IV YEAR
I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
POWER SEMICONDUCTOR DRIVES

Course Code: GR22A4014 **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 electrical drives.
3. Examine the performance characteristics of converter fed and chopper fed DC motor drives.
4. Illustrate speed control techniques of an induction motor drive for real time applications.
5. Compare Separate control and self-control of synchronous motors drive.

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
FOUR QUADRANT OPERATION OF DC DRIVES
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 only).

UNIT III
CONTROL OF DC MOTORS BY CHOPPERS
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 only).

UNIT IV
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 only). Static rotor resistance control – slip power recovery – static scherbius drive – static Kramer drive – their performance and speed torque characteristics – advantages -applications – problems.

UNIT V
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 only)

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. 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
WIDE BAND GAP POWER DEVICES
(PROFESSIONAL ELECTIVE -III)

Course Code: GR22A4015 **L/T/P/C: 3/0/0/3**
IV Year I Semester

Course Outcomes:
1. Compare SI based devices with wideband gap power devices.
2. Demonstration of GAN characteristics.
3. Illustrate characteristics of SIC devices.
4. Develop GAN based power electronics circuits.
5. Construct SIC based circuits for different power electronics applications.

UNIT I
INTRODUCTION OF DEVICES
Introduction to basic power devices, Fundamentals of semiconductors, Introduction of Wind band gap devices SiC, GaN, C(Diamond), necessity of wind band Gap, advantage of wide band gap semiconductors, Ideal specific on-resistance for Si and WBG devices, Material properties of Si and WBG semiconductors

UNIT II
GAN DEVICES
Fabrication of GaN Devices, Characterization, and modelling GaN devices, Switching Characteristics, Advantages of GaN over si power semiconductors, Driver design considerations for high power applications, Design for breakdown voltage – various edge terminations

UNIT III
SIC DEVICES
Fabrication of SiC Devices, Characterization and modelling SiC devices, Switching Characteristics, Advantages of SiC over silicon power semiconductors, Si and SiC vertical power and trench MOSFETs, Si and SiC Schottky diodes, Si and SiC PiN diodes, Driver design considerations for High frequency and High voltage applications.

UNIT IV
GAN APPLICATIONS
Consumer applications, Industrial applications, energy converters, Electric Vehicles, white goods, and battery chargers.

UNIT V
SIC APPLICATIONS
High efficiency inverters for solar and wind power, power converters for electric and hybrid vehicles, power inverters for Industrial equipment's, high voltage switches for X-ray generators.

Textbooks
1.Mohan, Undeland and Robbins, "Power Electronics: Converters, Applications and Design", John's Wiley and Sons.
2. B Jayant Balija, Fundamentals Power Electronic Devices, Springer.

References
1. B Jayant Balija, SIC Devices, world Scientific Publishing, 2005.

2. Fei (Fred) Wang, Zheyu Zhang, and Edward A. Jones, Characterization of Wide Bandgap Power Semiconductor Devices, IET ENERGY ENGINEERING.
3. B. W. Williams, Power Electronics: Devices, Drivers, Applications, and Passive Components, TMH.

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

Course Code: GR22A4016 **L/T/P/C: 3/0/0/3**
IV Year I Semester

Course Outcomes:
1. Explain the basic physics related to various breakdown processes in solid, liquid and gaseous insulating materials.
2. Categorize the different methods of breakdown mechanisms that occur on application of high voltages.
3. Interpret various methods for generating high voltages and currents.
4. Identify the procedures for the measurement of high D.C., A.C. & Impulse voltages and currents.
5. Analyze various tests to be conducted on HV equipment.

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
DIGITAL CONTROL SYSTEMS
(PROFESSIONAL ELECTIVE -III)

Course Code: GR22A4017 **L/T/P/C: 3/0/0/3**
IV Year I Semester

Course Outcomes:
1. Develop the mathematical model of LTI systems.
2. Interpret the stability of open loop and closed loop discrete-time systems.
3. Analyze the controllability and observability of discrete time system.
4. Construct digital controllers for time invariant systems.
5. Model state feedback and output feedback controllers.

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, reach-ability, 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 Sate 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
INDUSTRIAL AUTOMATION
(PROFESSIONAL ELECTIVE -III)

Course Code:GR22A4018 **L/T/P/C: 3/0/0/3**
IV Year I Semester

Course Outcomes:
1. Explain the importance of Automation and classification of industries.
2. Make use of Architecture, I/O Modules, and programming structure of PLC for industrial automation.
3. Construct 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.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
POWER QUALITY AND FACTS
(PROFESSIONAL ELECTIVE -IV)

Course Code: GR22A4019 **L/T/P/C: 3/0/0/3**
IV Year I Semester

Course Outcomes:
1. Interpret the basic types of FACTS controllers.
2.Classify the FACTS devices for power-flow control and working principles of Shunt compensators.
3. Summarize the working principles of various Series compensators and their characteristics.
4. Identify the various power quality problems in distribution systems.
5. Categorize the working principles of DVR and DSTATCOM, to improve power quality.

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 Systems 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
ELECTRICAL ENERGY AUDIT
(PROFESSIONAL ELECTIVE -IV)

Course Code: GR22A4020 **L/T/P/C: 3/0/0/3**
IV Year I Semester

Course Outcomes:
1. Interpret the current energy scenario and energy need of growing economy.
2. Identify the Energy and its various forms and Electricity tariffs.
3. Analyze types of energy audit, energy costs, bench marking, energy performance.
4. Illustrate Electricity billing, electrical load management and maximum demand control.
5. Interpret various types of air compressors, compressor efficiency and Compressed air system components.

UNIT I
ENERGY SCENARIO
Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change.

UNIT II
BASICS OF ENERGY AND ITS VARIOUS FORMS
Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.

UNIT III
ENERGY MANAGEMENT & AUDIT
Definition: energy audit, need, types of energy audit. Energy management (audit) approach understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments.

UNIT IV
ENERGY EFFICIENCY IN ELECTRICAL SYSTEMS
Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution transformer losses.

UNIT V
ENERGY EFFICIENCY IN INDUSTRIAL SYSTEMS
Compressed Air System: Types of air compressors, compressor efficiency, efficient compressor operation, Compressed air system components, capacity assessment, leakage test. Fans and blowers: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Pumps and Pumping System:
Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities, Cooling Towers: Types and performance evaluation, efficient system operation, flow control strategies and energy saving opportunities, assessment of cooling towers.

Textbooks

1. S. C. Tripathy, "Utilization of Electrical Energy and Conservation", McGraw Hill, 1991.
2. W.R. Murphy & G. Mckay Butter worth "Energy management", Elsevier publications 2012.

References

1. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects (available online).
2. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-3, Electrical Utilities (available online).
3. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-4, Energy Performance Assessment for Equipment and Utility Systems (available online).

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

Course Code: GR22A4021 **L/T/P/C: 3/0/0/3**
IV Year I Semester

Course Outcomes:
1. Summarize Various Special Electrical Machines.
2. Explain Permanent magnet brush less DC Motors.
3. Identify the control techniques used in PMSM.
4. Analyze the performance of Synchronous Reluctance Motor for different applications.
5. Interpret the different types of 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 DC 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”,CRCPress, NewYork, 2001.

2. P.P.Aearnley, “Stepping Motors–A Guide to Motor Theory and Practice”, Peter Perengrinus London, 1982.
3. T.Kenjoand, S.Nagamori, “Permanent Magnet and Brushless DC Motors”, Clarendon Press, London, 1988.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
VLSI DESIGN
(PROFESSIONAL ELECTIVE -IV)

Course Code: GR22A3108 **L/T/P/C: 3/0/0/3**
IV Year I Semester

Course Outcomes:

1. Visualize the fabrication process of IC technology.
2. Analyze and design CMOS subsystems.
3. Draw stick diagrams and layouts for NMOS and CMOS circuits using design rules.
4. Implement the VLSI design using programmable logic devices.
5. Understand various testing schemes of ICs.

UNIT I
INTRODUCTION

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 BiCMOS Circuits: I_{ds}- V_{ds} relationships, MOS transistor threshold Voltage V_t, g_m, g_{ds}, Figure of merit ω_o; Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter-analysis and design, BiCMOS Inverters, Power Dissipation

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, Dynamic CMOS Logic and Domino CMOS Logic

UNIT IV
DATA PATH SUBSYSTEMS

Data path Subsystems, Array Subsystems: Subsystem Design, Shifters, Adders- Ripple Carry, Carry Look ahead Adder, Carry Select Adder, Arithmetic Logic Unit(ALU), Multipliers –Array Type, Booth, Wallace tree, Parity generators, Comparators, Zero/One Detectors, SRAM, DRAM, ROM

UNIT V
SEMI CUSTOM INTEGRATED CIRCUIT DESIGN, IC TESTING

PLAs, Programmable Array Logic, FPGAs, CPLDs, Standard cells design approach, Need for Testing, Test Principles, Design Strategies for Test, Chip Level Test Techniques, System-Level Test Techniques.

