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## OPEN ELECTIVE II, SEMESTER VII

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OBJECTIVES:

- To make the students conversant with basics of polymer chemistry
- Principles of electrochemical reactions, redox reactions in corrosion of materials and methods for corrosion prevention and protection of materials.
- To acquaint the student with concepts of important photophysical and photochemical processes and spectroscopy.
- To make the student acquire sound knowledge of second law of thermodynamics and second law based derivations of importance in engineering applications in all disciplines.
- To acquaint the students with the basics of nano materials, their properties and applications.

UNIT I  POLYMERS AND SPECIALITY POLYMER  9

UNIT II  ELECTROCHEMISTRY, CORROSION AND PROTECTIVE COATINGS  9

UNIT III  PHOTOCHEMISTRY & ANALYTICAL TECHNIQUES  9
Chromatography: Basic principles of column & TLC – principles and applications.

UNIT IV  THERMODYNAMICS  9
Terminology of thermodynamics - Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function- Helmholtz and Gibbs free energy functions (problems); criteria of spontaneity; Gibbs- Helmholtz equation (problems); Clausius-Clapeyron equation; Maxwell relations – Van’t Hoff isotherm and isochore (problems).

UNIT V  NANOCHEMISTRY  9
Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties (surface to volume ratio, melting point, optical and electrical). nanoparticles, nanocluster, nanorod, nanotube (CNT: SWNT and MWNT) and nanowire, synthesis - precipitation, thermolysis, hydrothermal, solvothermal, electrodeposition, chemical vapour deposition, laser ablation, sol-gel process and applications (electronic and biomedical). Fullerenes: Types - C_{60} - preparation, properties and applications.

TOTAL: 45 PERIODS
OUTCOMES
• The knowledge gained on polymer chemistry, thermodynamics, spectroscopy, phase rule
  and nano materials will provide a strong platform to understand the concepts on these
  subjects for further learning.

TEXT BOOKS
   University Press, Delhi, 2015.
2. S. Vairam, P. Kalyani and Suba Ramesh, “Engineering Chemistry”, Wiley India PVT, LTD,
   New Delhi, 2013
   Ltd.,2012.

REFERENCES
   LTD, New Delhi, 2015
   LTD, New Delhi, 2015

OCE551 AIR POLLUTION AND CONTROL ENGINEERING

OBJECTIVE:
• To impart knowledge on the principle and design of control of Indoor/ particulate/ gaseous
  air pollutant and its emerging trends.

UNIT I INTRODUCTION
Structure and composition of Atmosphere – Definition, Scope and Scales of Air Pollution –
Sources and classification of air pollutants and their effect on human health, vegetation, animals,
property, aesthetic value and visibility- Ambient Air Quality and Emission standards.

UNIT II METEOROLOGY
Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind
profiles and stack plume patterns- Atmospheric Diffusion Theories – Dispersion models, Plume
rise.

UNIT III CONTROL OF PARTICULATE CONTAMINANTS
Factors affecting Selection of Control Equipment – Gas Particle Interaction – Working principle -
Gravity Separators, Centrifugal separators Fabric filters, Particulate Scrubbers, Electrostatic
Precipitators.

UNIT IV CONTROL OF GASEOUS CONTAMINANTS
Factors affecting Selection of Control Equipment – Working principle - absorption, Adsorption,
condensation, Incineration, Bio filters – Process control and Monitoring.

UNIT V INDOOR AIR QUALITY MANAGEMENT
Sources, types and control of indoor air pollutants, sick building syndrome and Building related
illness- Sources and Effects of Noise Pollution – Measurement – Standards –Control and
Preventive measures.

TOTAL: 45 PERIODS
OUTCOMES:
The students completing the course will have

- an understanding of the nature and characteristics of air pollutants, noise pollution and basic concepts of air quality management
- ability to identify, formulate and solve air and noise pollution problems
- ability to design stacks and particulate air pollution control devices to meet applicable standards.
- Ability to select control equipments.
- Ability to ensure quality, control and preventive measures.

