B.Tech
III Year II Semester

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)-AK19 REGULATIONS
B. Tech III Year II Semester
Common to ECE & EEE

COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19APC0417	MICROPROCESSORS AND MICROCONTROLLERS	3	0	0	3

Course Outcomes:
After completion of this subject the students will be able to:
CO1: Describe the concepts of Intel 8085 series of processors.
CO2: Discuss various Concepts of 8086.
CO3: Demonstrate the concepts of 8086 instruction set.
CO4: Program Discriminate the concepts of MSP430x2x Microcontroller series.
CO5: Summarize different peripherals of MSP430.

UNIT I
Overview of microcomputer systems and their building blocks, Introduction to 8-bit microprocessor (8085) Architecture, Addressing modes, Instruction set, Machine cycles, instruction cycle and timing states.

UNIT II
Introduction-8086 Architecture-Block Diagram, Register Organization, Flag Register, Pin Diagram, Timing and Control Signals, System Timing Diagrams, Memory Segmentation, Interrupt structure of 8086 and Interrupt Vector Table. Memory organization and memory banks accessing.

UNIT III
Instruction Formats -Addressing Modes-Instruction Set of 8086, Assembler Directives- Macros and Procedures.- Sorting, Multiplication, Division and multi byte arithmetic code conversion. String Manipulation instructions-Simple ALPs.

UNIT-IV
Low power RISC MSP430 – block diagram, features and architecture, Variants of the MSP430 family viz. MSP430x2x, MSP430x4x, MSP430x5x and their targeted applications, MSP430x5x series block diagram, Addressing modes, Instruction set Memory address space, on-chip peripherals (analog and digital), and Register sets. Sample embedded system on MSP430 microcontroller.

UNIT-V:
I/O ports pull up/down resistors concepts, Interrupts, Watchdog timer. System clocks. Low Power aspects of MSP430: low power modes, Active vs Standby current consumption, FRAM vs Flash for low power & reliability. Timer & Real Time Clock (RTC), timing generation and measurements. Analog interfacing and data acquisition: ADC and Comparator in MSP430, data transfer using DMA.

Text Books:
1. R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing, 1996.
2. Douglas V. Hall, “Microprocessors and interfacing: Programming and hardware”, 2nd Edition. Tata McGraw Hill, 1991.
3. “Microprocessor and Microcontrollers”, N. Senthil Kumar, M. Saravanan, S. Jeevanathan, Oxford Publishers. 1st Edition, 2010
4. “The X86 Microprocessors , Architecture, Programming and Inerfacing” , Lyla B. Das, Pearson Publications, 2010
5. MSP430 microcontroller basics. John H. Davies, Newnes Publication, I st Edition, 2008

References:
1. http://processors.wiki.ti.com/index.php/MSP430_LaunchPad_Low_Power_Mode
2. http://processors.wiki.ti.com/index.php/MSP430_16-Bit_Ultra- Low_Power_MCU_Training

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 3: Design/Development of Solutions	3.2	3.2.2
CO: 2	PO 4: Conduct investigations of complex problems	4.1	4.1.1
CO: 3	PO 5: Modern tool usage	5.1	5.1.2
CO: 4	PO 5: Modern tool usage	5.2	5.2.1
CO: 5	PO 5: Modern tool usage	5.2	5.2.2

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COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19APC0418	DIGITAL SIGNAL PROCESSING	3	0	0	3

Course Outcomes (COs): **Student can able to**

CO1: Interpret, represent and process discrete/digital signals and systems
CO2: Understand frequency domain analysis of discrete time signals
CO3: Design & analyze various Analog Filters and Digital Filters
CO4: Implement and realize various structures IIR and FIR systems
CO5: Acquire the basics of multi rate digital signal processing

UNIT-I

Review of discrete-time signals and systems- Standard discrete time signals, classification of discrete time signals, basic operations on sequences, classification of discrete time systems, DT LTI system, properties of DTLTI system –Time domain analysis of discrete-time signals & systems –natural response, forced response, total response , Frequency domain analysis of discrete-time signals and systems-transfer function.

UNIT-II

Discrete Fourier Transform: Frequency-domain sampling and reconstruction of discrete-time signals, Discrete Fourier Transform (DFT), The DFT as a linear transformation, Relationship of the DFT to other transforms, Properties of DFT, Linear filtering methods based on DFT, Frequency analysis of signals using the DFT Efficient computation of the DFT – Direct computation of DFT, Divide and conquer approach to computation of DFT, Radix-2 FFT algorithms, Implementation of FFT algorithms, Applications of FFT algorithms – Efficient computation of the DFT of two real sequences, 2N point real sequences, Use of the FFT algorithm in linear filtering and correlation, A linear filtering approach to computation of the DFT- the Goertzel, and the Chirp-z transform algorithms, Quantization errors in the computation of DFT.

UNIT-III

General considerations – Causality and its implications, Characteristics of practical Frequency Selective Filters, Design of Finite Impulse Response (FIR) filters – Symmetric and asymmetric FIR filters, Design of linear phase FIR filters using windows, Design of linear phase FIR filters by the frequency sampling method, Design of optimum equi-ripple linear phase FIR filters, Comparison of design methods for linear phase FIR filters, Design of Impulse Invariance Response (IIR) filters from analog filters – IIR filter design by approximation of derivatives, by Impulse invariance, and by bilinear transformation methods, Characteristics of commonly used analog filters, Design examples of both FIR and IIR filters, Frequency transformation in the analog and digital domains, Illustrative problems.

UNIT-IV

Structures for the realization of discrete-time systems, Structures for FIR systems - Direct form, Cascade form, Frequency sampling, and Lattice structures, Structures for IIR systems – Direct form, Signal flow graphs & Transposed, Cascade form, Parallel form and Lattice structures, Conversion from Lattice structure to direct form, lattice – Ladder structure.

UNIT-V

Introduction, Decimation, and interpolation, Sampling rate conversion by a rational factor, Implementation of sampling rate conversion, Multistage implementation of sampling rate conversion, Sampling rate conversion of band pass signals, Sampling rate conversion by arbitrary factor, Applications of multirate signal processing.