Textbooks

1. Kamran Eshraghian, Douglas A.Pucknell, Sholeh Eshraghian, “Essentials of VLSI circuits and systems” –PHI,2011.

2. Neil H.E Weste, David Harris, “CMOS VLSI Design–A circuits and systems perspective”, Fourth Edition, Addison Wesley, 2011.
3. K. Lal Kishore and V. S. V. Prabhakar, “VLSI Design”, 1st Edition, I.K. International, 2009.

References

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
BASICS OF DIGITAL SIGNAL PROCESSING LAB

Course Code: GR22A4023 **L/T/P/C: 0/0/4/2**
IV Year I Semester

Course Outcomes:
1. Outline importance of functions in programming DSP board.
2. Summarize the types of GPIOs of DSP board.
3. Interpret the output signal obtained from ADC of DSP board.
4. Develop the program to function as input and output of DSP board.
5. Examine the PWM pulses from DSP board.

LIST OF EXPERIMENTS

Task-1: Watchdog with CPU Timer interrupts.

Task-2: Implementing Loop instructions.

Task-3: Configuring GPIO port pins of DSP board.

Task-4: Toggling onboard LEDs of DSP board.

Task-5: Acquisition of signal from ADC.

Task-6: Interfacing an external LED using DSP board.

Task-7: Generation of PWM pulses for converter operation.

Task-8: Generation of enhanced PWM pulses with a dead band.

Task-9: Programming in FLASH.

Task-10: Speed control of DC Motor using DSP board.

Textbooks
1. A.V. Oppenheim and R. W. Schafer, “Discrete Time Signal Processing”, Prentice Hall, 1989.
2. J. G. Proakis and D.G. Manolakis, “Digital Signal Processing: Principles, Algorithms and Applications”, Prentice Hall, 1997.

References
1. J. R. Johnson, “Introduction to Digital Signal Processing”, Prentice Hall, 1992.
2. D. J. DeFatta, J. G. Lucas andW. S. Hodgkiss, “Digital Signal Processing”, John Wiley & Sons, 1988.
3. L. R. Rabiner and B. Gold, “Theory and Application of Digital Signal Processing”, Prentice Hall, 1992.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
POWER SEMICONDUCTOR DRIVES LAB

Course Code: GR22A4024 **L/T/P/C: 0/0/4/2**
IV Year I Semester

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

Task-1: Firing angle control of thyristor-based DC drive connected to DC motor.

Task-2: Closed loop speed control of DC motor using PI, PID, PD controllers.

Task-3: Response of DC motor for Step, Ramp and Parabolic input signals.

Task-4: Speed control of DC motor using armature voltage control with PI, PID controllers.

Task-5: Open loop V/F control of AC motor.

Task-6: Closed loop speed control of AC motor with step, ramp, parabolic inputs using PI, PID controllers.

Task-7: Closed loop speed control of AC motor coupled with DC generator using PI, PID controllers.

Task-8: Speed Control of SRM (Switched Reluctance Motor) in Forward Motoring and Reverse Motoring Mode.

Task-9: Speed Control of PMBLDC Motor in Forward Motoring, Reverse Motoring and Forward Breaking Mode.

Task-10: Speed Control of PMSM in Forward Motoring Mode.

Task-11: Closed loop control of Semi Converter fed separately Excited DC motor.

Task-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 ANDTECHNOLOGY
PROJECT WORK - PHASE I

Course Code:GR22A4082 **L/T/P/C: 0/0/12/6**
IV Year I Semester

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
POWER SYSTEM MONITORING AND CONTROL

Course Code: GR22A4096 **L/T/P/C: 2/1/0/3**
IV Year II Semester

Course Outcomes:
1. Analyze the optimal operation of generators and its characteristics.
2. Identify various methods to control the voltage, frequency, and power flow.
3. Make use of system data for power system control and security.
4. Classify electricity markets and their pricing principles.
5. Interpret the concepts of Energy management.

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 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.

References

1. B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, “Electric Power Systems”, Wiley, 2012.
2. P.Kundur, “Power System Stability and Control” McGraw Hill Education, 1994
3. O. I. Elgerd, “Electric Energy Systems Theory”, McGraw Hill Education, 1995.

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

Course Code: GR22A4097 **L/T/P/C: 3/0/0/3**
IV Year II Semester

Course Outcomes:
1. Explain vector control strategies for Induction motor drives.
2. Develop 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 PMBDCM 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. Taliyat 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
BIG DATA APPLICATIONS IN POWER SYSTEMS
(PROFESSIONAL ELECTIVE -V)

Course Code:GR22A4098 **L T/P/C: 3/0/0/3**
IV Year II Semester

Course Outcomes:
1.Summarize the challenges of creating a highly scalable, easily managed, secure foundation for data management.
2.Make use of analytical models specific to the utility enterprise.
3.Analyze the available and desired data sources as well as the business value of that data.
4.Identify the difficulties in adapting to the needs of high-volume and varied data types.
5.Select value from utility data and visualize the utility.

UNIT I
BUILDING THE FOUNDATION FOR DATA ANALYTICS
What Are Data Analytics? Building the Analytical Architecture, The Art of Data Management, Managing Big Data Is a Big Problem, The Truth Won't Set You Free, One Size Doesn't Fit All, Solving the "Situation-Specific" Dilemma, The Build-Versus-Buy War Rages On, When the Cloud Makes Sense, Change Is Danger and Opportunity.

UNIT II
APPLYING ANALYTICAL MODELS IN THE UTILITY
Understanding Analytical, What Exactly Are Models? Using Descriptive Models for Analytics, Using Diagnostic Models for Analytics, How Diagnostic Tools Help Utilities, Predictive, Prescriptive Analytics, An Optimization Model for the Utility, Toward Situational Intelligence
Moving Beyond Business Intelligence, Energy Forecasting, Asset Management, Demand Response and Energy Analytics, Dynamic-Pricing Analytics, Revenue-Protection Analytics.

UNIT III
SOURCING DATA
Smart Meters, Sensors, Control Devices, Intelligent Electronic Devices, Distributed Energy Resources, Consumer Devices, Historical Data, Third-Party Data, Working with a Variety of Data Sources, Data Fusion.

UNIT IV
BIG DATA INTEGRATION, FRAMEWORKS AND DATABASES
Storage Modalities, Hyperscale, Network-Attached Storage, Object Storage, Data Integration, The Costs of Low-Risk Approaches, Let the Data Flow, Hadoop, MapReduce, Hadoop Distributed File System, How Does This Help Utilities? Other Big Data Databases, NoSQL 166, In-Memory or Main Memory Databases, Object-Oriented Database, Management Systems, Time Series Database Servers, Spatial and GIS Databases, The Curse of Abundance.

UNIT V
EXTRACTING VALUE & ENVISIONING THE UTILITY
Mining Data for Information and Knowledge, The Process of Data Extraction, Hadoop: A Single-Purpose, Batch-Data Platform? Stream Processing, Complex Event Processing, Process Historians Big Data Comprehension, Why Humans Need Visualization? The Role of Human Perception: Preattentive Processing, The Utility Visualized, Advancing Business Intelligence, High-Impact Operations, Improving Customer Value, Making Sense of It All.

Textbooks

1.Carol L. Stimmel, "Big Data Analytics Strategies for the Smart Grid" , CRC Press, Taylor & Francis Group.
2. Reza Arghandeh &Yuxun Zhou,"Big Data Application in Power Systems", Elsevier publications.

References

1. Ali Tajer, Samir M. Perlaza, H. Vincent Poor,"Advanced Data Analytics for Power Systems", Cambridge University Press.
2. Arturo Román Messina, "Data Fusion and Data Mining for Power System Monitoring", CRC Press, Taylor & Francis Group.
3. Ahmed F. Zobaa and Trevor J. Bihl, "Big Data Analytics in Future Power Systems", CRC Press, Taylor & Francis Group.

