organized; professional presentation.
			B	Well-organized; minor coherence issues.
			C	Organization lacking in areas.
			D	Poor organization; hard to follow.
		Quality of Writing (5%)	A	Clear, concise, appropriate academic style.
			B	Mostly clear; some style or structure errors.
			C	Adequate but may be unclear.
			D	Poor, unclear, lacks academic style.
5.Oral Examination	10%	Preparation & Response (10%)	A	Excellently prepared; detailed, thoughtful responses.
			B	Well-prepared; adequate responses, lacking depth.
			C	Adequately prepared; lacks detail.
			D	Poorly prepared; superficial or incorrect responses.

CourseOutcomes–ProgramOutcomes–ProgramSpecificOutcomes(CO-PO-PSO)Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H	M	M	M	M	M	L	L	M	L	M	H	M	M
CO2	H	H	H	H	M	M	M	M	M	M	M	M	H	H	M
CO3	M	M	M	H	H	M	M	M	M	M	M	H	M	M	H
CO4	M	M	H	M	H	M	M	M	H	H	H	M	M	H	H
CO5	M	M	M	M	M	H	H	H	M	M	M	M	M	H	L

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23ECT27 – DIGITAL CIRCUITS

Credits - 3 | **Sessional Marks: 30**
L: T: P:: 3:0:0 | **University Exam Marks: 70**

Course Objectives:

1. To Learn Boolean algebra, logic simplification techniques, and combinational circuit design.
2. To analyze combinational circuits like adders, subtractors, and code converters.
3. To explore combinational logic circuits and their applications in digital design.
4. To understand sequential logic circuits, including latches, flip-flops, counters, and shift registers.
5. To gain knowledge about programmable logic devices and digital IC's.

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

1. Learn Boolean algebra, logic simplification techniques, and combinational circuit design. L1
2. Analyze combinational circuits like adders, subtractors, and code converters. L2
3. Explore combinational logic circuits and their applications in digital design. L3
4. Understand sequential logic circuits, including latches, flip-flops, counters, and shift registers.L1
5. Gain knowledge about programmable logic devices and digital IC's. L3

UNIT-I

Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Introduction to Logic Gates, Ex-OR, Ex-NOR operations, Minimization of Switching Functions: Karnaugh map method, Logic function realization: AND-OR, OR- AND and NAND/NOR realizations.

UNIT-II

Introduction to Combinational Design 1: Binary Adders, Subtractors and BCD adder, Code converters - Binary to Gray, Gray to Binary, BCD to excess3, BCD to Seven Segment display.

UNIT-III

Combinational Logic Design 2: Decoders, Encoders, Priority Encoder, Multiplexers, Demultiplexers, Comparators, Implementations of Logic Functions using Decoders and Multiplexers.

UNIT-IV

Sequential Logic Design: Latches, Flip-flops, S-R, D, T, JK and Master-Slave JK FF, Edge triggered FF, set up and hold times, Ripple counters, Shift registers.

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UNIT-V

Programmable Logic Devices: ROM, Programmable Logic Devices (PLA and PAL).

Digital IC's: Decoder (74x138), Priority Encoder (74x148), multiplexer (74x151) and de-multiplexer (74x155), comparator (74x85).

TEXT BOOKS:

1. Digital Design, M.Morris Mano & Michel D. Ciletti, 5th Edition, Pearson Education, 1999.

2. Switching theory and Finite Automata Theory, Zvi Kohavi and Nirah K.Jha, 2nd Edition, Tata McGraw Hill, 2005.

REFERENCE BOOKS:

1. Fundamentals of Logic Design, Charles H Roth,Jr., 5th Edition, Brooks/cole Cengage Learning, 2004

Course outcomes-Program outcomes- Program Specific Outcomes (CO-PO-PSO) Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2
CO1	H	M	L	-	-	-	-	-	-	-	-	L	H	M
CO2	H	H	M	-	-	-	-	-	-	-	-	L	H	H
CO3	H	M	H	-	L	-	-	-	-	-	-	M	H	H
C04	H	M	M	-	L	-	-	-	-	-	-	M	H	H
CO5	H	M	M	-	M	-	-	-	-	-	-	M	H	H

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OPEN ELECTIVE - II

23ECT30 - PRINCIPLES OF SIGNAL PROCESSING

Credits: 3 **Sessional Marks: 30**

L:T:P:: 3:0:0 **University Exam Marks: 70**

Course Objectives:

1. To understand the basic properties of signal & systems and LTI systems.
2. To learn Fourier series representation of periodic signals.
3. To study representation of signals in continuous and discrete time Fourier transform
4. To analyze the sampling theorem and characterize signals & systems in time & frequency domain.
5. To apply Laplace transform and Z transform to study about the stability of systems.