TEXT BOOKS:

1. John G. Proakis, Dimitris G. Manolakis, “Digital signal processing, principles, Algorithms and applications,” Pearson Education/PHI, 4th ed., 2007.
2. Sanjit K Mitra, “Digital signal processing, A computer base approach,” Tata McGraw Hill, 3rd

edition, 2009.

REFERENCES:

1. V. Oppenheim and R.W. Schaffer, & J R Buck, "Discrete Time Signal Processing," 2nd ed., Pearson Education, 2012.
2. P. Lathi, "Principles of Signal Processing and Linear Systems," Oxford Univ. Press, 2011.
3. Li Tan, Jean Jiang, "Digital Signal Processing, Fundamentals and Applications," Academic Press, Second Edition, 2013.

CO No.	PO No. and Keyword	Competency Indicator	Performance Indicator
CO1	PO 1: Engineering knowledge	1.3	1.3.1
	PO 4: Conduct investigations of complex problems	4.3	4.3.1
			4.3.2
			4.3.3.
			4.3.4
	PO 5: Modern tool usage	5.2	5.2.1
			5.2.2
CO2	PO 1: Engineering knowledge	1.3	1.3.1
	PO 2: Problem analysis	2.4	2.4.1
			2.4.2
			2.4.3
	PO 5: Modern tool usage	5.2	5.2.1
			5.2.2
CO3	PO 3: Design/Development of solutions	3.3	3.3.1
			3.3.2
	PO 5: Modern tool usage	5.2	5.2.1
			5.2.2
CO4	PO 2: Problem analysis	2.1	2.1.1
			2.1.3
		2.3	2.3.1
			2.3.2
CO5	PO 5: Modern tool usage	5.2	5.2.1
			5.2.2
	PO 10: Communication	10.3	10.3.1
			10.3.2

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COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19APC0419	MICROWAVE ENGINEERING AND OPTICAL COMMUNICATIONS	3	0	0	3

Course Outcomes:

CO1: Ability to analyze micro-wave circuits incorporating hollow, dielectric and planar waveguides, transmission lines, filters and other passive components, active devices.
CO2: Ability to Use S-parameter terminology to describe circuits and to explain how microwave devices and circuits are characterized in terms of their "S"- Parameters.
CO3: Ability to analyze the operation of Microwave tubes like klystron, magnetron, travelling wave tube and to measure the different parameters of microwave test bench setup.
CO4: Ability to understand the Optical sources, detectors and their working principle.
CO5: Ability to analyze the channel impairments like losses and dispersion.

UNIT-I

MICROWAVE TRANSMISSION LINES: Introduction, Microwave spectrum and bands, applications of Microwaves. Rectangular Waveguides-Solution of Wave Equation in Rectangular Coordinates, TE/TM mode analysis, Expressions for fields, Characteristic equation and cutoff frequencies, filter characteristics, dominant and degenerate modes, sketches of TE and TM mode fields in the cross-section. Mode characteristics- Phase and Group velocities, wavelengths and impedance relations, Illustrative Problems.
MICROWAVE SOLID STATE DEVICES: Introduction, classification, applications, Transfer Electronic Devices, Gunn diode-principles, RWH theory, characteristics, basic modes of operation - Gunn oscillation modes.

UNIT-II

WAVEGUIDE COMPONENTS AND APPLICATIONS: Coupling mechanisms- probe, loop, aperture types. Wave guide discontinuities-waveguide Windows, tuning screws and posts, matched loads. Waveguide attenuators-resistive card, rotary vane Attenuators; waveguide phase shifters-dielectric, rotary vane phase shifters. Wave guide multiport junctions and scattering parameters-E plane and H plane Tees, Magic Tee, Directional couplers-2 hole, Bothe hole types, Illustrative Problems.

UNIT-III

MICROWAVE TUBES: Limitations and losses of conventional tubes at microwave frequencies. Microwave tubes-O type and M type classifications. O type tubes: 2 cavity klystrons-structure, Reentrant cavities, velocity modulation process and Applegate diagram, bunching process and small signal theory-Expressions for O/P power and efficiency. Reflex Klystrons-structure, Velocity Modulation, Applegate diagram, mathematical theory of bunching, power output, efficiency , oscillating modes and O/P characteristics, Effect of Repeller Voltage on Power O/P, Illustrative Problems.
MICROWAVE MEASUREMENTS:
Description of Microwave bench-different blocks and their features, errors and precautions, Measurement of attenuation, frequency standing wave measurements- measurement of low and high VSWR ,impedance measurements.

UNIT-IV

Introduction to Optical Fibers: Evolution of fiber optic system- Element of an Optical Fiber Transmission link- Ray Optics-Optical Fiber Modes and Configurations – Mode theory of Circular Wave guides-Overview of Modes-Key Modal concepts- Linearly Polarized Modes –Single Mode Fibers-Graded Index fiber structure.

UNIT-V

Signal Degradation Optical Fibers: Attenuation – Absorption losses, Scattering losses, Bending Losses,

Core and Cladding losses, Signal Distortion in Optical Wave guides - Information Capacity determination – Group Delay- Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers-Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers-Mode Coupling –Design Optimization of SM fibers-RI profile and cut-off wavelength

TEXT BOOKS:

1. Microwave devices and circuits-Samuel Y. Liao, Pearson, 3rd Edition, 2003.
2. Microwave principles-Herbert J.Reich,J.G.Skalnik, P.F.Ordung and H.L.Krauss, CBS publishers and distributors, New Delhi,2004.
3. Gerd Keiser, "Optical Fiber Communication" McGraw –Hill International, Singapore, 3rd ed., 2000.
4. J.Senior, "Optical Communication, Principles and Practice", Prentice Hall of India, 1994.

REFERENCES:

1. Foundations for microwave engineering-R.E.Collin, IEEE press, John Wiley, 2nd edition, 2002.
2. Microwave circuits and passive devices-M.L.Sisodia and G.S.Raghuvanshi,Wiley Eastern Ltd.,New age International publishers Ltd., 1995.
3. Max Ming-Kang Liu, "Principles and Applications of Optical Communications", TMH, 2010.
4. S.C.Gupta, "Text book on optical fiber communication and its applications", PHI, 2005.
5. Satish Kumar, "Fundamentals of Optical Fiber communications", PHI, 2009.