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

Course Code:GR22A4099 **L/T/P/C: 3/0/0/3**
IV Year II Semester

Course Outcomes:
1. Develop state feedback model of the system.
2. Distinguish full order and reduced order state observers.
3. Illustrate robust controller for tracking and disturbance rejection.
4. Explain continuous and discrete time linear state regulator.
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.
3. M. Vidyasagar, Nonlinear Systems Analysis, Prentice - Hall International editions,1993.

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

Course Code: GR22A4100 **L/T/P/C: 3/0/0/3**
IV Year II Semester

Course Outcomes:
1. Summarize the terminologies of IoT and I-IoT.
2. Demonstrate the concept of Industrial process and devices used in IoT.
3. Identify how to generate data flow in industry and its protocols.
4. Analyze the strategy, implementation, and the developing architecture in I-IoT.
5. Examine the Solutions for Cloud I-IoT applications.

UNIT I
INTRODUCTION TO IOT
IoT background, IoT key technologies, IoT use cases, what is the I-IoT, use cases of the I-IoT, IoT and I-IoT – similarities and differences. IoT analytics and AI.

UNIT II
UNDERSTANDING THE INDUSTRIAL PROCESS AND DEVICES
Technical requirements, The industrial process, Automation in the industrial process; Control and measurement systems; Types of industrial processes; Continuous processes, Batch processes, Semi-continuous processes, Discrete processes. Introduction of CIM pyramid.

UNIT III
THE I-IOT DATA FLOW
The Industrial IoT data flow in a factory; The edge device; The Industrial IoT data flow in the cloud; Measurements and the actuator chain; Controllers; Designing Industrial Internet Systems.
Industrial Protocols: I-IoT WAN Technologies and Protocols.

UNIT IV
I-IOT STRATEGY AND IMPLEMENTATION
I-IoT Strategy Planning: I-IoT Implementation Methodology, Challenges in Adopting I-IoT, Managing Data Factors Need to Be Invested Primarily to Implement I-IoT.
Developing Industrial IoT and Architecture: Introduction to the I-IoT platform and architectures; Understanding the time-series technologies; Data-processing and the analytics platform; Advanced analytics; Big data analytics.

UNIT V
IMPLEMENTING A CLOUD INDUSTRIAL IOT SOLUTION
A brief overview on-I-IoT analytics; Implementing a Custom Industrial IoT Platform-Mosquitto as MQTT connector-Working with an MQTT client.

Textbooks
1. Giacomo Veneri, Antonio Capasso, “Hands-On Industrial Internet of Things: Create a powerful Industrial IoT”, Packt Publishing Ltd.
2. Internet of Things for Architects: by Perry LeaPackt Publishing Ltd.

References
1. Alasdair Gilchrist, “Industry 4.0 The Industrial Internet of Things”, Apress.

2. Uthayan Elangovan, “Smart Automation to Smart Manufacturing Industrial Internet of Things”, Perry LeaPackt Publishing Ltd
3. Iresh A. Dhotre, “Industrial Internet of Things”, Technical publications

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PRINTED CIRCUIT BOARD DESIGN
(PROFESSIONAL ELECTIVE -VI)

Course Code: GR22A4101 **L/T/P/C: 3/0/0/3**
IV Year II Semester

Course Outcomes:
1. Outline about the components process of PCB design flow.
2. Apply advanced techniques, skills, and modern tools for designing and fabrication of PCBs.
3. Build design considerations for layout planning of PCB.
4. Interpret various types of applications of digital circuit PCBs.
5. Analyze a schematic circuit and develop their own PCB circuit.

UNIT I
INTRODUCTION TO PRINTED CIRCUIT BOARD DESIGNING CONCEPTS
Introduction & Brief History: What is Printed Circuit Board (PCB), Difference between PWB and PCB, Types of PCBs: Single Sided (Single Layer), Multi-Layer (Double Layer), PCB Materials, Study of Packages of Electronic Components. Study of SMD Components. Process of PCB design and product development flow.

UNIT II
INTRODUCTION TO DEVELOPMENT TOOLS
Proprietary tools like Eagle, Ultiboard, Orcad and Opensource tools like KiCad, Design Issues: Transmission line, Cross talk, and Thermal management.

UNIT III
LAYOUT PLANNING AND DESIGN -I
Reading Drawing and diagrams, General PCB design considerations, Mechanical design considerations, Electrical design considerations, fabrication, and assembly considerations, Environmental factors.

UNIT IV
LAYOUT PLANNING AND DESIGN -II
Layout design, checklist, Design rules for Digital circuit PCBs, Analog circuit PCBs, high frequency and fast pulse applications, Power electronic applications, Microwave applications.

UNIT V
INTRODUCTION PRINTED CIRCUIT BOARD PRODUCTION TECHNIQUES
Photo printing, film master production, reprographic camera, basic process for double sided PCBs photo resists, Screen printing process, plating, relative performance and quality control, etching machines, Solders alloys, fluxes, soldering techniques, Mechanical operations.

Textbooks
1. R. S. Khandpur, “Printed circuit board design, fabrication assembly and testing”, Tata McGraw Hill 2006
2. Walter C. Bosshar, “Printed circuit Board: Design and technology”, Tata Mcgraw-hill 1983.

References
1. Clyde F. Coombs, Jr, Happy T. Holden, “Printed Circuits Handbook”, Sixth Edition, McGraw-Hill Education Year: 2016.
2. Robert torzwell, “Flexible Printed circuit board Design and manufacturing”, McGraw-Hill Education, 2018

3. Charles A. Harper" High Performance Printed Circuit Boards",1st Edition, ISBN-13:978-0070267138, McGraw-Hill Professional Engineering Publication.

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

Course Code: GR22A4102 **L/T/P/C: 3/0/0/3**
IV Year II Semester

Course Outcomes:
1. Explain the architecture of smart grid.
2. Identify suitable communications and measurement technology for smart grid.
3. Make use of various performance analysis tools for smart grid design.
4. Examine the stability of smart grid.
5. Utilize renewable energy resources and storage facilities for the sustenance of smart grid.

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. Krzyszt of 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
EMBEDDED SYSTEMS DESIGN
(PROFESSIONAL ELECTIVE – VI)

Course Code: GR22A3112 **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. Analyze to understand what a microcomputer is, the core of the embedded system.
5. Remember the definitions of ASICs, PLDs, memory, memory interface. Analyze to understand different concepts of a RTOS, sensors, memory interface, communication interface.

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.

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

References

1. Frank Vahid, Tony Givargis, “Embedded System Design” - John Wiley.
2. Lyla, “Embedded Systems” –Pearson, 2013.
3. David E. Simon, “An Embedded Software Primer” - Pearson Education.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
BIG DATA ANALYTICS
(PROFESSIONAL ELECTIVE – VI)

Course Code: GR22A3143 **L/T/P/C: 3/0/0/3**
IV Year II Semester

Pre - Requisites:
Students should have knowledge of one Programming Language (Java/ Python), thorough practice of SQL, and exposure to Linux/ UNIX Environment.

Course Outcomes:
1. Interpret the need for HDFS in processing big data.
2. Examine the purpose of data ingestion tools in Big Data Systems.
3. Implement distributed processing of big data using Map Reduce or Pig.
4. Compose Queries with Hive or HBase to analyze the data.
5. Inspect the components of Apache Spark to perform in memory processing.

UNIT - I
Introduction to Big Data and Hadoop
Types of Digital Data, Definition of Big Data, V's of Big Data, Advantages of Big Data, Characteristics of Hadoop, RDBMS Vs Hadoop, Ecosystem components of Hadoop, Big Data Analytics Pipeline, Hadoop Distributions, Need for HDFS, Characteristics of HDFS, HDFS Components, HDFS High Availability Architecture, Block Replication Method, Rack Awareness, HDFS Commands.

UNIT - II
Data Ingestion into Big Data Systems and ETL
Big Data Ingestion Tools, Apache Sqoop, Benefits of Apache Sqoop, Sqoop Connectors, Importing and Exporting to and from Hadoop using Sqoop, Limitations of Sqoop, Apache Flume Model, Data Sources for FLUME, Components of FLUME Architecture.

UNIT - III
Distributed Processing - Map Reduce and PIG
Need for YARN, Elements of YARN Architecture, Characteristics of Map Reduce, Phases of Map Reduce with an Example, Anatomy of MR Job Run with YARN, Handling Failures, Task Execution, Map Reduce Input and Output Formats, Shuffle and Sort, Joins in Map Reduce, Introduction to PIG, Components of PIG, Data Types in PIG – Simple and Complex, PIG Execution Modes, PIG Interactive Modes, Comparison of PIG with databases, Data Processing Operators.

