B. Tech. Seventh Semester (CBCS)
(Electronics & Communication/ Electronics & Telecommunication /Electronics Engineering)
PEC-III
Audio & Video Engineering

Duration: 3 Hr.
College Assessment: 30 Marks
University Assessment: 70 Marks

Subject Code: BEETC701PE-T **[L:3 P:0 T:1 – 4]** **Credit: 3-0-1-4**

Course Objectives:

1. To make students understand /explain the analysis and synthesis of T.V. system
2. To study various colour TV system with greater emphasis on PAL T.V. system.
3. To study Advance Technology of TV Engineering –Digital TV, HDTV & IPTV
4. To study various video recording system, display system and its application.

Course Outcome:

By the end of the course, the students shall be able to

1. Analyze colour T.V. System
2. Compare different T.V. standards.
3. Distinguish Advanced T.V. Technology.
4. Analyze audio & video recording, display and relevant consumer applications.

Unit 1: Fundamentals of Television and Display (07Hrs)

Television basics: Elements of TV system, low level TV transmission, monochrome TV receiver block diagram, Production of luminance & colour difference signal, Composite video signal, and channel bandwidth etc, Color TV systems, colour fundamentals, mixing of colors, color perception, chromaticity diagram.

Unit 2: TV Standards (07Hrs)

NTSC, PAL, SECAM systems, colour TV transmitter, colour TV receivers, remote control, antennas for transmission and TV pattern generation.

Unit 3: Digital TV (07Hrs)

Introduction to Digital TV, Principle of Digital TV, Digital TV signals and parameters, Digital TV Transmitters, MAC signals, advanced MAC signal transmission, Digital TV receivers, Basic principles of Digital Video compression techniques, MPEG1, MPEG2, MPEG4. Display devices: LED & LCD,

Unit 4: HDTV (07Hrs)

HDTV standards and systems, HDTV transmitter and receiver/encoder, Digital TV satellite Systems, CCTV, CATV, direct to home TV, set top box with recording facility, 3D TV systems, IPTV systems, Mobile TV; Video transmission in 3G mobile System

Unit 5: Audio & Video Recording System (08Hrs)

Digital Video Recorders, Colour TV Digital cameras, Camcorders, Handycams, and Digicams, CD/ DVD player, Blue Ray DVD Player, MP3 player.

Text Books

1. Television and Video Engineering, A. M Dhake, Tata McGraw Hill, 2nd edition
2. Video Demystified, Keith jack, Penram International Publication.
3. Audio Video Systems, R.G. Gupta, TMH Publication, 2nd edition

Reference Books

1. Color Television Theory and Practice, S. P. Bali, Tata McGraw Hill, 1st edition.
2. Basic TV and Video Systems, Bernard Grob, Charles E Herndon, TMH, 6th edition.
3. Modern Television Practice-Principles, Technology and Servicing, R.R.Gulati, New Age International Publisher, 2nd edition.
4. Television Engineering: Audio and Video Systems, D.S. Bormane, Wiley Publication, 2015.
5. Speech and Audio Processing, Shaila D. Apte, Wiley Publication, 2012.
6. Speech and Audio Signal Processing: Processing and Perception of Speech and Music, Ben Gold, Wiley Publication, 2006.
7. R.G. Gupta, "Television Engineering & Video Systems", McGraw Hill Publications,2011

NOTE: 8 to 10 Practical's based on above syllabus.

B. Tech. Seventh Semester (CBCS)
(Electronics & Communication/ Electronics & Telecommunication /Electronics Engineering)
PEC-III
Web Technologies

Duration: 3 Hr.
College Assessment: 30 Marks
University Assessment: 70 Marks

Subject Code: BEETC701PE -T **[L:3 P:0 T:1 – 4]** **Credit: 3-0-1-4**

Course Objectives:

1. To teach students the basics of server-side scripting using PHP
2. To explain web application development procedures
3. To impart servlet technology for writing business logic
4. To facilitate students to connect to databases using JDBC
5. To familiarize various concepts of application development using JSP

Course Outcome: By the end of the course, the students shall be able to

1. Create web pages using PHP, Identify the difference between the HTML PHP and XML documents.
2. Identify the engineering structural design of XML and parse tree, Analyze the difference between and PHP and XML.
3. Understand the concept of JAVA SCRIPTS.
4. Identify the difference between the JSP and Servlet.
5. Design web application using MVC architecture, Understand the JSP and Servlet concepts.

UNIT I: Web Basics and Overview: (07Hrs)
Introduction to Internet, World Wide Web, Web Browsers, URL, MIME, HTTP, Web Programmers Toolbox. HTML Common tags: List, Tables, images, forms, frames, Cascading Style Sheets (CSS) & its Types. Introduction to Java Script, Declaring variables, functions, Event handlers (onclick, onsubmit, etc.,) and Form Validation.

UNIT II: Introduction to XML: (07Hrs)
Document type definition, XML Schemas, Presenting XML, Introduction to XHTML, Using XML Processors: DOM and SAX. PHP: Declaring Variables, Data types, Operators, Control structures, Functions.

UNIT III: Web Servers and Servlets: (07Hrs)
Introduction to Servlets, Lifecycle of a Servlet, JSDK, Deploying Servlet, The Servlet API, The javax. Servlet Package, Reading Servlet parameters, Reading Initialization parameters. The javax.servlet HTTP package, Handling Http Request & Responses, Cookies and SessionTracking.

UNIT IV: Database Access: (07Hrs)
Database Programming using JDBC, JDBC drivers, Studying Javax.sql.* package, Connecting to database in PHP, Execute Simple Queries, Accessing a Database from a Servlet, Introduction to struts frameworks.

UNIT V: JSP Application Development: (08Hrs)

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.

