

IV YEAR -I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
POWER SEMICONDUCTOR DRIVES

Course Code: GR24A4027

L/T/P/C: 2/1/0/3

IV Year I Semester

COURSE OUTCOMES

1. Analyze 1Φ & 3Φ converters fed DC motors and categorize the electric drive system based on the applications.
2. Identify various modes of operation for DC drives.
3. Illustrate speed control techniques of an induction motor drive for real time applications.
4. . classification of CSI and VSI based Synchronous Motor Drives
5. Compare closed loop and open loop control of advanced electric drives

UNIT I

PHASE CONTROLLED CONVERTER FED DC MOTOR

Introduction to Thyristor controlled Drives, single phase semi and full controlled converters connected to DC separately excited and DC series motors – continuous current operation – output voltage and current waveforms – speed and torque expressions – speed-torque – characteristics – problems on converter fed DC motors. Three phase semi and fully controlled connected to DC separately excited and DC series motors - output voltage and current waveforms – speed and torque expressions – speed –torque characteristics – problems.

UNIT II

CONTROL OF DC DRIVES

Single quadrant, two quadrant and four quadrant chopper fed dc separately excited and series motors – continuous current operation – voltage and current waveforms – speed torque expressions and characteristics – problems – closed loop operation (block diagram). Introduction to four quadrant operation – motoring operations, electric braking – plugging, dynamic and regenerative braking operations. Four quadrant operation of DC motors by dual converters – Closed loop control of DC motor (block diagram).

UNIT III

CONTROL OF INDUCTION MOTOR

Variable voltage characteristics – control of induction motor by Ac voltage controllers – waveforms – speed torque characteristics. Variable frequency characteristics – variable frequency control of induction motor by voltage source and current source inverter and cyclo converters – PWM control of VSI and CSI – comparison of VSI and CSI operations - speed torque characteristics – problems on induction motor drives - closed loop operation of induction motor drives (block diagram). Static rotor resistance control – slip power recovery – static scherbius drive – static Kramer drive – their performance and speed torque characteristics – advantages -applications – problems.

UNIT IV

CONTROL OF SYNCHRONOUS MOTOR

Separate control & self-control of synchronous motors – operations of self-controlled synchronous motors by VSI and CSI, Cycloconverters. Load commutated CSI fed synchronous motor – operation – waveforms – speed torque characteristics – applications- advantages and problems- Closed loop control operation of synchronous motor drives (block diagram)

UNIT V

ADVANCED ELECTRICAL DRIVES

Introduction to Permanent magnet and SRM Drives – Open loop and closed loop control Permanent magnet brushless DC motor (PMBLDC) and Permanent magnet synchronous motor (PMSM). Open loop and Closed loop control Switched reluctance motor (SRM).

TEXTBOOKS

1. B. K. Bose, “Modern Power Electronics and AC Drives”, Pearson Education, Asia, 2003.
2. Dubey G. K. “Power semiconductor control drives” Prentice Hall, Englewood Cliffs, New Jersey, 1989.
3. T.J.E. Miller, “Brush less Permanent Magnet and Reluctance Motor Drives”, Clarendon Press, Oxford, 1989.

REFERENCES

1. G. K. Dubey, “Fundamentals of Electrical Drives”, CRC Press, 2002.
2. R. Krishnan, “Electric Motor Drives: Modeling, Analysis and Control”, Prentice Hall, 2001.
3. Simulation of Power Electronic Circuits, M.B. Patil, V. Ramanarayanan, V.T. Ranganathan, Narosa Publications, 2013.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
ELECTRIC AND HYBRID VEHICLES

Course Code: GR24A4028

L/T/P/C: 3/0/0/3

IV Year I Semester

COURSE OUTCOMES

1. Summarize the Economic Aspects of EVs compared to ICEs.
2. Explain the braking system in EVs and HEVs.
3. Identify various hybrid drive-train topologies.
4. Analyze the configuration and control of different motor drives.
5. Interpret the different possible ways of energy storage requirements in Hybrid and Electric Vehicles.

UNIT I

ENVIRONMENTAL IMPACT AND HISTORY OF MODERN TRANSPORTATION

Air Pollution and Global Warming, social and environmental importance and Impact of hybrid and electric vehicles, History of Electric Vehicles, History of Hybrid Electric Vehicles, History of Fuel Cell Vehicles.

UNIT II

BRAKING FUNDAMENTALS AND REGENERATIVE BRAKING IN ELECTRIC VEHICLES

General Description of Vehicle Movement, Vehicle Resistance, Dynamic Equation, Tire–Ground Adhesion and Maximum Tractive Effort, Power Train Tractive Effort and Vehicle Speed, Vehicle Power Plant and Transmission Characteristics, Brake Performance. Braking Energy Consumed in Urban Driving, Importance of Regenerative Braking in Electric and Hybrid Vehicles.

UNIT III

INTRODUCTION TO ELECTRIC AND HYBRID ELECTRIC VEHICLES

Hybrid Electric Drivetrains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies; Introduction to pure EV's (BEV, FCV).

UNIT IV

ELECTRIC PROPULSION SYSTEMS

Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration, and control of Switch Reluctance Motor drives, drive system efficiency.

UNIT V

ENERGY STORAGE REQUIREMENTS IN HYBRID AND ELECTRIC VEHICLES

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems.

TEXTBOOKS

1. Mehrdad Ehsani, Yimin Gao, Ali Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals”, CRC Press, 2010.
2. Iqbal Hussain, “Electric & Hybrid Vehicles – Design Fundamentals”, Second Edition, CRC Press, 2011.

REFERENCES

1. Hybrid Vehicles and the future of personal transportation, Allen Fuhs, CRC Press, 2011.
2. Vehicle Power Management: Modelling, Control and Optimization, Xi Zhang, Chris Mi, Springer, 2011.
3. James Larminie, “Electric Vehicle Technology Explained”, John Wiley & Sons, 2003.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
MODERN POWER ELECTRONICS
(PROFESSIONAL ELECTIVE -III)

Course Code: GR24A4029

L/T/P/C: 3/0/0/3

IV Year I Semester

COURSE OUTCOMES

1. Illustrate modern power semiconductor devices.
2. Interpret power electronic resonant converters in power control applications.
3. Compare the performance and control of multi-level inverters.
4. Explain the performance of DC power supplies.
5. Analyze the fundamental concepts of AC power supplies and UP.

UNIT I

MODERN POWER SEMICONDUCTOR DEVICES

Modern power semiconductor devices- MOS turn Off Thyristor (MTO) - Emitter Turn Off Thyristor (ETO) Integrated Gate- Commutated Thyristor (IGCTs)-MOS-controlled Thyristors (MCTs)-Static Induction circuit comparison of their features.

UNIT II

RESONANT PULSE INVERTERS

Resonant pulse inverters-series resonant inverters- with unidirectional & Bidirectional switches. Analysis of half bridge resonant inverter-evaluation of currents and voltages of a simple resonant inverter-Analysis of full bridge resonant inverter with bidirectional switches.

UNIT III

MULTILEVEL INVERTERS

Multilevel concept-Classification of multilevel inverters-Diode clamped multilevel inverter- principle of operation, main features. Improved Diode Clamped inverter-principle of operation- Flying capacitors multilevel inverter principle of operation-main features.

UNIT IV

DC POWER SUPPLIES

DC power supplies-classification-switched mode dc power supplies-fly back Converter-forward converter-push pull converter-half bridge converter-Full bridge converter-Resonant dc power supplies- bidirectional dc power supplies-Applications.

UNIT V

AC POWER SUPPLIES

AC power supplies classification-switched mode ac power supplies. Resonant AC power supplies-bidirectional ac power supplies-multistage conversions-control circuits-applications. Introduction-power line disturbances-power conditioners-uninterruptible power supplies applications.

TEXTBOOKS

- 1.M. H. Rashid, “Power Electronics: Circuits, Devices, and Applications”, Pearson Education India, 2009.
- 2.P. S. Bimbhra, “Power Electronics”, Khanna Publishers

REFERENCES

1. L. Umanand, “Power Electronics: Essentials and Applications”, Wiley India, 2009.
2. B K.Bose “Modern power Electronics and AC Drives” Prentice Hall India Learning Private Limited, 2005.
3. N. Mohan and T. M. Undeland, “Power Electronics: Converters, applications and Design”, John Wiley & Sons, 2007.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
HIGH VOLTAGE ENGINEERING
(PROFESSIONAL ELECTIVE -III)

Course Code: GR24A4030

L/T/P/C: 3/0/0/3

IV Year I Semester

COURSE OUTCOMES

1. Explain the breakdown mechanisms in solid, liquid, and gaseous insulations.
2. Identify different types of breakdown processes under high voltage conditions.
3. Explain methods used for generating high voltages and currents.
4. Apply standard techniques to measure high D.C., A.C., and impulse voltages and currents.
5. Analyze testing procedures on high-voltage equipment as per standard practices.

UNIT I

BREAKDOWN IN GASES

Ionization processes and de-ionization processes, Types of Discharge, Gases as insulating materials, Breakdown in Uniform gap, non-uniform gaps, Townsend's theory, Streamer mechanism, Paschen's law, Corona discharge.

UNIT II

BREAKDOWN IN LIQUID AND SOLID INSULATING MATERIALS

Breakdown in pure and commercial liquids, Solid dielectrics and composite dielectrics, intrinsic breakdown, electromechanical breakdown and thermal breakdown, Partial discharge, applications of insulating materials in transformers, rotating machines, circuit breakers and bushings.

UNIT III

GENERATION OF HIGH VOLTAGES

Generation of high voltages, Rectifier circuits, Cockcroft-Walton voltage multiplier circuit, electrostatic generator, generation of high AC voltage by cascaded transformers, series resonant circuit, tripping and control of impulse generators.

UNIT IV

MEASUREMENTS OF HIGH VOLTAGES AND CURRENTS

Introduction, generating voltmeter, capacitive voltage transformer, electrostatic voltmeter, spark gaps for measurement of impulse voltages, measurement of high DC, AC and impulse currents – hall generator, current transformer, Rogowski coil, Cathode ray oscillographs for impulse voltage and current measurement.

UNIT V

HIGH VOLTAGE TESTING OF ELECTRICAL APPARATUS AND HIGH VOLTAGE LABORATORIES

Various standards for HV Testing of electrical apparatus, IS, IEC standards, testing of insulators and bushings, testing of isolators and circuit breakers, testing of cables, power transformers and some high voltage equipment, High voltage laboratory layout, indoor and outdoor laboratories, testing facility requirements, safety precautions in H. V. Labs.

TEXTBOOKS

1. M. S. Naidu and V. Kamaraju, “High Voltage Engineering”, McGraw Hill Education, 2015.
2. C. L. Wadhwa, “High Voltage Engineering”, New Age International Publishers, 2007.

REFERENCES

1. Küchler, Andreas. High Voltage Engineering: Fundamentals, Technology, Applications. Springer, 2017.
2. E. Kuffel, W. S. Zaengl and J. Kuffel, “High Voltage Engineering Fundamentals”, Newnes, Publication, 2000.
3. Rizk, Farouk AM, and Giao N. Trinh. “High voltage engineering”. CRC Press, 2018.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
DIGITAL CONTROL SYSTEMS
(PROFESSIONAL ELECTIVE -III)

Course Code: GR24A4031

L/T/P/C: 3/0/0/3

IV Year I Semester

COURSE OUTCOMES

1. Explain the discrete representation of continuous systems and mathematical modelling of sample & hold circuits.
2. Analyze the stability of discrete-time systems using Jury test and bilinear transformation methods.
3. Apply state-space models to evaluate controllability, observability, and stability of discrete systems.
4. Develop digital controllers, observers, and compensators for discrete-time systems.
5. Solve optimal digital control problems using state-space concepts and eigenvalue Assignment.

UNIT I

DISCRETE REPRESENTATION OF CONTINUOUS SYSTEMS

Basics of Digital Control Systems. Discrete representation of continuous systems. Sample and hold circuit. Mathematical Modelling of sample and hold circuit. Effects of Sampling and Quantization. Choice of sampling frequency. ZOH equivalent. Z-Transform and Inverse Z Transforms.

UNIT II

DISCRETE SYSTEM ANALYSIS AND STABILITY OF DISCRETE TIME SYSTEM

Pulse Transfer function. Pulse transfer function of closed loop systems. Mapping from s-plane to z plane. Solution of Discrete time systems. Time response of discrete time system. Stability analysis by Jury test. Stability analysis using bilinear transformation. Design of digital control system with dead beat response. Practical issues with dead beat response design.

UNIT III

STATE SPACE APPROACH FOR DISCRETE TIME SYSTEMS

State space models of discrete systems, State space analysis. Lyapunov Stability. Controllability, reachability, Re-Constructability and observability analysis. Effect of pole zero cancellation on the controllability & observability.

UNIT IV

DESIGN OF DIGITAL CONTROL SYSTEM

Design of Discrete PID Controller, Design of discrete state feedback controller. Design of set point tracker. Design of Discrete Observer for LTI System. Design of Discrete compensator.

UNIT V

DESIGN OF DIGITAL CONTROL USING STATE SPACE CONCEPTS

Formulation of the Optimal Control Problem, Optimal State Regulator, Use of State Regulator results to

solve other optimal control problems, Eigen value Assignments by state feedback. State Observers, Stochastic Optimal State Estimations.

TEXTBOOKS

1. K. Ogata, “Digital Control Engineering”, Prentice Hall, Englewood Cliffs, 1995.
2. M. Gopal, “Digital Control Engineering”, Wiley Eastern, 1988.

REFERENCES

1. G. F. Franklin, J. D. Powell and M. L. Workman, “Digital Control of Dynamic Systems”, Addison- Wesley, 1998.
2. B.C. Kuo, “Digital Control System”, Holt, Rinehart and Winston, 1980.
3. M. Sami Fadali & Antonio Visioli, “Digital Control Engineering Analysis and Design”, Academic Press, 1980.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
INDUSTRIAL AUTOMATION
(PROFESSIONAL ELECTIVE -III)

Course Code : GR24A4032
IV Year I Semester

L/T/P/C : 3/0/0/3

COURSE OUTCOMES

1. Explain the importance of Automation and classification of industries.
2. Illustrate Architecture, I/O Modules, and programming structure of PLC for industrial automation.
3. Summarize the ladder logic for gates using instructions of PLC.
4. Examine various PLC functions to construct ladder logic for applications.
5. Demonstrate the analog operations of PLC and analyze the robot controlling.

UNIT I

INTRODUCTION TO AUTOMATION & INDUSTRIAL CONTROL SYSTEM

Basic Elements of an Automated System - Power to Accomplish the Automated Process, Program of Instructions, Control System. Advanced Automation Functions - Safety Monitoring, Maintenance and Repair Diagnostics, Error Detection and Recovery. Levels of Automation. Process Industries Versus Discrete Manufacturing Industries - Levels of Automation in the Two Industries, Variables and Parameters in the Two Industries. Continuous Versus Discrete Control - Continuous Control Systems, Discrete Control Systems. Computer Process Control – Control Requirements, Capabilities of Computer Control, Forms of Computer Process Control.

UNIT II

PLC BASICS & PLC PROGRAMMING

PLC System, I/O Modules and Interfacing, CPU Processor, Programming Equipment Programming Formats, Construction of PLC Ladder Diagrams, Devices connected to I/O Modules. Input Instructions, Outputs, Operational Procedures, Programming examples using contacts and coils. Drill press operation.

UNIT III

DIGITAL LOGIC GATES

Programming in the Boolean Algebra System, Conversion examples, Ladder diagrams for process control, Ladder Diagrams & Sequence Listings, Ladder Diagram Construction and Flow chart for Spray Process System. PLC REGISTERS Characteristics of Registers, Module addressing, Holding registers, Input registers, Output registers.

UNIT IV

PLC FUNCTIONS

Timer functions & Industrial Applications, Counters, Counter function Industrial Applications. Arithmetic functions, Number Comparison Functions, Number Conversion Functions.

DATA HANDLING FUNCTIONS: SKIP, Master Control Relay, Jump, Move, FIFO, FAL, ONS, CLR and Sweep functions and their applications.

UNIT V

SEQUENCE FUNCTIONS AND ANALOG OPERATIONS

Sequence Functions and Applications, Controlling of Two-Axis and Three Axis Robots with PLC, Matrix Functions. Analog Modules and Systems, Analog Signal Processing, Multi Bit Data Processing, Analog Output Application Examples. PID principles, Position indicator with PID Control, PID Modules, PID Tuning, PID Functions.

TEXTBOOKS

1. Mikell P. Groover, “Automation, Production Systems, and Computer-Integrated Manufacturing”, Fourth Edition, Pearson.
2. “Programmable Logic Controllers - Principle and Applications” by John W Webb and Ronald A Reiss, Fifth edition, PHI, 2009.

REFERENCES

1. Jr. Hackworth and F.D Hackworth Jr, “Programmable Logic Controllers - Programming Method and Applications”, Pearson India, 2003.
2. Gary Dunning, Delmar, “Introduction to Programmable Logic Controllers”, Thomas Learning, 3rd Edition, 2005.
3. RG Jamkar, “Industrial Automation Using PLC SCADA & DCS”, Global Education, second edition, 2018.

GOKARAJURANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
POWER QUALITY AND FACTS
(PROFESSIONAL ELECTIVE -IV)

Course Code: GR24A4033

L/T/P/C: 3/0/0/3

IV Year I Semester

COURSE OUTCOMES

1. Describe the basic types and differentiate the functions of FACTS controllers.
2. Classify FACTS devices and explain the operation of shunt compensators.
3. Summarize the working principles and features of series compensators.
4. Identify common power quality issues in distribution systems.
5. Distinguish the operation of DVR and DSTATCOM for power quality improvement.