Course Outcomes:

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

1. Explain the basic properties of signal & systems and LTI systems.
2. Apply Fourier series to represent periodic signals.
3. Represent signals in continuous and discrete time Fourier transform.
4. Analyze the sampling theorem and characterize signals & systems in time & frequency domain.
5. Analyse the stability of systems by applying Laplace transform and Z transform

UNIT I

Signals-Unit Impulse, Unit Step Functions, Ramp Signal, Rectangular function, Signum Function, Sinc, Exponential and Sinusoidal Signals, Classification of Signals & Systems, Basic System Properties, Linear Time Invariant (LTI) Systems, Discrete-Time LTI Systems, Convolution Sum, Continuous Time LTI Systems, Convolution Integral, Properties of LTI Systems, impulse response, Causality, Stability..**Signals and Systems :** Continuous and Discrete Time Signals, Elementary

UNIT II

Fourier series and Fourier Transform: Continuous time Fourier series (CTFS) Continuous time Fourier Transform (CTFT) and its properties, Relating the Laplace Transform to Fourier Transform, Frequency response of continuous time systems.

UNIT III

Sampling and Discrete Time Signals:

Sampling: Representation of a Continuous Time Signal by Its Samples, Sampling Theorem, Reconstruction of a Signal from Its Samples Using Interpolation, Effect of under sampling, Aliasing.

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Discrete Time Signals : Basic elementary Discrete Time signals – unit step, ramp, exponential, inusoidal. Classification of Discrete Time signals and systems. Discrete LTI system, causality and stability of Discrete systems, frequency response of LTI systems, Z – Transform and its properties, Inverse z-Transform.

UNIT IV

Discrete Fourier Transform & Fast Fourier Transform (DFT & FFT):

Discrete Fourier Transform – Definition and Properties, circular convolution, inverse DFT.

Fast Fourier Transform: Introduction, Radix-2 Decimation in time and Decimation in frequency FFT, Inverse FFT (Radix-2). UNIT V

IIR and FIR Filters

IIR Filters: Introduction to digital filters, Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital filters from analog filters by Impulse invariant and bilinear transformation methods, Basic structures of IIR Filters - Direct form- I, Direct form-II, Cascade form and Parallel form realizations.

FIR Filters: Introduction, Characteristics of FIR filters with linear phase, Frequency response of linear phase FIR filters, Design of FIR filters usingFourier series and windowing methods.

TEXT BOOKS:

1. Signals and Systems, Alan V. Oppenheim, Alan S. Willsky, & S. Hamid, 2nd Edition, Pearson Higher Education, 1997.
2. Principles of Linear Systems and Signals, B.P. Lathi, 2nd Edition, Oxford University Press, 2011.

REFERENCE BOOKS:

1. Signals & Systems, Simon Haykin and B. Van Veen, 2nd Edition, John Wiley, 2003.
2. Signals and systems, Narayana Iyer and K Satya Prasad, 1st Edition, CENGAGE Learning, 2011.
3. Signals, Systems and Transforms, C. L. Philips, J. M. Parr and Eve A. Riskin, 4th Edition, Pearson education, 2008.

Course outcomes-Program outcomes- Control Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	L	M	M	M		L			M		M	H		
CO2	L	M	M	H	L	L				L			H	M	L
CO3	L	M	H	M	H	L		M		L				M	H
CO4	M		M	M	L	M	L	L	L	M		L	H	L	L
CO5		M	M	L	H	H			L	L	L	M	L	H	L

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23ECT31 - MICROCONTROLLERS AND APPLICATIONS

Credits - 3 | **Sessional Marks: 30**
L: T: P:: 3:0:0 | **University Exam Marks: 70**

Course Objective:

1. This course introduces the architecture of 8051 Microcontroller, the instruction set of 8051,
2. Real-time interrupts, real time Timers and interfacing with 8051 Microcontroller.
3. To know the interrupt handling techniques.
4. To understand and Develop a microcontroller based system.
5. To know the assembly language programs.

Course Outcomes:

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

1. Describe the basic architecture of 8051microcontroller
2. Write assembly language programs for 8051 microcontroller.
3. Know the interrupt handling techniques.
4. Know the usage of timers in real time applications.
5. Develop a microcontroller based system.

UNIT I:

8051 Microcontroller

Introduction, Architecture of a 8051 microcontroller: Internal and External memories – Counters and Timers – Synchronous serial communication, asynchronous serial communication – Interrupts, I/O Ports, signal description of 8051.

UNIT II:

Instruction Set of 8051

Basic assembly language programming – Data transfer instructions – Data and Bit manipulation instructions – Arithmetic instructions – Logical operations, Internal RAM, and SFRs – Program flow control instructions – Interrupt control flow.

UNIT III:

Real-Time Control - Interrupts

A: Interrupt handling structure of an MCU – Interrupt Latency and Interrupt deadline – Multiple sources of the interrupts – Non-maskable interrupt sources

B: Enabling or disabling of the sources – Polling to determine the interrupt source and assignment of the priorities among them – Interrupt structure in Intel 8051.

UNIT IV:

Real-Time Control – Timers

Programmable Timers in the MCU's – Free running counter and real time control – Interrupt interval and density constraints, watch dog timer.

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UNIT V:

Interfacing

Switch and Keypad - LED and Array of LEDs - Seven Segment, LCD and its interfaces Stepper motor and DC motor interfacing.

TEXT BOOKS:

1. Microcontrollers Architecture, Programming, Interfacing and System Design – Raj Kamal,Pearson Education, 2005.
2. The 8051 Microcontroller and Embedded Systems – Mazidi and Mazidi, PHI, 2000.

