B.Tech
IV Year I Semester

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
B. Tech IV Year I Semester

COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19APC0423	DIGITAL IMAGE PROCESSING	3	0	0	3

Course Outcomes:

Upon completion of course student can be able to

CO1: Review the fundamental concepts of a digital image processing system.
CO2: Analyze images in the frequency domain using various transforms.
CO3: Learn different techniques employed for the enhancement of images.
CO4: Apply the techniques for image restoration and segmentation
CO5: Analyze and apply various spatial and frequency domain techniques of image compression.

UNIT–I

Image Processing Fundamentals:

Introduction to Digital Image processing – Example fields of its usage- Fundamental steps in Image Processing, Components of general image processing system, Image sensing and Acquisition – image Modeling - Sampling, Quantization and Digital Image representation - Basic relationships between pixels, - Mathematical tools/ operations applied on images - imaging geometry.

UNIT–II

Image Transforms:

Discrete Fourier Transform -Discrete Cosine Transforms- Discrete Sine Transform, Walsh- Hadamard Transforms- Haar Transform-Hotelling Transform, Comparison of properties of the above.

UNIT–III

Image Enhancement Techniques:

Background enhancement by point processing Histogram processing, Spatial filtering, Enhancement in frequency Domain, Image smoothing, Image sharpening, Color image Enhancement

UNIT–IV

Image Restoration:

Degradation model, Algebraic approach to restoration – Inverse filtering – Least Mean Square filters, Constrained Least square restoration, Blind Deconvolution.

Image segmentation: Edge detection -,Edge linking , Threshold based segmentation methods – Region based Approaches - Template matching –use of motion in segmentation

UNIT–V

Image Compression:

Redundancies in Images - Compression models, Information theoretic perspective- Fundamental coding theorem. Huffman Coding, Arithmetic coding, Bit plane coding, Run length coding, Transform coding, Image Formats and compression standards.

Text Books:

1. R.C .Gonzalez & R.E. Woods, “Digital Image Processing”, Addison Wesley/Pearson education, 3rd Edition, 2010.
2. A .K. Jain, “Fundamentals of Digital Image processing”, PHI.

References:

1. Rafael C. Gonzalez, Richard E woods and Steven L.Eddins, “Digital Image processing using MATLAB”, Tata McGraw Hill, 2010.
2. S jayaraman, S Esakkirajan, T Veerakumar, “Digital Image processing”,Tata McGraw Hill
3. William K. Pratt, “Digital Image Processing”, John Wilely, 3rd Edition, 2004.

CO No.	PO No. and Keyword	Competency Indicator	Performance Indicator
CO 1	PO 1: Engineering Knowledge	1.4	1.4.1
CO 2	PO 1: Engineering Knowledge	1.3	1.3.1
	PO 2: Problem Analysis	2.1	2.1.3
	PO 3: Design/Development of Solution	3.1	3.1.1
CO 3	PO 1: Engineering Knowledge	1.4	1.4.1
	PO 3: Design/Development of Solution	3.1	3.1.1
	PO 6: The Engineer and Society	6.1	6.1.1
CO 4	PO 1: Engineering Knowledge	1.4	1.4.1
	PO 2: Problem Analysis	2.2	2.2.1
	PO 3: Design/Development of Solution	3.3	3.3.1
	PO 6: The Engineer and Society	6.1	6.1.1
CO 5	PO 1: Engineering Knowledge	1.3	1.3.1
	PO 2: Problem Analysis	2.1	2.1.3
	PO 3: Design/Development of Solution	3.1	3.1.6
	PO 5::Modern Tool Usage	5.1	5.1.2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES: TIRUPATI
(AUTONOMOUS)
B. Tech IV Year I Semester

COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19APC0424	ELECTRONIC MEASUREMENT AND INSTRUMENTATION	2	0	0	2

Course Outcomes:

After the completion of the course the students will be able to

CO-1: Understand basic principles involved in the meters for measuring voltage, current, resistance, frequency and so on.

CO-2: Employ CRO for measuring voltage, current, resistance, frequency and so on.

CO-3: Get complete knowledge regarding working of advanced instruments such as logic analyzers and spectrum analyzers.

CO-4: Illustrate principles of measurements associated with different bridges.

CO-5: Analyze Electrical Parameters using advanced Electrical and Mechanical Transducers.

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-multi range, range extension/solid state and differential voltmeters, AC voltmeters – multi range, range extension. Thermocouple type RF ammeter, ohm meters, series type, shunt type, multimeter for voltage, current and resistance measurements.

UNIT – II

Oscilloscopes:

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, 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

Signal generators:

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 – IV

Review of DC Bridges:

Wheatstone bridge, Kelvin Bridge, errors and precautions in using bridges, AC bridges: Measurement of inductance- Maxwell's bridge, Anderson Bridge, Hays Bridge. Measurement of capacitance- Schearing Bridge, Wein Bridge, Q-meter.

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.