UNIT I

FACTS CONCEPTS

Transmission Interconnections, Power Flow and Dynamic Stability Considerations of a Transmission Interconnection, Basic Types of FACTS Controllers-Shunt Connected Controllers, Series Connected Controllers, Combined Shunt and Series Connected Controllers.

UNIT II

SHUNT COMPENSATORS

Objectives of shunt compensation, Midpoint voltage regulation, Improvement of Transient stability, power oscillation damping, Principle of operation of FC-TCR(SVC) compensator, characteristic of FC-TCR and control diagram, Basic concept of voltage source converter, principle of operation of STATCOM, characteristic of STATCOM, control diagram.

UNIT III

SERIES COMPENSATORS

Objectives of series compensation, Improvement of Transient stability, power oscillation damping, Principle of operation of Thyristor controlled series compensator (TCSC), operating characteristics, TCSC control diagram, Principle of operation voltage source converter type series compensator (SSSC). Basic principle of operation of UPFC, transmission control capabilities of UPFC.

UNIT IV

POWER QUALITY MEASUREMENTS

Power Quality problems in distribution systems: Transient and Steady state variations in voltage and frequency. Unbalance, Sags, Swells, Interruptions, Wave-form Distortions: harmonics, noise. Tolerance of Equipment: CBEMA curve.

UNIT V

WORKING PRINCIPLE OF DVR, DSTATCOM

Principle of operation of DSTATCOM, Control in UPF mode of operation and zero voltage regulation mode, Full bridge single phase DVR and Three phase three wire DVR topology description, Principle of operation of active series compensator (DVR).

TEXTBOOKS

1. N. G. Hingorani and L. Gyugyi, "Understanding FACTS: Concepts and Technology of FACTS Systems", Wiley-IEEE Press, 1999.
2. Bhim singh, Ambrish chandra and Kamal AL-Haddad, "Power Quality Problems and Mitigation Techniques" John wiley and sons Ltd 2015.

REFERENCES

- 1.K. R. Padiyar, "FACTS Controllers in Power Transmission and Distribution", New Age International(P) Ltd. 2007.
2. Roger C. Dugan "Electrical Power System s Quality", Second Edition, Mc Graw-Hill.
3. Bollen, Math HJ. *Understanding power quality problems*. Vol. 3. New York: IEEE press, 2000.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
UTILIZATION OF ELECTRICAL ENERGY
(PROFESSIONAL ELECTIVE -IV)

Course Code: GR24A4034
IV Year I Semester

L/T/P/C: 3/0/0/3

COURSE OUTCOMES

1. Describe the types of electric drives and characteristics for various industrial loads and applications.
2. Compare different electric heating and welding techniques based on their advantages, principles, and applications.
3. Apply the laws of illumination and design suitable lighting systems using various light sources and control methods.
4. Analyze speed-time curves and braking methods used in electric traction systems.
5. Calculate tractive effort, energy consumption, and analyze the effect of traction parameters such as adhesion and braking.

UNIT I

ELECTRIC DRIVES

Type of electric drives, choice of motor, starting and running characteristics, speed control, temperature rise, particular applications of electric drives, types of industrial loads, continuous, intermittent and variable loads, load equalization.

UNIT II

ELECTRIC HEATING & ELECTRIC WELDING

Advantages and methods of electric heating, resistance heating, induction heating, and dielectric heating. Electric welding, resistance and arc welding, electric welding equipment, comparison between A.C. and D.C. Welding.

UNIT III

ILLUMINATION

Introduction, terms used in illumination, laws of illumination, polar curves, photometry, integrating sphere, sources of light. Discharge lamps, MV and SV lamps comparison between tungsten filament lamps and fluorescent tubes, Basic principles of light control, Types and design of lighting and flood lighting.

UNIT IV

ELECTRIC TRACTION – I

System of electric traction and track electrification. Review of existing electric traction systems in India. Special features of traction motor, methods of electric braking – plugging, rheostatic braking and regenerative braking. Mechanics of train movement. Speed-time curves for different services – trapezoidal and quadrilateral speed time curves.

UNIT V

ELECTRIC TRACTION – II

Calculations of tractive effort, power, specific energy consumption for given run, effect of varying acceleration and braking retardation, adhesive weight and braking retardation adhesive weight and coefficient of adhesion.

TEXTBOOKS

1. Utilization of Electrical Energy - by E. Openshaw Taylor, University Press.
2. Art & Science of Utilization of Electrical Energy - by Parth, Dhanpat Ravi & Sons.

REFERENCES

1. Utilization of Electrical Power including Electric drives and Electric traction – by N.V.Suryanarayana, New Age International (P) Limited, Publishers, 1996.
2. Generation, Distribution and Utilization of Electrical Energy - by C.L. Wadhwa New Age International (P) Limited, Publishers, 1997.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
SPECIAL ELECTRICAL MACHINES
(PROFESSIONAL ELECTIVE -IV)

Course Code: GR24A4035
IV Year I Semester

L/T/P/C: 3/0/0/3

COURSE OUTCOMES

1. Summarize Various Special Electrical Machines
2. List the various control aspects of Permanent magnet brush less D.C. Motors.
3. Identify Various Power Controllers.
4. Analyze the Variable Reluctance and hybrid motors.
5. Interpret the Different Switched Reluctance motors

UNIT I

INTRODUCTION OF SPECIAL MACHINES.

Construction and principle of operation - Emf equation of BLPM sine wave motor- Flux density distribution.

UNIT II

PERMANENT MAGNET BRUSHLESS D.C MOTORS

Permanent Magnet materials– Magnetic Characteristics –Permeance coefficient-Principle of operation– Types–Magnetic circuit analysis–EMF and torque equations –Commutation Power controllers–Motor characteristics and control.

UNIT III

PERMANENT MAGNET SYNCHRONOUS MOTORS

Principle of operation–Ideal PMSM –EMF and Torque equations–Armature reaction MMF– Synchronous Reactance – Sine wave motor with practical windings - Phasor diagram – Torque/speed characteristics- Power controllers- Converter Volt-ampere requirements.

UNIT IV

SYNCHRONOUS RELUCTANCE MOTORS

Constructional features–Types–Axial and Radial flux motors–Operating principles–Variable Reluctance and Hybrid Motors–SYNREL Motors–Voltage and Torque Equations- Phasor diagram - Characteristics.

UNIT V

SWITCHED RELUCTANCE MOTORS

Constructional features–Rotary and Linear SRMs-Principle of operation–Torque production– Steady state performance prediction-Analytical method-Power Converters and their controllers – Methods of Rotor position sensing – Sensor less operation – Closed loop control of SRM - Characteristics.

TEXTBOOKS

1. T.J.E.Miller, Brush less Permanent Magnet and Reluctance Motor Drives', Clarendon Press, Oxford, 1989.
2. T.Kenjo, Stepping Motors and Their Microprocessor Controls', Clarendon Press London, 1984.

REFERENCES

1. R.Krishnan, Switched Reluctance Motor Drives—Modeling, Simulation, Analysis, Design and Application', CRC Press, New York, 2001
2. P.P.Aearnley, Stepping Motors—A Guide to Motor Theory and Practice', Peter Perengrinus London, 1982.
3. T.Kenjo and S.Nagamori, Permanent Magnet and Brushless DC Motors', Clarendon Press, London, 1988

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
INTRODUCTION TO VLSI DESIGN

Course Code: GR24A4036

L/T/P/C: 3/0/0/3

IV Year I Semester

COURSE OUTCOMES

1. Explain the fundamentals of MOS transistors and IC fabrication processes.
2. Analyse the electrical characteristics of MOS and CMOS circuits, including inverter behaviour.
3. Apply design rules, stick diagrams, and layouts for basic logic circuits.
4. Evaluate the design of simple subsystems such as adders, shifters, and memory blocks.
5. Demonstrate an understanding of semi-custom design approaches (FPGA, CPLD) and basic IC testing principles.

UNIT I

INTRODUCTION TO IC TECHNOLOGY

Introduction to IC Technology–MOS transistors, NMOS, CMOS & BiCMOS fabrication processes, Integrated Resistors and Capacitors

UNIT II

BASIC ELECTRICAL PROPERTIES

Basic Electrical Properties of MOS and Bi-CMOS Circuits: I_{ds} Versus V_{ds} relationships, MOS transistor threshold Voltage V_t , g_m , g_{ds} , Figure of merit ω_0 , Pass transistor, Analysis of NMOS Inverter, Various pull ups, CMOS Inverter, Bi-CMOS Inverters.

UNIT III

VLSI CIRCUIT DESIGN PROCESSES

VLSI Circuit Design Processes, Gate Level Design: VLSI Design Flow, Stick Diagrams, Layout, Lambda based Design rules for wires, contacts and Transistors, Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Design using Pass transistors and transmission gates,

UNIT IV

DATA PATH SUBSYSTEMS

Data path Subsystems, Array Subsystems: Subsystem Design, Shifters, Adders- Ripple Carry, Carry Look ahead Adder, Carry Select Adder, Basics of SRAM and ROM

UNIT V

SEMI CUSTOM IC DESIGN AND OVERVIEW OF TESTING

Introduction to PLAs, PALs, FPGAs, CPLDs, Standard cell design approach, Need for testing, Basic test principles.

TEXTBOOKS

1. Essentials of VLSI circuits and systems – Kamran Eshraghian, Douglas A.Pucknell, Sholeh Eshraghian, PHI,2011.
2. CMOS VLSI Design–A circuits and systems perspective, Neil H.E Weste, David Harris, Fourth Edition, Addison Wesley, 2011.
3. VLSI Design, K. Lal Kishore and V. S. V. Prabhakar, 1 st Edition, I.K. International, 2009.

REFERENCES

1. CMOS logic circuit Design- John. P. Uyemura, Springer, 2013.
2. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rdEdition, 1997.
3. VLSI Design–A. Albert Raj, Latha, PHI, 2008
4. Introduction to VLSI–Mead & Convey, BS Publications, 2010

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

FUNDAMENTALS OF MANAGEMENT AND ENTREPRENEURSHIP

Course Code: GR24A4069

L/T/P/C: 3/0/0/3

IV Year I Semester

COURSE OUTCOMES

1. Student gain knowledgeable about management thoughts, motivation theories and also capable of applying this knowledge in practical, real-world situations.
2. The students with a comprehensive understanding of the essential functions of management and equip them with the skills necessary to perform these functions effectively in career.
3. The students can explore the functional areas of management such as human resources, production and marketing management practices in their domain areas.
4. The student will be exposed to the basic concepts of entrepreneurship and its development process and also lights on the financial agencies supporting entrepreneurship in India
5. The student will be able to evaluate business ideas and attain hands on experience in designing and developing a business plan / model.

UNIT I

INTRODUCTION TO MANAGEMENT

Definition, Nature and Scope, Functions, Managerial Roles, Levels of Management, Managerial Skills; **Evolution of Management Thought**- Classical Approach- Scientific and Administrative Management; The Behavioural approach (Hawthorne Experiment); The Systems Approach; Contingency Approach.

UNIT II

PLANNING AND ORGANIZING

Planning – Planning Process, Types of Plans, Decision making and Steps in Decision Making; Organizing, Span of control, types of organizational Structures; Departmentalization, Delegation; Centralization, Decentralization. **controlling** – basic control process – control techniques.

UNIT III

HUMAN RESOURCES AND MARKETING MANAGEMENT

Concepts of HRM, HR planning, Recruitment & Selection methods, Training and Development methods, Performance Appraisal methods, Marketing concept, Marketing Mix, and Marketing Strategies based on Product Life Cycle.

UNIT IV

ORGANIZATION BEHAVIOUR

Introduction to organization behaviour, Group Dynamics and team development, Motivation and theories of motivation, Leadership: Concept, Nature, Importance, Attributes of a leader, leadership styles and theories of leadership (Managerial grid)

UNIT V

ENTREPRENEURSHIP AND BUSINESS PLAN DEVELOPMENT

Characteristics and skills of an entrepreneur, Types of entrepreneurs, small business in Indian economy. Financial aspects: sources of rising capital, Procedure for setting up an enterprise, Schemes of Central

level & State level - T Hub, Other institutional initiatives for entrepreneurial development. Risk Reduction strategies, Strategies for growth. Writing the business plan and functional plans.

Activity: Student need to submit their own business plan for the identified business area.

TEXTBOOKS

1. Fundamentals of management by Stephen P Robbins; Mary K Coulter; David A DiCenzo, Pearson 2019 (11th Edition)
2. Management: A Practical Introduction, Angelo Kinicki, Brian Williams, McGraw-Hill Education, 2018 (9th Edition)
3. Essentials of Management, Harold Koontz, Heinz Weihrich, Mark V. Cannice, McGraw-Hill Education, 2015 (10th Edition)
4. Fundamentals of Management, Ricky W. Griffin, Cengage Learning, 2020 (10th Edition)
5. Principles and Practice of Management, L. M. Prasad, Sultan Chand & Sons, 2012
6. Entrepreneurship- Robert D Hisrich, Michael P Peters, Dean A Shepherd, TMH.2009

REFERENCES

1. Essentials Of Management - An International Perspective: Harold Koontz, Heinz Weinrich Tata McGraw Hill,2019
2. Essentials of Management, Koontz Kleihrich, Tata Mc – Graw Hill, 2019.
3. Management Essentials, Andrew DuBrin, 9e, Cengage Learning, 2012.
4. Entrepreneurship- Rajeev Roy, Oxford, 2011
5. Intellectual Property- Deborah E.Bouchoux, Cengage, 2012

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
POWER SEMICONDUCTOR DRIVES LAB

Course Code: GR24A4038
IV Year I Semester

L/T/P/C: 0/0/2/1

COURSE OUTCOMES

1. Select appropriate power electronic converter for different electrical machines.
2. Examine DC Motor by giving different inputs step, ramp and parabolic signals.
3. Illustrate Closed loop speed control for Induction motor drives.
4. Apply Speed control in different modes of operation of BLDC and PMSM.
5. Estimate Speed of SRM from rotor position.

LIST OF EXPERIMENTS

Any ten experiments should be conducted.

1. Firing angle control of thyristor-based DC drive connected to DC motor.
2. Closed loop speed control of DC motor using PI, PID, PD controllers.
3. Response of DC motor for Step, Ramp and Parabolic input signals.
4. Speed control of DC motor using armature voltage control with PI, PID controllers.
5. Open loop V/F control of AC motor.
6. Closed loop speed control of AC motor with step, ramp, parabolic inputs using PI, PID controllers.
7. Closed loop speed control of AC motor coupled with DC generator using PI, PID controllers.
8. Speed Control of SRM (Switched Reluctance Motor) in Forward Motoring and Reverse Motoring Mode.
9. Speed Control of PMBLDC Motor in Forward Motoring, Reverse Motoring and Forward Breaking Mode.
10. Speed Control of PMSM in Forward Motoring Mode.
11. Closed loop control of Semi Converter fed separately Excited DC motor.
12. Closed loop V/F based control of induction motor.

TEXTBOOKS

1. B. K. Bose, "Modern Power Electronics and AC Drives", Pearson Education, Asia, 2003.
2. Dubey G. K. "Power semiconductor control drives" Prentice Hall, Englewood Cliffs, New Jersey, 1989.

REFERENCES

1. T.J.E. Miller, "Brush less Permanent Magnet and Reluctance Motor Drives", Clarendon Press, Oxford, 1989.
2. R. Krishnan, "Electric Motor Drives: Modeling, Analysis and Control", Prentice Hall, 2001.
3. Simulation of Power Electronic Circuits, M.B. Patil, V. Ramanarayanan, V.T. Ranganathan, Narosa Publications, 2013.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
PROJECT WORK PHASE-I

Course Code: GR24A4016
IV Year I Semester

L/T/P/C: 0/0/12/6

COURSE OUTCOMES

1. Practice and acquire the knowledge within the chosen area of technology for Project Development.
2. Identify, discuss, and justify the technical aspects of the chosen project with a comprehensive and systematic approach.
3. Design and develop Engineering Projects by implementing technical aspects.
4. Work as an individual or in a team in development of Technical Projects.
5. Compile and report effectively the project related activities and findings.

IV YEAR -II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
POWER SYSTEM MONITORING AND CONTROL

Course Code: GR24A4039
IV Year II Semester

L/T/P/C: 2/1/0/3

COURSE OUTCOMES

1. Evaluate the effect of transmission line losses on generation cost optimization using appropriate mathematical models.
2. Analyze the steady-state and dynamic behavior of single-area and two-area load frequency control systems.
3. Explain the processes of data acquisition, monitoring, event processing, and control functions in power systems.
4. Interpret power exchange mechanisms and pricing trends within vertically integrated and competitive electricity markets.
5. Summarize the roles of various stakeholders in implementing DSM, managing network charges, and complying with regulatory norms.

UNIT I

ECONOMIC OPERATION OF POWER SYSTEMS AND UNIT COMMITMENT

Optimal operation of Generators in Thermal Power Stations, - heat rate Curve – Cost Curve – Incremental fuel and Production costs, input-output characteristics, Optimum generation allocation with line losses neglected. Optimum generation allocation including the effect of transmission line losses – Loss Coefficients, General transmission line loss formula. Numerical problems.

Constraints in Unit Commitment, UC solution methods: Priority- list methods, forward dynamic programming approach.

UNIT II

CONTROL OF FREQUENCY AND VOLTAGE

Turbines and Speed-Governors, Load frequency control of single area and Two area system: Steady state analysis, Dynamic Response, Droop Control and Power Sharing, Automatic Generation Control, Excitation Systems.

UNIT III

MONITORING AND CONTROL

Overview of Energy Control Centre Functions: Introduction to SCADA: Grid Operation & Control, advantages of SCADA operation, Data Acquisition, Monitoring and Event Processing, Control Functions, State-estimation: Maximum likelihood weighted least squares estimation. Factors effecting power System Security, Introduction of Contingency analysis, Preventive Control and Emergency Control.