TEXTBOOKS:

REFERENCES:

OAT551 AUTOMOTIVE SYSTEMS L T P C
3 0 0 3

OBJECTIVES:
- To understand the construction and working principle of various parts of an automobile.
- To have the practice for assembling and dismantling of engine parts and transmission system

UNIT I AUTOMOTIVE ENGINE AUXILIARY SYSTEMS 9
Automotive engines- External combustion engines –Internal combustion engines -classification of engines- SI Engines- CI Engines- two stroke engines -four stroke engines- construction and working principles - IC engine components- functions and materials -valve timing –port timing diagram- Injection system -Unit injector system- Rotary distributor type - Electronically controlled injection system for SI engines-CI engines-Ignition system - Electronic ignition system -Transistorized ignition system, capacitive discharge ignition system.

UNIT II VEHICLE FRAMES AND STEERING SYSTEM 9
UNIT III    TRANSMISSION SYSTEMS  
Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints — Hotchkiss Drive and Torque Tube Drive- rear axle-Differential-wheels and tyres.

UNIT IV    SUSPENSION AND BRAKES SYSTEMS  
Suspension Systems- conventional Suspension Systems -independent Suspension Systems –leaf spring – coil spring –taper-lite - eligo,s spring Types of brakes -Pneumatic and Hydraulic Braking Systems, Antilock Braking System (ABS), electronic brake force distribution (EBD) and Traction Control. Derive the equation of Forces acting while applying a brakes on plain surface - inclined road-gradient .

UNITV    ALTERNATIVE ENERGY SOURCES  
Note: Practical Training in dismantling and assembling of Engine parts and Transmission Systems should be given to the students.

TOTAL: 45 PERIODS

OUTCOMES:
• Upon completion of this course, the students will be able to identify the different components in automobile engineering.
• Have clear understanding on different auxiliary and transmission systems usual.

TEXT BOOKS:

REFERENCES:

OIC551    BIOMEDICAL INSTRUMENTATION  
L T P C
3 0 0 3

OBJECTIVES:
• To Introduce Fundamentals of Biomedical Engineering
• To study the communication mechanics in a biomedical system with few examples
To study measurement of certain important electrical and non-electrical parameters
To understand the basic principles in imaging techniques
To have a basic knowledge in life assisting and therapeutic devices

UNIT I  HUMAN BODY SUBSYSTEM AND TRANSDUCERS  9
Brief description of muscular, cardiovascular and respiratory systems; their electrical, mechanical and chemical activities. Principles and classification of transducers for Bio-medical applications. Electrode theory, different types of electrodes; Selection criteria for transducers and electrodes.

UNIT II  NON ELECTRICAL PARAMETERS MEASUREMENT  9

UNIT III  ELECTRICAL PARAMETERS MEASUREMENT AND ELECTRICAL SAFETY  9

UNIT IV  IMAGING MODALITIES AND BIO-TELEMETRY  9

UNIT V  LIFE ASSISTING AND THERAPEUTIC DEVICES  9

TOTAL: 45 PERIODS

OUTCOMES:
- Ability to understand communication mechanics in a biomedical system.
- Ability to understand and analyze measurement of certain electrical and non-electrical parameters.
- Ability to understand basic principles of imaging techniques, life assisting and therapeutic devices.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To learn about the concept of cloud and utility computing.
- To have knowledge on the various issues in cloud computing.
- To be familiar with the lead players in cloud.
- To appreciate the emergence of cloud as the next generation computing paradigm.