TEXT BOOKS:

1. Web Programming, building internet applications, Chris Bates 2nd edition, WILEY Dreamtech
2. Core Servlets Andjavaserver Pages Volume 1: Core Technologies By Marty Hall And Larry Brown Pearson

REFERENCE BOOKS:

1. Programming world wide web-Sebesta, Pearson Education,2007.
2. Internet and World Wide Web – How to program by Dietel and Nieto PHI/ Pearson Education Asia.
3. An Introduction to WEB Design and Programming –Wang-Thomson
4. PHP: The Complete Reference Steven Holzner Tata-McGraw-Hill.

NOTE: 8 to 10 Practical's based on above syllabus.

B. Tech. Seventh Semester (CBCS)
(Electronics & Communication/ Electronics & Telecommunication /Electronics Engineering)
PEC-III
Wireless & Mobile Communication

Duration: 3 Hr.
College Assessment: 30 Marks
University Assessment: 70 Marks

Subject Code: BEETC701PE -T **[L:3 P:0 T:1 – 4]** **Credit: 3-0-1-4**

Course Objectives:
1. To impart the fundamental concept of mobile communication system.
2. To give the student the idea about cellular communication theory & technology
3. To introduce various technology and protocol involved in mobile communication
4. To provide the student with an understanding the cellular concept.

Course Outcome: By the end of the course, the students shall be able to:
1. Design a model of Cellular Communication System and analyze their operation and performance.
2. Quantify the causes and effects of path loss and signal fading on received signal Characteristics and design systems to reduce the effects of same.
3. To construct and analyze the GSM system, use the IRS technology to increase the range and quality of GSM signal.

Unit 1: The cellular concept (08Hrs)
Evolution of mobile radio communication. Cellular telephone system, frequency reuse, channel assignment and handoff strategies, interference and system capacity, trunking and grade of service, improving capacity in cellular system.

Unit 2: The mobile radio environment (07Hrs)
Causes of propagation path loss, causes of fading-long and short term, definition of sample average , statistical average, probability distribution, level crossing rate and average duration of fade, delay spread, coherence bandwidth, inter-symbol interference.

Unit 3: Equalization, diversity and channel coding (07Hrs)
Fundamentals of equalization, space polarization, frequency and time diversity techniques, space diversity, polarization diversity, frequency and time diversity, fundamentals of channel coding.

Unit 4: GSM (07Hrs)
Global system for mobile: services and features, GSM system architecture, GSM radio subsystem, GSM channel type, GSM frame structure, signal processing in GSM, introduction to CDMA digital cellular standard, Third generation wireless networks, 3G technology.

Unit 5:-Introduction to latest Wireless Technologies (07Hrs)
Introduction to 5G and 6G cellular communication, Comparison of 4G with 5G and 6G, concept of Intelligent Reflecting Surfaces, Introduction of Cognitive Radio Communication technology.

TEXT BOOKS:
1. Wireless Communications, Principles, Practice – Theodore, S. Rappaport, PHI, 2nd Edn.
2. Wireless Communication and Networking – William Stallings, PHI, 2003.
3. Mobile Communications- Jochen Schiller, Pearson Education, 2004.

REFERENCES:

1. Wireless Digital Communications – KamiloFeher, PHI, 1999.
2. Principles of Wireless Networks – KavehPahLaven and P. Krishna Murthy, Pearson Education, 2002.
3.Cognitive Radio: Basic Concepts, Mathematical Modelling and Applications-Rajeshree Raut, Ranjit Sawant , S. Madubashi, CRC, 2020
3. Fourozan, Data communications and Networking, third edition, Tata McGraw-Hill Publication,2004.
4. Mobile Cellular Telecommunications-William C Y Lee, 2 edition, Mc. Graw Hill Publication.

NOTE: 8 to 10 Practical's based on above syllabus.

B. Tech. Seventh Semester (CBCS)
(Electronics & Communication/ Electronics & Telecommunication /Electronics Engineering)
PEC – III
Robotics & Automation

Duration: 3 Hr.
College Assessment: 30 Marks
University Assessment: 70 Marks

Subject Code: BEETC701PE -T **[L:3 P:0 T:1 – 4]** **Credit: 3-0-1-4**

Course Objectives:

1. To understand the basic concepts associated with the design, functioning, applications and social aspects of robots
2. To study about the electrical drive systems and sensors used in robotics for various applications
3. To learn about analyzing robot kinematics, dynamics through different methodologies and study various design aspects of robot arm manipulator and end-effector
4. To learn about various motion planning techniques and the associated control architecture
5. To understand the implications of AI and other trending concepts of robotics.

Course Outcome: By the end of the course, the students shall be able to

1. Explain the concepts of industrial robots in terms of classification, specifications and coordinate systems, along with the need and application of robots and automation
2. Examine different sensors and actuators for applications like maze solving and self-driving cars.
3. Design a 2R robot and an end-effector and solve the kinematics and dynamics of motion for robots.
4. Explain navigation and path planning techniques along with the control architectures adopted for robot motion planning.
5. Describe the impact and progress in AI and other research trends in the field of robotics

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UNIT 1: Fundamentals of Robotics (8Hrs)

Introduction of Automation & Robotics robot applications robotic systems, robot anatomy and robot configurations, Joint types used in robots, robot wrists, joint notation schemes, work value for various robot anatomies, robot specifications, introduction to robot arm dynamics.

UNIT 2: Building Blocks of a Robot (8Hrs)

Types of electric motors – DC, Servo, Stepper; specification, drives for motors – speed and direction control and circuitry, Selection criterion for actuators, direct drives, non-traditional actuators; Sensors for localization, navigation, obstacle avoidance and path planning in known and unknown environments – optical, inertial, thermal, chemical, biosensor, other common sensors; Case study on choice of sensors and actuators for maze solving robot and self-driving cars.

UNIT 3: Robots end-effectors (8 Hrs)

classification of end-effectors, mechanical grippers, hooking or lifting grippers, grippers for molten metal's, plastics, vacuum cups, magnetic grippers, electrostatic grippers, multiple grippers, internal & external grippers, drive systems for gripers, active & passive grippers.

UNIT4: Robot Sensors (6 Hrs)

Scheme of robotic sensors, contact type sensors, force, torque, touch, position, velocity sensors, non-contact type sensors, electro-optical imaging sensors, proximity sensors, range imaging sensors, robot environment and robot input/output interfaces, machine intelligence, safety measures in robots.