UNIT - IV
Apache Hive and NOSQL Database - HBase
Features of HIVE, HIVE Architecture, HIVE Metastore, Datatypes in HIVE, HIVEQL, Tables, File Format Types–Text, Sequence, AVRO, Parquet, Querying Data, Types of NOSQL Database, Characteristics of HBASE, Architecture, HBase Vs RDBMS, HBASE Shell Commands.

UNIT - V
Apache Spark
Functional Programming, Components of Apache Spark, Applications of in - memory processing, Hadoop Ecosystem Vs. Spark, Spark Architecture, RDDs in Spark, SparkSQL, Architecture of SparkSQL, DataFrames, Data Analytics, Types of Analytics.

Textbooks

1. Tom White “Hadoop: The Definitive Guide”4thedition, O’reily Media, 2012.
2. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

References

1. Michael Berthold, David J.Hand, "Intelligent DataAnalysis”,Springer,2007.
2. Jay Liebowitz, “Big Data and Business Analytics” Auerbach Publications, CRCpress(2013)
3. Tom Plunkett, Mark Hornick, “Using R to Unlock the Value of Big Data: Big DataAnalyticswithOracleREnterpriseandOracleRConnectorforHadoop”, McGraw- Hill/Osborne Media(2013),Oracle press.
4. Anand Rajaramanand Jefrey David Ulman,“Mining of Massive Datasets”, Cambridge UniversityPress,2012.
5. Bill Franks, “Taming the Big Data Tidal Wave:Finding Opportunities in Huge Data Streams with Advanced Analytics”,JohnWiley&sons,2012.
6. GlenJ.Myat,“Making Sense of Data”,John Wiley&Sons,2007
7. PeteWarden,“BigDataGlossary”,O’Reily,2011.
8. Michael Mineli, Michele Chambers, Ambiga Dhiraj,"Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today'sBusinesses",WileyPublications,2013.
9. Arvind Sathi,“BigDataAnalytics:DisruptiveTechnologiesforChangingtheGame”,MCPress,2012 Paul Zikopoulos ,Dirk DeRoos , Krishnan Parasuraman , Thomas Deutsch ,
10. James Giles, David Corigan,"Harness the Power of Big Data The IBM Big Data Platform", Tata McGraw Hill Publications,2012.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PROJECT WORK - PHASE II

Course Code: GR22A4145 **L/T/P/C: 0/0/12/6**
IV Year II Semester

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
SOFT SKILLS AND INTERPERSONAL SKILLS
(OPEN ELECTIVE)

Course Code: GR22A3145 **L/T/P/C:3/0/0/3**

Course Outcomes:
- Develop soft skills communication skills, leadership skills etc.
- Implement goal setting techniques to build a promising career and evaluate the power of confidence building and self-esteem with examples.
- Design formal report and proposals with appropriate formal expressions.
- Create healthy workplace environment by treating others with respect and dignity.
- Describe team dynamics and exchange ideas about the elements of positive teamwork.

Unit 1: Soft Skills
- Introduction to soft skills, Definition of Soft skills, Importance of soft skills
- Communication skills, Usage of English in Business/Corporate scenario
- Nonverbal communication - Proxemics
- Presentation skills

Unit 2: Team Building & Leadership Qualities
- Qualities of a good leader
- Problem solving and Decision Making
- Strategic management
- Crisis management

Unit 3: Personality Development
- Motivation
- Goal setting
- Self-esteem
- Team skills

Unit 4: Developing Reports and Proposals
- Understanding reports and proposals
- Planning reports and proposals
- Writing beginning, body and ending
- Formats of reports and proposals

Unit 5: Interpersonal Skills
- Understanding professional relationships
- Networking professionally
- Showing basic office courtesies
- Interview skills

Text Books:
1. Soft Skills-Key to success in workplace and life Meenakshi Raman, Raman Upadhyay, CENAGE

Reference Books:
1. Soft skills for Everyone - Jeff Butterfield, CENAGE Learning
2. Soft skills for Interpersonal Communication - S.Balasubramaniam (ORIENT BLACKSWAN)

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

Course Code: GR22A4049 **L/T/P/C: 3/0/0/3**

Course Outcomes:

To acquaint the student with the determinants of intra -individual, inter-personnel and inter-group behaviour in organizational setting.

1. To 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.
2. To 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.
3. To impart and apprise the capable of applying the principles and techniques as professionals for developing human resources in an organization.
4. To 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: Organizational Behaviour- Concept and Emergence of OB Concept; Nature and Theoretical frameworks; Models of Organizational Behaviour, Challenges and Opportunities for Organizational 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 Organizations: Selected cases covering HRD practices in government Organizations, manufacturing and service industries and MNCs.

Text Books:

1. Robbins, Stephen P. and Timothy A. Judge, Organizational 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: GR22A4077 **L/T/P/C: 3/0/0/3**

Course Outcomes:
1. Students identify and analyze statutory, regulatory, constitutional, and organizational laws that affect the information technology professional.
2. Students locate and apply case law and common law to current legal dilemmas in the technology field.
3. Students apply diverse viewpoints to ethical dilemmas in the information technology field and recommend appropriate actions.
4. Students will be able understand cybercrime and ethical practices and the student will be able to know and learn web technologies and related issues.
5. The student will be 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).
5. Sudhir Naib, The Information Technology Act, 2005: A Handbook.
6. S. R. Bhansali, Information Technology Act, 2000
7. University Book House Pvt. Ltd. Jaipur (2003).
8. 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: GR22A4147 **L/T/P/C: 3/0/0/3**

Course Outcomes:
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 1: 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 2: Factors and measure, Meaning of Economic development, National income, Per capital income, Quality of life, Capital Formation – Savings, Investment.

Unit 3: 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 4: Private and Public Sector, Public Sector – role and growth, Achievements of the public sector, Private Sector – Importance Problems, New foreign Trade Policy.

Unit 5: 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
DATA SCIENCE FOR ENGINEERS
(OPEN ELECTIVE)

Course Code: GR22A3049 **L/T/P/C:3/0/0/3**

Course Outcomes:
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 data frames, Recasting and joining of data frames, 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 Half spaces, 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: GR22A3120 **L/T/P/C: 3/0/0/3**

Course Outcomes:
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 Euent 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, November2010: 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: GR22A4054 **L/T/P/C:3/0/0/3**

Course Outcomes:
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 VRSystem.
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 Healthand 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, MorganKaufmann, 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
BASICS OF JAVA PROGRAMMING
(OPEN ELECTIVE)

Course Code: GR22A3072 **L/T/P/C: 3/0/0/3**

Course Outcomes:

1. Apply knowledge on key attributes of Object-Oriented Programming (OOP) and control structures
2. create and manipulate classes and objects, employ various methods and method utilization.
3. Demonstrate expertise in both array-based and string-based structures.
4. understanding of Java's inheritance and interface concepts
5. proficient at organizing Java code using packages and exception handling

UNIT I:
Java Programming Fundamentals: Java Language, Key Attributes of Object-Oriented Programming, Java Development Kit, Simple Program, Create Blocks of Code, Keywords, Identifiers, The Java Class Libraries.
Data Types and Operators: Java's Primitive Types, Literals, Variables, Scope and Lifetime of Variables, Operators- Arithmetic, Relational, Logical, Bitwise, Assignment. Type conversion in Assignments, Using a Cast, Operator Precedence.
Program Control Structures: if, switch, for, enhanced for, while, do-while, break, continue.

UNIT II:
Introduction to Classes, Objects and Methods: Class Fundamentals, Objects creation, Reference Variables and Assignment, Methods, returning a Value, Using Parameters, passing objects to methods, passing arguments, Method Overloading, Constructors, Parameterized Constructors, Overloading Constructors. new Operator, this Keyword, Command-Line Arguments.

UNIT III:
Arrays: Introduction to Arrays, 1D Arrays, Multidimensional Arrays, Irregular Arrays, Using the Length Member. Arrays class of util package.
Strings: String class, constructors, length(), string literals, concatenation, Character extraction, string comparison, searching strings, modifying, data conversion, changing the case, joining, split(). String Buffer class: constructors, length(), capacity(), ensure Capacity(), set Length(), charAt(), setCharAt(), getChars(), append(), insert(), reverse(), delete(), deleteCharAt(), replace().

UNIT IV:
Inheritance: Basics, Inheritance Types, Using Super, Multilevel Hierarchy, Super class References and Subclass Objects, Method Overriding, Abstract Classes, Using final. **Interfaces:** Fundamentals, Creating and Implementing an Interface, Using Interface References, Implementing Multiple Interfaces, Extending Interfaces, Nested Interface.