UNIT I  INTRODUCTION TO CLOUD COMPUTING  9

UNIT II  VIRTUALIZATION  9

UNIT III  CLOUD ARCHITECTURE, SERVICES AND STORAGE  9

UNIT IV  RESOURCE MANAGEMENT AND SECURITY IN CLOUD  9

UNIT V  CASE STUDIES  9

OUTCOMES:
On Completion of the course, the students should be able to:
- Articulate the main concepts, key technologies, strengths and limitations of cloud computing.
- Learn the key and enabling technologies that help in the development of cloud.
- Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.
- Explain the core issues of cloud computing such as resource management and security.
- Be able to install and use current cloud technologies.
- Choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.

TEXT BOOKS:
REFERENCES:

OEC551 CONTROL SYSTEMS ENGINEERING

OBJECTIVES:
- To introduce the components and their representation of control systems
- To learn various methods for analyzing the time response, frequency response and stability of the systems.
- To learn the various approach for the state variable analysis.

UNIT I SYSTEMS COMPONENTS AND THEIR REPRESENTATION
Control System: Terminology and Basic Structure-Feed forward and Feedback control theory-
Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs
models-DC and AC servo Systems-Synchros -Multivariable control system

UNIT II TIME RESPONSE ANALYSIS
Transient response-steady state response-Measures of performance of the standard first
order and second order system-effect on an additional zero and an additional pole-steady
error constant and system- type number-PID control-Analytical design for PD,PI,PID control
systems

UNIT III FREQUENCY RESPONSE AND SYSTEM ANALYSIS
Closed loop frequency response-Performance specification in frequency domain-Frequency
response of standard second order system- Bode Plot - Polar Plot- Nyquist plots-Design of
compensators using Bode plots-Cascade lead compensation-Cascade lag compensation-
Cascade lag-lead compensation

UNIT IV CONCEPTS OF STABILITY ANALYSIS
Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-
Relative stability-Root locus concept-Guidelines for sketching root locus-Nyquist stability
criterion.

UNIT V CONTROL SYSTEM ANALYSIS USING STATE VARIABLE
METHODS
State variable representation-Conversion of state variable models to transfer functions-
Conversion of transfer functions to state variable models-Solution of state equations-Concepts
of Controllability and Observability-Stability of linear systems-Equivalence between transfer
function and state variable representations-State variable analysis of digital control system-
Digital control design using state feedback.

TOTAL:45 PERIODS

OUTCOMES:
Upon completion of the course, the student should be able to:

- Identify the various control system components and their representations.
- Analyze the various time domain parameters.
- Analyze the various frequency response plots and its system.
- Apply the concepts of various system stability criterions.
- Design various transfer functions of digital control system using state variable models.

TEXT BOOK:


REFERENCES


OIT551 DATABASE MANAGEMENT SYSTEMS

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OBJECTIVES

- To learn the fundamentals of data models
- To learn conceptual modeling using ER diagrams.
- To study SQL queries and database programming
- To learn proper designing of relational database.
- To understand database security concepts
- To understand Information retrieval techniques

UNIT I DBMS AND CONCEPTUAL DATA MODELING


UNIT II DATABASE QUERYING


UNIT III DATABASE PROGRAMMING

Database programming with function calls, stored procedures - views – triggers. Embedded SQL. ODBC connectivity with front end tools. Implementation using ODBC/JDBC and SQL/PSM, implementing functions, views, and triggers in MySQL / Oracle.

UNIT IV DATABASE DESIGN

UNIT V  ADVANCED TOPICS  9

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to:

- understand relational data model, evolve conceptual model of a given problem, its mapping to relational model and Normalization
- query the relational database and write programs with database connectivity
- understand the concepts of database security and information retrieval systems

TEXT BOOKS:

REFERENCES:

OME551  ENERGY CONSERVATION AND MANAGEMENT  L  T  P  C
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OBJECTIVES:
At the end of the course, the student is expected to
- understand and analyse the energy data of industries
- carryout energy accounting and balancing
- conduct energy audit and suggest methodologies for energy savings and
- utilise the available resources in optimal ways

UNIT I  INTRODUCTION  9

UNIT II  ELECTRICAL SYSTEMS  9

UNIT III  THERMAL SYSTEMS  9
UNIT IV ENERGY CONSERVATION IN MAJOR UTILITIES
Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. sets

UNIT V ECONOMICS
Energy Economics – Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing –ESCO concept

OUTCOMES:
Upon completion of this course, the students can able to analyse the energy data of industries.