UNIT5: AI and Other Research Trends in Robotics (6 Hrs)

Introduction to Machine learning – AI, Expert systems; Tele-robotics and Virtual Reality, Micro and Nanorobots, Unmanned vehicles, Cognitive robotics, Evolutionary robotics, Humanoids.

TEXT BOOKS:

1. Robotics Technology & Flexible Automation, S. R. Deb, Tata McGraw Hill.
2. Industrial Robotics, M. P. Groover, McGraw Hill.
3. Robotics for Engineers, Y. Koren, McGraw Hill.
4. Saeed. B. Niku, Introduction to Robotics, Analysis, system, Applications, Pearson educations, 2002
5. Roland Siegwart, Illah Reza Nourbakhsh, Introduction to Autonomous Mobile Robots, MIT Press, 2011

REFERENCE BOOKS:

1. Robots & Manufacturing Automation by Asfahal C. Ray, John Wiley.
2. Robotic Engineering, Richard D. Klafter, PHI.
3. Robots & Control, Mittal & Nagrath, Tata McGraw Hill.
4. Richard David Klafter, Thomas A. Chmielewski, Michael Negin, Robotic engineering: an integrated approach, Prentice Hall, 1989
5. Craig, J. J., Introduction to Robotics: Mechanics and Control, 2nd Edition, Addison-Wesley, 1989.
6. K.S. Fu, R.C. Gonzalez and C.S.G. Lee, Robotics: Control, Sensing, Vision and Intelligence, McGraw-Hill, 1987.
7. Wesley E Snyder R, Industrial Robots, Computer Interfacing and Control, Prentice Hall International Edition, 1988.
8. Robin Murphy, Introduction to AI Robotics, MIT Press, 2000

NOTE: Practical's based on above syllabus .

B. Tech. Seventh Semester (CBCS)
(Electronics & Communication/ Electronics & Telecommunication /Electronics Engineering)
PEC-IV
Mixed Signals Design

Duration: 3 Hr.
College Assessment: 30 Marks
University Assessment: 70 Marks

Subject Code: BEETC702PE-T **[L:3 P:0 T:1 – 4]** **Credit: 3-0-1-4**

Course Objectives:
1.To understand the concepts of Switched Capacitors Circuits
2.To understand the concepts of PLLS
3.To understand the concepts of Data Converter Fundamentals.
4.To understand the concepts of Nyquist Rate A/D Converters
Course Outcome: By the end of the course, the students shall be able to
1.Design and analysis of Nyquist Rate A/D Convertors.
2.Apply the Mixed Signal Design to Different Applications.
3.Apply the Concepts of Oversampling Convertors and Continuous-Time Filters.

Unit I: Switched Capacitor Circuits (06Hrs)

Introduction to Switched Capacitor circuits basic building blocks, Operation and Analysis, Non-ideal effects in switched capacitor circuits, switched capacitor, integrators: first order filters, Switch sharing, Biquad filters.

UNIT-II: Phased Lock Loop (PLL) (08Hrs)

Basic PLL topology, Dynamics of simple PLL, Charge pump PLLs Lock acquisition, Phase/Frequency detector and charge pump, Basic charge pump PLL, Non-ideal effects in PLLs-PFD/CP non idealities, Jitter in PLLs, Delay locked loops, applications.

UNIT-III: Data Converter Fundamentals (08Hrs)

DC and dynamic specifications, Quantization noise, Nyquist rate D/A converters- Decoder based converters, Binary-Scaled converters, Thermometer-code converters, Hybrid converters.

UNIT-IV: Nyquist Rate A/D Converters (08Hrs)

Successive approximation converters, Flash converter, Two-step, A/D converters: Interpolating A/D converters, Folding A/D converters, Pipelined A/D converters, Time-interleaved converters.

UNIT-V: Oversampling Converters (06Hrs)

Noise shaping modulators, Decimating filters and Interpolating filters, Higher order modulators, Delta sigma modulators with multi-bit quantizers, Delta sigma D/A.

TEXT BOOKS:

1. Design of Analog CMOS Integrated Circuits- Behzad Razavi, TMH Edition, 2002
2. Analog Integrated Circuit Design- David A. Johns,Ken Martin, Wiley Student Edition, 2013

REFERENCE BOOKS:

1. CMOS Mixed-Signal Circuit Design - R. Jacob Baker, Wiley Interscience, 2009.
2. CMOS Analog Circuit Design –Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.

NOTE: 8 to 10 Practical's based on above syllabus.

B. Tech. Seventh Semester (CBCS)
(Electronics & Communication/ Electronics & Telecommunication /Electronics Engineering)
PEC-IV
Data Science and Cloud Computing

Duration: 3 Hr.
College Assessment: 30 Marks
University Assessment: 70 Marks

Subject Code: BEETC702PE-T **[L:3 P:0 T:1 – 4]** **Credit: 3-0-1-4**

Course Objectives:

1. To understand the basic terminology used in data science
2. To Understand data management and data models
3. To understand basic terminology and concept of data analysis.
4. To understand and apply data visualization.

Course Outcome: By the end of the course, the students shall be able to

1. Identify the basic concepts and technologies involved in dealing with Data science process.
2. Apply data management for exploring and fixing data.
3. Understand different types of statistical data analysis.
4. Apply and use different technologies for data visualization.

UNIT-I: Introduction to Data Science: (08 Hrs)

Terminology Related with Data Science, Methods of Data Repository, Personnel involved with Data Science, Types of Data, The Data Science Process, Popular Data Science toolkits.

UNIT-II: Data Management: (07Hrs)
Data Management Planning, Data Management Plan, Data Collection and Management, Application Programming Interface, Exploring Data, Building Models, Storage Management, Importing Data.

UNIT-III: Data Analysis Using R :(07Hrs)
Introduction to Applied statistical Techniques, Types of Statistical Data, Types of Big Data Analytics, Collecting data for Sampling and Distribution, Probability, Frequency Distribution, Population and Parameters, Central Tendency or Central Value, Measures of Central Tendency, Different types of Statistical Means.