List of	PO no. and keyword	Competency	Performance
CO: 1	PO 4: Conduct investigations of complex problems	4.3	4.3.3
CO: 2	PO 2: Problem analysis:	2.4	2.4.1
CO: 3	PO 4: Conduct investigations of complex problems	4.1	4.1.2
CO: 4	PO 1: Engineering knowledge	1.3	1.3.1
CO: 5	PO 1: Engineering knowledge	1.3	1.3.1

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Course Code	Course Title	L	T	P	Credits
19APE0404	REAL TIME OPERATING SYSTEMS	3	0	0	3

Course Outcomes:
Upon successful completion of the course, students will be able to
CO1. Introduce real-time embedded systems
CO2. Describe the different types of policies.
CO3. Demonstrate the Multi-resource Services techniques.
CO4. Explain the Embedded System Components.
CO5. Explain the embedded system design based on avaiLaboratoryility and reliability.

UNIT-1: INTRODUCTION TO REAL-TIME EMBEDDED SYSTEMS
Brief history of Real Time Systems, A brief history of Embedded Systems. Resource Analysis, Real-Time Service Utility, Scheduling Classes, The Cyclic Executive, Scheduler Concepts, Preemptive Fixed Priority Scheduling Policies, Real-Time OS, Thread Safe Reentrant Functions.

UNIT II: RTOS POLICIES
Preemptive Fixed-Priority Policy, Feasibility, Rate Monotonic least upper bound, Necessary and Sufficient feasibility, Deadline – Monotonic Policy, Dynamic priority policies. I/O Resources: Worst-case Execution time, Intermediate I/O, Execution efficiency, I/O Architecture. Memory: Physical hierarchy, Capacity and allocation, Shared Memory, ECC Memory, Flash file systems.

UNIT III: MULTI-RESOURCE SERVICES
Blocking, Deadlock and livestock, Critical sections to protect shared resources, priority inversion. Soft Real-Time Services: Missed Deadlines, QoS, Alternatives to rate monotonic policy, mixed hard and soft real-time services.

UNIT IV: EMBEDDED SYSTEM COMPONENTS
Firmware components, RTOS system software mechanisms, Software application components. Debugging Components- Exceptions assert, checking return codes, Single-step debugging, kernel scheduler traces, Test access ports, Trace ports, Power-On self-test and diagnostics, External test equipment, Application-level debugging. Basic concepts of drill-down tuning, hardware – supported profiling and tracing, Building performance monitoring into software, Path length, Efficiency, and Call frequency, Fundamental optimizations.

UNIT V: AVAILABORATORYILITY AND RELIABILITY DESIGN
Reliability and AvaiLaboratoryility, Similarities and differences, Reliability, Reliable software, AvaiLaboratoryle software, Design tradeoffs, Hierarchical applications for Fail-safe design. Design of RTOS – PIC microcontroller.

CO No.	PO No. and keyword	Competency Indicator	Performance Indicator
CO1	PO 1: Engineering knowledge	1.3	1.3.1
CO2	PO 2: Problem analysis	2.3	2.3.2
CO3	PO 5: Modern tool usage	5.2	5.2.1
CO4	PO 3: Design/Development of solutions	3.2	3.2.2
CO5	PO 3: Design/Development of Solutions	3.2	3.2.2

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Course Code	Course Title	L	T	P	Credits
19APE0405	VLSI DESIGN	3	0	0	3

Course Outcomes:
CO1. Identify the various IC fabrication methods and Electrical Properties of MOS circuits
CO2. Design VLSI circuits using design rules
CO3. Design VLSI circuits at Gate level and Physical level.
CO4. Can implement circuit through various design styles and verification using VHDL synthesis.
CO5. Understand testing VLSI circuits and need of LPVLSI

UNIT-I
Introduction: Basic steps of IC fabrication: PMOS, NMOS, CMOS &BiCMOS,and SOI process technologies, MOS transistors - MOS transistor switches – Basic gate using switches, working polar transistor Resistors and Capacitors.
Basic Electrical Properties of MOS and BiCMOS Circuits: Working of MOS transistors – threshold voltage; MOS design equations: Ids–Vds relationships, Threshold Voltage, Body effect, Channel length modulation , gm, gds, figure of merit ω0; Pass transistor, NMOS Inverter, CMOS Inverter analysis and design, Various pull ups loads,
Bi-CMOS Inverters.

UNIT-II
Basic Circuit Concepts: Capacitance, resistance estimations- Sheet Resistance Rs, MOS Device Capacitances, routing Capacitance, Analytic Inverter Delays, Driving large Capacitive Loads, Fan-in and fan-out.
VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2μm CMOS 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.
Physical Design: Floor Planning Methods, Global Interconnect, Floor Plan Design, Off Chip Connections.

UNIT-IV
VLSI Design styles: Full-custom, Standard Cells, Gate-arrays, FPGAs, CPLDs and Design Approach for Full-custom and Semi-custom devices.
VHDL Synthesis: VHDL Synthesis, Circuit Design Flow, Circuit Synthesis, Simulation, Layout, Design capture tools, Design Verification Tools.

UNIT-V
Test and Testability: Fault-modeling and simulation, test generation, design for testability, Built-in-self-test.
Introduction to Low Power Design: Why Low Power? Sources of Power dissipation: Dynamic Power, Static Power, Low Power Design Methodologies.