- Can carryout energy accounting and balancing
- Can suggest methodologies for energy savings

TEXT BOOKS:

REFERENCES:

OAI551 ENVIRONMENT AND AGRICULTURE

OBJECTIVE:
- To emphasize on the importance of environment and agriculture on changing global scenario and the emerging issues connected to it.

UNIT I ENVIRONMENTAL CONCERNS
Environmental basis for agriculture and food – Land use and landscape changes – Water quality issues – Changing social structure and economic focus – Globalization and its impacts – Agro ecosystems.

UNIT II ENVIRONMENTAL IMPACTS
Irrigation development and watersheds – mechanized agriculture and soil cover impacts – Erosion and problems of deposition in irrigation systems – Agricultural drainage and downstream impacts – Agriculture versus urban impacts.

UNIT III CLIMATE CHANGE

UNIT IV ECOLOGICAL DIVERSITY AND AGRICULTURE
UNIT V EMERGING ISSUES
Global environmental governance – alternate culture systems – Mega farms and vertical farms – Virtual water trade and its impacts on local environment – Agricultural environment policies and its impacts – Sustainable agriculture.

TOTAL: 45 PERIODS

OUTCOMES:
- Students will appreciate the role of environment in the current practice of agriculture and concerns of sustainability, especially in the context of climate change and emerging global issues.
- Ecological context of agriculture and its concerns will be understood

TEXTBOOKS:

REFERENCES:
3. Environment and agriculture: environmental problems affecting agriculture in the Asia and Pacific region; World Food Day Symposium, Bangkok, Thailand. 1989

OCY552 FUEL CELL CHEMISTRY

OBJECTIVES
- To create awareness about alternate clean fuel available.
- To familiarize the students with the concepts and chemistry of fuel cell

UNIT I INTRODUCTION
Overview of fuel cells: Low and high temperature fuel cells; Fuel cell thermodynamics - heat, work potentials, prediction of reversible voltage, fuel cell efficiency.

UNIT II FUEL CELL KINETICS
Fuel cell reaction kinetics - electrode kinetics, overvoltage, Tafel equation, charge transfer reaction, exchange currents, electro catalysis - design, activation kinetics, Fuel cell charge and mass transport - flow field, transport in electrode and electrolyte.

UNIT III CHARACTERIZATION TECHNIQUES
Fuel cell characterization - in-situ and ex-situ characterization techniques, i-V curve, frequency response analysis; Fuel cell modeling and system integration: - 1D model – analytical solution and CFD models.

UNIT IV RENEWABLE SOURCES
Balance of plant; Hydrogen production from renewable sources and storage; safety issues, cost expectation and life cycle analysis of fuel cells.
UNIT V  APPLICATIONS OF FUEL CELL
Fuel cell power plants: fuel processor, fuel cell power section (fuel cell stack), power conditioner; automotive applications, portable applications

TOTAL: 45 PERIODS

OUTCOME
• Students will be aware of alternate energy sources and its importance of it.

TEXTBOOKS

REFERENCES

OCE552    GEOGRAPHIC INFORMATION SYSTEM    L T P C
3  0  0  3

OBJECTIVES :
• To introduce the fundamentals and components of Geographic Information System
• To provide details of spatial data structures and input, management and output processes.

UNIT I  FUNDAMENTALS OF GIS

UNIT II  SPATIAL DATA MODELS

UNIT III  DATA INPUT AND TOPOLOGY

UNIT IV  DATA ANALYSIS
Vector Data Analysis tools - Data Analysis tools - Network Analysis - Digital Education models - 3D data collection and utilisation.