UNIT V:
Packages: Package Fundamentals, Member Access, Importing Packages, Static import. **Exception Handling:** Exception Hierarchy, Fundamentals, Handling errors, Multiple Catch, Throwing and Rethrowing an Exception, Throwable, using finally, using throws, Creating Exception Subclasses.

Text Books:
1. Herbert Schildt, Dale Skrien, Java Fundamentals A Comprehensive Introduction, 1/e, Tata McGraw Hill, 2017.
2. Herbert Schildt, The Java complete References, 9/e, Tata McGraw Hill,2014.

Reference Books:

1. Y. Daniel Liang , An Introduction to JAVA Programming, 10/e, Tata McGraw Hill.

2. Kathy Sierra, Head First Java, 2/e, Shroff Publishers, 2012.

3. Balagurusamy, Programming with JAVA, 2/e, Tata McGraw Hill, 2014.

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

Course Code: GR22A3141 **L/T/P/C: 3/0/0/3**

Course Outcomes:
1. Identify the role of Database System Applications and the design issues related.
2. Design the logical model for the applications.
3. Construct a Database Schema, manipulate data using a SQL.
4. Apply the Schema Refinement techniques for a database design for optimized access.
5. For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.

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.

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 Systems design, Implementation, and Management", Rob & Coronel 5th Edition.
2. "Database Management Systems", P. Radha Krishna HI-TECH Publications 2005.
3. "Database Management System", Elmasri Navate, Pearson Education.
4. "Database Management System", Mathew Leon, Leo

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

Course Code: GR22A4080 **L/T/P/C:3/0/0/3**

Course Outcomes:

1. Learn the concepts of database technology evolutionary path which has led to the needfor data mining and its applications.
2. Apply pre-processing statistical methods for any given raw data.
3. Apply Apriori and FP growth algorithms for forming strong association rules.
4. Extract knowledge and implementation of data mining techniques
5. Apply the data mining algorithm for solving practical problems.

UNIT I

Introduction: Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, 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.

Introduction to Data Warehouse: Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Data Marts.

UNIT III

Mining Frequent Patterns, Associations: Basic Concepts, Market Basket Analysis, Efficient and Scalable Frequent Item set Mining Methods, Mining various kinds of Association Rules.

UNIT IV

Classification: Issues Regarding Classification, Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification.
Prediction: Issues Regarding Prediction, Regression techniques.
Accuracy and Error measures: Evaluating the accuracy of a Classifier or a Predictor.

UNIT V

Cluster Analysis Introduction: Types of Data in Cluster Analysis, A Categorization of MajorClustering Methods, Partitioning Methods - k-Means and k-Medoids, Hierarchical Methods – Agglomerative, BIRCH.

Textbooks:

1. Data Mining– Concepts and Techniques - Jiawei Han & Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, Second Edition,2006.
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, PearsonEdn Asia.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PROGRAMMING IN PYTHON
(OPEN ELECTIVE)

Course Code: GR22A3077 **L/T/P/C: 3/0/0/3**

Course Outcomes:

1. Demonstrate the concepts of control flow, data structures and Functions in Python
2. Design python programs using functional programming
3. Implement the file handling operations, exception handling mechanism
4. Design python programs using object oriented programming and multithreadedprogramming concepts
5. Develop GUI based applications using Tkinter

UNIT I

Basic features of Python-Interactive execution, comments, types, variables, operators, expressions, Statements-assignment, input, print, Control flow-Conditionals, Loops, break statement, continue statement, pass statement, Functions, definition, call, scope and lifetimeof variables, keyword arguments, default parameter values, variable length arguments, recursive functions.

UNIT II

Sequences-Strings, Lists and Tuples-basic operations and functions, iterating over sequences, Sets and Dictionaries- operations and functions, Functional programming-mapping, filtering and reduction, Lambda functions, List comprehensions. Scope, namespaces and modules, import statement, creating own modules, avoiding namespace collisions when importing modules.

UNIT III

Files-operations-opening, reading, writing, closing, file positions. Exceptions – raising and handling exceptions, try/except statements, finally clause, standard exceptions, custom exceptions. , iterators and generators, Python program examples.

UNIT IV

Object oriented programming- classes, constructors, objects, class variables, class methods, static methods, operator overloading. Inheritance-is-a relationship, composition, polymorphism, overriding, multiple inheritance, abstract classes, multithreaded programming, Python program examples.

UNIT V

GUI Programming with Tkinter, Widgets (Buttons, Canvas, Frame, Label, Menu, Entry, Text, Scrollbar, Combobox, Listbox, Scale), event driven programming-events, callbacks, binding, layout management- geometry managers: pack and grid, creating GUI based applications in Python.

Text Books:

1. Exploring Python, Timothy A. Budd, McGraw Hill Publications.
2. Introduction to Programming using Python, Ys.Daniel Liang, Pearson.
3. Python Programming, Sheetal Taneja and Naveen Kumar, Pearson.

Reference Books:

1. Introduction to Computer Science using Python, Charles Dierbach, Wiley India Edition.
2. Fundamentals of Python, K. A. Lambert, B.L. Juneja, Cengage Learning.

3. Think Python, how to think like a computer scientist, Allen B. Downey, SPD, O'Reilly.
4. Core Python Programming, Wesley J. Chun, second edition, pearson.

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

Course Code: GR22A3147 **L/T/P/C: 3/0/0/3**

Prerequisites
Students are expected to have knowledge on Operating systems, Virtualization and Networking

Course Outcomes:
1. Learn characteristics, applications, components and challenges of Internet of Things (IOT)
2. Create understanding of IOT networking concepts – terminologies, stack components, infrastructure and data protocols
3. Create understanding of the concept of Cloud based IOT technologies, cloud service providers and security aspects
4. Develop skills in understanding and programming the Arduino and Raspberry Pi hardware platforms
5. Make the student understand the requirements, components, challenges and develop various application areas - smart homes, smart grids, smart health care, smart cities and industrial IOT

UNIT I
Introduction to IOT: Characteristics of IOT, Applications of IOT, IOT Categories, IOT Enablers and Connectivity Layers, Sensors, Actuators, IOT Components & Implementation, Challenges for IOT

UNIT II
IOT Networking & Connectivity Technologies: Connectivity terminologies-IOT Node, LAN, WAN, Gateway, IOT protocol Stack vs. Web Stack, IOT Identification and Data Protocols-IPV4, IPV6, HTTP, MQTT, COAP, AMQP, DDS Connectivity Technologies – Zigbee, Bluetooth, LoRa

UNIT III
Cloud for IOT: IOT with Cloud-Challenges, Cloud service providers for IOT-Overview, Cloud service model, Cloud Computing – Security aspects, Case Study, Fog computing, Edge computing

UNIT IV
Hardware Platforms: Programming with Arduino-Features of Arduino, Components of Arduino Board, Arduino IDE, Program Elements, Raspberry Pi – Introduction, Architecture, PIN Configuration, Implementation of IOT with Raspberry Pi

UNIT V
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

Text Books:
1. Internet of Things, Jeeva Jose, Khanna Publishing, 2018
2. Internet of Things, Abhishek S Nagarajan, RMD Sundaram, Shriram K Vasudevan, Wiley, 2019
3. IOT Fundamentals: Networking Technologies, Protocols and Use Cases for IOT, Rowan Trollope, David Hanes, Patrick Gassetete, Jerome Henry,Pearson Education Limted, 2017

Reference Books:
1. The Internet of Things, Michael Miller, Pearson Education Limited, 2015

IoT Applications, Security Threats, and Countermeasures, Padmalaya Nayak, Niranjan Ray, P. Ravichandran, Taylor &Francis,2021
2. Internet of Things: Architecture, Implementation and Security, MayurRamgir, Pearson Education Limited, 2019
3. IOT Fundamentals: Networking Technologies, Protocols and Use Cases for IOT, Rowan Trollope, David Hanes, Patrick Gassetete, Jerome Henry, Pearson Education Limited, 2017

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

Course code: GR22A4085 **L/T/P/C: 3/0/0/3**

Course Outcomes:

1. Analyze a problem, identify and define the computing requirements appropriate to itssolution.
2. Design Web pages with DB.
3. Implement the PHP Authentication Methodologies.
4. Implement PHP Encryption functions and Mcrypt Package
5. Understand the syntax and functions in Perl and Python.

UNIT- I

PHP Basics

PHP Basics- Features, Embedding PHP Code in your Web pages, outputting the data to the browser, Data types, Variables, Constants, expressions, string interpolation, control structures. Function, Creating a Function, Function Libraries, Arrays, strings and Regular Expressions.