TEXT BOOKS:
1. Kamran Eshraghian, Eshraghian Douglas and A. Pucknell, “Essentials of VLSIcircuits and systems”, PHI, 2013 Edition.
2. K.Lal Kishore and V.S.V. Prabhakar, “VLSI Design”, IK Publishers

REFERENCES:

1. Weste and Eshraghian, “Principles of CMOS VLSI Design”, Pearson Education,1999.
2. Wayne Wolf, “Modern VLSI Design”, Pearson Education, 3rd Edition, 1997.
3. John P. Uyemura, “Chip Design for Submicron VLSI: CMOS layout andSimulation”, Thomson Learning.
4. Fault Tolerant and Fault Testable Hardware Design, Parag K.Lala
5. Low Power VLSI Circuits & Systems, Ajith Paul.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	**PO 3:** Design/Development of Solutions	3.4	3.4.2
CO: 2	**PO 2:** Problem analysis	2.3	2.3.1
CO: 3	**PO 2:** Problem analysis	2.4	2.4.4
CO: 4	**PO 4:** Conduct investigations of complex problems	4.1	4.1.3
CO:5	**PO4:** Conduct investigations of complex problems	4.1	4.1.1

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COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19APE0406	MEMS	3	0	0	3

Course Outcomes:

CO1: Able to understand the Micro sensors and different material properties
CO2: Able to understand the micro machine process for different techniques
CO3: Able to understand the types of Microsensors
CO4: Able to understand the MEMS accelerometers functionality and know its applications.
CO5: Able to know where to use MEMS devices and understand CNT

UNIT I

Introduction: Introduction to MEMS & Microsystems, Introduction to Microsensors, Evaluation of MEMS, Microsensors, Market Survey, Application of MEMS, MEMS Materials, MEMS Materials Properties, MEMS Materials Properties.

UNIT II

Microelectronic Technology for MEMS: Microelectronic Technology for MEMS, Micromachining Technology for MEMS, Micromachining Process, Etch Stop Techniques and Microstructure, Surface and Quartz Micromachining, Fabrication of Micro machined Microstructure, Micro stereo lithography,

UNIT III

Micro Sensors: MEMS Microsensors, Thermal Microsensors, Mechanical Micromachined Microsensors, MEMS Pressure Sensor, MEMS Flow Sensor, Micro machined Flow Sensors, MEMS Inertial Sensors, MEMS Gyro Sensor

UNIT IV

MEMS Accelerometers: Micromachined Micro accelerometers for MEMS, MEMS Accelerometers for Avionics, Temperature Drift and Damping Analysis, Piezo resistive Accelerometer Technology, MEMS Capacitive Accelerometer, MEMS Capacitive Accelerometer Process, MEMS for Space Application.

UNIT V

MEMS Applications: Polymer MEMS & Carbon Nano Tubes CNT, Wafer Bonding & Packaging of MEMS, Interface Electronics for MEMS, Introduction to Bio MEMS and Micro Fluidics, Introduction to Bio Nano Technology, Bio Sensors, Fluidics, MEMS for Biomedical Applications (Bio-MEMS)

Text Books:

1. Nadim Maluf Kirt Williams “An Introduction to Micro electro mechanical Systems Engineering”, Second Edition, Artech House, Inc. Boston London, International Standard Book Number: 1-58053-590-9.
2. Varadan, V KandVaradan “Microsensors, actuators, MEMS, and electronics for smart structures” Rai-Choudhury P (ed.) Handbook of Microlithography, Micromachining, and Micro fabrication, SPIE Optical Engineering Press

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 3: Design/Development of Solutions	3.4	3.4.1
CO: 2	PO 3: Design/Development of Solutions	3.4	3.4.1
CO: 3	PO 3: Design/Development of Solutions	3.4	3.4.1
CO: 4	PO 3: Design/Development of Solutions	3.4	3.4.1
CO: 5	PO 3: Design/Development of Solutions	3.4	3.4.1

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III B.Tech **Semester**-II **Branch : Common to all**

Subject Code **19AHE9902**	Subject Name **Principles of Effective Public Speaking**	L T P 3 0 0	Credit: 3

Course Outcomes:

Students will be able to:

1. Apply knowledge of principles, concepts and skills learned in speech preparation.
2. Develop skills in effective listening.
3. Evaluate the delivery of speeches.
4. Develop skills in speech composition.
5. Use supporting materials and presentation aids in speech preparation.

Unit -1 Introduction to Public Speaking:

Basic communication concepts, processes, and models Communication concepts and principles and public speaking Steps and methods of speech preparation; Ethics in public speaking

Unit -2 Listening and Speech Criticism:

Effective listening, the listening process, and types of listening; Listening barriers; Identifying and improving listening styles; Evaluating speech and effective speech techniques.

Unit -3Selecting Topic and Knowing your Audience:

Identifying sources; Tools and techniques for selecting and refining speech topics; Identifying speech purposes; Central idea statement; The central idea; Audience analysis techniques.

Unit – 4 Speaking with a Purpose:

Informative, persuasive, and ceremonial speeches

Unit:5 Delivering your speech and using Visual Aids.

The mechanics of verbal and nonverbal communication in speech delivery; Modes of speech delivery; Speaking style and language; Effective delivery techniques; Incorporating presentation aids

References:

1. DeVito, J.A. (2009). The Essential Elements of Public Speaking. (3rd ed.) Boston: Pearson Education, Inc.

2. Lucas, S.E. (2009). The Art of Public Speaking. (10th ed.) New York: McGraw - Hill Co.

3. Zarefsky, D. (2011). Public Speaking: Strategies for Success. (6th ed. Boston: Pearson Education, Inc).

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO1	PO10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	10.2	10.2.2
CO2	PO10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	10.2	10.2.1
CO3	PO9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings..	9.2	9.2.1
CO4	PO10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	10.2	10.2.2
CO5	PO10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	10.3	10.3.1

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B. Tech III Year II Semester
(Common to all branches of Engineering)

COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19AHSMB01	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS	3	0	0	3

Course Outcomes:

CO 1:Understand the fundamentals of Economics and Managerial economics viz., Demand, Production, cost, revenue and markets.

CO 1:Apply the Concept of Production cost and revenues for effective Business decision

CO 1:Analyze how to invest their capital and maximize returns.

CO 1:Evaluate the capital budgeting techniques.

Define the concepts related to financial accounting and management and able to develop the accounting statements and evaluate the financial performance of business entity.

UNIT - I Managerial Economics

Introduction – meaning, nature, meaning, significance, functions, and advantages, ME and its role in other fields. Demand - Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting- Factors governing forecasting, Methods.

UNIT - II Production and Cost Analysis

Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least- cost combination– Short run and Long run Production Function- Isoquants and Isocosts, MRTS - Cobb-Douglas Production Function - Laws of Returns - Internal and External Economies of scale. Cost & Break-Even Analysis - Cost concepts and Cost behavior- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems)-Managerial significance and limitations of Break-Even Analysis.