UNIT-IV: Data Visualization:(07Hrs)
Data Visualization, Importance of Data Visualization, Conventional Data Visualization Methods, Retinal Variables, Mapping Variables to Encodings, Case Study.

UNIT-V: Applications of Data Science:(07 Hrs)
Applications of Data Science Technologies for Visualization, Introduction to Python, Basic Numeric Operations, Data Types in Python, Modules, Libraries.

TEXT BOOKS:

1. V. K. Jain; "Data Science and Analytics" Khanna Publication 2018.

REFERENCE BOOKS:

1. Cathy O'Neil and Rachel Schutt, "Doing Data Science, Straight Talk from The Frontline", O'Reilly, 2014.
2. Mohammed J. Zaki and Wagner Miera Jr, "Data Mining and Analysis: Fundamental Concepts and Algorithms", Cambridge University Press, 2014.
3. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media, 2015.

NOTE: 8 to 10 Practical's based on above syllabus.

B. Tech. Seventh Semester (CBCS)
(Electronics & Communication/ Electronics & Telecommunication /Electronics Engineering)
PEC-IV
MICROWAVE & RADAR ENGINEERING

Duration: 3 Hr.
College Assessment: 30 Marks
University Assessment: 70 Marks

Subject Code: BEETC702PE-T **[L:3 P:0 T:1 – 4]** **Credit: 3-0-1-4**

Course Objectives:
1. To understand the principles of the advanced microwave engineering
2. To study Klystron amplifier and oscillator.
3. To learn working principle of Radar system.
4. To understand the radio wave propagation and interference in mobile communications..
5. To get knowledge and relate different components in Radar and use them in projects.

Course Outcome: At the end of the course the student should be able to:
1. Understand the use of active and passive microwave devices
2. Analyze scattering matrix, Different UHF components with the help of scattering parameter .
3. Understand the use of different Klystrons.
4. Analyze the different power distribution Tees.
5. Acquisition of technical competence in specialized areas of Radar engineering.
6.Identify, formulate and model problems and find Radar engineering solutions based on a system approach.

Unit 1: Microwave Tubes (08Hrs)

High frequency limitations of conventional tubes, Two Cavity and multi cavity Klystrons, Reflex Klystrons, slow-wave structure: TWT, BWO, Magnetron oscillator and its types.

Unit 2: Microwave Components (07Hrs)

Introduction to rectangular waveguide & waveguide excitation ,Principles of S-parameters, Sparameters for multi-ports (2-port, 3-port, 4-port etc.) properties of S-matrix, waveguide Tees (E, H, E-H planes), Directional Couplers, matched terminations, Microwave attenuators, Slotted line, Ferrite devices, Circulators, Isolators, gyrators.

Unit 3: Solid State Microwave Devices (07Hrs)

Parametric amplifiers, PIN diodes, Transferred Electron devices: Gunn diode, Avalanche diode, Transit Time devices like IMPATT, TRAPATT diodes.

Unit 4: Microwave measurement (07Hrs)

Introduction to microwave measurements, definition and measurement methods of frequency, power, attenuation, VSWR, impedance, insertion loss, dielectric constant, Q of a cavity resonator, phase shift.

Unit 5: Radar Fundamentals (07Hrs)

Basic principles and fundamentals of Radar, block diagram of basic radar, classification, radar performance factors, radar range equation, factors influencing maximum range, effects of noise, Pulsed radar systems. Antennas and scanning, display methods, moving target indication, radar beacons, CW Doppler radar, FM CW phased array radars, applications of radar

Text Books:

1. S.Y. Liao, "Microwave Devices and Circuits", Prentice Hall India.
2. Skolnik, "Principles of Radar Engineering", McGraw Hill Publications
3. David M. Pozar, "Microwave Engineering", John Willey & Sons.

Reference Books:

1. G.S.Raghuwanshi "Microwave Engineering",Cengage India Publications .
2. R.S. Rao, "Microwave Engineering", PHI Publications
3. Annapurna Das, Sisir Das, "Microwave Engineering", McGraw Hill Publications

NOTE: 8 to 10 Practical's based on above syllabus.

B. Tech. Seventh Semester (CBCS)
(Electronics & Communication/ Electronics & Telecommunication /Electronics Engineering)
PEC-IV
PLC and SCADA

Duration: 3 Hr.
College Assessment: 30 Marks
University Assessment: 70 Marks

Subject Code: BEETC702PE-T **[L:3 P:0 T:1 – 4]** **Credit: 3-0-1-4**

Course Objectives:

1. To understand the fundamental concepts, history, purpose and current state (evolvement), components, and functions of PLC and SCADA systems in the context of industrial automation and control.
2. To develop programming skills for PLC systems and gain proficiency in troubleshooting PLC programs to ensure efficient and reliable operations.
3. To gain practical knowledge and skills in designing, configuring, and utilizing SCADA systems for effective process control, data acquisition, operations and analysis.

Course Outcome: By the end of the course, the students shall be able to

1. Analyze and interpret (understand and define) industrial automation requirements and select appropriate PLC and SCADA systems for efficient process control and monitoring.
2. Develop proficiency in programming PLC systems using various programming languages and techniques, and the ability to troubleshoot and debug PLC programs effectively.
3. Competence in designing and configuring SCADA systems, including the development of human-machine interfaces (HMIs) / Dashboards for visualization, effective operations and data presentation.
4. Skills in utilizing SCADA systems for data acquisition, storage, retrieval, and analysis to optimize process performance and decision-making in industrial settings.

Unit I: PLC Fundamentals (6Hrs)

Introduction to Programmable Logic Controllers (PLCs) and history of PLC, PLC architecture (Modular Structure) and components, DI, DO, AI, AO, Types of PLC programming languages (ladder logic, function block diagram, etc.), Input/output (I/O) modules and addressing, PLC programming software and simulation tools.