UNIT V  APPLICATIONS

TOTAL: 45 PERIODS

OUTCOME:
This course equips the student to

- Have basic idea about the fundamentals of GIS.
- Understand the types of data models.
- Get knowledge about data input and topology.
- Gain knowledge on data quality and standards.
- Understand data management functions and data output

**TEXT BOOKS:**


**REFERENCE:**


**OMD552 HOSPITAL WASTE MANAGEMENT**

**OBJECTIVES:**

The student should be made to:

- Know about the healthcare hazard control and accidents
- Understand biomedical waste management
- Learn the facility guidelines, infection control and patient safety.

**UNIT I HEALTHCARE HAZARD CONTROL AND UNDERSTANDING ACCIDENTS**


**UNIT II BIOMEDICAL WASTE MANAGEMENT**

Biomedical Waste Management: Types of wastes, major and minor sources of biomedical waste, Categories and classification of biomedical waste, hazard of biomedical waste, need for disposal of biomedical waste, waste minimization, waste segregation and labeling, waste handling and disposal.

**UNIT III HAZARDOUS MATERIALS**


**UNIT IV FACILITY SAFETY**


**UNIT V INFECTION CONTROL, PREVENTION AND PATIENT SAFETY**

TOTAL : 45 PERIODS

OUTCOMES:

- After successful completion of the course, the students will be able to know the concepts of healthcare waste management, its prevention and safety.

REFERENCES:


OCY553 INDUSTRIAL CHEMISTRY

OBJECTIVES

- To get introduced to high polymers such as rubber and plastics and to industrial importance of cementing materials.
- To get introduction on the chemistry of various industrial processes such as sugar and leather processing.

UNIT I INORGANIC CEMENTING MATERIALS


UNIT II FUELS AND COMBUSTION


UNIT III RUBBER AND PLASTICS

Introduction to rubber - latex - processing latex - mastication - compounding of rubber - vulcanizations of rubber - engineering polymers thermoforming - degradation stability and environment- synthetic rubbers - preparation and applications of SBR - butyl rubber - nitrile rubber - neoprene and silicone rubber- plastic materials - classification of plastics (or resins) - moulding constituents of a plastic - fabrication techniques used for thermoplastic resin (moulding process)- important thermoplastic resins- natural resins - celluloses - polyethylene – PVC.

UNIT IV PAINTS, PIGMENTS AND INSULATING MATERIALS

UNIT V SUGAR AND LEATHER CHEMISTRY

Sugar Chemistry - introduction - manufacture of cane sugar - recovery of sugar from molasses - preparation of celotex - manufacture of sucrose from beat root - testing and estimation of sugar- leather chemistry - introduction - manufacture of leather preparation of hides for tanning - vegetable, chrome and oil tanning - byproduct.

OUTCOMES

- Will have knowledge about adsorption and oxidation process.
- Will gain idea about various methods available for water treatment.
- Will appreciate the necessity of water and acquire knowledge of preliminary treatment.

TEXTBOOKS:


REFERENCES:


OBM552 MEDICAL PHYSICS

OBJECTIVES:

- To study the complete non-ionizing radiations including light and its effect in human body.
- To understand the principles of ultrasound radiation and its applications in medicine.
- To learn about radioactive nuclides and also the interactions of radiation with matters and how isotopes are produced.
- To study the harmful effects of radiation and radiation protection regulations.

UNIT I NON-IONIZING RADIATION AND ITS MEDICAL APPLICATIONS


UNIT II ULTRASOUND IN MEDICINE

UNIT III  PRINCIPLES OF RADIOACTIVE NUCLIDES AND DECAY  

UNIT IV  INTERACTION OF RADIATION WITH MATTER  

UNIT V  RADIATION EFFECTS AND REGULATIONS  

TOTAL: 45 PERIODS

OUTCOMES: At the end of the course, the student should be able to:
• Analyze the low frequency and high frequency effects of non-ionizing radiation and physics of light.
• Define various clinical applications based on ultrasound wave.
• Explain the process of radioactive nuclide production using different techniques
• Analyze radiation mechanics involved with various physiological systems
• Outline the detrimental effects of radiation and regulations for radiation safety.