UNIT -II

MySQL Basics

Introduction to MYSQL: Database Concepts, General Overview of MySQL database, Installation. Connecting and disconnecting from MySQl Server, Querying the database, Data Definition Language, Functions and Logical operators, Access privilege system.

UNIT -III

Advanced PHP Programming

Advanced PHP Programming: PHP and Web Forms, Files, PHP Authentication and Methodologies -Hard Coded, File Based, Database Based, IP Based, and Uploading Files with PHP, Sending Email using PHP, PHP Encryption Functions, the 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 to Python language, Python-syntax, statements, functions, Built-in-functions and Methods, Modules in Python, Exception Handling.

Text Books:

1. The World of Scripting Languages, David Barron,Wiley India. Beginning PHP and MySQL, 3rd Edition, Jason Gilmore,Apress Publications (Dream tech.).
2. Python Web Programming, Steve Holden and David Beazley ,New Riders Publications.

Reference Books:

1. Open Source Web Development with LAMP using Linux ,Apache,MySQL,Perl and PHP, Lee and B.Ware(Addison Wesley) Pearson Education.
2. Programming Python,M.Lutz,SPD.

3. PHP 6 Fast and Easy Web Development ,Julie Meloni and Matt Telles, Cengage
4. Learning Publications.
5. PHP 5.1,I.Bayross and S.Shah,The X Team,SPD.
6. Core Python Programming,Chun,Pearson Education.
7. Guide to Programming with Python,M.Dawson,Cengage Learning.

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

Course Code: GR22A4134 **L/T/P/C: 3/0/0/3**

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

Course Outcomes:
1. Understand concepts of services and their significance in the economy and society anddistinguish it from goods.
2. Understand the service strategy, design, and development.
3. Comprehend ways to design services and able to understand service guarantee, recovery, andfailures.
4. Forecast the service demand, supply and facilitate various methods to operate and manageservices.
5. Understand the service productivity and how innovation can be approached from servicespoint 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
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 inservice

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 andcompete in a new era. John Wiley & Sons.

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

Course Code: GR22A4135 **L/T/P/C: 3/0/0/3**

Course Outcomes:

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 asDevOps.

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 Calculationand 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

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. Roman Pichler, Agile Product Management with Scrum
2. 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: GR22A4136 **L/T/P/C: 3/0/0/3**

Course Outcomes:

1. The students understand the significance of marketing management concepts, marketingenvironment, consumer behavior elements and strategies related to STP.
2. The student will be able to understand various product management strategies and the importance of branding and 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. Students will 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 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 inNew 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, 5M'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 ofMarketing (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. Relationships, 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 Schindl

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

Course Code: GR22A3056 **L/T/P/C: 3/0/0/3**

Prerequisites:
Knowledge of Python programming, Linear algebra, Statistics, Probability and Calculus

Course Outcomes:
1. Learn Numpy, Pandas for mathematical computation and Data Analysis
2. Analyze the importance of pre-processing techniques for Data Science
3. Learn and analyze various prediction and classification techniques on various datasets
4. Learn and analyze the applications of clustering techniques
5. Analyze Text data and Web scrapping data at morphological and syntactic and semantic levels using NLP techniques

UNIT I
Introduction to Data Science, Components of Data Science, Application of Data Science
NumPy: Array, Matrix and associated operations, Linear algebra and related operations
Pandas: Series, Data Frames, Panels, Reading files, Exploratory data analysis, Data preparation, Indexing, Slicing, Merging and Joining data. Working with MySQL databases
Data Pre-processing Techniques: Data Imputation, Data Encoding, Standardization and Normalization, Dimensionality reduction, Feature Selection methods

UNIT II
Regression Analysis: Introduction to Regression, Simple linear regression, Multi-linear regression, Evaluation metrics for regression
Classification Methods: Introduction to Classification, Naïve Bayes classifier, Decision Tree classifier, Support Vector Machines, Logistic Regression, Ensemble methods, Random Forest, Bagging, Boosting, Evaluation metrics for classification

UNIT III
Clustering Methods: Introduction to Clustering, Similarity distance measures, K-means algorithm, Hierarchical clustering algorithm, DB Scan algorithm, Evaluation metrics for clustering.

UNIT IV
NLP Overview, Tokenization, Stemming, stop words removal, POS tagging, Lemmatization, Feature extraction using SKlearn, Text Classification, Text Clustering.

UNIT V
Learning Best Practices for Model Evaluation:
Pipelining, Hyperparameter Tuning, Debugging algorithms with learning and validation curves

Text Books:
1. Python Machine Learning, Second Edition by Sebastian Raschka Vahid Mirjalili Statistics and Machine Learning in Python Edouard Duchesnay,

Reference Books:

1. Data Science From Scratch: First Principles with Python, Second Edition (Greyscale Indian Edition) Paperback – 5 May 2019 by Joel Grus (Author)
2. Practical Data Science with Python: Learn tools and techniques from hands-on examples to extract insights from data by Nathan George (Author)
3. HANDS ON INTRODUCTION TO DATA SCIENCE Hardcover – 2 April 2020 by Chirag Shah (Author)
4. 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
USER-CENTRIC HUMAN COMPUTER INTERACTION
(OPEN ELECTIVE)

Course Code: GR22A3127 **L/T/P/C: 3/0/0/3**

Course Outcomes:

1. Learn the concepts of interaction design and how it relates to human computer interaction and other fields.
2. Design how technologies can be to change people's attitudes and behavior.
3. Apply the difference between qualitative and quantitative data and analysis.
4. Extract the social Mechanisms that are used by people to communicate and collaborate.
5. Explore the user Experience design and analyze the factors involved in design

UNIT I

Introduction: Introduction to User Centric Computing(UCC) and history, Issues and challenges, Latest research trends, User-Centric Design and Software Engineering.

UNIT II

Engineering User-Centric Systems: Components of SDLC - Contextual Inquiry, - Design Guidelines, Prototyping.

UNIT III

User-Centric Computing: The UCC framework with illustrative case study, User-Centric models-descriptive, predictive models and taxonomy, Introduction to GOMS family of models

Computational user models (classical), Keystroke-Level Model(KLM), (CMN)GOMS Model, The Fitts' Law, The Hick-Hyman Law.

UNIT IV

Computational user models(contemperory): 2D and 3D pointing models, The steering Law and constrained navigation, Model for hierarchial menu selection, Mobile typing models(sibgle finger and two thumb typing), Model for touch performance(FFitts' law),

Formal system models: Introduction to formal models in UCD, Formal modelling of user-computer dialogue.

UNIT V

Empirical Research Methods: Introduction and research question formulation,Variables determination and experiment design, Data Analysis including model building

User-Centric Design Evaluation: Introduction to User-Centric design evaluation and expert evaluation technique, : User evaluation and model-based evaluation.

Text Books:

1. Samit Bhattacharya (July, 2019). Human-Computer Interaction: User-Centric Computing for Design, McGraw-Hill India, Print Edition: ISBN-13: 978-93-5316-804-9; ISBN-10: 93-5316-804-X, E-book Edition: ISBN-13: 978-93-5316-805-6; ISBN-10: 93-5316-805-8
2. Alan Dix, Janet E. Finlay, Gregory D. Abowd and Russel Beale. (2003). Human-Computer Interaction

(3rd Edition), Pearson.

Reference Books:

1. Ben Shneiderman, Catherine Plaisant, Maxine Cohen and Steven Jacobs. (2009). Designing the User Interfaces: Strategies for Effective Human-Computer Interaction (5th Edison), Pearson

Website Links:

https://paragnachaliya.in/wp-content/uploads/2017/08/HCI_Alan_Dix.pdf

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DESIGN PATTERNS
(OPEN ELECTIVE)

Course Code: GR22A4063 **L/T/P/C: 3/0/0/3**

Course Outcomes:

1. Ability to analyze and apply different design patterns for real life scenarios.
2. Ability to solve Object oriented design problems with a case study of designing a Document Editor.
3. Illustrates the skill apply creational design patterns.
4. Demonstrates the ability to apply different structural design patterns.
5. Analyze and Apply different behavioral design patterns.

UNIT I

Introduction: What Is a Design Pattern?, Design Patterns in Smalltalk MVC, Describing Design Patterns, The Catalog of Design Patterns, Organizing the Catalog, How Design Patterns solve Design Problems, How to Select a Design Pattern, How to Use a Design Pattern.