UNIT-II: PLC Programming and Troubleshooting (8hrs)

Creating ladder logic programs, Programming timers, counters, and mathematical operations, Main Loop, cycle time, functional blocks, troubleshooting techniques and practices, Monitoring and modifying PLC programs, Introduction to PLC networking and communication protocols

UNIT-III: SCADA Fundamentals (8hrs)

Introduction to SCADA systems, SCADA architecture and components, Human Machine Interface (HMI) / Dashboard design principles, Real-time data acquisition and monitoring, Alarm management and event handling in SCADA, closed loops, manual and auto modes. Closed Loop operations in system failure.

UNIT-IV: Communication and Networking (8 hrs)

Communication protocols used in PLC and SCADA systems (Modbus, Profibus, etc.), Network architecture and topology for PLC and SCADA systems, Configuring communication between PLCs and SCADA systems, Remote monitoring and control of industrial processes, New Developments: Examples of MODBUS TCP Remote Input Output.

UNIT-V: SCADA Data Acquisition, Operations and Analysis (6hrs)

Data acquisition from field devices using PLC and SCADA systems, Actuators / outputs Control from PLC and SCADA, Data logging, storage, and retrieval in SCADA systems, Analyzing and interpreting data for process optimization, Trending and reporting in SCADA systems, Alarms.

Text Books:

1. Programmable Logic Controllers and Industrial Automation: An Introduction Madhuchchanda Mitra, Samarjit Sengupta (Author), 2nd Edition.
2. Programmable Logic Controllers: W. Bolton, Newnes an imprint of Elesevier, 6th edition.

REFERENCE BOOKS:

1. Programmable Logic Controllers: John Hacworth and Frederick D. Hackworth Jr, Pearson publisher

NOTE: 8 to 10 Practical's based on above syllabus.

B. Tech. Seventh Semester (CBCS)
(Electronics & Communication/ Electronics & Telecommunication /Electronics Engineering)
PEC-V
Soft Computing

Duration: 3 Hr.
College Assessment: 30 Marks
University Assessment: 70 Marks

Subject Code: BEETC703PE **[L:3 P:0 T:0 – 3]** **Credit: 3-0-0-3**

Course Objectives:
The course would aim to make the student understand the basic idea of problem solving through the principles of soft computing, which would be seen as a well-balanced integration of fuzzy logic, evolutionary computing, and neural information processing.

1. To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
2. To familiarize with genetic algorithms.
3. To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems

Course Outcomes: By the end of the course, the students shall be able to

1. Recognize the feasibility of applying a soft computing methodology for a particular problem.
2. Apply fuzzy logic and reasoning to handle uncertainty and solve engineeringproblems.
3. Apply genetic algorithms to combinatorial optimization problems.
4. Apply neural networks to pattern classification and regression problems.

UNIT I (08Hrs)
Fuzzy Logic: Fuzzy Set Theory: Basic Definition and Terminology, Set Theoretic Operations, MF Formulation and Parameterization, MF of two dimensions, Fuzzy Union, Intersection and Complement.

UNIT II (07Hrs)
Fuzzy Rules and Fuzzy Reasoning: Extension Principles and Fuzzy Relations, Fuzzy IF THEN Rules, Fuzzy Reasoning. Fuzzy Inference System Introduction, Mamdani Fuzzy models, Other Variants, Sugeno Fuzzy Models, Tekamoto Fuzzy Models.

UNIT III (07Hrs)
Genetic Algorithms: Fundamentals of Genetic Algorithms: Basic Concepts Creation, Offspring's Encoding, Fitness functions, Reproduction, Genetic Modelling: Inheritance Operators, Cross over, Inversion and detection, Mutation operator, Bitwise operators.

UNIT IV (07Hrs)
Artificial Neural Networks: Introduction, Architecture, Back Propagation and feed Forward Networks, Offline Learning, Online Learning.
Supervised Learning of Neural Networks: Introduction, Perceptrons, Adaline Back Propagation Multilayer Perceptrons, Back Propagation Learning Rules, Methods of Speeding. Radial Basis Function Networks, Functional Expansion Networks.

UNIT V (07Hrs)

Neuro-FuzzyModeling: Adaptive Neuro-Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm – Learning Methods that Cross-fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling – Framework Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum.

TEXT BOOKS

1. J.S.R. Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing" PHI/Pearson Education, New Delhi 2004.

REFERENCE BOOKS

1. T. J. Ross, "Fuzzy Logic with Engineering Applications." TMH, New York, 1997.
2. D. E. Goldberg, Genetic Algorithms in Search Optimization and Machine Learning, Addison Wesley, 3rd Ed.
3. B. Kosko, Neural Network and fuzzy systems, Prentice Hall of India, 2006

B. Tech. Seventh Semester (CBCS)
(Electronics & Communication/ Electronics & Telecommunication /Electronics Engineering)
PEC-V
Fundamentals of Machine Learning

Duration: 3 Hr.
College Assessment: 30 Marks
University Assessment: 70 Marks

Subject Code: BEETC703PE **[L:3 P:0 T:0 – 3]** **Credit: 3-0-0-3**

Course Objectives:

1. To introduce students to the basic concepts and techniques of Machine Learning.
2. To have a thorough understanding of the Supervised and Unsupervised learning techniques.
3. To study the various probability-based learning techniques

Course Outcome: By the end of the course, the students shall be able to

1. Describe Machine learning and its types.
2. Discuss Bayesian Decision Theory and Parametric Methods.
3. Illustrate Multivariate and Dimensionality Reduction methods.
4. Categorize Non-Parametric methods.
5. Justify discrimination techniques in Machine learning

UNIT-I (08Hrs)
Introduction: What Is Machine Learning Examples of Machine Learning Applications, Learning Associations, Classification, Regression, Unsupervised Learning, Reinforcement Learning Supervised Learning: Learning a Class from Examples, Vapnik-Chervonenk is Dimension, Probably Approximately Correct Learning, Noise, Learning Multiple Classes, Regression, Model Selection and Generalization, Dimensions of a Supervised Machine Learning Algorithm.