UNIT - III Business Organizations and Markets

Introduction – Nature, meaning, significance, functions and advantages. Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly- Monopolistic Competition–Oligopoly-Price-Output Determination - Pricing Methods and Strategies

UNIT - IV Capital Budgeting

Introduction to Capital, Sources of Capital. Short-term and Long-term Capital : Working capital, types, Estimating Working capital requirements. Capital Budgeting – Features, Proposals, Time value of money. Methods and Evaluation of Projects – Pay Back Method, Accounting Rate of Return (ARR), Net Present Value (NPV), and Internal Rate Return (IRR) Method (simple problems).

UNIT - V Financial Accounting and Analysis

Introduction – Nature, meaning, significance, functions and advantages. Concepts and Conventions- Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

Textbooks:

1. Varshney&Maheswari: Managerial Economics, Sultan Chand, 2013.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH, 2019

Reference Books:

1. Ahuja Hl Managerial economics Schand,3/e,2013
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International, 2013.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage, 2013.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
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B.Tech III Year II Semester

COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19AOE0518	SCRIPTING LANGUAGES	3	0	0	3

Course Objectives:

1. To introduce client side scripting with JavaScript and HTML
2. To introduce server side programming with Java Servlets, JSP and PHP.
3. To learn the basic web concepts, protocols and frameworks for web development.

Course Outcomes:

1. Demonstrate knowledge on web page design elements, dynamic content and database Interaction,
2. Use HTML, JavaScript and PHP technologies for web application development
3. Design client-server applications using Scripting languages.
4. Able to do server side programming with Java Servlets, JSP and PHP.

UNIT I

Introduction: Fundamentals of HTML, Working with text, Organizing text in HTML, Working with links and URLS, Creating tables, Working with images, Canvas, Forms, Frames and Multimedia.

HTML5: Introduction, HTML5 Document Structure, Creating editable content, checking spelling mistakes, Exploring custom data attributes, Client-Side storage, Drag and drop feature, offline web application, Web communications, Cross-Document messaging and desktop notifications.

UNIT II

Java Script: An introduction to JavaScript–JavaScript DOM Model-Date and Objects,- Regular Expressions- Exception Handling- Validation-Built-in objects-Event Handling- DHTML with JavaScript.

Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies. Installing and Configuring Apache Tomcat Web Server: DATABASE CONNECTIVITY: JDBC perspectives, JDBC program example - JSP: Understanding Java Server Pages-JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code.

UNIT III

Java Script Advanced concepts : Unicode, strings, symbols, control flow elements, exception handling, calLaboratoryle values, modules-ECMA script module, Dynamic module.

JSP Application Development: The Anatomy of a JSP Page, JSP Processing. JSP Application Design and JSP Environment, JSP Declarations, Directives, Expressions, Scripting Elements, implicit objects. Java Beans: Introduction to Beans, Deploying java Beans in a JSP page.

UNIT IV

Introduction to PHP: The problem with other Technologies (Servlets and JSP), Downloading, installing, configuring PHP, Programming in a Web environment and The anatomy of a PHP Page.

Overview of PHP Data types and Concepts: Variables and data types, Operators, Expressions and Statements, Strings, Arrays and Functions.

PHP Advanced Concepts: Using Cookies, Using HTTP Headers, Using Sessions, Authenticating users, Using Environment and Configuration variables, Working with Date and Time.

UNIT V

Creating and Using Forms: Understanding Common Form Issues, GET vs. POST, Validating form input, Working with multiple forms, and Preventing Multiple Submissions of a form.

PHP and MYSQL Integration : Interacting with my SQL using PHP,

Using PHP to Create – (i) Online Address book, (ii) Discussion forms, (iii) Online Store, (iv) Shopping cart, (v) Simple Calendar.

Text Books

1. Deitel and Deitel and Nieto, "lnternet and World Wide Web - How to Program", Prentice Hall, 5 th Edition, 2011.
2. Sams Teach Yourself PHP & MySQL 5th Edition.
3. Java Script for Impatient Programmers by Dr.Axel Raushmayer.

Reference Books

1. Herbert Schildt, "Java-The Complete Reference", Eighth Edition, Mc Graw Hill Professional, 2011.
2. Core Servelets AND Java Server Pages VOLUME 1: CORE TECHNOLOGIES By Marty Hall and Larry Brown Pearson Snig Bahumik, Bootstrap Essentials, PACKT Publishing, 2015.
3. PHP 5 Recipes A problem Solution Approach Lee Babin, Nathan A Good, Frank M.Kromann and Jon Stephens.
4. W. Jason Gilmore, Beginning PHP & MySql, APress, Fourth Edition, 2011.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
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AK19 REGULATIONS

Year: III **Semester: II** **Branch of Study: ECE**

COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19APC0216	NEURAL NETWORKS AND FUZZY LOGIC	3	0	0	3

COURSE OUTCOMES

CO 1:Understand the basic architecture of artificial neural network terminologies and techniques.
CO 2:Understand approaches and architectures of Artificial Intelligence.
CO 3:Perform the training of neural networks using various learning rules.
CO 4:Create different neural networks of various architectures both feed forward and feed backward.
CO 5:Application of ANN to System Identification and Pattern recognition.

UNIT – I ARTIFICIAL NEURAL NETWORKS
Approaches to AI – Architectures of AI – Symbolic Reasoning System – Rule based Systems – Knowledge Representation – Expert Systems. Introduction and motivation: Neural Network, Human Brain, Structure of biological neuron, Memory, Comparison between Artificial and Biological Neural Networks – Basic Building Blocks of ANN – Artificial Neural Network Terminologies, Artificial Intelligence and Neural Networks.

UNIT – II
Learning Process: Layers, activation functions, learning methods: Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Memory, Adaption, Back Propagation and Differentiation, Supervised Learning, unsupervised learning.

UNIT – III NETWORKS
Basic Building Blocks of ANN – Artificial Neural Network Terminologies – McCulloch Pitts Neuron Model – Learning Rules – ADALINE and MADALINE Models – Perceptron Networks – Back Propagation Neural Networks – Associative Memories - Self-Organization Map – Hopfield models – ART networks.