REFERENCES:

1. Kenneth. J. Ayala, "The 8051 Microcontroller", Cengage Learning, 3rd Edition, 2004
2. Microcontrollers (Theory & Applications) – A.V. Deshmuk, WTMH, 2005.
3. Design with PIC Microcontrollers – John B. Peatman, Pearson Education, 2005.

Course Outcomes – Program Outcomes – ProgramSpecific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	H	L										L	L	
CO2	L	L	L	L		L				L			M		L
CO3			L	L	L									L	
CO4		L		M	M	L	L				L		H	L	L
CO5			M	M	M	L				M	M		H	L	L

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23ECT32 - PRINCIPLES OF COMMUNICATION ENGINEERING

Credits: 3 | **Sessional Marks: 30**
L:T:P:: 3:0:0 | **University Exam Marks: 70**

Course Objectives:

1. To understand the concept of various modulation schemes and multiplexing.
2. To apply the concept of various modulation schemes to solve engineering problems.
3. To analyse various modulation schemes.
4. To evaluate various modulation scheme in real time applications.
5. To analyse sampling theorem and pulse modulation techniques.

Course Outcomes:

1. Understand the concept of various modulation schemes and multiplexing
2. Apply the concept of various modulation schemes to solve engineering problems
3. Analyse various modulation schemes.
4. Understand the sampling theorem and pulse modulation techniques.
5. Evaluate various modulation schemes in real time applications.

UNIT I

Amplitude Modulation

Introduction to Noise and Fourier Transform. An overview of Electronic Communication Systems.

Need for Frequency Translation, Amplitude Modulation: DSB-FC, DSB-SC, SSB-SC and VSB. Frequency Division Multiplexing. Radio Transmitter and Receiver.

UNIT II

Angle Modulation

Angle Modulation, Tone modulated FM Signal, Arbitrary Modulated FM Signal, FM Modulation and Demodulation. Stereophonic FM Broadcasting.

UNIT III

Pulse Modulation

Sampling Theorem: Low pass and Band pass Signals. Pulse Amplitude Modulation and Concept of Time Division Multiplexing. Pulse Width Modulation. Digital Representation of Analog Signals.

UNIT IV

Digital Modulation

Binary Amplitude Shift Keying, Binary Phase Shift Keying and Quadrature Phase Shift Keying, Binary Frequency Shift Keying. Regenerative Repeater.

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UNIT V

Communication Systems

Satellite, RADAR, Optical, Mobile and Computer Communication (Block diagram approach only).

Note: The main emphasis is on qualitative treatment. Complex mathematical treatment may be avoided.

Textbooks:

1. Herbert Taub, Donald L Schilling and Goutam Saha, "Principles of Communication Systems", 3rdEdition, Tata McGraw-Hill Publishing Company Ltd., 2008.

References:

1. B. P. Lathi, Zhi Ding and Hari M. Gupta, "Modern Digital and Analog Communication Systems", 4th Edition, Oxford University Press, 2017.
2. K. Sam Shanmugam "Digital and Analog Communication Systems", Wiley India Edition, 2008.

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M		L	M							H	H	H	
CO2	H	M		L	H					L		H	M	M	
CO3	M	M		M	H							L	M	M	M
CO4	M	H		L	H							H	M	H	H
CO5	L	H	M	H	H							H	L	H	H

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23ECT33 - TRANSDUCERS AND SENSORS

Credits - 3 | **Sessional Marks: 30**
L: T: P:: 3:0:0 | **University Exam Marks: 70**

Course Objectives:

1. To understand characteristics of Instrumentation System and the operating principle of motion transducers.
2. To explore working principles, and applications of different temperature transducers and Piezo-electric sensors.
3. To provide knowledge on flow transducers and their applications.
4. To study the working principles of pressure transducers.
5. To introduce working principle and applications of force and sound transducers.

Course Outcomes:

After completing the course, the student will be able to,

1. Understand characteristics of Instrumentation System and the operating principle of motion transducers.
2. Explore working principles, and applications of different temperature transducers and Piezo-electric sensors.
3. Gain knowledge on flow transducers and their applications.
4. Learn the working principles of pressure transducers.
5. Understand the working principle and applications of force and sound transducers.

UNIT I

Introduction: General Configuration and Functional Description of measuring instruments, Static and Dynamic Characteristics of Instrumentation System, Errors in Instrumentation System, Active and Passive Transducers and their Classification.

Motion Transducers: Resistive strain gauge, LVDT, RVDT, Capacitive transducers, Piezo- electric transducers, seismic displacement pick-ups, vibrometers and accelerometers.

UNIT II

Temperature Transducers: Standards and calibration, fluid expansion and metal expansion type transducers - bimetallic strip, Thermometer, Thermistor, RTD, Thermocouple and their characteristics.

Hall effect transducers, Digital transducers, Proximity devices, Bio-sensors, Smart sensors, Piezo-electric sensors.

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UNIT III

Flow Transducers: Bernoulli's principle and continuity, Orifice plate, Nozzle plate, Venture tube, Rotameter, Anemometers, Electromagnetic flow meter, Impeller meter and Turbid flow meter.

UNIT IV

Pressure Transducers: Standards and calibration, different types of manometers, elastic transducers, diaphragm bellows, bourdon tube, capacitive and resistive pressure transducers, high and low pressure measurement.