UNIT-II (07Hrs)
Bayesian Decision Theory: Introduction, Classification, Losses and Risks, Discriminant Functions, Association Rules Parametric Methods: Introduction, Maximum Likelihood Estimation, Bernoulli Density, Multinomial Density Gaussian (Normal) Density, evaluating an Estimator: Bias and Variance, The Bayes' Estimator, Parametric Classification, Regression, Tuning Model Complexity: Bias/Variance Dilemma, Model Selection Procedures.

UNIT-III (07Hrs)
Multivariate Methods: Multivariate Data, Parameter Estimation, Estimation of Missing Values, Multivariate Normal Distribution, Multivariate Classification, Tuning Complexity, Discrete Features, Multivariate Regression Dimensionality Reduction: Introduction, Subset Selection, Principal Component Analysis, Feature Embedding, Factor Analysis, Singular Value Decomposition and Matrix Factorization, Multidimensional Scaling, Linear Discriminant Analysis, Canonical Correlation Analysis.

UNIT-IV (08Hrs)
Clustering: Introduction, Mixture Densities,k-Means Clustering, Expectation-Maximization Algorithm, Mixtures of Latent Variable Models, Supervised Learning after Clustering, Spectral Clustering,

Hierarchical Clustering, Choosing the Number of Clusters Nonparametric Methods: Introduction, Nonparametric Density Estimation, Histogram Estimator, Kernel Estimator, k-Nearest Neighbor Estimator, Generalization to Multivariate Data, Nonparametric Classification, Condensed Nearest Neighbor, Distance-Based Classification, Outlier Detection.

UNIT-V (06Hrs)

Decision Trees: Introduction, Univariate Trees, Classification Trees, Regression Trees, Pruning, Rule Extraction from Trees, Learning Rules from Data, Multivariate Trees. Linear Discrimination: Introduction, Generalizing the Linear Model, Geometry of the Linear Discriminant: Two Classes, Multiple Classes; Pairwise Separation, Parametric Discrimination Revisited, Gradient Descent, Logistic Discrimination: Two Classes, Multiple Classes; Discrimination by Regression.

TEXT BOOKS:

1. EthemAlpaydin, —Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series), Third Edition, MIT Press, 2014

REFERENCE BOOKS:

1. Stephen Marsland, —Machine Learning – An Algorithmic Perspective||, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
2. Tom M Mitchell, —Machine Learning, First Edition, McGraw Hill Education, 2013.
3. Peter Flach, —Machine Learning: The Art and Science of Algorithms that Make Sense of Data, First Edition, Cambridge University Press, 2012.

B. Tech. Seventh Semester (CBCS)
(Electronics & Communication/ Electronics & Telecommunication /Electronics Engineering)
PEC-V
Optical Communication

Duration: 3 Hr.
College Assessment: 30 Marks
University Assessment: 70 Marks

Subject Code: BEETC703PE **[L:3 P:0 T:0 – 3]** **Credit: 3-0-0-3**

Course Objectives:

1. To understand optical fiber technology to sophisticated modern telecommunication systems.
2. To understand the fundamental behavior of the individual optical components, optical fiber sources and detectors
3. To measure & analyze different measurements, parameters & properties of optical fiber.

Course Outcome: By the end of the course, the students shall be able to

1. Learn the basic elements and behavior of optical fiber.
2. Analyze the different kinds of losses, signal distortion in optical wave
3. Classify various optical source materials, LED structures, LASER diodes.
4. Explore the fiber optic receivers such as PIN, APD diodes, receiver operation & performance.
5. Understand the operational principle of WDM, SONET, and Optical Amplifiers

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Unit I: Overview of Optical Fiber Communication (06Hrs)

Introduction, Block diagram, advantages, disadvantages, and applications of optical fiber communication, optical fiber waveguides, Ray theory, Modes, Classification of optical fibers.

Unit- 2: Transmission Characteristics Of Optical Fibers: (08 Hrs)

Introduction, Attenuation, absorption, scattering losses, bending loss, dispersion, Intra modal dispersion, Inter modal dispersion. Fiber alignment and joint loss, single mode fiber joints, fiber splices, fiber connectors and fiber couplers.

Unit-3 Optical Sources and Detectors: (08 Hrs)

Introduction, LED's, LASER diodes, Photo detectors, Responsivity, quantum efficiency, Photo detector noise, Response time, Photo diodes, comparison of photo detectors. Introduction of Optical Receiver, its Operation, receiver sensitivity, quantum limit, eye diagrams, coherent detection, , Analog receivers.

Unit 4 Analog and Digital Links: (06 Hrs)

Analog links – Introduction, overview of analog links, CNR, RIN, multichannel transmission techniques, RF over fiber, key link parameters, Radio over fiber links, Digital links – Introduction, point–to–point links, System considerations, link power budget, Rise Time budget, Power penalties.

Unit 5 WDM, Optical Amplifiers and Networks: (08 Hrs)

WDM concepts, overview of WDM operation principles, WDM standards, Isolators and circulators, optical amplifiers, basic applications and types, semiconductor optical amplifiers, EDFA. Optical Networks: Introduction, SONET / SDH, Optical Interfaces, SONET/SDH rings, High speed light waveguides.

Text Books:

1. Optical Fiber Communication – Gerd Keiser, 4th Ed., MGH, 2008.

2. Optical Fiber Communications– – John M. Senior, Pearson Education. 3 rd Impression, 2007.

Reference Books:

1. Fiber optic communication – Joseph C Palais: 4th Edition, Pearson Education.

2. "Textbook on Optical Fiber Communication & its Application", S.C. Gupta, PHI Publications

3. "Optical Communication & Networks", M.N. Bandopadhyay, PHI Publications.