UNIT – IV FUZZYLOGIC
Classical Sets – Fuzzy Sets – Fuzzy Properties and Operations – Fuzzy Logic System – Fuzzification – Defuzzification – Membership Functions – Fuzzy Rule base – Fuzzy Logic Controller Design.

UNIT – V FUZZY LOGIC APPLICATIONS
Fuzzy pattern recognition – Fuzzy control system – Aircraft landing control problem - Statistical process control- Fuzzy cognitive mapping – Probability measures – Possibility and necessity measures.

TEXT BOOKS:
1. S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Neural Networks using MATLABORATORY", McGraw Hill Edition, 2006.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Third Edition, WILEY India Edition, 2012.

REFERENCES:

1. S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Fuzzy Logic using MATLABORATORY", Springer International Edition, 2013.
2. Laurene V. Fausett "Fundamentals of Neural Networks: Architectures, Algorithms and Applications" United States Edition.
3. Yung C. Shin and Chengying Xu, "Intelligent System – Modeling, Optimization & Control, CRC Press, 2009.

CO No.	PO No. and keyword	Competency Indicator	Performance Indicator
CO1	PO1: Engineering knowledge	1.3	1.3.1
CO2	PO1: Engineering knowledge	1.3	1.3.1
CO3	PO2: Problem analysis	2.4	2.4.1
CO4	PO1: Engineering knowledge	1.3	1.3.1
		1.4	1.4.1
CO5	PO1: Engineering knowledge	1.3	1.3.1

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AK19 REGULATIONS
B. Tech III Year II Semester
Common to ECE & EEE

COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19AHE9907	**ADVANCED OPTICS**	**3**	**0**	**0**	Credits:3

Course Outcomes

1. Analyze the wave properties of light.
2. Interpret the interaction of energy with matter.
3. Analyze the semiconductor photo devices.
4. Interpret structural spectroscopic techniques.
5. Analyze NMR and ESR spectra.

UNIT I Polarization **10 Hours**

Polarization-Experimental observation-Polarization by reflection and refraction-Brewster angle-Pile of plates-Biot's polariscope- Malus laws, Double refraction - Optic axis, Uniaxial and biaxial crystals, Geometry of calcite crystals, Nicol prism, Nicol as analyzer and polarizer. Huygen's explanation of double refraction, Quarter wave and Half wave plates, Production and detection of plane, elliptical and circular polarization of light

UNIT II Semiconductor Optics **12 Hours**

Semiconductor light emitting diodes (LEDs)- Radiative and non-radiative recombination mechanisms in semiconductors-LED: device structure, materials and characteristics,- Review of laser physics-Rate equations for carrier- and photon-density, and their steady state solutions-Semiconductor laser: structure, materials, device characteristics, and figures of merit; DFB, DBR, and vertical-cavity surface-emitting lasers (VECSEL)- Tunable semiconductor lasers.

UNIT III Photo devices and their instrumentation **8 Hours**

Photodetectors -Types of semiconductor photodetectors -p-n junction, PIN, and Avalanche --- and their structure, materials, working principle and characteristics-Noise limits on performance- Solar cells. Low-dimensional optoelectronic devices -Quantum-well, -wire, and -dot based LEDs, lasers, and photodetectors.

UNIT IV Spectroscopic Techniques-I **9 Hours**

UV-visible Spectroscopy: principles- instrumentation- quantitative analysis by absorption measurements-simultaneous determinations- applications.

Raman Spectroscopy**:**Quantum theory of Raman effect –degree of depolarisation–FT Raman spectrometer-Instrumentation and sampling methods– construction of character table – calculation of normal modes of vibration - Raman and I.R activity.

UNIT V Spectroscopic Techniques-II **11 Hours**

NMR Spectroscopy **:** Theory of NMR method – Bloch equations- Steady state solution of Bloch equations-Theory of chemical shifts- Experimental methods –Single coil and double coil methods –Pulse method – High resolution method –Application of NMR to quantitative measurements. ESR Spectroscopy: Quantum mechanical treatment of ESR- hyperfine structure-Basic principles of spectrographs-Application of ESR method.

Textbooks:

1. Optics by Ajay Ghotak.
2. A textbook of Optics by Brij Lal and Dr. M. Subhramanyam.
3. Optics by Dr. S. P. Singh and Dr. A.P. Agarwal.

References:

1. Fundamental of Optics by F.A. Jenkins and H. E. White.
2. The Feynman Lecture of Physics by Richard Feynman.
3. Optics by Eugene Hecht.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO1 : Apply the knowledge of science	1.2	1.2.1
CO: 2	PO1: Apply the knowledge of science	1.2	1.2.1
CO: 3	PO1: Apply the knowledge of science	1.2	1.2.1
CO: 4	PO1: Apply the knowledge of science	1.2	1.2.1
CO: 5	PO1: Apply the knowledge of science	1.2	1.2.1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES: TIRUPATI
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B. Tech III Year II Semester
Humanities Elective Course (ECE)

Subject Code	Subject Name	L	T	P	Credits
19AHE9905	MATERIALS CHEMISTRY	**3**	**0**	**0**	**3**

Course Outcomes

CO-1. Student should be able to understand the grain boundaries, properties, grain size measurement and types of solid solutions.
CO-2. Student should be able to understand in detail about one component and binary component system.
CO-3. Ability to know about composite materials, preparation of metal powders.
CO-4. Ability to understand Chemical analysis and different types of spectroscopic techniques.
CO-5. Student should be able to understand in detail about material structure, crystal defects and constitution of alloys.

Unit- I: Introduction To Materials Science

Structure of metals: Bonds in Solids, Crystallization of metals, Grain and grain boundaries, Effect of grains and boundaries on the properties of metals / alloys, Determination of grain size measurement.
Constitution of alloys: Necessity of alloying, Types of solid solutions, Humerothery rules, Intermediate alloy phases.