UNIT IV

POWER SYSTEM ECONOMICS

Basic Pricing Principles: Generator Cost Curves, Utility Functions, Power Exchanges, Spot Pricing. Electricity Market Models (Vertically Integrated, Purchasing Agency, Whole-sale competition, Retail Competition).

UNIT V

POWER MANAGEMENT

Demand Side-management, Transmission and Distributions charges, Ancillary Service Management: Type and start capability service, Provisions of ancillary services, Markets for ancillary services, Co-optimization of energy and reserve services, Loss of opportunity cost, International practices of ancillary services. Regulatory framework.

TEXTBOOKS

1. J. Grainger and W. D. Stevenson, “Power System Analysis”, McGraw Hill Education, 1994.
2. D. P. Kothari and I. J. Nagrath, “Modern Power System Analysis”, McGraw Hill Education, 2003.
3. D. Kirschen and G. Strbac, Fundamentals of Power System economics, John Wiley & Sons Ltd, 2019, 2nd Edition.

REFERENCES

1. S. Hunt, Making competition work in electricity, John Wiley & Sons, Inc., 2002, 1st Edition.
2. Ashikur Bhuiya: Power System Deregulation: Loss Sharing in Bilateral Contracts and Generator Profit Maximization, VDM Verlag Publisher, 2008 .

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
ADVANCED ELECTRIC DRIVES
(PROFESSIONAL ELECTIVE -V)

Course Code: GR24A4040

L/T/P/C: 3/0/0/3

IV Year II Semester

COURSE OUTCOMES

1. Explain vector control strategies for Induction motor drives.
2. Illustrate vector control strategies for Synchronous motor drives.
3. Classify Speed and Torque control techniques in BLDC and PMSM.
4. Demonstrate the operation of switched reluctance motor drives.
5. Interpret the implementation of DSP based motion control.

UNIT I

THEORY OF TRANSFORMATIONS

Concept of space vector, direct and quadrature axis variables, various types of Krause transformation, condition for power invariance, Expression for power with various types of transformation, Transformations between reference frames, Clarke and Park's Transformations, Variables observed from various frames.

UNIT II

PERMANENT MAGNET SYNCHRONOUS MACHINES AND THEIR CONTROL

Dynamic Modeling of Permanent Magnet Synchronous- Transformation to Rotor Reference Frames, Three-Phase to Two-Phase Transformation, Evaluation of Control Characteristics of the PMSM, Design of Current and Speed Controllers, Applications of PMSM drive.

UNIT III

PERMANENT MAGNET BRUSH LESS DC MACHINES AND THEIR CONTROL

Modeling of PM Brushless dc Motor, The PMBLDCM Drive Scheme, Design Considerations for the PMBDC Motor, Design of Current and Speed Controllers, Applications of PMBLDC drive.

UNIT IV

SWITCHED RELUCTANCE MOTOR DRIVES

Principle of Operation of the Switched Reluctance Motor, SRM Configurations, Closed-Loop, Speed-Controlled SRM Drive, Design of Current Controllers, Torque Control, Design of the Speed Controller, Applications of SRM drive.

UNIT V

REALIZATION OF BLDC MOTOR DRIVES USING DSP BASED CONTROL

Main Circuit, Driving Circuit, Microprocessor Control Circuit, DSP Control Circuit, Protecting Circuit, Sensor less Control Circuits, ASIC for BLDC Motor Drives.

TEXTBOOKS

- 1.B.K. Bose, “Modern Power Electronics & AC Drives”, Pearson Education India, 2015, 1st Edition.
2. R. Krishnan, “Permanent Magnet Synchronous and Brushless DC motor Drives”, CRC Press, 2009.

REFERENCES

1. Ramu, Krishnan, “Switched reluctance motor drives: modeling, simulation, analysis, design, and applications” CRC Press, 2001.
2. Chang-liang Xia, “Permanent magnet brushless DC motor drives and controls” Science Press, 2012.
3. H. A. Tiliyat and S. G. Campbell, “DSP based Electromechanical Motion Control”, CRC press, 2003.
4. T.J.E. Miller, “Brush less Permanent Magnet and Reluctance Motor Drives”, Clarendon Press, Oxford, 1989.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

**ENERGY STORAGE SYSTEMS
(PROFESSIONAL ELECTIVE -V)**

Course Code: GR24A4041

L/T/P/C: 3/0/0/3

IV Year II Semester

COURSE OUTCOMES

1. Explain the need, classification, and applications of various energy storage systems.
2. Analyze the operation and performance parameters of electrochemical, mechanical, thermal, and electrical storage systems.
3. Compare storage technologies based on technical, economic, and operational factors.
4. Design integration strategies for ESS in renewable-rich and smart grid environments.
5. Evaluate emerging storage solutions and their potential impact on future power systems.

UNIT I

INTRODUCTION TO ENERGY STORAGE SYSTEMS

Need for energy storage in modern power systems – challenges and opportunities - Classification of energy storage technologies - Applications: grid stability, renewable integration, peak shaving, and ancillary services - Performance metrics: efficiency, energy density, power density, response time, lifetime and cost.

UNIT II

ELECTROCHEMICAL ENERGY STORAGE SYSTEMS

Batteries: working principles, types – lead-acid, lithium-ion, sodium-sulphur, flow batteries - Battery performance characteristics and degradation mechanisms - Battery Management Systems (BMS) – monitoring, control, safety - Case studies of battery deployment in grid and renewable applications.

UNIT III

MECHANICAL AND THERMAL ENERGY STORAGE SYSTEMS

Pumped hydro storage – principle, design, operation - Compressed Air Energy Storage (CAES) – configurations, efficiency improvements - Flywheel energy storage – rotor design, magnetic bearings, high-speed operation - Thermal energy storage – sensible, latent, and thermochemical storage - Applications in load leveling and renewable energy smoothing.

UNIT IV

ELECTRICAL ENERGY STORAGE TECHNOLOGIES

Supercapacitors – working principle, equivalent circuit, applications - Superconducting Magnetic Energy Storage (SMES) – operation, cryogenic systems, applications - Comparison of electrochemical, mechanical, thermal, and electrical storage systems - Hybrid energy storage systems.

UNIT V

INTEGRATION, CONTROL, AND EMERGING STORAGE SOLUTIONS

Energy Storage System (ESS) integration in microgrids and smart grids - Control strategies for ESS: state of charge (SOC) management, power dispatch, frequency/voltage support - Communication, monitoring, and control architectures for large-scale ESS - Emerging storage solutions: hydrogen storage, metal-air batteries, solid-state batteries - Future trends, policy, and market mechanisms for ESS adoption.

TEXTBOOKS

1. Wu, Fu-Bao; Yang, Bo; Ye, Ji-Lei, *Grid-scale Energy Storage Systems and Applications*, Elsevier-Academic Press, 2019.
2. Hu, Zechun, *Energy Storage for Power System Planning and Operation*, Wiley, 2020.

REFERENCES

1. Dhameja, Sandeep. *Electric Vehicle Battery Systems*. Newnes, USA, 2002.
2. Eicker, U., *Energy Storage Systems – Fundamentals, Classification and a Technical Comparison*, Springer, 2019.
3. Chen, Haisheng, *Energy Storage: Technologies and Applications*, Artech House, 2023.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
MODERN CONTROL THEORY
(PROFESSIONAL ELECTIVE -V)

Course Code: GR24A4042

L/T/P/C: 3/0/0/3

IV Year II Semester

Course Outcomes:

1. Develop a state feedback model of the system.
2. Distinguish full order and reduced order state observers.
3. Illustrate robust controllers for tracking and disturbance rejection.
4. Explain continuous and discrete time linear state regulators.
5. Model sliding mode controller and reduce chattering problem.

UNIT I

STATE FEEDBACK

Non uniqueness of state model, Similarity transformation, Invariance of system properties. Controllability – necessary and sufficient condition - Pole assignment using State feedback – Ackerman's formula for feedback gain determination, Observability. Duality. Effect of state feedback on controllability and observability. Controllable subspace – decomposition of state into controllable and uncontrollable components.

UNIT II

DESIGN OF FULL AND REDUCED ORDER OBSERVERS

Design of full order observer – Bass Gura algorithm. The separation principle - Combined observer – controller compensator. Design of reduced order observer. Unobservable subspace – decomposition of state into observable and unobservable components – Canonical decomposition theorem.

UNIT III

DESIGN OF ROBUST CONTROL SYSTEM

Reducibility – realization of transfer function matrices. Model decomposition and decoupling by state feedback. Design of robust control system for asymptotic tracking and disturbance rejection using State variable equations. Transfer function interpretations – transfer function form of observer and state estimate feedback. State space interpretation of internal model principle.

UNIT IV

STATE REGULATOR

Discrete time linear state regulator – Algorithm for the solution, Use of observer in implementing the control law. Continuous time linear state regulator – Matrix Riccati equation. Time invariant linear state regulator – the reduced matrix Riccati equation - An iterative method to solve the reduced matrix Riccati equation. Suboptimal linear regulator.

UNIT V

VARIABLE - STRUCTURE CONTROLLER

Concept of variable - structure controller and sliding control, reaching condition, and reaching mode, implementation of switching control laws. Reduction of chattering in sliding and steady state mode.

TEXTBOOKS

1. Modern Control Engineering, Katsuhiko Ogata, 5th Edition, Prentice Hall India, 1997.
2. Modern Control System Theory, M. Gopal, Revised 2nd Edition, New Age International Publishers, 2005.

REFERENCES

1. Control System Design, Graham C. Goodwin, StefanF. Graebe and Mario E. Salgado, Pearson Education, 2000.
2. Richard C. Dorf and Robert H. Bishop, Modern Control Systems, 11th Edition, Pearson Edu India, 2009. M. Vidyasagar, Nonlinear Systems

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
INDUSTRIAL IOT
(PROFESSIONAL ELECTIVE -V)

Course Code: GR24A4043
IV Year II Semester

L/T/P/C: 3/0/0/3

COURSE OUTCOMES

1. Explain the fundamental concepts of Industrial IoT, Industry 4.0, and cyber-physical systems.
2. Illustrate the layered architecture of IIoT and differentiate among various industrial communication protocols and reference models.
3. Apply knowledge of industrial sensors, actuators, and gateways to design basic data acquisition and communication setups for IIoT systems.
4. Analyze the role of data analytics, cloud/fog/edge computing, and machine learning in optimizing industrial processes.
5. Evaluate IIoT security challenges and propose suitable solutions through case studies in manufacturing, healthcare, and energy sectors.

UNIT I

FOUNDATIONS OF IIOT AND INDUSTRY 4.0

Introduction to IoT and Industrial IoT, scope and significance, IoT versus IIoT and IT–OT convergence, evolution of Industry 4.0 and role of cyber-physical systems, characteristics and advantages of IIoT, interoperability and scalability challenges, applications in manufacturing, energy, healthcare and logistics, case studies highlighting industrial transformations.

UNIT II

IIOT ARCHITECTURE AND TECHNOLOGIES

IIoT layered architecture including perception, network and application layers, Industrial Internet Reference Architecture (IIRA), communication technologies such as Ethernet, Wi-Fi and LPWAN, role of gateways, middleware and edge devices, industrial communication protocols including MQTT, OPC UA, Modbus and PROFIBUS, cloud computing models and services in IIoT, business models and value creation enabled by IIoT adoption.

UNIT III

SENSORS, DEVICES AND DATA ACQUISITION

Industrial sensors including temperature, vibration, pressure and proximity sensors, smart sensors and sensor fusion, actuators and control devices, data acquisition systems and real-time monitoring, embedded boards such as Arduino, Raspberry Pi and ESP32 for IIoT applications, networking interfaces and device integration, case examples of sensor-driven industrial automation and control.

UNIT IV

IIOT ANALYTICS, EDGE/FOG COMPUTING AND SECURITY

Data analytics in IIoT including descriptive, predictive and prescriptive methods, big data frameworks such as Hadoop and Spark, machine learning applications for predictive maintenance, edge and fog computing concepts for low-latency data handling, cybersecurity challenges in IIoT environments, access control, authentication and intrusion detection techniques, blockchain and AI-enabled approaches for enhancing IIoT security.

UNIT V

APPLICATIONS AND CASE STUDIES

Applications of IIoT in smart manufacturing and smart factories, energy sector applications such as smart grids and predictive energy management, healthcare applications including remote monitoring and wearable devices, oil and gas industry and process automation, logistics, inventory management and supply chain optimization, safety and quality control in industrial environments, case studies of successful IIoT implementations, future scope including digital twins, Industry 5.0 and human–machine collaboration.

TEXTBOOKS

1. S. Misra, C. Roy, and A. Mukherjee, 2020 “Introduction to Industrial Internet of Things and Industry 4.0”, CRC Press.
2. Simone Cirani, Gianluigi Ferrari, Marco Picone, and Luca Veltri, “Internet of Things: Architectures, Protocols and Standards” WILEY.

REFERENCES

1. Andrew Minter, “Analytics for the Internet of Things (IoT): Intelligent analytics for your intelligent devices”.

GOKARAJURANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
AI AND ML APPLICATIONS TO POWER ELECTRONICS
(PROFESSIONAL ELECTIVE -VI)

Course Code: GR24A4044
IV Year II Semester

L/T/P/C: 3/0/0/3

COURSE OUTCOMES

1. Describe the importance of designing the System with AI and Machine Learning.
2. Learn Support Vector Machines and its Regression.
3. Distinguish the various Neural Networks Architectures.
4. Categorize Fuzzy rule base and neuro-fuzzy systems.
5. Analyze various power electronic systems using neural & fuzzy systems.

UNIT I

INTRODUCTION

Towards Intelligent Machines, Well-Posed Machine Learning Problems, Examples of Applications- Machine Vision, Biometric Recognition & Handwriting recognition, load forecasting and Control & Automation. Time Series Forecasting, Datasets for Unrealistically Simple and Realistic Problems, Domain Knowledge for Productive use of Machine Learning, Diversity of Data: Structured/Unstructured. Forms of Learning, Machine Learning and Data Mining, Basic Linear Algebra in Machine Learning Techniques.

UNIT II

SUPPORT VECTOR MACHINES

Learning with Support Vector Machines, Perceptron Algorithm, Linear Soft Margin Classifier for Overlapping Classes, Nonlinear Classifier, Regression by Support Vector Machines, Variants of Basic SVM Techniques.

UNIT III

NEURAL NETWORKS

Towards Cognitive Machine, Neuron Models, Network Architectures, Perceptrons, Linear Neuron and the Widrow-Hoff Learning Rule, Error-Correction Delta Rule, Multi-Layer Perceptron Networks, Radial Basis Functions Networks.

UNIT IV

FUZZY INFERENCE SYSTEMS

Cognitive Uncertainty and Fuzzy Rule-Base, Fuzzy Quantification of Knowledge, Fuzzy Rule-Base and Approximate Reasoning, Takagi-Sugeno Fuzzy Mode, Neuro-Fuzzy Inference Systems.

UNIT V

APPLICATIONS

Neural Network Topologies for space vector pulse width modulation of three level inverter, Neural Network based feedback signal estimator performance – Torque & Rotor Flux, Neural Network topology for stator flux estimator, Neuro-fuzzy based efficiency optimization control, Neuro-Fuzzy Controller based Direct Torque Control

TEXTBOOKS

1. Applied Machine Learning – M. Gopal, Mc Graw Hill.

REFERENCES

1. Power Electronics & Motor Drives – Advances & Trends, Bimal K Bose, 2nd Edition, Academic Press

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
ELECTRIC SMART GRID
(PROFESSIONAL ELECTIVE -VI)

Course Code: GR24A4045
IV Year II Semester

L/T/P/C: 3/0/0/3

COURSE OUTCOMES

1. Determine the functions of smart grid components and explain how they differ from traditional power grid elements.
2. Identify different communication and measurement technologies like PMUs and smart meters used in smart grids.
3. Apply load flow methods to analyze power flow in a smart grid.
4. Analyze voltage and angle stability problems in smart grid systems.
5. Explain the impact of renewable energy and storage systems on smart grid operation.

UNIT I

SMART GRID ARCHITECTURAL DESIGNS

Introduction – Comparison of Power grid with Smart grid – power system enhancement – communication and standards - General View of the Smart Grid Market Drivers - Stakeholder Roles and Function - Measures -Representative Architecture - Functions of Smart Grid Components Wholesale energy market in smart grid-smart vehicles in smart grid.

UNIT II

SMART GRID COMMUNICATIONS AND MEASUREMENT TECHNOLOGY

Communication and Measurement - Monitoring, Phasor Measurement Unit (PMU), Smart Meters, Wide area monitoring systems (WAMS) – Advanced metering infrastructure- GIS and Google Mapping Tools.

UNIT III

PERFORMANCE ANALYSIS TOOLS FOR SMART GRID DESIGN

Introduction to Load Flow Studies - Challenges to Load Flow in Smart Grid and Weaknesses of the Present Load Flow Methods - Load Flow State of the Art: Classical, Extended Formulations, and Algorithms –Load flow for smart grid design-Contingencies studies for smart grid.

UNIT IV

STABILITY ANALYSIS TOOLS FOR SMART GRID

Voltage Stability Analysis Tools-Voltage Stability Assessment Techniques Voltage Stability Indexing- Application and Implementation Plan of Voltage Stability in smart grid-Angle stability

assessment in smart grid-Approach of smart grid to State Estimation-Energy management in smart grid.

UNIT V

RENEWABLE ENERGY AND STORAGE

Renewable Energy Resources-Sustainable Energy Options for the Smart Grid-Penetration and Variability Issues Associated with Sustainable Energy Technology-Demand Response Issues-Electric Vehicles and Plug-in Hybrids PHEV Technology-Environmental Implications-Storage Technologies-Grid integration issues of renewable energy sources.