TEXTBOOKS:

1. A.D. Helfrick and W.D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", PHI, 5th Edition, 2002.
2. H.S.Kalsi, "Electronic instrumentation", second edition, Tata McGraw Hill, 2004.
3. K. Lal Kishore, "Electronic Measurements & Instrumentations", Pearson Education, 2009.

REFERENCES:

1. 1.H.S.Kalsi, “Electronic instrumentation”, second edition, Tata McGraw Hill, 2004.
2. Ernest O Doebelin and Dhanesh N Manik, “Measurement Systems Application and Design”, TMH, 5th Edition, 2009.
3. Oliver and Cage, “Electronic Measurement and Instrumentation”, TMH.
4. Robert A.Witte, “Electronic Test Instruments, Analog and Digital Measurements”, Pearson Education, 2nd Ed., 2004.
5. David A. Bell, “Electronic Instrumentation & Measurements”, PHI, 2nd Edition, 2003.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 1: Engineering Knowledge	1.4	1.4.1
CO: 2	PO 2: Problem analysis	2.1	2.1.2
CO: 3	PO 1: Engineering Knowledge	1.3	1.3.1
CO: 4	PO 2: Problem analysis	2.3	2.3.1
CO: 5	PO 1: Engineering Knowledge	1.4	1.4.1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES: TIRUPATI (AUTONOMOUS)

B. Tech IV Year I Semester

COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19APC0510	COMPUTER NETWORKS	3	0	0	3

Course Outcomes: Student will be able to

CO: 1 Understand the basics of data communications and networking
CO: 2 Classify the functionalities of two sub layers of Data link Layer
CO: 3 Know briefly about Network Layer through algorithms and protocols
CO: 4 Distinguish the services provided by Transport Layer.
CO: 5 Recognize the services offered by Application Layer to the user

Unit I

Introduction: Data Communications, Networks, Network Types, Internet History, Standards and Administration.

Network Models: Protocol Layering, TCP/IP Protocol Suite, The OSI Model

Introduction to Physical Layer: Data and Signals, Transmission Impairment, Data Rate Limits, Performance.

Transmission Media: Introduction, Guided Media, Unguided Media, Switching: Introduction, Circuit Switched Networks, Packet Switching

Unit II

The Data Link Layer: Introduction, Link layer addressing, Error detection and Correction: Cyclic codes, Checksum, Forward error correction, Data link control: DLC Services, Data link layer protocols, HDLC, Point to Point Protocol.

Media Access control: Random Access, Controlled Access, Channelization, Connecting devices and virtual LANs: Connecting Devices.

Unit III

The Network Layer: Network layer design issues, Routing algorithms, Congestion control algorithms, Quality of service, Internetworking.

The network layer in the Internet: IPV4 Addresses, IPV6, Internet Control protocol, OSPF, BGP, IP, ICMPv4, IGMP.

Unit IV

The Transport Layer: The Transport Service, Elements of Transport Protocols, Congestion Control, The internet transport protocols: UDP, TCP, Performance problems in computer networks, Network performance measurement.

Unit V

The Application Layer: Introduction, Client-Server Programming, WWW and HTTP, FTP, e-mail, TELNET, Secure Shell, Domain Name System, SNMP.

Text Books:

1. "Data communications and networking", Behrouz A. Forouzan, Mc Graw Hill Education, 5th edition, 2012.
2. "Computer Networks", Andrew S. Tanenbaum, Wetherall, Pearson, 5th edition, 2010.

References:

1. Data Communication and Networks, Bhushan Trivedi, Oxford
2. "Internetworking with TCP/IP – Principles, protocols, and architecture - Volume 1, Douglas E. Comer, 5th edition, PHI
3. "Computer Networks", 5E, Peterson, Davie, Elsevier.

4. “Introduction to Computer Networks and Cyber Security”, Chawan- Hwa Wu, Irwin, CRC Publications.
5. “Computer Networks and Internets with Internet Applications”, Comer.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO1	PO1. Engineering knowledge	1.3	1.3.1
CO2	PO2. Problem Analysis	2.2	2.2.2
CO3	PO1. Engineering knowledge	1.3	1.3.1
CO4	PO1. Engineering knowledge	1.4	1.4.1
CO5	PO2. Problem Analysis	2.1	2.1.1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES: TIRUPATI
(AUTONOMOUS)
B. Tech IV Year I Semester

COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19AOE0304	ROBOTICS	3	0	0	3

Course Outcomes:

CO: 1 The fundamental concepts of various configurations of the robot manipulators and their working principlesused in the industries
CO: 2 The basics of motion analysis of manipulator and process to find forward kinematics and inverse kinematicsof the robot manipulator
CO: 3 The path planning of a robot manipulator for given polynomial equation and how to avoid obstacles in its path
CO: 4 The performance of various feedback components like sensors.
CO: 5 The performance of actuators and how they can be usedaccording to the specifications of the manipulator

UNIT I
INTRODUCTION AND COMPONENTS OF THE INDUSTRIAL ROBOTICS
Introduction: **Automation** and Robotics, CAD/CAM and Robotics – An over view of Robotics – present and future applications. Components of the Industrial Robotics: common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, Design of end effectors, Precision of Movement: Resolution, Accuracy and Repeatability, Speed of Response and Load Carrying Capacity.