Unit II: Multiphase Materials

Introduction to interstitial and substitutional solid solutions, complex solid solutions intermetallic compounds, condensed phase rule, one component system Si and Fe. Binary isomorphous system: Cu-Ni, Au-Cu,Liver Rule, Fe-Ni, Fe-C phase diagrams, phase transformation in Fe-C alloys, Ferrous and non-ferrous alloys.

Unit – III: Powder Metallurgy and Composite Materials

Methods of production of metal powders, Atomization process, Electrolysis, Reduction, Mechanical Alloying, Mixing, Blending, Compacting, Hot and Cold Isostatic pressing, Sintering, Applications, Advantages and limitations of powder metallurgy; Composite materials – types of matrices and reinforcement, polymer matrix composites, metal matrix composites.

Unit – IV: Characterization of Materials

Introduction, Steps in metallographic specimen preparation, Optical Microscopy, Elements of Image Analysis and Quantitative Metallography, X-Ray Diffraction, Intensity of diffracted beam, Scanning Electron Microscopy, Modes of Operation, Fractography, Chemical Analysis using Energy Dispersive Analysis – Transmission Electron Microscopy Principles.

Unit V: Crystal structures and imperfections in crystals

Materials Structure: Space lattice, Unit cells and Metallic crystal structures (SC, BCC, FCC and HCP), Crystal defects: Point, Line, Interstitial and Volume, Primary and secondary bonding in materials. Constitution of Alloys: Necessity of Alloying, Gibb's phase.

References:

1. Callister W.D., “Material Science and Engineering- An Introduction”, 9th Edition, Wiley Eastern, 2013.
2. V.D. Kodgire and S.V. Kodgire, “Material Science and Metallurgy for Engineers”, 41st Edition, Everest Publishing House, 2017.
3. George E. Dieter, “Mechanical Metallurgy”, McGraw Hill, 1988
4. V. Raghavan, “Materials Science and Engineering”, 5th Edition, PHI, 2005.
5. Matthew J. Donachie, “Super Alloys: A Technical Guide”, 2nd Edition, 2002.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 1: Apply the knowledge of basic science	1.2	1.2.1
CO: 2	PO 1: Apply the knowledge of basic science	1.2	1.2.1
CO: 3	PO 1: Apply the knowledge of basic science	1.2	1.2.1
CO: 4	PO 1: Apply the knowledge of basic science	1.2	1.2.1
CO: 5	PO 1: Apply the knowledge of basic science	1.2	1.2.1

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B. Tech III Year II Semester
Branch of Study: Common to all

Subject Code	Subject Name	L	T	P	Credits
19AMC9904	PROFESSIONAL ETHICS AND HUMAN VALUES	3	0	0	0

Course Objective:

To enable the students to imbibe and internalize the Values and Ethical Behaviour in the personal and Professional lives.

UNIT - I:

Introduction to Human Values: Need, basic Guidelines, Content and Process for Value Education, Self Exploration - 'Natural Acceptance' and Experiential Validation. Continuous Happiness and Prosperity - A look at basic Human Aspirations. Right understanding, Relationship and Physical Facilities. Understanding Happiness and Prosperity correctly.

UNIT - II:

Understanding Harmony in the Family and Society: Harmony in Human - Human Relationship: Understanding harmony in the Family the basic unit of human interaction. Understanding values in human - human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship. Understanding the harmony in the society (society being an extension of family). Visualizing a universal harmonious order in society - Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha) - from family to world family!

UNIT – III:

Introduction to Professional Ethics: Basic Concepts, Governing Ethics, Personal & Professional Ethics, Ethical Dilemmas, Life Skills, Emotional Intelligence, Thoughts of Ethics, Value Education, Dimensions of Ethics, Profession and professionalism, Professional Associations, Professional Risks, Professional Accountabilities, Professional Success, Ethics and Profession.

UNIT – IV:

Professional Practices in Engineering: Work Place Rights & Responsibilities, Professions and Norms of Professional Conduct, Norms of Professional Conduct vs. Profession; Responsibilities, Obligations and Moral Values in Professional Ethics, Professional codes of ethics, the limits of predictability and responsibilities of the engineering profession. Central Responsibilities of Engineers – The Centrality of Responsibilities of Professional Ethics; lessons from 1979 American Airlines DC-10 Crash and Kansas City Hyatt Regency Walk away Collapse.

UNIT – V:

Global issues in Professional Ethics: Introduction – Current Scenario, Technology Globalization of MNCs,

International Trade, World Summits, Issues, Business Ethics and Corporate Governance, Sustainable Development Ecosystem, Energy Concerns, Ozone Depletion, Pollution, Ethics in Manufacturing and Marketing, Media Ethics, War Ethics, Bio Ethics, Intellectual Property Rights.

TEXT BOOKS:

1.R. R. Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

2.Professional Ethics: R. Subramanian, Oxford University Press, 2015. 3.Ethics in Engineering Practice & Research, Caroline Whitbeck, 2e, Cambridge University Press 2015.

REFERENCE BOOKS:

1.Prof. K. V. Subba Raju, 2013, Success Secrets for Engineering Students, Smart Student Publications, 3rd Edition.

2.Ivan IIlich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA 3.Engineering Ethics, Concepts Cases: Charles E Harris Jr., Michael S PritchaMichael J Rabins, 4e , Cengage learning, 2015.

4.Business Ethics concepts & Cases: Manuel G Velasquez, 6e, PHI, 2008.

Course Outcome:

1. It ensures students sustained happiness through identifying the essentials of human values and skills.
2. The students will understand the importance of Values and Ethics in their personal lives and professional careers.
3. The students will learn the rights and responsibilities as an employee, team member and a global citizen.
4. Students understand practically the importance of trust, mutually satisfying human behavior and enriching interaction with nature.

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Common to ECE & EEE

COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19APC0420	MICROPROCESSORS AND MICROCONTROLLERS LABORATORYORATORY	0	0	2	1

Course Outcomes:
After completion of this subject the students will be able to :
CO1: To apply the assembly language instructions of 8086 microprocessor to describe the concept of programming and its applications to real world.
CO2: To demonstrate the steps in executing an assembly language program using an assembler.
CO3: Understand concepts of MSP 430 Controllers
CO4: Program MSP 430 for designing any basic Embedded System
CO5: Design and implement some specific real time applications Using MSP 430 low power microcontroller.