TEXTBOOKS

1. James Momoh, “Smart Grid: Fundamentals of design and analysis”, John Wiley & sons Inc, IEEE press 2012.
2. Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage, JianzhongWu, Akihiko Yokoyama, “Smart Grid: Technology and Applications”, JohnWiley & sons inc, 2012.

REFERENCES

1. Clark W.Gellings, “The smart grid: Enabling energy efficiency and demand response”, Fairmont Press Inc, 2009.
2. Krzysztof Iniewski, “Smart Grid Infrastructure & Networking”. McGraw Hill Education Pvt. Ltd., 2014.
3. Fereidoon P. Sioshansi, “Smart Grid: Integrating Renewable, Distributed & Efficient Energy”, Academic Press, 2011.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

EMBEDDED SYSTEMS DESIGN
(PROFESSIONAL ELECTIVE -VI)

Course Code: GR24A3084

L/T/P/C: 3/0/0/3

IV Year II Semester

COURSE OUTCOMES

1. Understand basic concepts of embedded systems.
2. Apply and analyze the applications in various processors and domains of embedded systems.
3. Analyze and develop embedded hardware and software development cycles and tools.
4. Remember the fundamentals of RTOS-based embedded system design and synchronization techniques.
5. Analyze various task communication and synchronization mechanisms in RTOS-based systems.

UNIT I

INTRODUCTION TO EMBEDDED SYSTEMS

Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

UNIT II

TYPICAL EMBEDDED SYSTEM

Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT III

EMBEDDED FIRMWARE

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

UNIT IV

RTOS BASED EMBEDDED SYSTEM DESIGN

Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

UNIT V

TASK COMMUNICATION

Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

TEXTBOOKS

1. Introduction to Embedded Systems - Shibu K.V, McGraw Hill.
2. Embedded Systems - Raj Kamal, TMH.

REFERENCES

1. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
INTRODUCTION TO BIG DATA ANALYTICS
(PROFESSIONAL ELECTIVE -VI)

Course Code: GR24A4046
IV Year II Semester

L/T/P/C: 3/0/0/3

COURSE OUTCOMES

1. Explore the fundamentals of Big Data, the Hadoop ecosystem, and HDFS for managing large-scale energy datasets.
2. Demonstrate the use of data ingestion tools to efficiently handle structured and unstructured data from smart grids and IoT devices.
3. Develop distributed data processing solutions using MapReduce and Pig for energy data analytics.
4. Apply Hive and HBase to query, manage, and analyse real-time energy datasets.
5. Utilize Apache Spark for advanced energy forecasting, monitoring, and large-scale data analysis.

UNIT I

INTRODUCTION TO BIG DATA AND HADOOP

Types of Digital Data in EEE applications. Definition of Big Data and the 5 V's, Advantages of Big Data in smart grids, IoT devices, and renewable energy systems. Characteristics of Hadoop, RDBMS vs Hadoop, Core Components of Hadoop Ecosystem (HDFS, YARN, Hive, HBase, Pig, Sqoop, Flume).

UNIT II

DATA MANAGEMENT IN HDFS

Handling large-scale energy datasets using HDFS, Characteristics of HDFS. HDFS Components: Name Node, Data Node. HDFS High Availability & Replication (reliability for grid/sensor data). Basic HDFS Commands.

Data Ingestion into Big Data Systems

Importance of data ingestion in IoT-enabled power systems & SCADA logs.

UNIT III

APACHE SGOOP

Role in transferring RDBMS data (billing, SCADA, sensors) to Hadoop. Importing & Exporting datasets.

Apache Flume: Collecting streaming data from smart meters, sensors, and transformer logs. Flume Architecture (Source, Channel, Sink).

UNIT IV

DISTRIBUTED PROCESSING WITH MAPREDUCE AND PIG

Need for distributed processing in energy data analytics, Overview of YARN (basic idea only).

MapReduce: Concept of Key-Value processing, Phases with an example from power consumption analysis, Shuffle and Sort (basic idea).

Pig: Introduction to Pig scripting. Simple & Complex Data Types. Common Operators (Load, Filter, Group, Join)

UNIT V

APACHE HIVE AND NOSQL DATABASE (HBASE)

Hive: Features of Hive, Hive Architecture (simplified). HiveQL basics for analysing energy datasets. Tables (Managed & External).

HBase: Introduction to NoSQL. HBase for real-time smart grid monitoring. HBase vs RDBMS.

Apache Spark: Introduction to Apache Spark, Components of Apache Spark (Spark Core, Spark SQL). Applications of Spark in load forecasting, renewable energy prediction, fault detection.

TEXTBOOKS

1. Tom White, Hadoop: The Definitive Guide, 4th Edition, O'Reilly Media, 2015.
2. Seema Acharya and Subhasini Chellappan, Big Data and Analytics, Wiley India, 2015.
3. Sridhar Alla, Big Data Analytics with Hadoop 3, Packt Publishing, 2018.

REFERENCES

1. Anand Rajaraman, Jeffrey D. Ullman, Mining of Massive Datasets, Cambridge University Press, 3rd Edition, 2020.
2. Chuck Lam, Hadoop in Action, Manning Publications, 2011.
3. Vignesh Prajapati, Big Data Analytics with R and Hadoop, Packt Publishing, 2013.
4. Smarter Grid Solutions, Big Data Analytics in Smart Grids, Springer, 2017.
5. Sumit Gupta, Practical Big Data Analytics: Processing, Analysis, and Visualization for Smart Grid Applications, Packt Publishing, 2016.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)**

PROJECT WORK PHASE-II

**Course Code: GR24A4026
IV Year II Semester**

L/T/P/C: 0/0/12/6

COURSE OUTCOMES

1. Practice and acquire the knowledge within the chosen area of technology for Project Development.
2. Identify, discuss, and justify the technical aspects of the chosen project with a comprehensive and systematic approach.
3. Design and develop Engineering Projects by implementing technical aspects.
4. Work as an individual or in a team in development of Technical Projects.
5. Compile and report effectively the project related activities and findings.

OPEN ELECTIVES

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
HUMAN RESOURCE DEVELOPMENT AND ORGANIZATIONAL BEHAVIOUR
(OPEN ELECTIVE)

Course Code: GR24A3010

L/T/P/C: 3/0/0/3

Course Outcomes: After completing this course, students will be able to:

1. Acquaint with the determinants of intra -individual, inter-personnel and inter-group behaviour in organizational setting.
2. Understand individual behavior in organizations, including diversity, attitudes, job satisfaction, emotions, moods, personality, values, perception, decision making, and motivational theories and apply in the organizational context.
3. Assess the group behavior in organizations, including communication, leadership, power and politics, conflict, and negotiations in the framework of organization and to familiarize the concepts, techniques and practices of human resource development in the current organizational view.
4. Impart and apprise the capable of applying the principles and techniques as professionals for developing human resources in an organization.
5. Report the current trends and applications in HRD and Balanced Scorecard to measures the performance and to develop, implement, and evaluate organizational human resource development strategies aimed at promoting organizational effectiveness in different organizational environments.

UNIT-I: Introduction to OB :

Organisational Behaviour- Concept and Emergence of OB Concept; Nature and Theoretical frameworks; Models of Organisational Behaviour, Challenges and Opportunities for Organisational Behavior;

UNIT-II: Individual Behaviour:

Individual Behaviour: Personality, Learning, Values and Attitudes, Perception, Stress at work. Management's assumptions about people- McGregor's Theory X and Theory Y. Motivation - Maslow's Need Hierarchy, Herzberg's Two Factors Theory, Vroom's Expectancy Theory.

UNIT-III: Inter-personal and Group Behaviour:

Interpersonal communication and Feedback; Transactional Analysis (TA); Johari Window. Group Behaviour: Group Dynamics, Cohesiveness and Productivity; Management of Dysfunctional groups; Group Decision Making. Leadership- Concept and Styles.

UNIT-IV: Introduction to Human Resource Development:

Concept; Relationship between human resource management and human resource development; HRD mechanisms, processes and outcomes; HRD matrix; Roles and competencies of HRD professionals; Challenges in HRD, steps in HRD Process.

UNIT-V: HRD Applications and Trends:

Coaching and mentoring; Career management and development; Competency mapping; Balanced Score Card. HRD in Organisations: Selected cases covering HRD practices in government organisations, manufacturing and service industries and MNCs.

TEXT BOOKS:

1. Robbins, Stephen P. and Timothy A. Judge, Organisational Behaviour, Prentice -Hall, New Delhi.
2. Werner J. M., DeSimone, R.L., Human resource development, South Western.

REFERENCE BOOKS:

1. Luthans, Fred, Organizational Behaviour, McGraw-Hill, New York.
2. Gregory, Moorhead and Ricky W. Griffin, Managing Organizational Behaviour, Thomson South

Western Publication.

3. Pareek, Udai and V. Sisodia, "HRD in the New Millennium, Tata McGraw - Hill Publishing Co. Ltd., New Delhi, 1999.
4. Haldar, U. K., Human resource development, Oxford University Press India.
5. Rao, T.V., Future of HRD, Macmillan Publishers India.
6. Rao, T.V., HRD Score Card 2500: Based on HRD audit, Response Books, SAGE Publications.
7. Mankin, D., Human resource development, Oxford University Press India.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
CYBER LAW AND ETHICS
(OPEN ELECTIVE)

Course Code: GR24A3024

L/T/P/C: 3/0/0/3

Course Outcomes: After completing this course, students will be able to:

1. Identify and analyze statutory, regulatory, constitutional, and organizational laws that affect the information technology professional.
2. Locate and apply case law and common law to current legal dilemmas in the technology field.
3. Apply diverse viewpoints to ethical dilemmas in the information technology field and recommend appropriate actions.
4. Understand cybercrime and ethical practices and the student will be able to know and learn web technologies and related issues.
5. In position to interface with various issues pertaining to Intellectual Property, copy rights, patents rights etc. and provide an overview of cybercrime and framework.

UNIT-I: The Legal System: Sources of Law and The Court Structure:

Enacted law -Acts of Parliament are of primary legislation, Common Law or Case law- Principles taken from decisions of judges constitute binding legal rules. The Court System in India and Foreign Courtiers. (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court), Arbitration: As an alternative to resolving disputes in the normal courts, parties who are in dispute can agree that this will instead be referred to arbitration.

UNIT-II: Introduction cyber law:

Computers and its Impact in Society, Overview of Computer and Web Technology, Need for Cyber Law, Cyber Jurisprudence at International and Indian Level. , NITI Aayog and some current aspects.

UNIT-III: Constitutional & Human Rights Issues in Cyber space :

Freedom of Speech and Expression in Cyberspace, Right to Access Cyberspace, Access to Internet, Right to Privacy, Right to Data Protection.

UNIT-IV: Cyber Crimes & Legal Framework:

Cyber Crimes against Individuals, Institution and State, Hacking, Digital Forgery, Cyber Stalking/Harassment, Cyber Pornography, Identity Theft & Fraud, Cyber terrorism, Cyber Defamation, Different offences under IT Act

UNIT-V: Intellectual Property Issues in Cyber Space:

Interface with Copyright Law, Interface with Patent Law, Trademarks & Domain Names Related issues.

TEXT BOOKS:

1. Chris Reed & John Angel, Computer Law, OUP, New York, (2007).
2. Justice Yatindra Singh, Cyber Laws, Universal Law Publishing Co, New Delhi, (2012)
3. Verma S, K, Mittal Raman, Legal Dimensions of Cyber Space, Indian Law Institute, New Delhi, (2004)
4. Jonthan Rosenoer, Cyber Law, Springer, New York, (1997).

REFERENCE BOOKS:

1. Sudhir Naib, The Information Technology Act, 2005: A Handbook.
2. S. R. Bhansali, Information Technology Act, 2000
3. University Book House Pvt. Ltd. Jaipur (2003).

4. Vasu Deva, Cyber Crimes and Law Enforcement, Commonwealth Publishers, New Delhi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ECONOMIC POLICIES IN INDIA
(OPEN ELECTIVE)

Course Code: GR24A4013

L/T/P/C: 3/0/0/3

Course Outcomes: After completing this course, students will be able to:

1. Familiarize with the nature of business environment and its components.
2. The students will be able to demonstrate and develop conceptual framework of business environment.
3. Understand the definition of ethics and the importance and role of ethical behaviour in the business world today.
4. Explain the effects of government policy on the economic environment.
5. Outline how an entity operates in a business environment.

UNIT-I: Business environment:

Factors effecting Business Environment-need for industrial policies, Overview of Indian Economy, Trends towards market economy, problems of underdevelopment – meaning, Main problems, reasons, of underdevelopment.

UNIT-II: Factors and measure:

Meaning of Economic development, National income, Per capital income, Quality of life, Capital Formation – Savings, Investment.

UNIT-III: NITI Aayog and Planning in India:

Niti Aayog and its function, how is Niti Aayog different from planning commission, Meaning, Importance, Main reasons of adopting, planning in India, Objectives of planning, Economic development, moderation, stability, self-sufficiency, employment etc, foreign aid, Employment. Allocation of Resources.

UNIT-IV: Private and Public Sector, Public Sector:

Role and growth, Achievements of the public sector, Private Sector – Importance Problems, New foreign Trade Policy.

UNIT-V: Present Economic Policy:

Main feature, Globalization, Expansion of Private sector, more market orient approach. Public distribution system, Industrial policies before and after 1991, Industrial Licensing, Monetary and Fiscal Policy, elements of Indian current GDP and review of current budget.

TEXT BOOKS:

1. Francis Cherunilam: Business Environment: Text and Cases. 18/e. Himalaya. 2009.
2. Misra and Puri: Indian Economy, Himalaya, 2009.

REFERENCE BOOKS:

1. Indian Economy- A. N. Agarwal
2. Indian Economy – Mishra &Puri
3. Indian Development and planning – M. L. Jhingan
4. Indian Economy – R. S. Rastogi Yozna and Kurukshetra Magazines

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
INDIAN KNOWLEDGE SYSTEM
(OPEN ELECTIVE)

Course Code: GR24A3023

L/T/P/C: 3/0/0/3

Course Outcomes: After completing this course, students will be able to:

1. Understand nature, scope and related fields of Indian knowledge system.
2. Demonstrate the scientific literature available in ancient Indian traditions
3. Understanding the application of Bharatiya Jnana Parampara
4. Understand Indian approach towards Wellbeing
5. Appreciate vast contribution of ancient Indian researchers, engineers, scientists and architects to the modern world

UNIT-I: Introduction to Indian Knowledge Systems:

Meaning, Nature, Scope and Salient Aspects of Bharatiya Jnana Parampara - Introduction to Vedas, Upanishads, Vidya, Kala, Jnana, Shastra - Practices and Continuity of Tradition

UNIT-II: Overview of History of Indian Education and Scientific Literature:

Gurukul System - Role of Sanskrit in Natural Language Processing - Scientific Literature – Vedic. Literature - Available Scientific Treatises - Interlinkings

UNIT-III: Introduction to Scientific Theories from Pure Sciences from Ancient Indian Knowledge Systems:

Overview of theories from available ancient Indian Literature about Physics, Chemistry and Mathematics - Interlinking's and applications

UNIT-IV: Introduction to Ancient Indian Wellness Systems:

Concept of Wellness – Yoga System - Ayurveda System - Ancient Indian Aesthetics Achievements of the public sector, Private Sector – Importance Problems, New foreign Trade Policy.

UNIT-V: Development of Engineering, Science, Technology & Fine Arts in India:

Various Industries - Silk, Cotton and Ship Building - Evolution of Indian Fine Arts – Cave and Temp Architecture, Vastu - Vidya, Sculpture, Forts and Stepwells, Observatories and Paintings - Music and Natyakala - Cultural Traditions & Folk Arts.

Pedagogy for Teachers: Apart from Classroom Instruction, the following Methods are Suggested.

1. Project based activities and learning.
2. Presentation and case studies.
3. Film screening and book reviews.
4. Visit to historical places, archives centre, research centre or library nearby.

Note: Activities mentioned above are only suggestive. Teacher-educators should encourage students to be innovative.

TEXT BOOKS:

1. B. Mahadevan, Bhat Vinayak and Nagendra Pavan R.N., (2022) 'Introduction to Indian Knowledge Systems: Concepts and Applications' PHI learning PVT, New Delhi ISBN [9789391818203]
2. Dharmapal (1971) 'Indian Science and Technology in the Eighteenth Century'. Other India Press, Goa.
3. Kapil Kapoor, Singh Avdhesh Kumar, (2005) 'Indian Knowledge Systems' D.K. Printworld (P) Ltd. ISBN 10: 8124603367 / ISBN 13: 9788124603369

4. Chakradeo, Ujwala, Temples of Bharat, Aayu Publications, New Delhi, 2024.
5. D.N. Bose, S.N. Sen and B. V. Subbarayappa, A Concise History of Science in India, Indian National Science Academy, New Delhi, 2009.
6. Datta B. and A. N. Singh, History of Hindu Mathematics: Parts I and II, Asia Publishing House, Bombay, 1962.
7. Kapoor, K. (2021), Indian Knowledge System: Nature, Philosophy, Character in Indian Knowledge System, vol. 1, Pub. Indian Institute of Advanced Studies, Shimla
8. Mahadevan, B., Bhat, V.R., Pavana, N. (2022), Philosophical Systems, in Introduction to Indian Knowledge System, Pub. PHI Learning, New Delhi.
9. Mahadevan, B., Bhat, V.R., Pavana, N. (2022), Knowledge: Framework and Classification, in Introduction to Indian Knowledge System, Pub. PHI Learning, New Delhi.