UNIT II
MOTION ANALYSIS:
Motion Analysis: Basic Rotation Matrices, Equivalent Axis and Angle, Euler Angles, Composite Rotation Matrices. Homogeneous transformations as applicable to rotation and translation – problems. Manipulator Kinematics-H notation-H method of Assignment of frames-H Transformation Matrix, joint coordinates and world coordinates, Forward and inverse kinematics – problems on Industrial Robotic Manipulation.

UNIT III
TRAJECTORY PLANNING (09)
Differential transformation of manipulators, Jacobians – problems. Dynamics: Lagrange – Euler and Newton – Euler formations – Problems.
Trajectory planning and avoidance of obstacles, path planning, Slew motion, joint interpolated motion – straight line motion.

UNIT IV
ROBOT ACTUATORS AND FEEDBACK COMPONENTS (09)
Robot actuators and Feedback components: Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison of Actuators, Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors, Tactile and Range sensors, Force and Torque sensors.

UNIT V
ROBOT APPLICATION IN MANUFACTURING (09)
Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

Text Books:

1. Groover M P, “Industrial Robotics”, Mc Graw Hill.
2. Ramachandran Nagarajan, “Introduction to Industrial Robotics”, Pearson.

Reference Books:

1. Spony, Vidyasagar, “Robot Dynamics and Controls”, John Wiley,
2. Asada, Slotine, “Robot Analysis and control”, Wiley Inter-Science

List of COs	PO no. and keyword	Competency	Performance Indicator
CO 1	PO 1: Engineering knowledge	1.4	1.4.1
CO 2	PO 2: Problem analysis	2.1	2.1.3
CO 3	PO 4: Conduct investigations of complex problems	4.1	4.1.2
CO 4	PO 2: Problem analysis	2.1	2.1.2
CO 5	PO 1: Engineering knowledge	1.4	1.4.1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES: TIRUPATI
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B.Tech IV Year I Semester

COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19AOE0301	MANAGEMENT SCIENCE	3	0	0	3

Course Outcomes:

CO: 1 Understand the concepts & principles of management and designs of organization in a practical world.
CO: 2 Apply the knowledge of Work-study principles & Quality Control techniques in industry.
CO: 3 Analyze the concepts of HRM in Recruitment, Selection and Training & Development.
CO: 4 Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT.
CO: 5 Create Modern technology in management science

UNIT I

Introduction to Management:

Management - Concept - Nature - Functions – Levels - Evolution of Management Thought - Taylor's Scientific Theory - Henry Fayol's principles - Elton Mayo's Human relations - Leadership styles - Autocratic leadership - Democratic & Free rein leadership.

Organizational Designs: Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization.

UNIT II

Operations Management:

Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study. **Material Management** - Objectives – Inventory classification - Inventory Techniques - EOQ-ABC Analysis

Marketing Management: Concept - Meaning - Nature- Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

UNIT III

Human Resources Management (HRM):

HRM - Definition and Meaning - Managerial and Operative functions - Evolution of HRM - Job Analysis & Job Evaluation - Human Resource Planning (HRP) Process/Procedure- Employee Recruitment Process - Employee Selection Process and Tests in Employee Selection - Employee Training and Development - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration

UNIT IV

Strategic Management:

Definition & Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - SWOT Analysis

Project Management - Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).

UNIT V

Contemporary Management:

The concept of Management Information System (MIS) - Materials Requirement Planning (MRP) - Customer Relations Management (CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management (SCM) - Enterprise Resource Planning (ERP) - Performance Management - Business Process Outsourcing (BPO) - Business Process Re-engineering and Bench Marking - Balanced Score Card.

Textbooks:

1. A.R Aryasri, “Management Science”, TMH, 2013
2. Stoner, Freeman, Gilbert, Management, Pearson Education, New Delhi, 2012.

References:

1. Koontz & Weihrich, “Essentials of Management”, 6th edition, TMH, 2005.
2. Thomas N.Duening & John M.Ivancevich, “Management Principles and Guidelines”, Biztantra.
3. Kanishka Bedi, “Production and Operations Management”, Oxford University Press, 2004.

List of COs	PO no. and keyword	Competency	Performance Indicator
CO 1	PO 1: Engineering knowledge	1.4	1.4.1
CO 2	PO 2: Problem analysis	2.1	2.1.3
CO 3	PO 4: Conduct investigations of complex problems	4.1	4.1.2
CO 4	PO 2: Problem analysis	2.1	2.1.2
CO 5	PO 1: Engineering knowledge	1.4	1.4.1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES: TIRUPATI
(AUTONOMOUS)
B.Tech IV Year I Semester

COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19APE0407	RADAR SYSTEMS	3	0	0	3

Course Outcomes:

After completion of the course, the student will be able to:

CO1: Understand RADAR fundamentals and detection of the radar signals.

CO2: Explain the design of CW and FM-CW RADAR.