UNIT V

Force and Sound Transducers: Proving ring, hydraulic and pneumatic load cell, dynamometer and gyroscopes. Sound level meter, sound characteristics, Microphone.

TEXT BOOKS

1. A.K. Sawhney, —A course in Electrical and Electronics — Measurements and Instrumentationl, Dhanpat Rai& Co. 3rd edition Delhi, 2010.
2. Rangan C.S, Sarma G.R and Mani V S V,—Instrumentation Devices and Systemsl, TATA McGraw Hill publications, 2007.

REFERENCE BOOKS

1. Doebelin. E.O, —Measurement Systems Application and Designl,McGraw Hill International, New York, 2004.
2. Nakra B.C andChaudharyK.K , —Instrumentation Measurement and Analysisl, Second Edition, Tata McGraw-Hill Publication Ltd.2006.

Course Outcomes-Program Outcomes -Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	L										H	M	
CO2	M	L	H	M									L	H	
CO3	L	M	H	M									M	H	
CO4	M	L		H									L	M	H
CO5			H	M						M	L	M		M	H

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23ECT16 - ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

Credits - 3 **Sessional Marks: 30**
L: 1: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives:

1. To know about the performance characteristics of instruments and measurement of electrical quantities.
2. To understand the construction, working and applications of different types of CRO's.
3. To analyze the working of different types of bridges.
4. To study the working of signal & function generators and analyzers.
5. To analyze the working of sensors and transducers in measuring physical parameters.

Course Outcomes:

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

1. Learn about the performance characteristics of instruments and measurement of electrical quantities.
2. Understand the construction, working and applications of different types of CRO's.
3. Compare the working of different types of bridges.
4. Know the working of signal & function generators and analyzers.
5. Grasp the working of sensors and transducers in measuring physical parameters.

UNIT-I

Performance characteristics of Instruments: Static characteristics, Accuracy, Precision, Resolution, Sensitivity, static and dynamic calibration, Errors in Measurement, and their statistical analysis, dynamic characteristics-speed of Response, fidelity, Lag and dynamic error. DC ammeters, DC voltmeters-multirange, range extension/solid state and differential voltmeters, AC voltmeters–multirange, range extension. Thermocouple type RF ammeter, ohm meters, series type, shunt type, multimeter for voltage, current and resistance measurements.

UNIT-II

Oscilloscopes: Introduction, Basic Principle, Standard specifications of CRO,CRT features, vertical and horizontal amplifiers, horizontal and vertical deflection systems, sweep trigger pulse, delay line, sync selector circuits, probes for CRO – active, passive, and attenuator type, triggered sweep CRO, and Delayed sweep, dual trace/beam CRO, Measurement of amplitude, frequency and phase (Lissajous method). Principles of sampling oscilloscope, storage oscilloscope, and digital storage oscilloscope, Digital frequency counters, time & Period measurements.

UNIT-III

Bridges: DC Bridges for Measurement of resistance: Wheat stone bridge, Kelvin's Bridge, AC Bridges for Measurement of inductance- Maxwell's bridge, Hay's Bridge, Anderson bridge. Measurement of capacitance- Schearing Bridge, Wien Bridge. Errors and precautions in using bridges.

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UNIT-IV

Signal Generators: Signal generator-fixed and variable, AF oscillators, function generators, pulse, random noise, sweep, and arbitrary waveform generators, their standards, specifications and principles of working (Block diagram approach).Wave analyzers, Harmonic distortion analyzers, Spectrum analyzers, and Logic analyzers.

UNIT-V

Sensors and Transducers - Active and passive transducers: Measurement of displacement (Resistance, capacitance, inductance; LVDT) Force (strain gauges) Pressure (piezoelectric transducers) Temperature (resistance thermometers, thermocouples and thermistors), Velocity, Acceleration, Vibration, pH measurement Signal Conditioning Circuits.

TEXT BOOKS:

1. A.D. Helfrick and W.D. Cooper, —Modern Electronic Instrumentation and Measurement Techniquesl, 5th Edition, PHI, 2002.
2. H.S.Kalsi, —Electronic Instrumentationl, 2nd edition, Tata McGraw Hill, 2004.

REFERENCES:

1. David A. Bell, —Electronic Instrumentation & Measurementsl, 2nd Edition, PHI, 2003.
2. K. Lal Kishore, —Electronic Measurements & Instrumentationsl, Pearson Education, 2009.

Course Outcomes – Program Outcomes – ProgramSpecific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	L		L	M						L	L	H		L
CO2	M	L			L					L	L	L	M	L	
CO3	H	L		L	M								H	M	M
CO4	M				L		L				M	L	H	H	L
CO5	M	L	M		L	L				M		M	L	H	L

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23ECT14 - INFORMATION THEORY AND CODING

Credits - 3 **Sessional Marks: 30**

L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives:

1. To provide an insight into the concept of information in the context of communication theory and communication receivers.
2. To implement various source coding algorithms and analyze their performance.
3. To gain knowledge about techniques for error detection and error correction.
4. To design linear block codes and cyclic codes.
5. To get familiar with various convolutional codes.