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
- This course will cover the basic principles and techniques of optical and electron microscopy. This course also deals with the sample preparation techniques for the microstructural analysis.

UNIT I INTRODUCTION 9

UNIT II MICROSCOPY 9

UNIT III ELECTRON MICROSCOPY 9

UNIT IV SAMPLE PREPARATION FOR MICROSTRUCTURAL ANALYSIS 9

UNIT V CHEMICAL ANALYSIS 9

TOTAL: 45 PERIODS

OUTCOMES:
- Able to understand the physics behind the microscopy.
- Ability to describe the principle, construction and working of light microscopy.
- Ability to appreciate about electron microscopy.
- Ability to understand about the important of sample preparation technique.
- Ability to identify the appropriate spectroscopy technique for chemical analysis.

TEXT BOOKS

REFERENCES:

OAI552 PARTICIPATORY WATER RESOURCES MANAGEMENT

OBJECTIVE:
- To gain an insight on local and global perceptions and approaches on participatory water resource management

UNIT I FUNDAMENTALS: SOCIOLOGY AND PARTICIPATORY APPROACH
Sociology – Basic concepts – Perspectives- Social Stratification – Irrigation as a Socio technical Process - Participatory concepts– Objectives of participatory approach

UNIT II UNDERSTANDING FARMERS PARTICIPATION

UNIT III ISSUES IN WATER MANAGEMENT

UNIT IV PARTICIPATORY WATER CONSERVATION

UNIT V PARTICIPATORY WATERSHED DEVELOPMENT
Concept and significance of watershed - Basic factors influencing watershed development — Principles of watershed management - Definition of watershed management – Identification of problems - Watershed approach in Government programmes — People’s participation – Entry point activities - Evaluation of watershed management measures.

TOTAL: 45 PERIODS

OUTCOMES:
The students will be able to
- Gain knowledge on various processes involved in participatory water resource management.
- Understand famers participation in water resources management.
- Aware of the issues related to water conservation and watershed development
- Get knowledge in participatory water conservation
- Understand concept , principle , approach of watershed management.

TEXTBOOKS:


REFERENCE:

OMF551 PRODUCT DESIGN AND DEVELOPMENT

OBJECTIVE:
- The course aims at providing the basic concepts of product design, product features and its architecture so that student can have a basic knowledge in the common features a product has and how to incorporate them suitably in product.

UNIT I INTRODUCTION

UNIT II CONCEPT GENERATION AND SELECTION

UNIT III PRODUCT ARCHITECTURE

UNIT IV INDUSTRIAL DESIGN

UNIT V DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT

TOTAL: 45 PERIODS
OUTCOME:

- The student will be able to design some products for the given set of applications; also the knowledge gained through prototyping technology will help the student to make a prototype of a problem and hence product design and development can be achieved.

TEXT BOOK:


REFERENCES:


OAI533 PRODUCTION TECHNOLOGY OF AGRICULTURAL MACHINERY L T P C
3 0 0 3

OBJECTIVES:

- To understand the concept and basic mechanics of metal cutting, working of standard machine tools, such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching.
- To understand the basic concepts of Computer Numerical Control (CNC) machine tool and CNC programming.

UNIT I ENGINEERING MATERIALS


UNIT II MACHINING

Basic principles of lathe - machine and operations performed on it. Basic description of machines and operations of Shaper-Planner, Drilling, Milling & Grinding.

UNIT III WELDING


UNIT IV ADVANCED MANUFACTURING PROCESS

Abrasive flow machining - abrasive jet machining - water jet machining - Electro Discharge Machining (EDM) - Wire cut EDM - Electro Chemical Machining (ECM) - Ultrasonic Machining / Drilling (USM / USD) - Electron Beam Machining (EBM) - Laser Beam Machining (LBM).