VIDEO RESOURCES:

1. Introductory lectures by Prof. Gauri Mahulikar
2. Introductory lectures by Prof. Kapil Kapoor

WEBSITES:

- <https://iksindia.org/index.php>
- Official Website of IKS- Indian Knowledge System
- <https://www.youtube.com/watch?v=uKcf-hSlcUE>
- Address by Prof Kapil Kapoor | Indian Institute of Advanced Study (FDP 2021)
- https://www.youtube.com/watch?v=MDJTXNiH2_A
- Mukul Kanitkar on Bharatiya Knowledge System
- <https://www.youtube.com/watch?v=uARMhv97pjk>
- <https://www.youtube.com/watch?v=oTwgf56GbsA>
- Scientific History of India | Mukul Kanitkar Lecture in DTU
- <https://youtu.be/gNJNmPJqXJc?si=WFBbuUT65mLZzpOW>
- Ancient India's Scientific Achievements & Contribution in Mathematics, Astronomy, Science & Medicine

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
A PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS
(OPEN ELECTIVE)

Course Code: GR24A4012

L/T/P/C: 3/0/0/3

Course Outcomes:

1. Study of Shrimad- Bhagwad-Gita will help the student in developing his personality and achieve the highest goal in life
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity
3. Study of Neethishatakam will help in developing versatile personality of students
4. To develop self-developing attitude towards work without self-aggrandizement and to develop suffering free meditative mind
5. To develop tranquil attitude in all favorable and unfavorable situations and to develop high spiritual intelligence

UNIT-I: Neetisatakam-Holistic development of personality

- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride & heroism)
- Verses- 26,28,63,65 (virtue)

UNIT-II: Neetisatakam-Holistic development of personality

- Verses- 52,53,59 (don't's)
- Verses- 71,73,75,78 (do's)

UNIT-III: Approach to day to day work and duties

- Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48,
- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
- Chapter 18-Verses 45, 46, 48.

UNIT-IV: Statements of basic knowledge

- Shrimad Bhagwad Geeta: Chapter 2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16,17, 18
- Personality of Role model. Shrimad Bhagwad Geeta:

UNIT-V:

- Classification, Chapter 2-Verses 17, Chapter 3-Verses 36,37,42,
- Chapter 4-Verses 18, 38,39
- Chapter 18 – Verses 37,38,63

TEXT BOOKS/ REFERENCE BOOKS:

1. “Srimad Bhagavad Gita” by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGINEERING MATERIALS FOR SUSTAINABILITY
(OPEN ELECTIVE)

Course Code: GR24A3009

L/T/P/C: 3/0/0/3

Course Outcomes: After completing this course, students will be able to:

1. Describe the different types of environmental factors effecting materials
2. Report the work in sustainability for research and education
3. Illustrating the broad perspective in thinking for sustainable practices by utilizing the engineering knowledge and principles gained from this course
4. Perform cost/benefit analysis and life-cycle analysis of green buildings.
5. Identify the balance affordability, functionality, and environmental responsibility to create sustainable and effective building designs.

UNIT-I: Sustainability:

Introduction, need, and concept of sustainability, Social- environmental and economic sustainability concepts. Sustainable development, Nexus between Technology and Sustainable development, Challenges for Sustainable Development. Multilateral environmental agreements and Protocols – Clean Development Mechanism (CDM), Environmental legislations in India – Water Act, Air Act

UNIT-II: Environmental management standards:

ISO 14000 series, Life Cycle Analysis (LCA) – Scope and Goal, Bio-mimicking, Environment Impact Assessment (EIA) – Procedures of EIA in India

UNIT-III:

Green Building Materials, Basic concepts of sustainable habitat, green buildings, green materials for building construction, material selection for sustainable design, green building certification, Methods for increasing energy efficiency of buildings. Sustainably managed Materials, Depleting natural resources of building materials; renewable and recyclable resources; energy efficient materials; Embodied Energy of Materials

UNIT-IV:

Green cement, Biodegradable materials, Smart materials, Manufactured Materials, Volatile Organic Compounds (VOC's), Natural Non-Petroleum Based Materials, Recycled materials, Renewable and Indigenous Building Materials, Engineering evaluation of these materials

UNIT-V:

Green Building Planning and Specifications, Environment friendly and cost effective Building Technologies, Integrated Life cycle design of Materials and Structures, Green Strategies for Building Systems, Alternative Construction Methods, Energy Conservation Measures in Buildings, Waste & Water management and Recycling in Sustainable Facilities, Heating, Ventilation and Air Conditioning, Passive Solar & Daylight, Plumbing and its Effect on Energy Consumption

TEXT BOOKS:

1. Alternative Building Materials and Technologies – By K S Jagadeesh, B V Venkata Rama Reddy & K S Nanjunda Rao – New Age International Publishers, 2007
2. Integrated Life Cycle Design of Structures – By Asko Sarja – SPON Press, 2011
3. Non-conventional Energy Resources – By D S Chauhan and S K Srivastava – New Age International Publishers, 2021

REFERENCE BOOKS:

1. Emerald Architecture: case studies in green buildings, The Magazine of Sustainable Design, 2008
2. Understanding Green Building Guidelines: For Students and Young Professionals, Traci Rose Rider, W. W. Norton & Company Publisher.2009
3. Understanding Green Building Materials, Traci Rose Rider, W. W. Norton & Company Publisher.2011
4. Green Buildings (McGraw hill publication): by Gevorkian, 2006

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
GEOGRAPHIC INFORMATION SYSTEMS AND SCIENCE
(OPEN ELECTIVE)

Course Code: GR24A3022

L/T/P/C: 3/0/0/3

Course Outcomes: After completing this course, students will be able to:

1. Interpret the fundamental concepts of Geographic Information Science and Technology along with different data structures.
2. Demonstrate Map creation and design principles, including thematic map display, employment of map projections and cartographic design.
3. Analyze the types of digital maps for different themes.
4. Apply the spatial analysis to remote sensing data to generate thematic maps.
5. Solve the real-life problems associated with geospatial and remote sensing.

UNIT-I:

Fundamentals of GIS – Information Systems, Modelling Real World Features Data, Data Formats, Applications of GIS, – Spatial and Non-spatial, Components, Data Collection and Input, Data Conversion, Database Management – Database Structures, Files; Standard Data Formats, Compression Techniques, Hardware – Computing, printing and scanning systems; Software – Standard Packages like Arc view, ArcGIS (commercial) & Auto-CAD Map, Map Info etc. QGIS open software- Salient features.

UNIT-II:

Topology – Types of Errors, Editing and Error Rectification, Types of Topology, Modeling topological Relationships, Tolerances.

UNIT-III:

Map – mapping concepts, analysis with paper-based maps, limitations, Computer Automated Cartography– History and Developments, GIS- Definition, advantages of digital maps.

UNIT-IV:

Spatial Analysis and Modelling – Proximity Analysis, Overlay Analysis, Buffer Analysis, Network Analysis, Spatial Auto Correlation, Gravity Modelling, DTM/DEM, Integration with Remote Sensing data

UNIT-V:

GIS Project Planning and Implementation – Under Standing the Requirements, Phases of Planning, Specifications, Data Procurement, Tendering, Human Resources, Back Up, Monitoring Progress

TEXT BOOKS:

1. Concepts & Techniques of GIS by C. P. Lo Albert, K. W. Yonng, Prentice Hall (India) Publications, 2nd edition, 2016.
2. Fundamental of GIS by Mechanical designs John Wiley & Sons, 4th edition, 2008.
3. Principals of Geographic Information Systems – Peter Beur and Rachael A. Mc Donnell, Oxford Publishers 2016.
- 4.

REFERENCE BOOKS:

1. Remote Sensing and Geographical Information systems by M. Anji Reddy JNTU Hyderabad. 4th Edition 2014, B. S. Publications.
2. Introduction to Geographic Information Systems by Kang-tsung Chang, Tata McGraw-Hill Publishing

Company Limited- 2008.

3. Remote sensing of the environment –An earth resource perspective by John R Jensen, Prentice Hall 4.
- GIS by Kang – tsung chang, TMH Publications & Co., 2nd edition, 2013.
4. Basics of Remote sensing & GIS by S.Kumar, Laxmi Publications, 1st edition,2016.
5. Remote Sensing and its applications by LRA Narayana, University Press 1999.
6. Remote sensing and image interpretation by Thomas Lillesand, 7th Edition, John Wiley & sons,6th Edition 2011.
7. Fundamentals of Geographic Information systems by Michael N. Demers, 4th Edition, Wiley Publishers, 2012.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PLUMBING -WATER AND SANITATION
(OPEN ELECTIVE)

Course Code: GR24A4011

L/T/P/C: 3/0/0/3

Course Outcomes: After completing this course, students will be able to:

1. Coordinate plumbing works from inception to completion with Owners, Architects, other consultants, and contractors.
2. Select proper plumbing materials and systems.
3. Read and interpret plumbing drawings.
4. Supervise code based plumbing installations. Understand methods to conserve water and energy, Protect health and safety of end users.
5. Enjoy better job opportunities and career options

UNIT-I: Introduction to Plumbing and Sanitation Importance of Codes, Architectural and Structural Coordination Codes and Standards: Scope, purpose; codes and standards in the building industry, UIPC-I (Uniform Illustrated Plumbing Code-India), NBC (National Building Code) and other codes, Local Municipal Laws, approvals, general regulations, standards, water supply, sewerage system, drainage system, workmanship, water conservation, protection of pipes and structures, waterproofing. of GIS – Information Systems, Modelling Real World Features Data, Data Formats, Applications of GIS, – Spatial and Non-spatial, Components, Data Collection and Input, Data Conversion, Database Management – Database Structures, Files; Standard Data Formats, Compression Techniques, Hardware – Computing, printing and scanning systems; Software – Standard Packages like Arc view, ArcGIS (commercial) & Auto-CAD Map, Map Info etc. QGIS open software- Salient features.

Architectural and Structural coordination: Provisions for plumbing systems, coordination during the planning stage, various agencies involved and their roles, space planning for plumbing systems, water tanks, pump room, centralized hot water systems, toilet locations.

UNIT-II: Plumbing Terminology:

Definitions, use/purpose of the following. **Plumbing Fixtures:** accessible, readily accessible, aerated fittings, bathroom group, carrier, flood level rim, floor sink, flush meter valve, flush tanks, lavatories, macerating toilet, plumbing appliances, plumber. **Traps:** indirect waste, vent, blow off, developed length, dirty arm, indirect waste, receptors, slip joints, trap, and vent. **Drainage:** adapter fitting, adjusted roof area, air break, air gap, area drain, base, bell and spigot joint, building drain, branch, (DFU) Drainage Fixture Units, grease interceptor, joints, roof drain, smoke test, stack. **Water supply:** angle valve, anti-scald valve, backflow, bypass, check valve, cross connection, gate valve, gray water, joints.

UNIT-III: Plumbing Fixtures and Fittings:

Definitions of plumbing fixtures, fittings, appliances and appurtenances; maximum flow rates, water closets, urinals, flushing devices, washbasins, bath/shower, toilets for differently abled, kitchen sinks, water coolers, drinking fountain, clothes washer, dish washer, mop sink, overflows, strainers, prohibited fixtures, floor drains, floor, location of valves, hot water temperature controls, installation standard dimensions in plan and elevation.

UNIT-IV:

Traps, Interceptors, Indirect Waste and Vents Traps required, trap arms, developed length, trap seals, venting to traps, trap primers, prohibited traps, building traps. Discharge for indirect waste piping, nature of contents or systems, proper methods to install indirect waste piping, air gap and air break, sink traps,

dish washers. Vent requirement, purpose of venting, trap seal protection, materials, vent connections, **Sanitary Drainage and Storm Drain** Preamble, one pipe and two pipe systems, different pipe materials and jointing methods, special joints, hangers and supports, protection of pipes and structures, alternative materials, workmanship, prohibited fittings and practices.

Water Supply, Gray and Reclaimed Water: Preamble, one pipe and two pipe systems, different pipe materials and jointing methods, special joints, hangers and supports, protection of pipes and structures, alternative materials, workman ship, prohibited fittings and practices, change in direction of flow, T and Y fittings, Storm drain required, prohibited connections, subsoil drains, sub-drains, gutters, channels or scuppers, roof drains, catchment, collect/capture storm water, discharging storm water, Rain Water Harvesting (RWH) definition, need, catchment, conduits, settlement tanks, treatment, possible uses, recharging pits, NBC requirements.

UNIT-V:

Water Supply, Gray and Reclaimed Water (Preamble, sources of water, potable and non-potable water, reclaimed water, calculating daily water requirement and storage, hot and cold water distribution system. pipe materials and jointing methods, alternative materials, hangers and supports, workmanship, prohibited fittings and practices, protection of pipes and Plumbing (Water and Sanitation) structures, pressure controls, unions, thermal expansion, types of valves, Definition of gray water, approvals, specifications and drawings, safety, total gray water discharge, holding tanks, valves and piping.

Introduction to water treatment plant (WTP) and STP: Introduction to Net Zero concept, need to reduce and reuse, rating of Water Efficient Plumbing fixtures and fittings, 24x7 water supply, metering and sub-metering, typical daily water and wastewater calculations for a project.

TEXT BOOKS:

1. Elements of Water Pollution Control Engineering, O.P. Gupta, Khanna Book Publishing, New Delhi. Edition ·1, 2019.
2. Plumbing Engineering” Author: R. G. Saran Publisher: S. K. Kataria & Sons Latest Edition: 2022 (Revised Edition)
3. “Water Supply and Sanitary Engineering” Authors: G. S. Birdie and J. S. Birdie Publisher: Dhanpat Rai Publishing Company Latest Edition: 2022 (33rd Revised Edition)
4. “Plumbing: Design and Installation” Author: L. G. Wade Publisher: Cengage Learning Latest Edition: 2019 (4th Edition)

REFERENCE BOOKS:

1. “Plumbing Engineering Design Handbook” (Volumes I & II) Publisher: American Society of Plumbing Engineers 2022 Edition (Volume 1: Fundamentals; Volume 2: Systems)
2. Water Efficiency and Sanitation Standard published by IPA Indian Plumbing Association (IPA) and IAPMO International Association of Plumbing and Mechanical Officials (India) Water Pollution, Berry, CBS Publishers, 2023 edition.
3. ‘A Guide to Good Plumbing Practices’, a book published by IPA, 2016 edition.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
NON-CONVENTIONAL ENERGY SOURCES
(OPEN ELECTIVE)

Course Code: GR24A3035

L/T/P/C: 3/0/0/3

Course Outcomes: After completing this course, students will be able to:

1. Recall the concepts of Solar Energy and Solar collectors.
2. Illustrate the PV Solar system with energy backup.
3. Analyze the basic physics of wind power generation.
4. Determine the energy generation from biomass, biogas, and geothermal energy.
5. Discuss Tidal power systems and fuel cells.

UNIT-I: Solar Radiation:

Solar spectrum-Solar Radiation on Earth's surface- Solar radiation geometry-Solar radiation measurements- Solar radiation data-Solar radiation on horizontal and tilted surfaces. Solar Thermal Conversion-Flat plate collectors, concentrated collectors- construction and thermal analysis- Solar applications-Solar ponds-Heliostat systems- water heater-air heater- solar still.

UNIT-II: Photo Voltaic System:

Photo voltaic cells-Equivalent circuit- V-I Characteristics- Photovoltaic modules-constructural details-design considerations-Tracking-Maximum power point tracking-algorithms-PV solar system design with energy backup-Solar Thermo electric Conversion.

UNIT-III: Wind Energy:

Fundamentals of wind energy-power available in wind-Betz Limit-Aerodynamics of wind turbine- Wind turbines-Horizontal and vertical axis turbines-their configurations-Wind Energy conversion systems.

UNIT-IV: Biogas and Geothermal Energy:

Various fuels-Sources- Conversion technologies-Dry Processes-Biogas generation-Aerobic and anaerobic digestion- Factors affecting the generation of biogas -Classification of biogas plants- Different Indian digesters- Digester design considerations- Gasification process-Gasifiers- Applications. Geothermal Energy-sources-Hydro thermal convective-Geo-pressure resources- Petro-thermal systems(HDR)-Magma Resources-Prime Movers

UNIT-V: Tidal Energy:

Principle of operation-Open and closed cycles, Energy from Tides-Principle of Tidal Power-Components of tidal Power plants-Operation Methods-Estimation of Energy in Single and double basin systems-Energy and Power from Waves-Wave energy conversion devices-Fuel Cells-Design and Principle of operation- Types of Fuel Cells-Advantages and disadvantages-Types of Electrodes- Applications-Basics of Batteries - Constructural details of Lead acid batteries- Ni-Cd Batteries.

TEXT BOOKS:

1. John Twidell & Wier, Renewable Energy Resources, CRC Press, 2009.
2. D.P. Kothari, Singal, Rakesh, Ranjan, Renewable Energy Sources and Emerging Technologies, PHI, 2009.

REFERENCE BOOKS:

1. G.D. Rai-Non-Conventional Energy sources, Khanna publishers.

2. B.H.Khan,“Non-ConventionalEnergyResources”,2ndedition,TataMcGraw-Hill,New Delhi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
CONCEPTS OF CONTROL SYSTEMS
(OPEN ELECTIVE)

Course Code: GR24A3046

L/T/P/C: 3/0/0/3

Course Outcomes: On completion of the course, the student will be able to

1. Infer the basic concept control systems.
2. Develop the mathematical model of the systems.
3. Analyze the time domain specifications and steady state error.
4. Outline the concept of stability of the system.
5. Solve the frequency response analysis

UNIT-I: Basic Concepts of Control System:

Terminology - plant, process, system, disturbances, controlled variable, manipulated variable etc., Block diagram of basic control system, application areas with examples. Classifications of control systems

UNIT-II: Mathematical Modelling of Systems:

Translational and rotational mechanical systems, electrical systems, Force voltage and force current analogy, Block diagram and signal flow graph representation of physical systems along with rules, properties, comparison and limitation, Mason's gain formula.