Course Outcomes:

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

1. Learn the concepts of information in the context of communication theory and communication receivers.
2. Implement various source coding algorithms and analyze their performance.
3. Gain knowledge about techniques for error detection and error correction.
4. Design linear block codes and cyclic codes.
5. Understand various convolutional codes.

UNIT I

Information Theory: Introduction, Definition of Entropy, Conditional Entropy, Relative Entropy, Basic Properties of Entropy, Mutual Information, Information Inequalities, Problem solving.

Block to Variable length Coding: Prefix-free Code, Coding a single Random Variable, Prefix, Free Code, Kraft Inequality, Bounds on optimal Code length, Coding a Single Random Variable, Rooted Tree with Probabilities, Shanon-Fano Coding, Free fix code, Coding an information Source, Huffman Coding, Example.

Variable to Block Length Coding: Proper message set, Assigning probabilities to K-ary rooted tree corresponding to a proper message set, Prefix free Coding of a proper message set, Tunstall message set, Tunstall coding.

UNIT II

Asymptotic Equi-partition Property, Chebyshev inequality, Weak law of large numbers, Typical Sequences, Block to Block Coding of DMS: Consequences of Asymptotic Equipartition Property, Problem solving.

Universal Source Coding: Lempel-Ziv Algorithm, LZ -77 Encoding and Decoding, Lempel-Ziv Welch (LZW) Algorithm, LZW Encoding, and Decoding.

Coding of Sources with memory, Channel Capacity, Noisy Channel Coding Theorem, Differential Entropy, Gaussian Channel, Rate Distortion Theory, Blahut-Arimoto Algorithm, problem solving.

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UNIT III

Error Control Coding: Introduction to Error Control Codes, Error Probability with Repetition in the Binary Symmetric Channel, Parity Check Bit Coding for Error Detection, Block Coding for Error Detection and Correction, The Hamming Distance, The upper bound of the Probability of Error with Coding, Soft Decision Decoding, Hard Decision Decoding.

UNIT IV

Linear Block Codes: Introduction to Linear Block Codes, Syndrome and Error Detection, Encoding Block Codes, Decoding of Block Codes, Single Parity Check bit Code, Repeated Codes, Hadamard Code, Hamming Code, Cyclic Codes, Generator and Parity-Check Matrices of Cyclic Codes, Encoding and Decoding of Cyclic Codes, BCH codes, Reed-Solomon Code.

UNIT V

Convolutional Coding, Code Generation, Decoding Convolutional Code, the Code Tree, Decoding in the presence of Noise, State and Trellis Diagrams, The Viterbi Algorithm, Comparison of Error Rates in Coded and Uncoded Transmission, Turbo Codes, LDPC codes, Hard and Soft Decision Decoding.

Textbooks:

1. Thomas M.Cover, Joy A. Thomas, Elements of Information Theory, John Wiley & Sons,2nd Edition, 2006.
2. Herbert Taub, Donald L Shilling, Goutam Saha, Principles of Communication Systems, 4th Edition, McGraw Hill, 2017.

References:

1. Shu Lin, Daniel J. Costello Jr., Error Control Coding, Pearson, Second Edition, 2013.
2. Simon Haykin, Communication Systems, John Wiley, 4th Edition, 2010.

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO
CO1	M	H	L										L	M	
CO2	H	L	H	M									M	H	
CO3	L	L	H	M									M	H	
CO4	M	M		L									L	M	H
CO5			H	M					L	M	L	M		M	H

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23ECT20 - DIGITAL IMAGE PROCESSING

Credits – 3 **Sessional Marks: 30**

L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives:

1. To learn the fundamentals of Image Processing with different Transforms.
2. To understand functions of Intensity Transformations and working fundamentals of Spatial Filters
3. To implement various models of Restoring and Reconstruction of Images from filtering projections.
4. To study the concepts of image compression using different coding & Wavelets and Multiresolution Processes.
5. To design image processing systems using Segmentation techniques for Morphological & Color Images.

Course Outcomes:

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

1. Learn the fundamentals of Image Processing with different Transforms.
2. Understand the functions of Intensity Transformations and working fundamentals of Spatial Filters
3. Implement various models of Restoring and Reconstruction of Images from filtering projections.
4. Grasp the concepts of image compression using different coding &Wavelets and Multiresolution Processes.
5. Design the image processing systems using Segmentation techniques for Morphological & Color Images.

UNIT I

Introduction: Introduction to Image Processing, Fundamental steps in digital image processing, components of an image processing system, image sensing and acquisition, image sampling and quantization, some basic relationships between pixels, an introduction to the mathematical tools used in digital image processing. Image Transforms: Need for image transforms, Discrete Fourier transform (DFT) of one variable, Extension to functions of two variables, some properties of the 2-D Discrete Fourier transform, Importance of Phase, Walsh Transform, Hadamard transform, Haar Transform, Slant transform, Discrete Cosine transform, KL Transform, SVD and Radon Transform, Comparison of different image transforms.

UNIT II

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 Filtering in the Frequency Domain: Preliminary concepts, The Basics of filtering in the frequency domain, image smoothing using frequency domain filters, Image Sharpening using frequency domain filters, Selective filtering.

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UNIT III

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, Estimating the degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering, constrained least squares filtering, geometric mean filter ,image reconstruction from projections.