Minimum of Ten experiments to be conducted (Five from each Part-A&B)
Part A: 8086 Microprocessor Programs using MASM/8086 microprocessor kit.
1. Introduction to MASM Programming.
2. Programs using arithmetic and logical operations
3. Programs using ASCII arithmetic operations
4. Programs for code conversion
5. Sorting of the given numbers
6. String operations

Part B: Embedded C Experiments using MSP430 Microcontroller
1. Interfacing and programming GPIO ports in C using MSP430 (blinking LEDs, push buttons)
2. Usage of Low Power Modes: (Use MSPEXP430FR5969 as hardware platform and demonstrate the low power modes and measure the active mode and standby mode current)
3. Interrupt programming examples through GPIOs
4. Interfacing potentiometer with MSP430
5. Using ULP advisor in Code Composer Studio on MSP430
6. Low Power modes and Energy trace++:

Note: Any six experiment from Part A and Six experiments from Part B are to be conducted

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 3: Design/Development of Solutions:	3.3	3.3.1
CO: 2	PO 4: Conduct investigations of complex problems:	3.3	3.3.2
CO: 3	PO 5: Modern tool usage:	5.1	5.1.2
CO: 4	PO 5: Modern tool usage:	5.2	5.2.1
CO: 5	PO 5: Modern tool usage:	5.3	5.3.2

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COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19APC0421	DIGITAL SIGNAL PROCESSING LABORATORYORATORY	0	0	2	1

Course Outcomes (COs): Student can able to
CO1: Generate various standard discrete time signals /sequences.
CO2: Perform basic operations on discrete time signals
CO3: Compute Fourier Transform of discrete time/digital signal
CO4: Design & analyze various Butterworth & Chebyshev Analog Filters
CO5: Design & analyze various IIR & FIR Digital Filters

List of Experiments: (Minimum of 5 experiments are to be conducted from each part)
Software Experiments (PART – A)
1. Finding Power and (or) Energy of a given signal.
2. Convolution and Correlation (auto and cross correlation) of discrete sequences without using built in functions for convolution and correlation operations.
3. DTFT of a given signal
4. N – point FFT algorithm
5. Design of analog filters.
6. Design of FIR & IIR filter and verify the frequency response of the filter.

Using DSP Processor kits (Floating point) and Code Composure Studio (CCS) (PART – B)
1. Finding Power and (or) Energy of a given signal.
2. Convolution and Correlation (auto and cross correlation) of discrete sequences without using built in functions for convolution and correlation operations.
3. DTFT of a given signal
4. N – point FFT algorithm
5. Design of analog filters.
6. Design of FIR & IIR filter and verify the frequency response of the filter.

Equipment/Software Required:
1. Licensed MATLABORATORY software with required tool boxes for 30 users.
2. DSP floating Processor Kits with Code Composure Studio (8 nos.)
3. Function generators
4. CROs
5. Regulated Power Supplies.

CO No.	PO No. and Keyword	Competency Indicator	Performance Indicator
CO1	PO 1: Engineering knowledge	1.3	1.3.1
	PO 4: Conduct investigations of complex problems	4.3	4.3.1
			4.3.2
			4.3.3.
			4.3.4
	PO 5: Modern tool usage	5.2	5.2.1
			5.2.2
CO2	PO 1: Engineering knowledge	1.3	1.3.1
	PO 2: Problem analysis	2.4	2.4.1
			2.4.2
			2.4.3
	PO 5: Modern tool usage	5.2	5.2.1
			5.2.2
CO3	PO 2: Problem analysis	2.4	2.4.1
			2.4.2
	PO 5: Modern tool usage	5.2	5.2.1
			5.2.2
CO4	PO 3: Design/Development of solutions	3.3	3.3.1
			3.3.2
CO5	PO 3: Design/Development of solutions	3.3	3.3.1
			3.3.2

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COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19APC0422	MICROWAVE ENGINEERING AND OPTICAL COMMUNICATIONS LABORATORYORATORY	0	0	2	1

Course Outcomes:
CO1: Capable of Applying microwave Concepts/ Microwave components and test them .
CO2: Able to analyze Microwave Active Devices by conducting experiments and measuring various parameters.
CO3: Able to analyze antenna performance by conducting experiments and measuring various parameters.
CO4: Able to design and analyse an optical fiber communications link.
CO5: Able to analyze the characteristics of Optical Sources and Optical fiber by conducting experiments and measuring various parameters.

Microwave Laboratory (PART – A) --- Any Six (6) Experiments
1. Reflex Klystron Characteristics.
2. Gunn Diode Characteristics.
3. Attenuation Measurement.
4. Directional Coupler Characteristics.
5. VSWR Measurement.
6. Frequency and Wavelength measurements using slotted section.
7. Radiation Pattern Measurement of any two Antennas.

Optical Fiber Laboratory (PART – B) --- Any four (4) Experiments
1. Characterization of LED.
2. Characterization of Laser Diode.
3. Measurement of Numerical Aperture of the given fiber.
4. Measurement of Data rate for Digital Optical link.
5. Measurement of losses for Analog Optical link.

Equipment required for Laboratoryoratories:
1. Regulated Klystron Power Supply 6 nos.
2. VSWR Meter 6 nos.
3. Milli/Micro Ammeters 10 nos.
4. Multi meters 10 nos.
5. CROs 8 nos.
6. GUNN Power Supply, Pin Moderator4 nos.
7. Relevant Microwave components--
8. Fiber Optic Analog Trainer based LED3 nos.
9. Fiber Optic Analog Trainer based laser2nos.
10. Fiber Optic Digital Trainer 1 no.
11. Fiber cables - (Plastic, Glass)

List of	PO no. and keyword	Competency	Performance
CO: 1	PO 4: Conduct investigations of complex problems	4.3	4.3.1
CO: 2	PO 4: Conduct investigations of complex problems	4.1	4.1.2
CO: 3	PO 4: Conduct investigations of complex problems	4.3	4.3.3
CO: 4	PO 4: Conduct investigations of complex problems	4.2	4.2.1
CO: 5	PO 4: Conduct investigations of complex problems	4.3	4.3.3