UNIT-III: Time Response Analysis:

Standard test signals along with examples of their usage, steady state errors for step, ramp and parabolic inputs, analysis of first and second order systems, Transient response specifications with numerical examples, Basic control actions and two position, proportional, P, PI, PID controllers, Limitations of time domain analysis.

UNIT-IV: Stability:

Concept of stability, types of stability, Routh's stability criterion, special cases with numerical examples, stability of closed loop system, concept of root locus, open loop and closed loop transfer poles, step by step procedure for root loci, numerical examples.

UNIT-V: Frequency Response Analysis:

Need of frequency response analysis, Sinusoidal response of linear system, methods used in frequency response, Bode Plot, Frequency domain specifications.

TEXT BOOKS:

1. IJNagrath, M.Gopal, Control System Engineering, New Age International Publishers, Fifth edition.
2. Norman S. Nise, Control system engineering, John Wiley & Sons, Inc., Sixth edition

REFERENCE BOOKS:

1. Richard C. Dorf, Robert H. Bishop, Modern control systems, Pearson Education International, Twelfth edition.
2. A. Nagorani, Control Systems, CBS Publishers. Jon. S. Wilson; "Sensor Technology Hand Book", Elsevier Inc., 2005.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ARTIFICIAL NEURAL NETWORKS AND FUZZY LOGIC
(OPEN ELECTIVE)

Course Code: GR24A4037

L/T/P/C: 3/0/0/3

Course Outcomes: On completion of the course, the student will be able to

1. Outline importance of BNN, ANN and its learning techniques and architectures.
2. Summarize the algorithms for various applications using Back propagation networks.
3. Interpret the concept of Fuzzy and Crispsets.
4. Model Fuzzy membership Function and rules for Applications.
5. Analyze the parameters of Genetic Algorithm.

UNIT-I: NEURAL NETWORKS I (Introduction & Architecture):

Neuron, Nerve structure and synapse, Biological Neural network, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques.

to Information Theory, Shannon Capacity, Multimedia Data, Data Processing, Boolean Logics, Information Content, Entropy, Source Coding, Channel Coding, Modulation Schemes, Internet.

UNIT-II: NEURAL NETWORKS II (Back Propagation Networks):

Architecture: perceptron model, solution, single layer artificial neural network, multilayer perceptron model; back propagation learning methods, effect of learning rule coefficient; back propagation algorithm, factors affecting back propagation training, application of Neural Networks in Load Forecasting.

UNIT-III: FUZZY LOGIC I (Introduction):

Basic concepts of fuzzy logic, Fuzzy sets and Crispsets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.

UNIT-IV: FUZZY LOGIC II (Fuzzy Membership, Rules):

Membership functions, inference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzifications & Defuzzification's, Fuzzy Controller, application of Fuzzy logic control in washing machines

UNIT-V: GENETIC ALGORITHMS (GA):

Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators, Mutation, Generational Cycle, application of genetic algorithm in economic load dispatch.

TEXT BOOKS:

1. J. M. Zurada, "An Introduction to ANN", Jaico Publishing House.
2. Neural Networks, Fuzzy Logic, And Genetic Algorithms: Synthesis and Applications - by S. Rajasekaran, G. A. Vijayalakshmi Pai, PHI publishers.

REFERENCE BOOKS:

1. Hung T. Nguyen, Nadipuram R. Prasad, Carol L. Walker and Elbert A. Walker, "A First Course in Fuzzy and Neural Control" Chapman & Hall, CRC.
2. Driankov, Dimitra, "An Introduction to Fuzzy Control", Narosa Publication.
3. Timothy J. Ross, "Fuzzy Logic with Engg. Applications", McGraw-Hill.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
INDUSTRIAL AUTOMATION AND CONTROL
(OPEN ELECTIVE)

Course Code: GR24A3056

L/T/P/C: 3/0/0/3

Course Outcomes: After completing this course, students will be able to:

1. Explain the major automation theories, approaches and methodologies used in manufacturing.
2. Apply the knowledge for implementing the automated flow lines.
3. Employ the assembly systems and line balancing for automation
4. Implement the knowledge of material handling and storage systems in current industries.
5. Design adaptive control system for automated manufacturing.

UNIT-I: Introduction:

Introduction to automation, principles, reasons, types and strategies of automation, pneumatic and hydraulic components circuits, Automation in machine tools. Mechanical feeding, tool changing and machine tool control transfer the automaton.

UNIT-II: Automated flow lines:

Methods of work part transport transfer, Mechanical buffer storage control function, design and fabrication consideration. Analysis of Automated flow lines: General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines.

UNIT-III: Assembly system and line balancing:

Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT-IV: Automated material handling and storage systems:

Types of equipment, functions, analysis and design of material handling systems, conveyor systems, automated guided vehicle systems. Automated storage and retrieval systems; work in process storage, interfacing handling and storage with manufacturing.

UNIT-V: Adaptive control systems:

Introduction, adaptive control with optimization, adaptive control with constraints, application of adaptive control in machining operations. Consideration of various parameters such as cutting force, temperatures, vibration and acoustic emission in the adaptive controls systems.

TEXT BOOKS:

1. Mikell P.Groover, Automation, Production Systems, and Computer- integrated Manufacturing, prentice Hall, 2014
2. Serope Kalpakjian and Steven R. Schmid, edition, Pearson, 2013

REFERENCE BOOKS:

1. Automation, Production Systems, and Computer-Integrated Manufacturing. (2016). India: Pearson India.
2. Bolz, R. W. (2012). Manufacturing Automation Management: A Productivity Handbook. United States: Springer US.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
OPERATIONS RESEARCH
(OPEN ELECTIVE)

Course Code: GR24A3034

L/T/P/C: 3/0/0/3

Course Outcomes: On completion of the course, the student will be able to

1. Formulate and solve linear programming problems using simplex and duality approaches for resource allocation.
2. Apply non-linear optimization techniques (single and multi-variable unconstrained methods) to practical engineering and management problems.
3. Analyze and solve transportation and assignment models for effective decision-making in logistics and resource allocation.
4. Evaluate inventory control systems and queuing models to optimize stock management and service efficiency.
5. Apply replacement and dynamic programming models for long-term decision-making in capital budgeting, maintenance, and system optimization.

UNIT-I: Introduction & Linear Programming:

Introduction: Development, Definition, Characteristics and Phases of Operations Research, Types of models: Operations Research models – Applications: Linear Programming Problem (LPP) formulation, Graphical solution method, Simplex method – Artificial variables techniques (Two-phase method, Big-M method), Duality principle

UNIT-II: Non-Linear Programming:

Introduction – Difference between linear and nonlinear programming, applications in engineering & management; **Single-variable unconstrained optimization:** Uni-modal functions, Elimination methods – Bisection/interval halving, Fibonacci method, Golden Section method; **Multi-variable unconstrained optimization:** Gradient of a function, optimality condition, Gradient methods – Steepest Descent Method, Conjugate Gradient Method (Fletcher-Reeves)

UNIT-III: Transportation & Assignment Models:

Transportation models: Formulation, Methods for finding feasible solution and optimal solution, Unbalanced transportation problems, degeneracy; **Assignment models:** Formulation, Optimal solution, Variants of Assignment Problem (e.g., unbalanced, maximization, traveling salesman problem)

UNIT-IV: Inventory & Queuing Models:

Inventory models: Single-item deterministic models, Purchase inventory models with one price break and multiple price breaks, Shortages not allowed, Stochastic models – demand as discrete or continuous variable, Instantaneous production, instantaneous demand and continuous demand (no setup cost)

Queuing models: Introduction, Single-channel system: Poisson arrivals, exponential service times, infinite/finite population, Multi-channel systems: Poisson arrivals, exponential service times with infinite population

UNIT-V: Replacement & Dynamic Programming:

Replacement models: Replacement of items that deteriorate with time (with and without time value of money), Replacement of items that fail completely, Group replacement policy

Dynamic programming: Introduction – Bellman's Principle of Optimality Applications: capital budgeting, shortest path problem, linear programming problem

TEXT BOOKS:

1. Operations Research/ Prem Kumar Gupta, Dr. D.S. Hira
2. Operations Research / S. D.Sharma-Kedarnath
3. Operation Research /J.K.Sharma/MacMilan.

REFERENCE BOOKS:

1. A.K. Operations Research / R.Pannerselvam, PHI Publications.
2. Introduction to O.R /Taha/PHI
3. Operations Research / Wagner/ PHI Publications.
4. Introduction to O.R/Hiller and Libermann (TMH).
5. Operations Research /A.M.Natarajan, P.Balasubramani,A. Tamilarasi/Pearson Education.
6. Operations Research: Methods and Problems / Maurice Saseini, ArhurYaspan and Lawrence Friedman
7. O.R/Wayne L.Winston/Thomson Brooks/cole

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
COMPOSITE MATERIALS
(OPEN ELECTIVE)

Course Code: GR24A3066

L/T/P/C: 3/0/0/3

Course Outcomes: On completion of the course, the student will be able to

1. Identify the types of composite materials and their characteristic features
2. Explain the methods employed in composite fabrication.
3. Differentiate the strengthening mechanisms of composite and its corresponding effect on performance
4. Analyze the various criterions for isotropic, anisotropic and composite materials, prediction of laminates failure.
5. Examine experimental techniques utilized for failure mode of composites.

UNIT-I:

Definition and applications of composite materials, Fibers- glass, carbon, ceramic and aramid fibers; Matrices- polymer, graphite, ceramic and metal matrices; characteristics of fibers and matrices. Lamina- assumptions, macroscopic viewpoint, generalized Hooke's law, reduction of homogeneous orthotropic lamina, isotropic limit case, orthotropic stiffness matrix, commercial material properties, rule of mixtures, transformation matrix, transformed stiffness

UNIT-II:

Manufacturing of composite materials, bag moulding, compression moulding, pultrusion, filament welding, other manufacturing processes

UNIT-III:

Basic assumptions of laminated anisotropic plates, symmetric laminates, angle ply laminates, cross ply laminates, laminate structural moduli, evaluation of lamina properties, determination of lamina stresses, maximum stress and strain criteria.

UNIT-IV:

Von Mises Yield criterion for isotropic materials, generalized Hill's criterion for anisotropic materials, Tsai-Hill's criterion for composites, prediction of laminate failure, thermal analysis of composite laminates

UNIT-V:

Analysis of laminated plates- equilibrium equations of motion, energy formulation, static bending analysis, buckling analysis, free vibrations, natural frequencies.

TEXT BOOKS:

1. Gibson R.F. Principles of Composite Material Mechanics, second edition, McGraw Hill, 1994.
2. Hyer M.W., Stress Analysis of Fiber- Reinforced Composite Materials, McGraw Hill, 1998.

REFERENCE BOOKS:

1. Clyne, T. W. and Withers, P. J., "Introduction to Metal Matrix Composites", Cambridge University Press, 1993.
2. Strong, A.B., "Fundamentals of Composite Manufacturing", SME, 1989.
3. Sharma, S.C., "Composite materials", Narosa Publications, 2000.
4. Broutman, L.J. and Krock, R.M., "Modern Composite Materials", Addison-Wesley, 1967.

5. Introduction to Composite Materials Design by Ever J. Barbero 3rd Edition 2017

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DIGITAL ELECTRONICS FOR ENGINEERING
(OPEN ELECTIVE)

Course Code: GR24A3076

L/T/P/C: 3/0/0/3

Course Outcomes: After completing this course, students will be able to:

1. Get basic knowledge on logic gates, Universal gates and their switching logics.
2. Realize Boolean expressions using NAND/NOR gates and reduce them using K map.
3. Know all types of combinational and sequential circuits.
4. Acquire knowledge on realization of logic families using diodes and transistor, and also on different types of integrated circuits.
5. Understand the characteristics and applications of operational amplifiers in different modes of operation.

UNIT-I: Number Systems:

Number systems, Complements of Numbers, Codes- Weighted and Nonweighted codes and its properties. Boolean Algebra: Basic Theorems and Properties, Switching Functions- Canonical and Standard Form, Algebraic Simplification, Digital Logic Gates, EX-OR gates, Universal Gates, Multilevel NAND/NOR realizations.

UNIT-II: Minimization of Boolean functions:

Karnaugh Map Method - Up to four Variables, Don't Care Map Entries, Tabular Method, Combinational Logic Circuits: Adders, Subtractors, Comparators, Multiplexers, Demultiplexers, Encoders, Decoders and Code converters, Hazards and Hazard Free Relations.

UNIT-III: Sequential Circuits Fundamentals:

Basic Architectural Distinctions between Combinational and Sequential circuits, SR Latch, Flip Flops: SR, JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Fundamentals of shift registers, ripple and decade counters.

UNIT-IV: Realization of Logic Gates Using Diodes & Transistors:

AND, OR and NOT Gates using Diodes and Transistors, DCTL, RTL, DTL, TTL, CML and CMOS Logic Families and its Comparison, standard TTL NAND Gate Analysis & characteristics, TTL open collector O/Ps, Tristate TTL, MOS & CMOS open drain and tristate outputs, CMOS transmission gate.

UNIT-V: Integrated Circuits:

Classification, chip size and circuit complexity, basic information of op-amp, ideal and practical Op-amp, internal circuits, Op-amp characteristics, DC and AC Characteristics, 741 op-amp and its features, modes of operation-inverting, non-inverting, differential.

TEXT BOOKS:

1. Switching and Finite Automata Theory - ZviKohavi& Niraj K. Jha, 3rd Edition, Cambridge, 2010.
2. Modern Digital Electronics – R. P. Jain, 3rd Edition, 2007- Tata McGraw-Hill
3. Linear Integrated Circuits, D. Roy Chowdhury, New Age International(p) Ltd.
4. Op-Amps & Linear ICs, Ramakanth A. Gayakwad, PHI

REFERENCE BOOKS:

1. Digital Design- Morris Mano, PHI, 4th Edition,2006

2. Operational Amplifiers & Linear Integrated Circuits, R.F. Coughlin & Fredrick F. Driscoll, PHI
3. Operational Amplifiers & Linear Integrated Circuits: Theory & Applications, Denton J. Daibey, TMH.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
SENSOR TECHNOLOGY
(OPEN ELECTIVE)

Course Code: GR24A3085

L/T/P/C: 3/0/0/3

Course Outcomes: On completion of the course, the student will be able to

1. Demonstrate the concept of resistive sensors which can be employed for real life applications
2. Realize the concept of reactive sensors and understand the implications while deploying them in practice.
3. Understand the working principle of special purpose sensors and the need or developing smart sensors.
4. Comprehend the design and development of various wearable sensors for use in healthcare applications.
5. Able to design and perform experiments on the sensors and develop the projects based on the customer needs.

UNIT-I: Introduction to Sensor Systems:

General concepts and terminology of Sensor systems, Transducers classification-sensors and actuators, General input-output configurations, Static and dynamic characteristics of measurement system.

UNIT-II: Resistive sensors:

Potentiometers, strain gages (piezo-resistive effect), resistive temperature detectors (RTD), thermistors, light dependent resistor (LDR), resistive hygrometers, resistive gas sensors.

UNIT-III: Inductive sensors:

Variable reluctance sensors, Hall effect, Eddy current sensors, Linear variable differential transformers (LVDT), variable transformers, magneto-elastic, magneto- resistive, and magneto strictive sensors. Capacitive sensors- variable capacitor, differential capacitor.

UNIT-IV: Accelerometers:

Characteristics and working principle of accelerometer sensors, Types- Capacitive, Piezoresistive, piezoelectric; Gyroscopes: Characteristics and working principle, Rotor Gyroscope; Diaphragm Pressure Sensor-resistive & capacitive type (micro press sensor).

UNIT-V: Overview of various smart sensors:

Digital temperature sensor (DS1621, TMP36GZ), Humidity sensor (DHT11, DHT22), Gas sensor (MQ2,MQ8), Pressure sensors (BMP180), Accelerometers (ADXL335); Structural health monitoring sensors, Introduction to MEMS and Flexible sensors.

TEXT BOOKS:

1. B. C. Nakra, K.K. Choudhury, "Instrumentation, Measurement and Analysis"-3rd Edition, Tata McGraw, 2009
2. Jacob Fraden, "Hand Book of Modern Sensors: Physics, Designs and Applications", 3rd Edition.,

REFERENCE BOOKS:

1. Er. R.K. Rajput, "Electronic Measurements and Instrumentation", S. Chand & Company Ltd. 3rd Edition.
2. A.K.Sawhney, "Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai.
3. Bentley, John P., "Principles of Measurement Systems", 4th Edition, Pearson/Prentice Hall, 2005
4. Jon. S. Wilson; "Sensor Technology Hand Book", Elsevier Inc., 2005.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
COMMUNICATION TECHNOLOGIES
(OPEN ELECTIVE)

Course Code: GR24A4078

L/T/P/C: 3/0/0/3

Course Outcomes: On completion of the course, the student will be able to

1. Understand the information theory and its coding styles.
2. Acquire knowledge on wireless communications and services.
3. Understand the various mobile networks and generations
4. Acquire knowledge on optical communications.
5. Know about network security through encryption and decryption.

UNIT-I: Information Theory:

Introduction to Information Theory, Shannon Capacity, Multimedia Data, Data Processing, Boolean Logics, Information Content, Entropy, Source Coding, Channel Coding, Modulation Schemes, Internet.

UNIT-II: Wireless Communication Technologies:

Introduction to Wireless Communication Technologies, WLAN, Wifi, Bluetooth, Other Wireless PAN And WAN Technologies, Satellite Communications, Broadcast Services.