UNIT II

A Case Study: Designing a Document Editor: Design Problems, Document Structure, Formatting,Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window Systems, User Operations Spelling Checking and Hyphenation, Summary.

UNIT III

Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns.
Structural Pattern Part-I: Adapter, Bridge, Composite.

UNIT IV

Structural Pattern Part-II: Decorator, Façade, Flyweight, Proxy.
Behavioral Patterns Part-I: Chain of Responsibility, Command, Interpreter, Iterator.

UNIT V

Behavioral Patterns Part-II: Mediator, Memento, Observer, State, Strategy, Template Method Visitor, Discussion of Behavioral Patterns. What to Expect from Design Patterns, A Brief History,The Pattern Community An Invitation, A Parting Thought.

Text Books:

1. Design Patterns by Erich Gamma, Pearson Education.

Reference Books:

1. Pattern's in JAVA Vol-I by Mark Grand,Wiley DreamTech.
2. Pattern's in JAVA Vol-II by Mark Grand,Wiley DreamTech.
3. JAVA Enterprise Design Patterns Vol-III by Mark Grand,Wiley DreamTech.

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

Course Code:GR22A3019 **L/T/P/C: 3/0/0/3**

Course Outcomes:

1. Illustrate the concepts of solar radiation at different instants.
2. Analyze the performance characteristics of PV modules.
3. Compare the performance of wind energy at various circumstances.
4. Make use of various sustainable energy resources for power generation.
5. Explain operation and performance of Wave energy, Fuel cells and Batteries.

UNIT I

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

Photovoltaic Cells - Equivalent Circuit - V-I Characteristics- Photovoltaic Modules – Constructional details - Design considerations – Tracking - Maximum power point tracking – Algorithms - PV solar system design with energy backup - Solar Thermo electric conversion.

UNIT III

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

UNIT IV

Various fuels-Sources-Conversion Technologies-Wet Processes–Dry Processes-Biogas generation–Aerobic and an aerobic digestion- Factors affecting generation of bio gas – Classification of bio gas plants-Different Indian digesters-Digester design considerations- Gasification process-Gasifiers – Applications. Geo-thermal Energy-sources-Hydrothermal Convective-Geo-pressure resources-Petro-thermal systems (HDR)-Magma Resources-Prime Movers.

UNIT V

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 –Constructional details of Lead acid batteries- Ni-Cd Batteries.

Text Books:

1. G.D. Rai, Non Conventional Energy Sources, Khanna publishers.
2. D.P.Kothari, Singal, Rakesh, Ranjan, Renewable Energy sources and Emerging Technologies, PHI, 2009.

Reference Books:

1. B.H.Khan, Non Conventional Energy Sources, PHI Publications.
2. John Twidell & Wier, Renewable Energy Resources, CRC Press, 2009.
3. T. Ackermann, "Wind Power in Power Systems", John Wiley and Sons Ltd., 2005.

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

Course Code: GR22A3095 **L/T/P/C: 3/0/0/3**

Course Outcomes:
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. I J Nagrath, 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 Nagoor Kani, Control Systems, CBS Publishers.

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

Course Code: GR22A4022 **L/T/P/C: 3/0/0/3**

Course Outcomes:
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 Crisp sets.
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.

UNIT II
NEURAL NETWORKS II (Back Propagation Networks)
Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back propagation learning methods, effect of learning rule co-efficient; 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 Crisp sets, 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, interference 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
PRINCIPLES OF COMMUNICATIONS
(OPEN ELECTIVE)

Course Code: GR22A3040 **L/T/P/C: 3/0/0/3**

Course Outcomes:

1. Apply concepts of modulation, frequency translation, gain and attenuation in communication systems.
2. Analyse the power spectrum characteristics of different modulation techniques.
3. Understand the role of multiplexing techniques in optimizing bandwidth utilization of Communication Systems.
4. Evaluate the suitability of specific digital modulation techniques for different communication applications.
5. Critically perform error analysis of each modulation scheme.

UNIT - I: Basics of Communication Systems

Definition and scope of communication systems, Types of communication systems: Analog and Digital, Block diagram of a communication system, Need for Modulation, Frequency translation, Electromagnetic spectrum, Gain, Attenuation and decibels.

UNIT - II: Analog Modulation

Amplitude Modulation (AM), Frequency Modulation (FM), Phase Modulation (PM) and its variants, Power Spectrum of different modulations, Comparison of modulation techniques.

UNIT - III: Pulse Analog Modulation

Ideal sampling, Sampling theorem, aliasing, interpolation, natural and flat top sampling in time and frequency domains. Introduction to PAM, PWM, PPM modulation schemes. Frequency Division Multiplexing (FDM) and Time division multiplexing (TDM).

UNIT – IV: Digital Modulation

Basics of digital modulation, Advantages of digital modulation over analog modulation, Types of digital modulation: ASK, FSK, PSK, QAM, Comparison of digital modulation techniques

UNIT - V: Performance Analysis of Analog and Digital Modulation

Sources of Noise in Communication Systems, Super heterodyne Receiver, Figure of Merit, Noise Figure. Signal-to-Noise Ratio (SNR) and Eb/N0 ratio, Bit Error Rate (BER) and its significance, Error performance analysis for different modulation schemes, Channel capacity and bandwidth efficiency.

Text Books:

1. An Introduction to Analog and Digital Communications, 2nd Edition, Simon Haykin, Michael Moher, John Wiley, March 2006.
2. Communication Systems by Simon Haykin, Second Edition, Wiley Student Edition, 2007.
3. Digital Communications by John G. Proakis and Masoud Salehi, 5e, McGraw Hill Publications, 2014

Reference Books:

1. Introduction to Data Communications and Networking, Wayne Tomasi, Pearson Education, 2005.
2. Digital & Analog Communication Systems By K.S. Shanmugam, John Wiley

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

Course Code: GR22A3113 **L/T/P/C: 3/0/0/3**

Course Outcomes:
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 for 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
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 magnetostrictive sensors. Capacitive sensors- variable capacitor, differential capacitor.

UNIT-IV
Accelerometers: Characteristics and working principle, 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, “HandBook of Modern Sensors: physics, Designs and Applications”, 3rd ed., Springer, 2010.

Reference Books:
1. A.K. Sawhney, “Electrical and Electronic Measurements and Instrumentation”, DhanpatRai.

2. Er. R.K. Rajput, “Electronic Measurements and Instrumentation”, S. Chand & Company Ltd. 3rd Edition.
3. Bentley, John P., “Principles of Measurement Systems”, 4th edition, Pearson/Prentice Hall, 2005
4. Jon. S. Wilson, “Sensor Technology HandBook”, Elsevier Inc., 2005.

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

Course Code: GR22A4045 **L/T/P/C: 3/0/0/3**

Course Outcomes:

1. Analyze the properties of basic Modulation techniques and apply them to Digital Communication
2. Apply error probability concepts to evaluate the performance of spread spectrum systems.
3. Understand the principle concepts of telecommunication systems and networking
4. Analyze link budgets for satellite communication, considering factors such as path loss, atmospheric effects, and antenna gain.
5. Evaluate the suitability of various technologies in cellular, mobile and wireless communication scenarios.

UNIT- I: Review of Digital Communication System

Review of fundamental concepts and parameters in Digital Communication. Digital modulation schemes, Power spectra of digital modulation signals.

UNIT- II: Spread-Spectrum Modulation

Introduction, Pseudo-Noise sequences, direct- sequence spread spectrum (DSSS) with coherent BPSK, processing gain, probability of error, frequency-hop spread spectrum (FHSS). Application of spread spectrum: CDMA.

UNIT- III: Telecommunication Systems: Telephones Telephone system, Paging systems, Internet Telephony. **Networking and Local Area Networks:** Network fundamentals, LAN hardware, Ethernet LANs, Token Ring LAN.

UNIT- IV

Satellite Communication: Satellite Orbits, satellite communication systems, satellite subsystems, Ground Stations Satellite Applications, Global Positioning systems.

Optical Communication: Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

UNIT-V:

Cellular and Mobile Communications: Cellular telephone systems, AMPS, GSM, CDMA, and WCDMA.

Wireless Technologies: Wireless LAN, PANs and Bluetooth, ZigBee and Mesh Wireless Networks, Wimax and MANs, Infrared wireless, RFID communication, UWB.

Text Books:

1. Introduction to Data Communications and Networking, Wayne Tomasi, Pearson Education, 2005.
2. Simon Haykin and Michael Moher, “Modern Wireless Communications,” Pearson Education, 2005.
3. Marvin K. Simon, Sami M. Hinedi and W. C. Lindsay, “Digital Communication Techniques,” Eastern Economy Edition, 2010.