UNIT V CNC MACHINE

OUTCOME:
- Upon completion of this course, the students can apply the different manufacturing process and use this in industry for component production.

TEXTBOOKS:

REFERENCES:

ORO551 RENEWABLE ENERGY SOURCES L T P C

OBJECTIVES:
- To get exposure on solar radiation and its environmental impact to power.
- To know about the various collectors used for storing solar energy.
- To know about the various applications in solar energy.
- To learn about the wind energy and biomass and its economic aspects.
- To know about geothermal energy with other energy sources.

UNIT I PRINCIPLES OF SOLAR RADIATION 10
Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

UNIT II SOLAR ENERGY COLLECTION 8
Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT III SOLAR ENERGY STORAGE AND APPLICATIONS 7
Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

UNIT IV WIND ENERGY 10

UNIT V  GEOTHERMAL ENERGY:  9
Resources, types of wells, methods of harnessing the energy, potential in India. OCEAN ENERGY: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics. DIRECT ENERGY CONVERSION: Need for DEC, Carnot cycle, limitations, principles of DEC.

TOTAL : 45 PERIODS

OUTCOMES:
- Understanding the physics of solar radiation.
- Ability to classify the solar energy collectors and methodologies of storing solar energy.
- Knowledge in applying solar energy in a useful way.
- Knowledge in wind energy and biomass with its economic aspects.
- Knowledge in capturing and applying other forms of energy sources like wind, biogas and geothermal energies.

TEXT BOOKS:

REFERENCES:

OAN551  SENSORS AND TRANSDUCERS  L T P C
3 0 0 3

OBJECTIVES:
- To understand the concepts of measurement technology.
- To learn the various sensors used to measure various physical parameters.
- To learn the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development.

UNIT I  INTRODUCTION  9

UNIT II  MOTION, PROXIMITY AND RANGING SENSORS  9

UNIT III  FORCE, MAGNETIC AND HEADING SENSORS  9

UNIT IV  OPTICAL, PRESSURE AND TEMPERATURE SENSORS  9

UNIT V  SIGNAL CONDITIONING and DAQ SYSTEMS  9

TOTAL : 45 PERIODS

OUTCOMES:
The students will be able to

CO1. Expertise in various calibration techniques and signal types for sensors.
CO2. Apply the various sensors in the Automotive and Mechatronics applications
CO3. Study the basic principles of various smart sensors.
CO4. Implement the DAQ systems with different sensors for real time applications

TEXT BOOKS:

REFERENCES

OCS551  SOFTWARE ENGINEERING  L T P C
3 0 0 3

OBJECTIVES:
• To understand the phases in a software development project
• To learn project management concepts
• To understand the concepts of requirements analysis and modeling.
• To understand software design methodologies
• To learn various testing methodologies
• To be familiar with issues related to software maintenance
UNIT I SOFTWARE PROCESS

UNIT II PLANNING AND ESTIMATION

UNIT III REQUIREMENTS ANALYSIS AND SPECIFICATION

UNIT IV SOFTWARE DESIGN AND IMPLEMENTATION

UNIT V TESTING AND MAINTENANCE

TOTAL: 45 PERIODS

OUTCOMES:
At the end of this course, the students will be able to
- Understand different software life cycle models.
- Perform software requirements analysis
- Apply systematic methodologies for software design and deployment.
- Understand various testing approaches and maintenance related issues.
- Plan project schedule, and estimate project cost and effort required.

TEXT BOOKS:

REFERENCES:
5. http://nptel.ac.in/.
OBJECTIVES:
The student should be made to:
- Learn the key principles for telemedicine and health.
- Understand telemedical technology.
- Know telemedical standards, mobile telemedicine and its applications.

UNIT I  TELEMEDICINE AND HEALTH
History and Evolution of telemedicine, Organs of telemedicine, Global and Indian scenario, Ethical and legal aspects of Telemedicine - Confidentiality, Social and legal issues, Safety and regulatory issues, Advances in Telemedicine.