UNIT-III: Cellular Mobile Networks:

Introduction to Cellular Mobile Networks, GSM(2G), UMTS (3G), LTE(4G), 5G Mobile Networks, Mobile Network Planning Aspects.

UNIT-IV: Optical Communication:

Introduction to Optical Communications, Optical Fiber, FTTC, FTTH, FTTBS, Free Space Optical Link, Channel Model with Different Factors, Deep Space Optical Communications.

UNIT-V: Network Security and Management:

Introduction to Network Security and Management, Symmetrical Encryption, Asymmetrical Encryption, Authentication, Hash-Value, Integrity Check, Telecommunications Management Network, SNMP, Functionalities of Network Management, Trends and Future Development.

TEXT BOOKS:

1. Shun-Ping Chen, "Fundamentals of Information and Communication Technologies" 2020
2. B.P. Lathi, "Communication systems"- BS Publications, 2006..

REFERENCE BOOKS:

1. Simon Haykin, John Wiley "Digital Communications" 2005.
2. Herbert Taub, Donald L Schilling Gautham Saha "Principles of Communication systems" 3rd edition McGraw-Hill 2008.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DATA SCIENCE FOR ENGINEERS
(OPEN ELECTIVE)

Course Code: GR24A3092

L/T/P/C: 3/0/0/3

Course Outcomes: After completing this course, students will be able to:

1. Illustrate a flow process for data science problems.
2. Demonstrate the mathematical foundations for data science.
3. Analyze the data science process and predictive modelling.
4. Develop R codes for data science solutions.
5. Correlate results to the solution approach followed.

UNIT-I:

Introduction to R, Variables and datatypes in R, Data frames, Recasting and joining of dataframes, Recasting and joining of dataframes, Arithmetic, Logical and Matrix operations in R, Advanced programming in R : Functions, Control structures, Data visualization in R Basic graphics.

UNIT-II:

Linear Algebra and Statistics for Data Science: Solving Linear Equations, Linear Algebra Distance, Hyperplanes and Halfspaces, Eigenvalues, Eigenvectors, Statistical Modelling, Random Variables and Probability Mass/Density Functions, Sample Statistics.

UNIT-III:

Introduction to Data Science, Solving Data Analysis Problems - A Guided Thought Process, Predictive Modelling, Linear Regression, Model Assessment, Diagnostics to Improve Linear Model Fit.

UNIT-IV:

Simple Linear Regression Model Building, Cross Validation, Multiple Linear Regression Modelling Building and Selection.

UNIT-V:

Classification, K - Nearest Neighbors (KNN), K - Nearest Neighbors implementation in R, K - means Clustering, K - means implementation in R.

TEXT BOOKS:

1. Data Science for Engineers, 1st Edition, Raghunathan Rengaswamy, Resmi Suresh, CRC Press, Taylor & Francis Group.
2. Introduction to Linear Algebra, Fifth Edition, Gilbert Strang, ISBN: 978-09802327-7-6.
3. Applied Statistics and Probability for Engineers, Douglas Montgomery, George C Runger, Fifth Edition, John Wiley & Sons, Inc.

REFERENCE BOOKS:

1. Hands On Introduction To Data Science Hardcover – 2 April 2020 by Chirag Shah (Author)
2. Essential Math for Data Science: Take Control of Your Data with Fundamental Linear Algebra, Probability, and Statistics by Thomas Nield (Author)

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DATA ANALYTICS USING OPEN SOURCE TOOLS
(OPEN ELECTIVE)

Course Code: GR24A3103

L/T/P/C: 3/0/0/3

Course Outcomes: On completion of the course, the student will be able to

1. Interpret about graphics techniques in data analysis.
2. Implement data modeling techniques for a dataset.
3. Develop the simulation for mining and clustering the data.
4. Infer the data using business intelligence and predictive analytics
5. Implement the data analytics using Programming Environments

UNIT-I: Graphics:

A Single Variable – Dot and Jitter Plots, Histograms and Kernel Density Estimates, The Cumulative Distribution Function, Rank-Order Plots and Lift Charts, Summary Statistics and Box Plots, Practice using Numpy, Two Variables- Scatter Plots, Smoothing, Logarithmic Plots, Banking, Practice using Matplotlib, Time As A Variable- Time-Series Analysis, More Than Two Variables- False-color plots, Multiplots.

UNIT-II: Modeling Data:

Guesstimation and the back of the envelope- Principles, Perturbation Theory and Error Propagation, Models from scaling arguments- Models, Arguments from Scale, Mean-Field Approximations, Common Time-Evolution Scenarios, Arguments from probability models- The Binomial Distribution and Bernoulli Trials, The Gaussian Distribution and the Central Limit Theorem, Power-Law Distributions and Non-Normal Statistics, Bayesian Statistics.

UNIT-III: Mining Data:

Simulations- Monte Carlo Simulations, Resampling Methods, Discrete Event Simulations with *SimPy*, Finding Clusters- Distance and Similarity Measures, Clustering Methods, Pre and Postprocessing, *Pycluster*, Seeing the Forest for the trees- PCA, Kohonen Maps, PCA with R.

UNIT-IV: Applications:

Reporting, Business intelligence and Dashboards- Corporate Metrics and Dashboards, Data Quality Issues, Financial calculations and modeling- The Time Value of Money ,Uncertainty in Planning and Opportunity Costs, Cost Concepts and Depreciation, Predictive analytics- algorithms for classification.

UNIT-V: Programming Environments and Data analytics:

Programming Environments: Software Tools, A Catalog of Scientific Software - Matlab, R, Python Results from Calculus: Common Functions, Calculus, Useful Tricks -Binomial theorem, Linear transformation. Working with data: Sources for Data, Cleaning and Conditioning, Sampling, Data File Formats, The Care and Feeding of Your Data Zoo.

TEXT BOOKS:

1. Philipp K. Janert, Data Analysis with Open Source Tools, O'Reilly Media, Inc, November 2010: First Edition

REFERENCE BOOKS:

1. G James, D. Witten, T Hastie, and R. Tibshirani, An Introduction to Statistical Learning: with Applications in R, Springer, 2013

2. Chambers, John, Software for Data Analysis Programming with R, Springer, 2008
3. Trevor Hastie Robert Tibshirani Jerome Friedman, The Elements of Statistical Learning, Data Mining, Inference, and Prediction (2nd Edn.), Springer, 2014
4. Mark Gardener, Beginning R: The Statistical Programming Language, Wiley, 2013
5. Upadhyaya and A. Upadhyaya, Material Science and Engineering, Anshan Publications, 2007

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
AUGMENTED REALITY AND VIRTUAL REALITY
(OPEN ELECTIVE)

Course Code: GR24A4096

L/T/P/C: 3/0/0/3

Course Outcomes: On completion of the course, the student will be able to

1. Analyze about augmented reality.
2. Identify AR devices for various applications.
3. Analyze about virtual reality.
4. Interpret about usage of VR devices and human factors involved.
5. Apply AR & VR technology in various domains.

UNIT-I:

Introduction to Augmented Reality, The Relationship Between Augmented Reality and Other Technologies, Augmented Reality Concepts, How Does Augmented Reality Work?, Ingredients of an Augmented Reality Experience.

UNIT-II:

Augmented Reality Hardware, Major Hardware Components for Augmented Reality Systems, Augmented Reality Software, Major Software Components for Augmented Reality Systems, Software used to Create Content for the Augmented Reality Application.

UNIT-III:

Virtual Reality: The Three I's of Virtual Reality, A Short History of Early Virtual Reality, Early Commercial VR Technology, VR Becomes an Industry, The Five Classic Components of a VR System.

Input Devices: Trackers, Navigation, and Gesture Interfaces: Three-Dimensional Position Trackers, Navigation and Manipulation Interfaces

UNIT-IV:

Output Devices: Graphics, Three-Dimensional Sound, and Haptic Displays : Graphics Displays, Sound Displays, Haptic Feedback.

Human Factors in VR: Methodology and Terminology, User Performance Studies, VR Health and Safety Issues, VR and Society

UNIT-V:

Augmented Reality Applications, What Makes a Good Augmented Reality Application? Application Areas: Education, Gaming, Robotics, Health care, Manufacturing, Evaluating Augmented Reality Applications.

TEXT BOOKS:

1. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.
2. Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley IEEE Press, 2003/2006.

REFERENCE BOOKS:

1. LaValle, "Virtual Reality", Cambridge University Press, 2016.

2. Alan B Craig, William R Sherman and Jeffrey D Will, “Developing Virtual Reality Applications: Foundations of Effective Design”, Morgan Kaufmann, 2009.
3. John Vince, “Virtual Reality Systems “, Pearson Education Asia, 2007.
4. Anand R., “Augmented and Virtual Reality”, Khanna Publishing House, Delhi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
SERVICES SCIENCE AND SERVICE OPERATIONAL MANAGEMENT
(OPEN ELECTIVE)

Course Code: GR24A4115

L/T/P/C: 3/0/0/3

Course Pre-Requisite(s): Fundamentals of Management, Operations Research

Course Outcomes: After completing this course, students will be able to:

1. Understand concepts of services and its significance in the economy and society and distinguish it from goods.
2. Understand the service strategy, design, and development.
3. Comprehend ways to design services and able to understand service guarantee, recovery, and failures.
4. Forecast the service demand, supply and facilitate various methods to operate and manage services.
5. Understand the service productivity and how innovation can be approached from services point of view.

UNIT-I:

Introduction: Service operations, Role of service in economy and society, Indian service sector.

Nature of Services and Service Encounters: Differences between services and operations, Service package, characteristics, various frameworks to design service operation system, Kind of service encounter, importance of encounters

Service-Dominant Logic: From Goods-Dominant logic to Service-Dominant logic, Value Co- creation.

UNIT-II:

Service Strategy and Competitiveness: Development of Strategic Service Vision (SSV), Data Envelopment Analysis.

New Service Development: NSD cycle, Service Blueprinting, Elements of service delivery system Service Design: Customer Journey and Service Design, Design Thinking methods to aid Service Design.

Locating facilities and designing their layout: models of facility locations (Huff's retail model), Role of service-scape in layout design.

Service Quality: SERVQUAL, Walk through Audit, Dimensions of Service quality & other quality tools.

UNIT-III:

Service Guarantee & Service Recovery: Service guarantee and its types; Service failure – reasons for failure and service recovery strategies.

UNIT-IV:

Simple Forecasting Demand for Services: A review of different types of forecasting methods for demand forecasting.

Managing Capacity and Demand: Strategies for matching capacity and demand, Psychology of waiting, Application of various tools used in managing waiting line in services.

Managing Facilitating Goods: Review of inventory models, Role of inventory in services Managing service supply relationship: Understanding the supply chain/hub of service, Strategies for managing suppliers of service

Vehicle Routing Problem: Managing after sales service, understanding services that involve transportation of people and vehicle, Techniques for optimizing vehicle routes.

UNIT-V:

Service Innovation: Services Productivity, Need for Services Innovation

Student Project:

Option 1: Choose any service organization around and present it from the perspective of: nature of service, classification of service, blueprint or service design analysis, service quality, and any additional perspective you would like to add.

Option 2: Choose any latest research paper in services and explain your understanding and feedback on the same.

TEXT BOOKS:

1. Fitzsimmons & Fitzsimmons, Service Management: Operations, Strategy, Information Technology, McGraw Hill publications (7th edition)

REFERENCE BOOKS:

1. Wilson, A., Zeithaml, V. A., Bitner, M. J., & Gremler, D. D. (2012). Services marketing: Integrating customer focus across the firm. McGraw Hill.
2. Lovelock, C. (2011). Services Marketing, 7/e. Pearson Education India
3. Reason, Ben, and Lovlie, Lavrans, (2016) Service Design for Business: A Practical Guide to Optimizing the Customer Experience, Pan Macmillan India,
4. Chesbrough, H. (2010). Open services innovation: Rethinking your business to grow and compete in a new era. John Wiley & Sons.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
IT PROJECT MANAGEMENT
(OPEN ELECTIVE)

Course Code: GR24A4116

L/T/P/C: 3/0/0/3

Course Outcomes: On completion of the course, the student will be able to

1. Learn the techniques to effectively plan manage, execute the projects.
2. Learn the techniques to control projects within time and cost targets with a focus on Information Technology and Service Sector.
3. Learn various agile methodologies.
4. Apply agile project management techniques such as Scrum on real time applications.
5. Develop real time applications using agile project management techniques such as DevOps.

UNIT-I:

Project Overview and Feasibility Studies- Identification, Market and Demand Analysis, Project Cost Estimate, Financial Appraisal

Project Scheduling: Project Scheduling, Introduction to PERT and CPM, Critical Path Calculation, Precedence Relationship, Difference between PERT and CPM, Float Calculation and its importance, Cost reduction by Crashing of activity.

UNIT-II:

Cost Control and Scheduling: Project Cost Control (PERT/Cost), Resource Scheduling & Resource Leveling **Project Management Features:** Risk Analysis, Project Control, Project Audit and Project Termination.

UNIT-III:

Agile Project Management: Introduction, Agile Principles, Agile methodologies, Relationship between Agile Scrum, Lean, DevOps and IT Service Management (ITIL).

Other Agile Methodologies: Introduction to XP, FDD, DSDM, Crystal

UNIT-IV:

Reporting **Scrum:** Various terminologies used in Scrum (Sprint, product backlog, sprint backlog, sprint review, retro perspective), various roles (Roles in Scrum), Best practices of Scrum.

UNIT-V:

DevOps: Overview and its Components, Containerization Using Docker, Managing Source Code and Automating Builds, Automated Testing and Test-Driven Development, Continuous Integration, Configuration Management, Continuous Deployment, Automated Monitoring.

TEXT BOOKS:

1. Mike Cohn, Succeeding with Agile: Software Development Using Scrum
2. Notes to be distributed by the course instructor on various topics

REFERENCE BOOKS:

1. Pichler, Agile Product Management with Scrum
2. Roman Ken Schwaber, Agile Project Management with Scrum (Microsoft Professional

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
MARKETING RESEARCH AND MARKETING MANAGEMENT
(OPEN ELECTIVE)

Course Code: GR24A4117

L/T/P/C: 3/0/0/3

Course Outcomes: On completion of the course, the student will be able to

1. Understand the significance of marketing management concepts, marketing environment, consumer behaviour elements and strategies related to STP.
2. Understand various product management strategies and importance of branding, packing.
3. Comprehend the dynamics of marketing mix elements such as pricing, distribution, and promotion mix elements to leverage marketing concepts for effective decision making.
4. Demonstrate analytical skills in identification and resolution of problems pertaining to marketing management and marketing research and uses of various statistical tools in marketing research.
5. Understanding about the concepts of internet marketing and the fundamentals of business- to-business marketing strategy, CRM strategies.

UNIT-I:

Marketing Concepts and Applications: Introduction to Marketing & Core Concepts, Marketing of Services, Importance of marketing in service sector.

Marketing Planning & Environment: Elements of Marketing Mix, Analyzing needs & trends in Environment - Macro, Economic, Political, Technical & Social

Understanding the consumer: Determinants of consumer behavior, Factors influencing consumer behavior

Market Segmentation: Meaning & Concept, Basis of segmentation, selection of segments, Market Segmentation strategies, Target Marketing, Product Positioning

UNIT-II:

Product Management: Product Life cycle concept, New Product development & strategy, Stages in New Product development, Product decision and strategies, Branding & packaging.

UNIT-III:

Pricing, Promotion and Distribution Strategy: Policies & Practices – Pricing Methods & Price determination Policies. Marketing Communication – The promotion mix, Advertising & Publicity, 5 M's of Advertising Management. Marketing Channels, Retailing, Marketing Communication, Advertising

UNIT-IV:

Marketing Research: Introduction, Type of Market Research, Scope, Objectives & Limitations Marketing Research Techniques, Survey Questionnaire design & drafting, Pricing Research, Media Research, Qualitative Research

Data Analysis: Use of various statistical tools – Descriptive & Inference Statistics, Statistical Hypothesis Testing, Multivariate Analysis - Discriminant Analysis, Cluster Analysis, Segmenting and Positioning, Factor Analysis

UNIT-V:

Internet Marketing: Introduction to Internet Marketing. Mapping fundamental concepts of Marketing (7Ps, STP); Strategy and Planning for Internet Marketing

Business to Business Marketing: Fundamental of business markets. Organizational buying process. Business buyer needs. Market and sales potential. Product in business markets. Price in business markets.

Place in business markets. Promotion in business markets. Relationship, networks and customer relationship management. Business to Business marketing strategy

Home Assignments:

Written Analyses of Cases – Students are expected to report on their analysis and recommendations of what to do in specific business situations by applying concepts and principles learned in class (Case Studies to be shared by Faculty) e.g. “Marketing Myopia”

1. Field visit & live project covering steps involved in formulating Market Research Project.
2. Measuring Internet Marketing Effectiveness: Metrics and Website Analytics.

TEXT BOOKS:

1. Marketing Management (Analysis, Planning, Implementation & Control) – Philip Kotler.
2. Fundamentals of Marketing – William J. Stanton & Others.
3. Marketing Management – V.S. Ramaswamy and S. Namakumari.
4. Marketing Research – Rajendra Nargundkar.
5. Market Research – G.C. Beri.
6. Market Research, Concepts, & Cases – Cooper Schindler.