CO3: Explain the performance of MTI Radar systems and its applications.

CO4: Demonstrate the Principle of tracking RADAR

CO5: Illustrate the working of RADAR receiver devices.

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), 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 and width Requirements, Applications of CW radar, Illustrative Problems.

M-CW RADAR: Range and Doppler Measurement, Block Diagram and Characteristics (Approaching/ Receding Targets), FM-CW altimeter, Multiple Frequency CW Radar.

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, Matched Filter Receiver – Response Characteristics and Derivation, Correlation Function and Cross-correlation Receiver, Efficiency of Non-matched Filters, Matched Filter with Non-white Noise.

RADAR RECEIVERS: Noise Figure and Noise Temperature, Displays – types. Duplexers –
Branch type and Balanced type, Circulators as Duplexers. Introduction to Phased Array Antennas – Basic Concepts, Radiation Pattern, Beam Steering and Beam Width changes, Series versus Parallel Feeds, Applications, Advantages and Limitations.

Text Books:

1. Introduction to Radar Systems – Merrill I. Skolnik, TMH Special Indian Edition, 2nd Edition, 2007.

References:

1. Introduction to Radar Systems – Merrill I. Skolnik, 3rd Edition, Tata McGraw-Hill, 2001.
2. Radar Principals, Technology, Applications – Byron Edde, Pearson Education, 2004.
3. Radar Principles – Peebles, Jr., P.Z.Wiley, NweYork, 1998.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 1: Engineering knowledge	1.3	1.3.1
CO: 2	PO 2: Problem analysis	2.3	2.3.2
CO: 3	PO 3: Design/Development of Solutions	3.3	3.3.1
CO: 4	PO 4: Conduct Investigations on complex problems	5.1	5.1.1
CO: 5	PO 2: Problem analysis	5.2	5.2.1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)

B. Tech IV Year I Semester

Course Code	Course Title	L	T	P	Credits
19APE0408	DIGITAL SYSTEM DESIGN	3	0	0	3

Course Outcomes:
Upon completion of the course students will be able to
CO1: Understand and analyze different Logic families and its interfacing
CO2: Illustrate various concepts to program an application using VHDL
CO3: Design and analyze different combinational circuits and its logic
CO4: Analyze different Sequential circuits and its logic
CO5: Implement various applications with the knowledge of designing CMOS circuits.

UNIT-I
CMOS LOGIC:
Introduction to logic families, CMOS logic, CMOS logic families; BIPOLAR LOGIC AND INTERFACING: Bipolar logic, Transistor logic, TTL families, CMOS/TTL interfacing, low voltage CMOS logic and interfacing, Emitter coupled logic, Comparison of logic families.

UNIT-II
HARDWARE DESCRIPTION LANGUAGES:
HDL Based Digital Design, The VHDL Hardware Description Language–Program Structure, Types, Constants and Arrays, Functions and procedures, Libraries and Packages, Structural design elements, Dataflow design elements, Behavioral design elements, The Time Dimension, Simulation, Test Benches, VHDL Features for Sequential Logic Design, Synthesis.

UNIT-III
COMBINATIONAL LOGIC DESIGN PRACTICES:
Description of basic structures like Decoders, Encoders, Comparators, Multiplexers (74 –series MSI); Design of complex Combinational circuits using the basic structures; Designing Using combinational PLDs like PLAs, PALs ,PROMs CMOS PLDs; Adders & subtractors, ALUs, Combinational multipliers; VHDL models for the above standard building block ICs.

UNIT-IV
SEQUENTIAL MACHINE DESIGN PRACTICES:
Review of design of State machines; Standard building block ICs for Shift registers, parallel / serial conversion , shift register counters, Ring counters; Johnson counters, LFSR counter ; VHDL models for the above standard building block ICs. Synchronous Design example using standard ICs

UNIT –V
DESIGN EXAMPLES (USING VHDL):
Barrel shifter, comparators, floating-point encoder, and dual parity encoder. Sequential logic Design: Latches & flip flops, PLDs and their VHDL models.

Text Books:
1.John F.Wakerly ,"Digital Design Principles and Practices" 4th edition, Pearson Education., 2009
2.Charles H.Roth,Jr., "Fundamentals of Logic Design" 5th edition , CENGAGE Learning 2012.

Reference Books:
1. M.Morris Mano and Michael D. Cilleti., "Digital Logic Design" 4th edition Pearson Education., 2013
2. Stephen Brown and ZvonkoVranesic, "Fundamentals of digital logic with VHDL design" 2nd edition McGraw Hill Higher Education.
3. J. Bhasker, "A VHDL PRIMER" 3rd edition Eastern Economy Edition, PHI Learning,2010.