UNIT IV

Image compression: Fundamentals, Basic compression methods: Huffman coding, Golomb coding, Arithmetic coding, LZW coding, Run-Length coding, Symbol-Based coding, Bit-Plane coding, Block Transform coding, Predictive coding Wavelets and Multiresolution Processing: Image pyramids, subband coding, Multiresolution expansions, wavelet transforms in one dimensions & two dimensions, Wavelet coding.

UNIT V

Image segmentation: Fundamentals, point, line, edge detection, thresholding, region –based segmentation. Morphological Image Processing: Preliminaries, Erosion and dilation, opening and closing, basic morphological algorithms for boundary extraction, thinning, gray-scale morphology. Segmentation using morphological watersheds.

Color image processing: color fundamentals, color models, pseudo color image processing, basics of full color image processing, color transformations, smoothing and sharpening. Image segmentation based on color, noise in color images, color image compression.

Textbooks:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd edition, Prentice Hall, 2008.
2. Jayaraman, S. Esakkirajan, and T. Veerakumar,I Digital Image Processingl, Tata McGraw-Hill Education, 2011.

Reference Books:

1. Anil K.Jain. —Fundamentals of Digital Image Processingl, Prentice Hall of India, 9th Edition, Indian Reprint, 2002.
2. B.Chanda, D.DuttaMajumder, —Digital Image Processing and Analysisl, PHI, 2009

Online Learning Resources:

https://nptel.ac.in/courses/117105079

https://nptel.ac.in/courses/117105135

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Course outcomes-Program outcomes- Control Specific Outcomes (CO-PO-PSO)Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO
	H	L	M	M	M		L			M		M	H		
	L	M	M	H	L	L				L			H	M	L
	L	M	H	M	M	H		M		L				H	M
	M		M	M	L	M	L	L	L	M		L	H	L	L
		H	M	L	H	L			M	L	L	L	M	H	L

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23ECT34 – FUNDAMENTALS OF COMMUNICATION NETWORKS

Credits - 3
L: T: P:: 3:0:0

Sessional Marks: 30
University Exam Marks: 70

Course Objectives

1. To understand the architecture, components, and models of computer networks.
2. To explore the functions and services of each layer in the OSI and TCP/IP models.
3. To analyze various transmission media, switching, and routing techniques.
4. To study network protocols, addressing, and error control mechanisms.
5. To introduce basic concepts of network security and performance evaluation.

Course Outcomes

After successful completion of the course the student should be able to

CO1: Analyze the functioning of Computer Communication and Network.
CO2: Select relevant Transmission Media and Switching Techniques as per need.
CO3: Analyze the Transmission Errors with respect to IEEE standards.
CO4: Configure different TCP/IP services.
CO5: Implement relevant Network Topology using Networking Devices.

UNIT I

Fundamentals of computer Communications and Networks: Process of data communication and its components: Transmitter, Receiver, Medium, Message, Protocol, Protocols, Standards, Standard organizations, Bandwidth, Data Transmission Rate, Baud Rate and Bits per second, Modes of Communication (Simplex, Half duplex, Full Duplex), Analog Signal and Digital Signal, Analog and Digital Transmission: Analog To Digital, Digital To Analog Conversion, Fundamental Of Computer Network: Definition And Need Of Computer Network, Applications, Network Benefits, Classification Of Network: LAN, WAN,MAN

UNIT-II

Transmission Media And Switching: Communication Media: Guided Transmission Media Twisted-Pair Cable, Coaxial Cable, Fiber-Optic Cable, Unguided Transmission Media: Radio Waves, Microwaves, Infrared, Satellite, Line-of-Sight Transmission, Point-to-Point, Broadcast, Multiplexing: Frequency-Division Multiplexing ,Time - Division Multiplexing, Switching: Circuit-switched network, Packet switched network.

UNIT-III

Error Detection and Correction: Types of Errors, Forward Error Correction Versus Retransmission, Framing: Fixed Sized and Variable Sized Framing, Error Detection: Repetition codes, Parity bits, Checksums, CRC, Error Correction: Automatic Repeat Request (ARQ), Hamming Code, Wireless LAN IEEE 802.11 standard Architecture, Features of IEEE 802.11 versions: 802.11, 802.11a, 802.11b, 802.11g, 802.11n, 802.11p, Bluetooth Architecture: Piconet, Scatternet, Mobile Generations: 3G, 4G and 5G.

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UNIT-IV

Network Communication Models: THE OSI MODEL: Layered Architecture, Encapsulation, Layers in OSI Model(Functions of each layer)-Physical Layer, Data-Link Layer, Network Layer, Transport Layer, Session Layer, Presentation Layer, Application Layer, TCP/IP Layers and their functions: Host To Network Layer, Internet Layer, Transport Layer, Application Layer, Protocols: Host To Network Layer-SLIP,PPP, Internet Layer-IP, ARP, RARP, ICMP, Transport Layer-TCP and UDP, Application Layer-FTP,HTTP,SMTP,TELNET,BOOTP,DHCP, Addressing: Physical Address, Logical Address, Port Address 4.6 IP Address-Concept, Notation, Address Space, IPv4 Addressing: Classful and Classless Addressing ,subnet mask, supernetting, subnetting, IPV6 Addressing scheme and basic structure

UNIT-V

Network Topologies and Network Devices: Network Computing Model: Peer To Peer, Client Server, Network Topologies: Introduction, Definition, Selection criteria, Types of Topology-Star, Mesh, Tree, Hybrid, Network Connecting Devices: Switch, Router, Repeater, Bridge, Gateways and Modem.