B. Tech. Seventh Semester (CBCS)
(Electronics & Communication/ Electronics & Telecommunication /Electronics Engineering)
PEC-V
Biomedical Engineering

Duration: 3 Hr.
College Assessment: 30 Marks
University Assessment: 70 Marks

Subject Code: BEETC703PE **[L:3 P:0 T:0 – 3]** **Credit: 3-0-0-3**

Course Objectives:

1.To understand the biomedical signal acquisition and analysis.
2.To understand x-ray, MRI, CT, VR technologies and infra-red imaging.
3.To understand the biomedical sensors.
4.To have thorough understanding of medical instruments & devices.
5. To understand medical informatics & new training & simulation technologies.

Course Outcome: By the end of the course, the students shall be able to

1.Analyze the biomedical signals.
2.Describe x-ray, MRI, CT, VR technologies and infra-red imaging.
3.Explain Biomedical sensors & understand the measurements.
4. Describe different medical instruments & their applications.
5. Understand hospital information system & relevant training & simulation technologies.

Unit I: Introduction to biomedical engineering (6 Hrs)

Introduction to biomedical engineering, scope of electronics in biomedical engineering, block diagram of bio medical Electronics, Biomedical Signal Analysis: Origin and Dynamic Characteristics; Frequency-Domain Analysis , Digital Biomedical Signal Acquisition and Processing, advantages and disadvantages of Electronics in bio medical fields.

UNIT-II: Imaging (6 Hrs)

Imaging: X-Ray, Computed Tomography, Magnetic Resonance Imaging, Ultrasound, Magnetic Resonance Microscopy, Positron-Emission Tomography (PET), Electrical Impedance Tomography, Medical Applications of Virtual Reality Technology

Infrared Imaging: Advances in Medical Infrared Imaging, Quantitative Active Dynamic Thermal IR-Imaging and Thermal Tomography in Medical Diagnostics, Applications of thermal imaging.

UNIT-III: Biomedical Sensors (8 Hrs)

Biomedical Sensors: Physical Measurements, Biopotential Electrodes, Electrochemical Sensors, Optical Sensors, Bioanalytic Sensors, Biological Sensors for Diagnostics.

UNIT-IV: Medical Instruments and Devices (8 Hrs)

Bio potential Amplifiers, Bioelectric Impedance Measurements, Implantable Cardiac Pacemakers, Noninvasive Arterial Blood Pressure and Mechanics, Cardiac Output Measurement, Implantable Stimulators for Neuromuscular Control, Mechanical Ventilation, Essentials of Anesthesia, Biomedical Lasers Instrumentation for Cell Mechanics, Blood Glucose Monitoring, Noninvasive Optical Monitoring, Medical Instruments and Devices Used in the Home.

UNIT-V: Medical Informatics (8Hrs)

Hospital Information Systems: Their Function and State, Computer-Based Patient Records, Overview of Standards Related to the Emerging Health Care Information Infrastructure, Risk Factors, Safety, and Management of Medical Equipment, Medical Informatics and Biomedical Emergencies: New Training and Simulation Technologies for First Responders, Regulatory and Assessment Agencies, Ethical Issues Associated with the Use of Medical Technology

Text Books:

1."Medical Devices and Systems", 3rd Edition, Joseph D. Bronzino Trinity College Hartford, Connecticut, U.S.A.

2.Biomedical Engineering- from theory to applications, Reza Fazel-Rezai , University of North Dakota, United States of America

3.Medical Instrumentation: Application and Design Fifth Editionby John G. Webster (Editor), Amit J. Nimunkar

Reference Books:

1. Biomedical digital signal processing, Willis J. Tompkins, Prentice Hall India, 1995.

2. Biomedical Signal Processing and Signal Modeling, E. N. Bruce, Wiley, 2009.

3. Bio signal and Medical Image Processing, John L. Semmlow and Benjamin Griffel, CRC Press, Third Edition 3rd Edition, 2014.

B. Tech. Seventh Semester (CBCS)
(Electronics & Communication/ Electronics & Telecommunication /Electronics Engineering)
OE-II
Mechatronics

Duration: 3 Hr.
College Assessment: 30 Marks
University Assessment: 70 Marks

Subject Code: BEETC704OE **[L:3 P:0 T:0 – 3]** **Credit: 3-0-0-3**

Course Objectives:
1. To understand the mechatronics.
2. To understand sensors and actuators
3. To understand the Industrial Automation.
4. To understand the concept of industry 4.0

Course Outcomes: By the end of the course, the students shall be able to
1.To model and simulate physical systems.
2. Incorporate sensors, actuators and interfacing modules
3. Develop logic to automate, and supervise a system
4. Design mechatronics subsystem\system \process to meet consumer and industry need by incorporating State-of-the-art technologies
5. Conduct experiments to demonstrate the knowledge of Automation, Supervisory control and Human machine interfaces.

Unit I: (7 Hrs)

Introduction: Mechatronics key elements, design processes and issues, Modeling and simulation of physical system, Electrical system, Mechanical translation-rotation system, electromechanical coupling, Ball screws, Electronic cams, Indexing mechanisms.

Unit II: (7 Hrs)

Sensors: Sensor characteristics and classification, Position sensor, Gas sensors, Piezoelectric sensor, Proximity sensor, Load Cell, Accelerometer, Gyroscope, Inclinometer, Wearable sensors for robotic applications, Signal conditioning and data conversion.

Unit III: (7 Hrs)

Actuators: Direct current motor and drive, Stepper motor and drives, Servo-motor and drive, Piezoelectric actuators, MEMS actuators, Shape memory alloy Actuator, Pneumatic and fluid power actuation, Power estimation of actuator.

Unit IV: (9 Hrs)

Industrial automation: Industrial revolutions, Basic Components of automation, PLC commissioning and installation, Architecture of PLC, PLC programming techniques, Ladder logic programming, Advanced instructions of PLC, Introduction to programmable automation controller (PAC)Components and features, SCADA Scripting, Graphical Animation, PLC networking and Communication, Introduction to Human machine interface.

Unit V: (6 Hrs)

Case studies: Industry 4.0, Defence systems, Automotive Electronics, Biomedical Systems, agriculture.