CO No.	PO No. and Keyword	Competency Indicator	Performance Indicator
CO1	PO 1: Engineering knowledge	1.4	1.4.1
	PO 3: Design/Development of solutions	3.3	3.3.1
	PO 4: Conduct investigations of complex problems	4.2	4.2.2
CO2	PO 1: Engineering knowledge	1.3	1.3.1
	PO 3: Design/Development of solutions	2.3	2.3.1
	PO 5: Modern tool usage	5.2	5.2.1
CO3	PO 1: Engineering knowledge	1.3	1.3.1
	PO 3: Design/Development of solutions	3.3	3.3.1
CO4	PO 1: Engineering knowledge	1.3	1.3.1
	PO 3: Design/Development of solutions	3.3	3.3.1
CO5	PO 1: Engineering knowledge	1.3	1.3.1
	PO 2: Problem analysis	2.3	2.3.1
	PO 3: Design/Development of solutions	3.3	3.3.1
	PO 4: Conduct investigations of complex problems	4.2	4.2.1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES: TIRUPATI
(AUTONOMOUS)
B. Tech IV Year I Semester

Course Code	Course Title	L	T	P	Credits
19APE0409	RF SYSTEM DESIGN	3	0	0	3

Course Outcomes:
By the end of this course, the student will be able to
CO-1: Understand working of Series/Parallel RLC networks & Transmission lines at Radio frequencies.
CO-2: Analyze MOS devices in RF amplifier circuits and different types of noise effect on RF devices.
CO-3: Compare different noise parameters and mixers.
CO-4: Design different RF power amplifier circuits for high frequency application.
CO-5: Illustrate fundamental techniques in cellular mobile communication systems

UNIT – I
Introduction RF systems – basic architectures, Transmission media and reflections, Maximum power transfer, Passive RLC Networks, Parallel RLC tank, Series RLC networks, matching, Pi match, T match, Passive IC Components Interconnects and skin effect, Resistors, capacitors Inductors.
UNIT – II
Review of MOS Device Physics – MOS device review, Distributed Systems, Transmission lines, reflection coefficient, the wave equation, examples, Lossy transmission lines, High Frequency Amplifier Design, Bandwidth estimation using open-circuit time constants, Bandwidth estimation, using short-circuit time constants, Shunt-series amplifiers, tuned amplifiers, Cascaded amplifiers
UNIT – III
Noise – Thermal noise, flicker noise, Noise figure, LNA Design, Intrinsic MOS noise parameters, Power match versus, noise match, large signal performance, Multiplier based mixers. Mixer Design, Subsampling mixers.
UNIT – IV
RF Power Amplifiers, Class A, AB, B, C amplifiers, Class D, E, F amplifiers, RF Power amplifier design examples, Voltage controlled oscillators, Resonators, Phase locked loops, Linearized PLL models, Phase detectors, charge pumps, Loop filters, and PLL design examples.
UNIT - V
Introduction to Cellular Mobile system, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, Hexagonal shaped cells, Analog and Digital Cellular systems. Radio architectures, GSM radio architectures, CDMA, UMTS radio architectures.

TEXT BOOKS:

1. The design of CMOS Radio frequency integrated circuits by Thomas H. Lee Cambridge university press, 2004.
2. RF Micro Electronics by Behzad Razavi, Prentice Hall, 1997.
3. Mobile cellular telecommunications-W .C. Y. Lee, Tata Mc-Graw Hill, 2nd Edition,
4. 2006.

REFERENCES:

1. Matthew M. Radmanesh," Radio frequency and Microwave Electronics illustrated", Pearson Education Inc, Delhi, 2006.
2. B. Razavi, "RF Microelectronics", Pearson Education, 1997.
3. Devendra. K. Misra," Radio Frequency and Microwave communication Circuits – Analysis and Design", John Wiley and Sons, Newyork,2004.
4. B. Razavi, "Design of Analog COMS Integrated Circuits", Mc Graw Hill, 2001.
5. Wireless communications-Theodore. S. Rapport, Pearson Education,2ndEdn.,2002.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 1: Engineering Knowledge	1.3	1.3.1
CO: 2	PO 3: Design/Development of Solutions	3.1	3.1.1
CO: 3	PO 1: Engineering Knowledge	1.3	1.3.1
CO: 4	PO 3: Design/Development of Solutions	3.1	3.1.1
CO: 5	PO 1: Engineering Knowledge	1.4	1.4.1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES: TIRUPATI
(AUTONOMOUS)
B. Tech IV Year I Semester

COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19APE0410	SATELLITE COMMUNICATION	3	0	0	3

Course Outcomes:
By the end of this course, the student will be able to
CO1: Understand the architecture of satellite system.
CO2: Analyze various aspects related to satellite systems.
CO3: Analyze the effects on Satellite communication.
CO4: Design of satellite link for specified parameters.
CO5: Apply various modulation and multiple access schemes in Satellite Communication.

Unit -I
INTRODUCTION TO SATELLITE COMMUNICATION: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication. Orbital Mechanics: Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc. of a satellite, concepts of Solar day and Sidereal day.

Unit -II
SATELLITE SUB-SYSTEMS: Study of Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems etc.

Unit III
EFFECTS ON SATELLITE COMMUNICATION: Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift.