TEXT BOOKS:

1. Behrouz A. Forouzan, Data Communication and Networking, McGraw-Hill Higher Education ISBN-13 978-0-07- 296775-3.
2. Behrouz A. Forouzan: TCP/IP Protocol Suit, McGraw Hill Education ISBN-13 978-0073376042.

REFERENCES:

1. A.S. Tanenbaum, Computer Networks, PRENTICE HALL ISBN-10: 0-13-212695-8 , ISBN13:978-0-13-212695-3.
2. Godbole Achyut, Data Communication and Networks, McGraw Hill Education ISBN-10 9780071077705,ISBN-13 978-0071077705.
3. Comer Douglas E., TCP/IP Principles, Protocols and Architectures, PEARSON ISBN 10: 0-13-608530-X ISBN 13: 978- 0-13-608530-0.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M								M		L	H		
CO2	H	H								M		L	H		
CO3	H	H	M	M						M		L	H	M	L
CO4	H	H	M	M						M		L	H	M	
CO5	H	M	M	M						M		L	M	M	

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23ECT25 – INTERNET OF THINGS & APPLICATIONS

Credits – 3 **Sessional Marks: 30**

L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives:

1. Understand the basics of Internet of Things and protocols.
2. Discuss the requirement of IoT technology
3. Introduce some of the application areas where IoT can be applied.
4. Understand the vision of IoT from a global perspective, understand its applications, determine its market perspective using gateways, devices and data management.
5. To analyze IoT solutions using sensors, actuators and Devices.

Course Outcomes:

After completion of the course, students will be able to

1. Understand general concepts of Internet of Things.
2. Apply design concept to IoT solutions
3. Analyze various M2M and IoT architectures
4. Evaluate design issues in IoT applications
5. Create IoT solutions using sensors, actuators and Devices

UNIT I

Introduction to IoT

Definition and Characteristics of IoT, physical design of IoT, IoT protocols, IoT communication models, IoT Communication APIs, Communication protocols, Embedded Systems, IoT Levels and Templates

UNIT II

Prototyping IoT Objects using Microprocessor/Microcontroller

Working principles of sensors and actuators, setting up the board – Programming for IoT, Reading from Sensors, Communication: communication through Bluetooth, Wi-Fi.

UNIT III

IoT Architecture and Protocols

Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, Protocols- 6LowPAN, RPL, CoAP, MQTT, IoT frameworks- Thing Speak.

UNIT IV

Device Discovery and Cloud Services for IoT

Device discovery capabilities- Registering a device, Deregister a device, Introduction to Cloud Storage models and communication APIs Web-Server, Web server for IoT.

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UNIT V

UAV IoT

Introduction toUnmanned Aerial Vehicles/Drones, Drone Types, Applications: Defense, Civil, Environmental Monitoring; UAV elements and sensors- Arms, motors, Electronic Speed Controller(ESC), GPS, IMU, Ultra sonic sensors; UAV Software –Arudpilot, Mission Planner, Internet of Drones(IoD)- Case study FlytBase.

Textbooks:

1. Vijay Madisetti and ArshdeepBahga, Internet of Things (A Hands-on-Approach), 1st Edition, VPT, 2014.
2. Handbook of unmanned aerial vehicles, K Valavanis;George J Vachtsevanos, New York, Springer, Boston, Massachusetts : Credo Reference, 2014. 2016.

Reference Books:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligencel, 1st Edition, Academic Press, 2014.
2. ArshdeepBahga, Vijay Madisetti - Internet of Things: A Hands-On Approach, Universities Press, 2014.
3. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.
4. Francis daCosta, - Rethinking the Internet of Things: A Scalable Approach to Connecting Everythingl, 1st Edition, Apress Publications, 2013
5. Cuno Pfister, Getting Started with the Internet of Things, O Reilly Media, 2011, ISBN: 9781-4493- 9357-1
6. DGCA RPAS Guidance Manual, Revision 3 – 2020
7. Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs, John Baichtal

Course outcomes-Program outcomes- Control Specific Outcomes (CO-PO-PSO)Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		M	L	M									H	M	
CO2	M	H	L	L									H	M	
CO3	M	L	L										H		
CO4	L	H	M										H	M	L
CO5		M	L	H									L	L	H

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23ECT17 - EMBEDDED SYSTEMS

Credits - 3
L: T: P:: 3:0:0

Sessional Marks: 30
University Exam Marks: 70

Course Objectives:

1. To understand the history, classification, and design process of embedded systems.
2. To explore the core components of embedded systems, including processors, memory, and I/O components.
3. To introduce onboard and external communication interfaces used in embedded systems.
4. To explain different firmware design approaches and programming techniques for embedded systems.
5. To provide an understanding of real-time operating systems and task management in embedded systems.