REFERENCE BOOKS:

1. Marketing Management – Rajan Saxena.
2. Marketing Management – S.A. Sherlekar.
3. Service Marketing – S.M. Zha.
4. Journals – The IUP Journal of Marketing Management, Harvard Business Review.
5. Research for Marketing Decisions by Paul Green, Donald, Tull.
6. Business Statistics, A First Course, David M Levine et al, Pearson Publication.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
BASICS OF JAVA PROGRAMMING
(OPEN ELECTIVE)

Course Code: GR24A3133

L/T/P/C: 3/0/0/3

Course Outcomes: After completing this course, students will be able to:

1. Apply OOP principles by writing Java programs using data types, operators, and control structures.
2. Analyze Java programs by implementing classes, constructors, arrays, and inheritance, and differentiate overloading and overriding.
3. Demonstrate modular design with packages, interfaces, and abstract classes, and evaluate exception handling.
4. Implement multithreading and synchronization and utilize collections for efficient data management.
5. Design modern Java applications using JavaFX, Spring Boot, and Hibernate/JPA

UNIT-I:

Object Oriented Thinking: Introduction, Need of object-oriented programming, principles of object-oriented languages, Applications of OOP, history of JAVA, Java Virtual Machine, Java features, Program structures, Installation of JDK.

Variables, Primitive data types, Identifiers- Naming Conventions, Keywords, Literals, Operators- Binary, Unary and Ternary, Expressions, Primitive Type conversion and casting, flow of control- branching, conditional, loops.

UNIT-II:

CLASSES, INHERITANCE, POLYMORPHISM:

Classes and Objects: Classes, Objects, creating objects, methods, constructors- constructor overloading, cleaning up unused objects- Garbage collector, class variable and methods- static keyword, this keyword, arrays, Command line arguments, Nested Classes

Strings: String, String Buffer, String Tokenizer

Inheritance and Polymorphism: Types of Inheritance, deriving classes using extends keyword, super keyword, Polymorphism – Method Overloading, Method Overriding, final keyword, abstract classes.

UNIT-III:

INTERFACES, PACKAGES, EXCEPTIONS

Interfaces: Interface, Extending interface, interface Vs Abstract classes.

Packages: Creating Packages, using Packages, Access protection, java I/O package. Exceptions

Introduction, Exception handling Techniques: try...catch, throw, throws, finally block, user defined Exception.

UNIT-IV:

MULTI-THREADING, COLLECTIONS

java.lang.Thread, the main Thread, creation of new Threads, Thread priority, multithreading- using isAlive() and join(), Synchronization, suspending and resuming Threads, Communication between Threads. Exploring java.io, Exploring java.util

Collections: Overview of Collection Framework : Array List, LinkedList, Vector, HashSet, TreeSet, HashMap, Hashtable, TreeMap, Iterator, Comparator

UNIT-V:

Introduction to Spring Framework Overview of the Spring ecosystem, concepts of Inversion of Control

(IoC) and Dependency Injection (DI), Spring Boot basics for rapid application development, and building a simple REST API with Spring Boot.

Data Access with Java Introduction to JDBC, an overview of JPA (Java Persistence API), using Hibernate with Spring Data JPA, and creating a simple CRUD application as an example.

Teaching Methodologies:

Power Point Presentations

Tutorial Sheets

Assignments

TEXT BOOKS:

1. Java: The Complete Reference, 10th edition, Herbert Schildt, McGrawHill.
2. Java Fundamentals: A Comprehensive Introduction, Herbert Schildt and Dale Skrien, TMH.
3. Java for Programming, P.J. Dietel Pearson Education.

REFERENCE BOOKS:

1. Object Oriented Programming through Java, P. Radha Krishna, Universities Press.
2. Thinking in Java, Bruce Eckel, Pearson Education
3. Programming in Java, S. Malhotra and S. Choudhary, Oxford University Press

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
INTRODUCTION TO DBMS
(OPEN ELECTIVE)

Course Code: GR24A3141

L/T/P/C: 3/0/0/3

Course Outcomes: On completion of the course, the student will be able to

1. Demonstrate the concepts of data mining, its applications
2. Apply data preprocessing techniques such as cleaning, integration, transformation, and reduction.
3. Implement clustering algorithms and evaluate their performance using similarity measures
4. Analyze association rules using Apriori and other frequent pattern mining techniques.
5. Examine outlier detection methods and justify their applications in real-world scenarios.

UNIT-I:

Introduction to Database And System Architecture: Database Systems and their Applications, Database Vs File System, View of Data, Data Models, Database Languages- DDL and DML, Transaction Management, Database users and Administrators, Database System Structure.

UNIT-II:

Introduction to Database Design: ER Diagrams, Entities, Attributes and Entity sets, Relationships and Relationship set, Extended ER Features, Conceptual Design with the ER Model, Logical database Design. Relational Model: Introduction to Relational Model, Basic Structure, Database Schema, Keys, Relational Algebra

UNIT-III:

SQL Queries and Constraints: SQL Data Definition, Types of SQL Commands, Form of Basic SQL Query, SQL Operators, Set Operators, Nested Queries, Aggregate Operators, NULL values, Integrity Constraints Over Relations, Joins, Introduction to Views, Destroying Altering Tables and Views, Cursors, Triggers.

UNIT-IV:

Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies, Properties of Decomposition, Reasoning about FD, Normal Forms,

UNIT-V:

Transaction Management: Transaction Concept, Transaction State, Concurrent Executions, Serializability, Testing for Serializability.

Concurrency Control: Lock based Protocols, Timestamp based protocols,

Recovery System: Recovery and Atomicity, Log based recovery, Shadow Paging, Recovery with concurrent Transactions.

Teaching Methodologies:

Power Point Presentations

Tutorial Sheets

Assignments

TEXT BOOKS:

1. "Data base Management Systems", Raghurama Krishnan, Johannes Gehrke, TATA McGraw Hill 3rd Edition
2. "Data base System Concepts", Silberschatz, Korth, McGraw hill, V Edition.

3. "Introduction to Database Systems", C.J.Date Pearson Education.

REFERENCE BOOKS:

1. "Database Management Systems", P. Radha Krishna HI-TECH Publications 2005.
2. "Database Management System", Elmasri Navate, Pearson Education.
3. "Database Management System", Mathew Leon, Leo

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
INTRODUCTION TO DATA MINING
(OPEN ELECTIVE)

Course Code: GR24A4124

L/T/P/C: 3/0/0/3

Prerequisites: Students are expected to have knowledge of transactional and relational databases, probability, and statistics.

Course Outcomes: On completion of the course, the student will be able to

1. Demonstrate the concepts of data mining, its applications
2. Apply data preprocessing techniques such as cleaning, integration, transformation, and reduction.
3. Implement clustering algorithms and evaluate their performance using similarity measures
4. Analyze association rules using Apriori and other frequent pattern mining techniques.
5. Examine outlier detection methods and justify their applications in real-world scenarios.

UNIT-I:

Introduction: Why Data mining, What is Data Mining, What Kinds of Data Can Be Mined, What Kinds of Patterns Can Be Mined, Which Technologies are used, Data Mining Task Primitives, Integration of a Data Mining System with a Database or a Data Warehouse System, Major issues in Data Mining.

UNIT-II:

Data Preprocessing: Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction.

UNIT-III:

Association Rule Mining: Introduction to association rule mining. Apriori algorithm and other frequent pattern mining techniques. Measuring the strength of association rules.

UNIT-IV:

Classification: Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Back propagation, k-Nearest-Neighbor Classifiers.

UNIT-V:

Clustering: Introduction to clustering and similarity measures.

Clustering algorithms: k-means, hierarchical clustering, density-based clustering.

Evaluating clustering results: silhouette score, Davies-Bouldin index.

Teaching Methodologies:

Power Point Presentations

Tutorial Sheets

Assignments

TEXT BOOKS:

1. Data Mining Concepts and Techniques - Jiawei Han & Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, Third Edition, 2012.
2. Introduction to Data Mining Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Pearson Education.

REFERENCE BOOKS:

1. Data Mining Techniques – Arun K. Pujari, Second Edition, Universities Press.

2. Data Warehousing in the Real World, Sam Aanhory and Dennis Murray, Pearson Edn Asian

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
INTRODUCTION TO OPERATING SYSTEMS
(OPEN ELECTIVE)

Course Code: GR24A3143

L/T/P/C: 3/0/0/3

Prerequisite: Students should have prior knowledge of:

- Basics of Programming, and
- Fundamentals of Data Structures and Algorithms, such as stacks, queues, and linked lists.

Course Outcomes: After completing this course, students will be able to:

1. Explain the objectives, structure, and functions of an operating system, including process, memory, storage, and security management, and demonstrate how OS services interact with users and hardware.
2. Apply process management concepts such as process states, scheduling algorithms, and interprocess communication; design and solve synchronization problems using semaphores, monitors, and classical solutions.
3. Analyze memory management strategies such as paging, segmentation, and swapping, and evaluate virtual memory techniques including demand paging, page replacement, and thrashing control.
4. Implement basic file operations and explain file system structure, directory management, allocation methods, and disk scheduling techniques for efficient storage management.
5. Identify, prevent, and recover from deadlocks; apply system protection principles and access control mechanisms to safeguard resources and files in different operating system environments.

UNIT-I: Introduction:

Overview, Objectives, User view, System view, Operating system definition, Computer System Organization, Computer System Architecture, OS Structure, OS Operations, Process Management, Memory Management, Storage Management, Protection and Security.

Operating System services, User and OS Interface, System Calls, Types of System Calls, System Programs, Operating System Design and Implementation, OS Structure.

UNIT-II: Process and CPU Scheduling:

Process concepts: The Process, Process State, Process Control Block, Threads, Process Scheduling-Scheduling Queues, Schedulers, Context Switch, Operations on Processes, System calls-fork(), exec(), wait(), exit(), Interprocess communication.

Process Scheduling: Basic concepts, Scheduling Criteria, Scheduling algorithms, Multiple- Processor Scheduling, Real-Time Scheduling, Thread scheduling. Process Synchronization, Critical Section Problem, Peterson's solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors.

UNIT-III: Memory Management and Virtual Memory:

Memory Management Strategies - Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of Page Table.

Virtual Memory Management - Background, Demand Paging, Page Replacement, Page Replacement Algorithms, Allocation of Frames, Thrashing.

UNIT-IV: Storage Management and File System:

Storage Management - File System, Concept of a File, System calls for File Operations – open (), read (), write (), close (), seek (), unlink (), Access methods - Directory and Disk Structure, File System Mounting, File Sharing, Protection.

File System Structure, File System Implementation, Directory Implementation, Allocation methods, Free-space Management, Efficiency, and Performance. Mass Storage Structure – Overview, Disk Structure, Disk Attachment, Disk Scheduling.

UNIT-V: Deadlocks and Protection:

Deadlocks - System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

Protection – System Protection, Goals of Protection, Principles of Protection, Domain of Protection, Access Matrix, Access Control, Revocation of Access Rights, Capability-based Systems, Language-based Protection.

TEXT BOOKS:

1. William Stallings, Operating Systems: Internals and Design Principles, 9th Edition, PHI, 2019.
2. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles, 7th Edition, Wiley, 2006.

REFERENCE BOOKS:

1. Andrew S. Tanenbaum, Modern Operating Systems, 5th Edition, PHI, 2022.
2. Gary J. Nutt, Operating Systems: A Modern Perspective, 3rd Edition, Addison-Wesley, 2004.
3. R. Elmasri, A.G. Carrick, D. Levine, Operating Systems, First Edition, McGraw Hill, 2009.
4. Charles Crowley, Operating System: A Design-oriented Approach, Irwin Publishing, First Edition, 1996.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
INTERNET OF THINGS
(OPEN ELECTIVE)

Course Code: GR24A3145

L/T/P/C: 3/0/0/3

Prerequisite:

The fundamental knowledge in C programming, Data Structures and Operating Systems

Course Outcomes: On completion of the course, the student will be able to

1. Understand IoT architecture and fundamental networking protocols and models.
2. Develop Arduino-based IoT applications integrating sensors and actuators.
3. Program Raspberry Pi using Python for cloud-connected IoT solutions.
4. Analyse various IoT applications including smart home and industrial systems.
5. Apply cloud and edge computing for IoT data analytics.

UNIT-I:

Introduction to IoT and Sensor Networks: Introduction to Internet of Things (IoT), Characteristics and Applications of IoT, IoT Architecture and Reference Models(IETF, ITU-T), Physical Design of IoT-Devices, Gateways, and Data Centers, Functional Blocks of IoT- Sensing, Actuation, Communication, Enabling Technologies: RFID, Wireless Sensor Networks.

Networking and Communication Protocols: MQTT, CoAP, ZigBee, HTTP Sensor Networks- Types, Topologies, and Protocols, Introduction to IoT Security and Privacy Fundamentals.

UNIT-II:

Machine to Machine (M2M) and Embedded Programming for IoT: Machine-to-Machine Communications Overview, Difference between IoT and M2M, Interoperability in IoT, Standards and Protocols.

Arduino: Introduction to Arduino Programming for IoT, Integration of Sensors and Actuators with Arduino, Hands-on Exercises- Sensor Data Acquisition and Actuator Control, Basic Communication Protocols, Implementation on Arduino-IoT Device Interoperability, Challenges and Solutions.

UNIT-III:

Raspberry Pi with Python Programming for IoT: Introduction to Python Programming , Basics, Overview of Raspberry Pi and its Role in IoT, Interfacing Raspberry Pi with Sensors and Actuators (UART, SPI, I2C).

Data Acquisition and Processing: Data Acquisition and Local Processing, Sending Data to Cloud Platforms, Implementation of IoT Projects Using Raspberry Pi.

Case Studies: Smart Home Automation, Healthcare Monitoring, Environmental Sensing.

UNIT-IV:

IoT Applications: Smart Homes-Smart Home Origin, Technologies, Implementation, Smart Grids- Characteristics, Benefits, Architecture, Components, Smart Cities-Characteristics, Frameworks, Challenges, Industrial IoT-Requirements, Design Considerations, Applications.

UNIT-V:

Cloud and Edge Computing Models with IoT Use Cases: Introduction to Cloud Computing and Cloud Storage Models, Edge and Fog Computing Concepts for IoT, Web Servers and Cloud Platforms for IoT (AWS IoT, Azure IoT, etc.).

IoT Use Cases: Smart Cities, Smart Homes, Connected Vehicles, Smart Grid, Industrial IoT

TEXT BOOKS:

1. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017.
2. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach", 2015.
3. IOT Fundamentals: Networking Technologies, Protocols and Use Cases for IOT, Rowan. Trollope, David Hanes, Patrick Gassetete, Jerome Henry, Pearson Education Limited, 2017.

REFERENCE BOOKS:

1. Terokarvinen, kemo, karvinen and villeyvaltokari, "Make sensors": 1st edition, Maker Media, 2014.
2. Waltenegus Dargie, Christian Poellabauer, Fundamentals of Wireless Sensor Networks: Theory and Practice, 2010.
3. Charles Bell, Beginning Sensor networks with Arduino and Raspberry Pi, Apress, 2013.
4. Fei Hu, Security and Privacy in Internet of Things (IoTs), CRC Press, Taylor & Francis Group, 2020.
5. S. Sahoo, S. Sahoo, S. Mishra, Software-Defined Networking for Future Internet Technology: Concepts and Applications, Routledge, 2022.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
SCRIPTING LANGUAGES
(OPEN ELECTIVE)

Course Code: GR24A4134

L/T/P/C: 3/0/0/3

Prerequisites: Basic knowledge of programming concepts (loops, functions, arrays) and fundamentals of databases.

Course Outcomes: On completion of the course, the student will be able to

1. Understand PHP basics including variables, constants, control structures, arrays, and functions for web application development.
2. Apply MySQL database concepts with PHP to design, query, and manage relational databases securely.
3. Implement advanced PHP features such as authentication, file upload, email handling, and encryption in dynamic websites.
4. Design and develop Perl programs using arrays, hashes, subroutines, and advanced features like file system interaction, modules, and object-oriented constructs.
5. Apply Python programming concepts including functions, built-in modules, exception handling, and OOP paradigms for web and general-purpose scripting.

UNIT-I: PHP Basics:

Basics - Features, Data types, Variables, Constants, Expressions, String interpolation, Control structures, Embedding PHP Code in Web pages.

Functions: Creating a Function, Function Libraries, Arrays, Strings and Regular Expressions.

UNIT-II: MySQL Basics:

Introduction: Database Concepts, Overview of MySQL database, Installation. Connection establishment and Accessing MySQL Server, Querying the database. Data Definition Language. Functions and Logical operators, Access Privilege System.

UNIT-III: Advanced PHP Programming:

PHP and Web Forms, Files, PHP Authentication and Methodologies - File-based, Database-based, IP-based. Uploading Files with PHP, Sending Email, PHP Encryption Functions, Mcrypt package.

UNIT-IV: PERL:

Names and Values, Variables, Scalar Expressions, Control Structures, Arrays, List, Hashes, Strings, Pattern and Regular Expressions, Subroutines.

Advanced PERL: Finer points of Looping, Pack and unpack, File system, Data structures, Packages, Modules, Objects, Interfacing to the Operating System.

UNIT-V: Python:

Introduction, Syntax and Indentation, Statements, Functions, Built-in-Functions, Basics of Object-Oriented Paradigm, Modules and Packages, Exception Handling.

TEXT BOOKS:

1. David Barron, The World of Scripting Languages, Wiley India Pvt. Ltd., 1st Edition, 2003.
2. Jason Gilmore, Beginning PHP and MySQL, From Novice to Professional, Apress (Dreamtech India), 3rd Edition, 2008.
3. Steve Holden and David Beazley, Python Web Programming, New Riders Publications, 1st Edition, 2001.

REFERENCE BOOKS:

1. James Lee and Brent Ware, Open Source Web Development with LAMP: Using Linux, Apache, MySQL, Perl, and PHP, Addison-Wesley (Pearson Education), 1st Edition, 2003.
2. Julie Meloni and Matt Telles, PHP 6 Fast & Easy Web Development, Cengage Learning, 1st Edition, 2008.
3. Ivan Bayross and Sharanam Shah, PHP 5.1, The X Team, SPD Publications, 1st Edition, 2006.