Unit -IV
SATELLITE LINK DESIGN: Basic transmission theory, system noise temperature and G/T ratio, design of down links, uplink design, design of satellite links for specified C/N, system design example

Unit-V
MODULATION AND MULTIPLE ACCESS SCHEMES: Various modulation schemes used in satellite communication, Meaning of Multiple Access, Multiple access schemes based on time, frequency, and code sharing namely TDMA, FDMA and CDMA.

Text /Reference Books:

1. Timothy Pratt Charles W. Bostian, Jeremy E. Allnutt: Satellite Communications: Wiley India. 2nd edition 2002.
2. Tri T. Ha: Digital Satellite Communications: Tata McGraw Hill, 2009. 3. Dennis Roddy: Satellite Communication: 4th Edition, McGraw Hill, 2009

CO No.	PO No. and keyword	Competency Indicator	Performance Indicator
CO1	PO 2: Problem analysis	2.3	2.3.2
	PO 3: Design/Development of solutions	3.2	3.2.2
CO2	PO 3: Design/Development of solutions	3.2	3.2.2
CO3	PO 3: Design/Development of solutions	3.2	3.2.2
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
19APE0411	EMBEDDED SYSTEMS	3	0	0	3

Course Outcomes:

Upon successful completion of the course, students will be able to

CO1: Understand the fundamental concepts of Embedded systems.

CO2: Analyze TM4C Architecture, Instruction Set, addressing modes to develop programs for various applications using Assembly and Embedded C.

CO3: Develop an embedded system by interfacing the microcontrollers and IDE tools.

CO4: Figure out problems using TM4C On chip Resources such as Timer, Clock System, Low Power Modes/techniques and Interrupt Structure.

CO5: Implement the protocols used by microcontroller to communicate with external sensors and actuators in real world.

UNIT-I

INTRODUCTION TO EMBEDDED SYSTEMS

Embedded system introduction, host and target concept, embedded applications, features and architecture considerations for embedded systems- ROM, RAM, timers; data and address bus concept, Embedded Processor and their types, Memory types, overview of design process of embedded systems, programming languages and tools for embedded design

UNIT-II

EMBEDDED PROCESSOR ARCHITECTURE

CISC Vs RISC design philosophy, Von-Neumann Vs Harvard architecture. Introduction to ARM architecture and Cortex – M series, Introduction to the TM4C family viz. TM4C123x & TM4C129x and its targeted applications. TM4C block diagram, address space, on-chip peripherals (analog and digital) Register sets, addressing modes and instruction set basics.

UNIT- III

OVERVIEW OF MICROCONTROLLER AND EMBEDDED SYSTEMS

Embedded hardware and various building blocks, Processor Selection for an Embedded System, Interfacing Processor, Memories and I/O Devices, I/O Devices and I/O interfacing concepts, Timer and Counting Devices, Serial Communication and Advanced I/O, Buses between the Networked Multiple Devices. Embedded System Design and Co-design Issues in System Development Process, Design Cycle in the Development Phase for an Embedded System, Uses of Target System or its Emulator and In-Circuit Emulator (ICE), Use of Software Tools for Development of an Embedded System Design metrics of embedded systems - low power, high performance, engineering cost, time-to-market.

UNIT-IV

MICROCONTROLLER FUNDAMENTALS FOR BASIC PROGRAMMING

I/O pin multiplexing, pull up/down registers, GPIO control, Memory Mapped Peripherals,
programming System registers, Watchdog Timer, need of low power for embedded systems, System Clocks and control, Hibernation Module on TM4C, Active vs Standby current consumption. Introduction to Interrupts, Interrupt vector table, interrupt programming. Basic Timer, Real Time Clock (RTC), Motion Control Peripherals: PWM Module & Quadrature Encoder Interface (QEI).

UNIT-V

EMBEDDED COMMUNICATIONS PROTOCOLS AND INTERNET OF THINGS

Synchronous/Asynchronous interfaces (like UART, SPI, I2C, USB), serial communication basics, baud rate concepts, Interfacing digital and analog external device, Implementing and programming UART, SPI and I2C, SPI interface using TM4C.Case Study: Tiva based embedded system application using the interface protocols for communication with external devices “Sensor Hub BoosterPack” Embedded Networking fundamentals, IoT overview and architecture, Overview of
wireless sensor networks and design examples. Adding Wi-Fi capability to the Microcontroller, Embedded Wi-Fi, User APIs for Wireless and Networking applications Building IoT applications using CC3100 user API.Case Study: Tiva based Embedded Networking Application: “Smart Plug with Remote Disconnect and Wi-Fi Connectivity”

Text Books:

1. Embedded Systems: Real-Time Interfacing to ARM Cortex-M Microcontrollers, 2014, Create space publications ISBN: 978-1463590154.
2. Embedded Systems: Introduction to ARM Cortex - M Microcontrollers, 5th edition Jonathan W Valvano, Create space publications ISBN-13: 978-1477508992
3. Embedded Systems 2E Raj Kamal, Tata McGraw-Hill Education, 2011 ISBN-0070667640, 9780070667648

References:

1. http://processors.wiki.ti.com/index.php/HandsOn_Training_for_TI_Embedded_Processors
2. http://processors.wiki.ti.com/index.php/MCU_Day_Internet_of_Things_2013_Workshop
3. http://www.ti.com/ww/en/simplelink_embedded_wi-fi/home.html
4. CC3100/CC3200 SimpleLink™ Wi-Fi® Internet-on-a-Chip User Guide Texas Instruments Literature Number: SWRU368A April 2014–Revised August 2015

CO No.	PO No. and keyword	Competency Indicator	Performance Indicator
CO1	PO 1: Engineering knowledge	1.3	1.3.1
CO2	PO 1: Engineering knowledge PO 3: Design/Development of solutions	3.4	3.4.2
CO3	PO 3: Design/Development of solutions	3.1	3.1.1
CO4	PO 5: Modern tool usage	3.4	3.4.2
CO5	PO 3: Design/Development of Solutions PO 5: Modern tool usage	3.4	3.4.2

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COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19APE0412	DIGITAL IC DESIGN	3	0	0	3

Course Outcomes:

Upon completion of the course student should be able to

CO1: Understand the Design concepts of CMOS inverters with specified noise margins and propagation.
CO2: Verify the Analysis of Complex CMOS logic circuits.
CO3: Realize and implement basic sequential elements that are commonly observed in digital ICs.
CO4: Analyze the dynamic characteristics of CMOS circuits
CO5: Implement CMOS Digital IC concepts for usage of modern CAD tools and their Limitations.

UNIT-I

MOS Design Pseudo NMOS Logic:

Inverter, Inverter threshold voltage, Output high voltage, Output Low voltage, Gain at gate threshold voltage, Transient response, Rise time, Fall time, Pseudo NMOS logic gates, Transistor equivalency, CMOS Inverter logic.

UNIT – II

Combinational MOS Logic Circuits:

MOS logic circuits with NMOS loads, Primitive CMOS logic gates – NOR & NAND gate, Complex Logic circuits design – Realizing Boolean expressions using NMOS gates and CMOS gates , AOI and OIA gates, CMOS full adder, CMOS transmission gates, Designing with Transmission gates.

UNIT – III

Sequential MOS Logic Circuits:

Behaviour of Bistable elements, SR Latch, Clocked latch and flip flop circuits, CMOS D latch and edge triggered flip-flop.

UNIT – IV

Dynamic Logic Circuits:

Basic principle, Voltage Bootstrapping, Synchronous dynamic pass transistor circuits, Dynamic CMOS transmission gate logic, High performance Dynamic CMOS circuits.

UNIT - V

Semiconductor Memories:

Types, RAM array organization, DRAM – Types, Operation, Leakage currents in DRAM cell and refresh operation, SRAM operation Leakage currents in SRAM cells, Flash Memory-NOR flash and NAND flash

TEXTBOOKS:

1. Digital Integrated Circuit Design – Ken Martin, Oxford University Press, 2011.
2. CMOS Digital Integrated Circuits Analysis and Design – Sung-Mo Kang, Yusuf Leblebici, TMH, 3rd Ed., 2011.
3. Neil H. E. Weste, David Money Harris,"CMOS VLSI Design-A Circuit andSystems Perspective", Pearson 4th Edition,2011.

REFERENCES:

1. Introduction to VLSI Systems: A Logic, Circuit and System Perspective – Ming-BO Lin, CRC Press, 2011
2. Digital Integrated Circuits – A Design Perspective, Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, 2nd Ed., PHI.
3. John P.Uyemura, "Introduction to VLSI Circuits and Systems", Wiley Edition, 2002.
4. Eugene D Fabricus, "Introduction to VLSI Design, "McGraw Hill International Edition, 1990.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	**PO 1:** Engineering knowledge	1.4	1.4.1
CO: 2	**PO 4:** Conduct Investigations of complex problems	4.2, 4.3	4.2.1, 4.3.4
CO: 3	**PO 3:** Design/Development of Solutions	3.2	3.2.2
CO: 4	**PO 3:** Design/Development of Solutions	3.4	3.4.1,3.4.2
CO: 5	**PO 2:** Problem analysis **PO 5:** Modern tool usage	2.2 5.2	2.2.2, 2.2.3 5.2.1

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COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19AHE9901	Technical Writing	**2**	**0**	**0**	**2**

Course Objectives:

CO1. To acquaint students with a variety of forms of writing in science and technology;
CO2. Develop research skills;
CO3. Discuss and apply writing and formatting techniques;

Unit -1

An Introduction to Technical Writing

Technical writing vs. General writing b. Purpose, importance and characteristics of technical writing, Objectives of technical writing: Clarity, conciseness, accuracy, organization, ethics, Audience recognition and involvement: High tech audience, low-tech. audience, gender neutral language

Unit -2

Memorandum

Objectives, difference between memos, letters and emails. Criteria and format for writing and memos, minutes & agenda

Unit -3

Letter Writing

Business letters- (Greetings, salutations, order, complaint, inquiry), Job-applications(Covering letters) Resume