Text Books

1. Devdas Shetty and Richard A. Kolk, Mechatronics System Design, CENGAGE Learning, Second Edition, Indian reprint, 2012
2. John Hackworth and F. Hackworth Jr, Programmable Logic Controllers, Pearson Education.

Reference Books

1. W. Bolton, Mechatronics, Pearson Education Asia, Third Indian reprint 2001
2. David G. Alciatore and Michael B.Hisland, Introduction to Mechatronics and measurement Systems, Tata McGraw hill, Third Edition, 2007
3. Nitaigour Mahalik, Mechatronics, Principles, Concepts and application, McGraw Hill Publication, Indian seventeenth reprint 2014.

B. Tech. Seventh Semester (CBCS)
(Electronics & Communication/ Electronics & Telecommunication /Electronics Engineering)
OE-II
Bioengineering

Duration: 3 Hr.
College Assessment: 30 Marks
University Assessment: 70 Marks

Subject Code: BEETC704OE **[L:3 P:0 T:0 – 3]** **Credit: 3-0-0-3**

Course Objectives:
1.To understand the biomedical signal acquisition and analysis.
2.To understand x-ray, MRI, CT, VR technologies and infra-red imaging.
3.To understand the biomedical sensors.
4.To have thorough understanding of medical instruments & devices.
5. To understand medical informatics & new training & simulation technologies.

Course Outcome: By the end of the course, the students shall be able to
1.Analyze the biomedical signals.
2.Describe x-ray, MRI, CT, VR technologies and infra-red imaging.
3.Explain Biomedical sensors & understand the measurements.
4. Describe different medical instruments & their applications.
5. Understand hospital information system & relevant training & simulation technologies.

Unit I: Introduction to bioengineering (6 hrs)
Introduction to bio engineering, scope of electronics in biomedical engineering, advantages and disadvantages of Electronics in bio medical fields,
Bio signals: Characteristics of ECG, EEG and EMG signals,
Biomedical Signal Analysis: Origin and Dynamic Characteristics, Frequency-Domain Analysis, Use of filter for biomedical signal analysis, design of filter suitable for Bio-medical signal analysis.

UNIT-II: Biomedical Sensors (8hrs)
Biomedical Sensors: Physical Measurements, Bio potential Electrodes, Electrochemical Sensors, Optical Sensors, Bio analytic Sensors, Biological Sensors for Diagnostics.

UNIT-III: Imaging (6hrs)
Imaging: X-Ray, Computed Tomography, Magnetic Resonance Imaging, Ultrasound, Magnetic Resonance Microscopy, Positron-Emission Tomography (PET), Electrical Impedance Tomography , Medical Applications of Virtual Reality Technology
Infrared Imaging, Applications of thermal imaging.

UNIT-IV: Introduction of Medical Instruments and Devices (8 hrs)
Biopotential Amplifiers, Bioelectric Impedance Measurements, Implantable Cardiac Pacemakers, Noninvasive Arterial Blood Pressure and Mechanics, Cardiac Output Measurement, Implantable Stimulators for Neuromuscular Control, Mechanical Ventilation, Essentials of Anesthesia, Biomedical Lasers Instrumentation for Cell Mechanics, Blood Glucose Monitoring, Noninvasive Optical Monitoring, Medical Instruments and Devices Used in the Home, Virtual Instrumentation: Applications in Biomedical Engineering.

UNIT-V: Introduction to Medical **Informatics (8hrs)**

Hospital Information Systems: Their Function and State, Computer-Based Patient Records, Overview of Standards Related to the Emerging Health Care Information Infrastructure, Risk Factors, Safety, and Management of Medical Equipment, Introduction to Informatics and Nursing, Non-AI Decision Making, Medical Informatics and Biomedical Emergencies: New Training and Simulation Technologies for First Responders, Regulatory and Assessment Agencies, Ethical Issues Associated with the Use of Medical Technology

Text Books:

1. "Medical Devices and Systems", 3rd Edition, Joseph D. Bronzino Trinity College Hartford, Connecticut, U.S.A.
2. Biomedical Engineering- from theory to applications, Reza Fazel-Rezai , University of North Dakota, United States of America
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Reference Books:

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2. Biomedical Signal Processing and Signal Modeling, E. N. Bruce, Wiley, 2009.
3. Bio signal and Medical Image Processing, John L. Semmlow and Benjamin Griffel, CRC Press, Third Edition 3rd Edition, 2014.

B. Tech. Seventh Semester (CBCS)
(Electronics & Communication/ Electronics & Telecommunication /Electronics Engineering)
Intellectual Property Rights

Subject Code: BEETC706A **[L:1 P:0 T:0 – 1]** **Audit Course**

Course Outcomes

1. Read about the concepts of Intellectual Property Rights.
2. Distinguish and understand the world of Intellectual Property.
3. Explain why it needs to be protected? How is it protected?
4. Analyze discuss and debate about the latest legal problems confronting the world and the solutions being offered.
5. Consider new and upcoming areas of Intellectual Property (IP) like Biotechnology, Domain
6. Names, Creative Commons etc.

UNIT I

Introduction: What is Intellectual Property, What are the various forms of Intellectual Property, Difference between Tangible and In-tangible property, Need for Intellectual Property

UNIT II

Copyrights: What is copyright? Registration procedure and copyright authorities, Assignment and transfer of copyright, Software copyright

UNIT III

Patents: What are patents and conditions for patentability, Procedure for obtaining patents, Rights of a patentee, Patent infringements, Patents from an international perspective.

UNIT IV

Trademarks: What are Trade Marks (TM), Statutory authorities associated with and its registration procedure, Rights conferred by registration, Licensing, assignment and transfer of trademark rights

UNIT V

Designs and Geographical Indications: What are designs, Industrial Designs - Registration and piracy, Geographical Indication of Goods & Appellations of Origin

REFERENCES:

1. The Law of Trademarks, Copyrights, Patents, and Trade Secrets 3rd Edition (Paperback) by Deborah E. Bouchoux
2.Intellectual Property Rights in India 1st Edition (Hardcover) by VK Ahuja
3.Intellectual Property Law 3rd Edition, P Narayanan