Reference Books:

1. Principles of communication systems By Taub Schilling, T.M.H
2. Andrew J Viterbi, “CDMA principles spread spectrum communications,” Adison Wesley, 1995.

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

Course Code: GR22A3030 **L/T/P/C:3/0/0/3**

Prerequisites: Manufacturing Technology

Course Outcomes:
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 Kalpak Jian and Steven R.Schmid, Manufacturing – Engineering and Technology, 7th 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.

3. Boucher, T. O. (2012). Computer Automation in Manufacturing: An Introduction. Switzerland: Springer US.
4. Altintas, Y. (2012). Manufacturing Automation: Metal Cutting Mechanics, Machine Tool Vibrations, and CNC Design. United States: Cambridge University Press.
5. Morriss, S. B. (1995). Automated manufacturing systems. United Kingdom: Glencoe.

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

Course Code: GR22A3105 **L/T/P/C: 3/0/0/3**

Prerequisites: Material Engineering

Course Outcomes:

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
OPERATIONS RESEARCH
(OPEN ELECTIVE)

Course Code: GR22A3018 **L/T/P/C: 3/0/0/3**

Course Outcomes:

1. Apply the various linear programming techniques for optimal allocation of limited resources such as machine, material and money
2. Solve transportation problems to minimize cost and understand the principles of assignment of jobs and recruitment policies.
3. Solve sequencing problems and to distinguish various inventory models and develop proper inventory policies
4. Apply game theory to analyze various business competitions and analyze the various waiting line oriented situations.
5. Develop optimum replacement policy and Dynamic Programming Techniques.

UNIT I

Introduction: Development – Definition– Characteristics and Phases of operations Research– Types of models – operation Research models– applications.
Allocation: Linear Programming Problem Formulation – Graphical solution – Simplex method – Artificial variables techniques -Two–phase method, Big-M method – Duality Principle.

UNIT II

Transportation models: Formulation – Methods for finding feasible solutions; North west corner rule, Least cost entry method, Vogel's approximation method. Optimal solution; MODI method. Unbalanced transportation problem and Degeneracy.
Assignment models - Formulation – Optimal solution - Variants of Assignment Problem

UNIT III

Sequencing: Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through 'm' machines.
Inventory: Introduction – Single item – Deterministic models – Purchase inventory modelwith one price break and multiple price breaks – shortages are not allowed – Stochastic models – demand may be a discrete variable or continuous variable – Instantaneous production. Instantaneous demand and continuous demand and no set up cost.

UNIT IV

Theory of games: Introduction – Minimax (maximin) – Criterion and optimal strategy – Solution of games with saddle points – Rectangular games without saddle points – 2 X 2 games – dominance principle– m X 2 and 2 X n games -graphical method.
Waiting lines: Introduction – Single Channel – Poisson arrivals – exponential service times – with infinite population and finite population models– Multichannel – Poisson arrivals – exponential service times with infinite population single channel Poisson arrivals.

UNIT V

Replacement: Introduction – Replacement of items that deteriorate with time – when money

value is not counted and counted – Replacement of items that fail completely, group replacement.
Dynamic programming: Introduction – Bellman's Principle of optimality – Applications of dynamic programming- capital budgeting problem – shortest path problem – linear programming problem.

Text Books:

1. Operations Research - Prem Kumar Gupta and D S Hira/ S Chand Publishing/ 2015
2. Operations Research / S. D.Sharma / KedarNath RamNath Publication/2020

Reference Books:

1. Operations Research / R.Panneerselvam, 3rd Edition/PHI Publications/ 2023
2. Operations Research An Introduction - Hamdy A Taha/8 th Edition/ Prentice Hall/2006
3. Principles of Operations Research: With Applications to Managerial Decisions - Harvey M. Wagner/Prentice-Hall Operations Research/2020
4. Operations Research - Kanthi Swarup, P.K. Gupta, Man Mohan Sultan Chand & Sons/ 2019
5. Operations Research / A.M.Natarajan, P.Balasubramani,A. Tamilarasi / Pearson Education/2006

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

Course Code: GR22A3009 **L/T/P/C: 3/0/0/3**

Pre-requisites: Building materials and construction planning, Concrete Technology

Course Outcomes:
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
4. Perform cost/benefit analysis and life-cycle analysis of green buildings.
5. Identify and compare cost and performance of building materials

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 legislationsin India – Water Act, Air Act

UNIT II

Air Pollution, effects of Air Pollution; Water pollution-sources, Sustainable wastewater treatment, Solid waste-sources, impacts of solid waste, zero waste concept, 3R concept, Global environmental issues-Resource degradation, climatic change, Global warming, Ozone layer depletion, Regional and Local Environmental issues. Carbon credits and carbon trading, carbon foot print.

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; non-renewable Energy of Materials

UNIT IV

Green cement, Biodegradable materials, Smart materials, Manufactured Materials, Volatile Organic Compounds like acetone, formaldehyde, BTEX substances, 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 (2007) – K S Jagadeesh, B V Venkata Rama Reddy & K S Nanjunda Rao – New Age International Publishers
2. Integrated Life Cycle Design of Structures (2002)– AskoSarja – SPON Press
3. Non-conventional Energy Resources (2012) – D S Chauhan and S K Srivastava – New Age International Publishers

Reference Books:

1. Green Buildings (2007) McGraw hill publication by Gevorkian
2. Emerald Architecture (2008) case studies in green buildings, The Magazine of Sustainable Design
3. Understanding Green Building Guideline (2010): For Students and Young Professionals, Traci Rose Rider, W. W. Norton & Company Publisher.
4. Understanding Green Building Materials (2011) Traci Rose Rider, W. W. Norton & Company Publisher.

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

Course Code:GR22A3086 **L/T/P/C: 3/0/0/3**

Pre-Requisites: Surveying and Geomatics

Course Outcomes:
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.

Reference Books:
1. Remote Sensing and Geographical Information systems by M. Anji Reddy JNTU Hyderabad.4thedition, 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, PrenticeHall 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
ENVIRONMENTAL IMPACT ASSESSMENT
(OPEN ELECTIVE)

Course Code:GR22A4011 **L/T/P/C: 3/0/0/3**

Pre-Requisites: Environmental science

Course Outcomes:

1. Identify, predict and evaluate the environmental effects of proposed actions and projects.
2. Explain the appropriate methodologies for environmental impact prediction and assessment.
3. Analyze the importance of Public Participation, Fault Tree Analysis and Consequence analysis in EIA.
4. Understand the activities in environmental auditing.
5. Plan EIA for developmental projects.

UNIT I

Introduction: Concepts of EIA methodologies – Sustainable development- Need for Environmental Impact Assessment (EIA) - Environmental Impact Statement (EIS) – Evolution of EIA: Screening and scoping; Rapid EIA and Comprehensive EIA

UNIT II

Introduction to EIA, Criteria for the selection of EIA Methodology, General Framework for Environmental Impact Assessment, Characterization, and site assessment. Environmental Risk Analysis, Definition of Risk, Matrix Method; Checklist method.

UNIT III

Prediction and Assessment: Public participation Fault tree analysis, Consequence Analysis; Socioeconomic aspects, measures of the effectiveness of pollution control activities.

UNIT IV

Environmental Legislation: Introduction to Environmental Management Systems; Environmental Statement - procedures; Environmental Audit: Cost-Benefit Analysis.

UNIT V

Life Cycle Assessment, Resource Balance, Energy Balance & Management Review - Operational Control - Case Studies on EIA with reference to Indian Scenario.

Text Books:

1. Y Anjaneyulu, and Valli Manikkam, Environmental Impact Assessment Methodologies, BSP Books PVT Ltd., 2nd edition, 2011.
2. R.R. Barthwal, Environmental Impact Assessment, New Age International Private Limited, 2nd edition, 2012.
3. Canter R.L., Environmental Impact Assessment, Mc Graw Hill International Edition, 2nd edition,1997.

Reference Books:

1. Kolluru Rao, Bartell Steven, Pitblado R and Stricoff "Risk Assessment and Management Handbook",

McGraw Hill Inc., New York, 1996.

2. Judith Petts, Handbook of Environmental Impact Assessment Vol. I &II, Blackwell Science,1999.
3. Cutter, S.L., "Environmental Risk and Hazards", Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.
4. Anji Reddy Mareddy, Environmental Impact Assessment: Theory and Practice, Butterworth-Heinemann publisher, 1st Edition, 2017.
5. MoEF & CC, Govt. of India: EIA notification and subsequent amendments