Unit – 4

Report Writing

Characteristics, types and writing of various reports: feasibility reports, inventory report, mishap report, progress report, laboratory report, Project report, clusters & link words

Unit:5

Graphic representation of Technical Data, SOP writing, Promotional Writings

Technical Brochure designing ,Content writing for Websites (For promotional and troubleshooting purposes), Writing Fliers and Newsletters

References:

1. Sharon J. Gerson and Steven M. Gerson, Technical writing – process and product ,Pearson Education Asia
2. Andrea J. Ratherford ,Basic Communication Skills for Technology, Pearson Education Asia
3. Pfeiffer, W.S. and T.V.S. Padmaja. Technical Communication. Pearson.
4. Muralikrishna and Sunita Mishra. Communication Skills for Engineers. Pearson
5. CharlesW.Knisely and KarinI.Knisely.Engineering Communication. Cengage

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO 1	PO9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	9.2	9.2.1 9.2.2 9.2.3 9.2.4
CO 2	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 10.2.2
CO 3	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 10.3.2

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B.Tech **Semester- VII** **Branch : Common to all**
Humanities Elective

Subject Code	Subject Name	L T P	Credit: 2
19AHE9906	Effective Technical Communication	2 0 0	

Course Outcomes

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

CO1: Understand the importance of effective technical communication
CO1: 2. Analyze non-verbal language suitable to different situations in professional life
CO1: Evaluate different kinds of methods used for effective presentations
CO1: Create trust among people and develop employability skills
CO1: Develop skills in speech composition**.**

Unit 1: Information Design and Development- Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media.

Unit 2: Technical Writing, Grammar and Editing: Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style.

Unit 3: Self Development and Assessment: Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time; Personal memory, Rapid reading, taking notes; Complex problem solving; Creativity.

Unit 4: Technical Writing: Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.

Unit 5: Speaking with a purpose: Public speaking, Group discussion, Oral presentation, Interviews, Graphic presentation, Presentation aids, Personality Development.

TEXT BOOKS/REFERENCES:

1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004.
2. Kulbhushan Kumar, Effective Communication Skills, Khanna Publishing House, 2019.
3. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843).
4. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
5. Raman Sharma, Technical Communications, Oxford Publication, London, 2004.
6. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4)

List of COs	PO.No. and Key word
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.
CO2	PO12 : Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
CO3	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
CO4	PO9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
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.

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COURSE CODE	COURSE TITLE	L	T	P	CREDITS
19APC0427	EMBEDDED SYSTEMS AND UAV LABORATORY	0	0	2	1

Course Outcomes:
Upon completion of the course student can be able to
CO1: Understand the concepts of TM4C123GH6PM microcontroller
CO2: Perform the Program using TM4C123GH6PM for various tasks.
CO3: Design and implement some specific real time applications Using TM4C123GH6PM microcontroller
CO4: Assemble quadcopter, hexacopter and RC Electric Glider Aircraft.
CO5: Operate quadcopter, hexacopter and RC Electric Glider Aircraft.

List of Experiments

(Minimum of Ten Experiments has to be performed 5 Experiments from PART A and 5 from PART-B)

PART-A

1. Write a C program for configuration of GPIO ports for Input and output operation (blinking LEDs, push buttons interface).
2. Write a C program for EK-TM4C123GXL Launchpad and associated Timer ISR to toggle onboard LED using interrupt programming technique.
3. Configure hibernation module of the TM4C123GH6PM microcontroller to place the device in low power state and then to wake up the device on RTC (Real- Time Clock) interrupt.
4. Configure in-build ADC of TM4C123GH6PM microcontroller and interface potentiometer with EK-TM4C123GXL Launchpad to observe corresponding 12- bit digital value.
5. Learn and understand the generation of Pulse Width Module (PWM) signal by configuring and programming the in-build PWM module of TM4C123GH6PM microcontroller.
6. Learn and understand to connect EK-TM4C123GXL Launch pad to PC terminal and send an echo of the data input back to the PC using UART
7. Learn and understand interfacing of accelerometer in Sensor Hub Booster pack with EK-TM4C123GXL Launch pad using I2C.

PART-B

1. Study of UAV subsystems, sensors and their main characteristics.
2. Assemble Quadcopter Drone with GPS.
3. Assemble Hexacopter Drone with GPS.
4. Take a snapshot using Quad copter Drone with Camera.
5. Takeoff and land Quadcopter and Hexacopter drones.
6. Fly RC Electric Glider Aircraft.
7. Attach 5 Liter sprayer tank and fly Quadcopter Drone.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	**PO 1:** Engineering knowledge	1.4	1.4.1
CO: 2	**PO 4:** Conduct Investigations of complex problems	4.2, 4.3	4.2.1, 4.3.4
CO: 3	**PO 3:** Design/Development of Solutions	3.2	3.2.2
CO: 4	**PO 3:** Design/Development of Solutions	3.4	3.4.1,3.4.2
CO: 5	**PO 2:** Problem analysis **PO 5:** Modern tool usage	2.2 5.2	2.2.2, 2.2.3 5.2.1