Course Outcomes:

After completing the course, the student will be able to,

1. Classify embedded systems based on their purpose, generation, and complexity.
2. Identify and select appropriate hardware components for an embedded system design.
3. Differentiate and implement various communication protocols like I2C, SPI, and CAN.
4. Develop firmware using assembly and high-level programming languages.
5. Analyze and apply RTOS-based task scheduling and synchronization techniques.

UNIT I
Introduction to Embedded Systems

History of embedded systems, Classification of embedded systems based on generation and complexity, Purpose of embedded systems, The embedded system design process-requirements, specification, architecture design, designing hardware and software, components, system integration, Applications of embedded systems, and characteristics of embedded systems.

UNIT II
Typical Embedded System

Core of the embedded system-general purpose and domain specific processors, ASICs, PLDs, COTs; Memory-ROM, RAM, memory according to the type of interface, memory shadowing, memory selection for embedded systems, Sensors, actuators, I/O components: seven segment LED, relay, piezo buzzer, push button switch, other sub-systems: reset circuit, brownout protection circuit, oscillator circuit real time clock, watch dog timer.

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UNIT III
Communication Interface

Onboard communication interfaces-I2C, SPI, CAN, parallel interface; External communication interfaces-RS232 and RS485, USB, infrared, Bluetooth, Wi-Fi, ZigBee, GPRS, GSM.

UNIT IV
Embedded Firmware Design and Development

Embedded firmware design approaches-super loop based approach, operating system based approach; embedded firmware development languages-assembly language based development, high level language based development.

UNIT V
RTOS based Embedded System Design

Operating system basics, types of operating systems, tasks, process and threads, multiprocessing and multitasking, task scheduling: non-pre-emptive and pre-emptive scheduling; task communication-shared memory, message passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/ Synchronization Issues, Task Synchronization Techniques

Textbooks:

1. Introduction to Embedded Systems - Shibu KV, Mc Graw Hill Education.
2. Computers as Components –Wayne Wolf, Morgan Kaufmann (second edition).

References:

1. Embedded System Design -Frank Vahid, Tony Grivargis, john Wiley.
2. Embedded Systems- An integrated approach - Lyla b das, Pearson education 2012.
3. Embedded Systems – Raj Kamal, TMH

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		L				M						H		
CO2	L	M	H	M	L					L				M	H
CO3				M	H		L		L	M	L		L	M	H
CO4		L	M	H				L	M		M	L		L	H
CO5			M	L		H	L	M	L	L	M	M	L	H	M

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23ECT23 - WIRELESS SENSOR NETWORKS

Credits – 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives:

1. To introduce the fundamental concepts and architecture of wireless sensor networks.
2. To explore various network architectures, optimization techniques, and design principles for wireless sensor networks.
3. To study MAC protocols, routing techniques, and addressing mechanisms for efficient sensor network communication.
4. To understand the infrastructure establishment of sensor networks, including topology control and synchronization.
5. To provide knowledge on sensor network platforms, programming challenges, and simulation tools.

Course Outcomes:

After completing the course, the student will be able to,

1. Learn the fundamental concepts and architecture of wireless sensor networks.
2. Explore various network architectures, optimization techniques, and design principles for wireless sensor networks.
3. Gain knowledge of MAC protocols, routing techniques, and addressing mechanisms for efficient sensor network communication.
4. Understand the infrastructure establishment of sensor networks, including topology control and synchronization.
5. Grasp the knowledge on sensor network platforms, programming challenges, and simulation tools.

UNIT I

Overview of Wireless Sensor Networks: Single-Node Architecture - Hardware Components- Network Characteristics- unique constraints and challenges, Enabling Technologies for Wireless Sensor Networks- Types of wireless sensor networks.

UNIT II

Architectures: Network Architecture- Sensor Networks-Scenarios- Design Principle, Physical Layer and Transceiver Design Considerations, Optimization Goals and Figures of Merit, Gateway Concepts.

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UNIT III

Networking Sensors: MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wakeup Concepts - SMAC, - B-MAC Protocol, IEEE 802.15.4 standard and ZigBee, the Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols Energy-Efficient Routing, Geographic Routing.

UNIT IV

Infrastructure Establishment: Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

UNIT V

Sensor Network Platforms and Tools: Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node level Simulators, State-centric programming.

Textbooks:

1. Holger Karl & Andreas Willig, "Protocols and Architectures for Wireless Sensor Networksl, John Wiley, 2005.
2. Feng Zhao & Leonidas J.Guibas, —Wireless Sensor Networks-An Information Processing Approach", Elsevier, 2007

Reference Books:

1. WaltenegusDargie , Christian Poellabauer, —Fundamentals Of Wireless Sensor Networks Theory And Practicel, By John Wiley & Sons Publications, 2011
2. KazemSohraby, Daniel Minoli, &TaiebZnati, —Wireless Sensor Networks-Technology, Protocols, and Applicationsl, John Wiley, 2007.
3. Anna Hac, —Wireless Sensor Network Designsl, John Wiley, 2003

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO
CO1	H	M	L	L	L		L					M	H	L	L
CO2	H	L	H	L	L		M					M	H	M	L
CO3	H	M	L	L	H		L					L	H	L	M
CO4	H	L	H	M	M		L					L	H	M	L
CO5	H	L	L	M	H		L					M	H	L	M

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