UNIT II  TELEMEDICAL TECHNOLOGY

UNIT III  TELEMEDICAL STANDARDS

UNIT IV  MOBILE TELEMEDICINE
Tele radiology: Image Acquisition system Display system, Tele pathology, Medical information storage and management for telemedicine- patient information, medical history, test reports, medical images, Hospital information system.

UNIT V  TELEMEDICAL APPLICATIONS

OUTCOMES:
At the end of the course, the student should be able to:
- Apply multimedia technologies in telemedicine.
- Explain Protocols behind encryption techniques for secure transmission of data.
- Apply telehealth in healthcare.

TEXT BOOK:

REFERENCES:

OAI751 AGRICULTURAL FINANCE, BANKING AND CO-OPERATION L T P C

OBJECTIVES:
- To make the students aware about the agricultural Finance, Banking and Cooperation.
- To acquaint the students with the basic concepts, principles and functions of management.
- To understand the process of finance banking and cooperation.

UNIT I AGRICULTURAL FINANCE - NATURE AND SCOPE
Agricultural Finance: Definition, Importance, Nature and Scope - Agricultural Credit: Meaning, Definition, Need and Classification - Sources of credit - Role of institutional and non - Institutional agencies: Advantages and Disadvantages - Rural indebtedness: consequences of rural indebtedness - History and Development of rural credit in India.

UNIT II FARM FINANCIAL ANALYSIS

UNIT III FINANCIAL INSTITUTIONS
Institutional Lending Agencies - Commercial banks: Nationalization, Agricultural Development Branches - Area Approach - Priority Sector Lending - Regional Rural Banks, Lead bank, Scale of finance - Higher financial institutions: RBI, NABARD, AFC, ADB, World Bank and Deposit Insurance and Credit Guarantee Corporation of India - Microfinance and its role in poverty alleviation - Self-Help Groups - Non -Governmental Organizations - Rural credit policies followed by State and Central Government - Subsidized farm credit, Differential Interest Rate (DIR), Kisan Credit Card (KCC) Scheme - Relief Measures and Loan Waiver Scheme and Know Your Customer (KYC).

UNIT IV CO-OPERATION
Co-operation: Philosophy and Principles - History of Indian Cooperative Credit Movement: Pre and Post-Independence periods and Cooperation in different plan periods - Cooperative credit institutions: Two tier and three tier structure, Functions: provision of short term and long term credit, Strength and weakness of cooperative credit system, Policies for revitalizing cooperative credit: Salient features of Vaithiyananthan Committee Report on revival of rural cooperative credit institutions, Reorganisation of Cooperative credit structure in Andhra Pradesh and single window system and successful cooperative credit systems in Gujarat, Maharashtra, Punjab etc. - Special
OUTCOME:
After completion of this course, the students will

- Be familiar with agricultural finance, Banking, cooperation and basic concepts, principles and functions of management.

REFERENCES:

OBJECTIVES:
- To understand the basics of weather and climate
- To have an insight on Atmospheric dynamics and transport of heat
- To develop simple climate models and evaluate climate changes using models

UNIT I  BASICS OF WEATHER AND CLIMATE:

UNIT II  ATMOSPHERIC DYNAMICS:
UNIT III  GLOBAL CLIMATE


UNIT IV  CLIMATE SYSTEM PROCESSES


UNIT V  CLIMATE CHANGE MODELS


TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course the student will be able to understand

- The concepts of weather and climate
- The principles of Atmospheric dynamics and transport of heat and air mass
- The develop simple climate models and to predict climate change

TEXTBOOKS:


OCS751  DATA STRUCTURES AND ALGORITHMS  L T P C

3 0 0 3

OBJECTIVES:

- To understand the various algorithm design and analysis techniques
- To learn linear data structures – lists, stacks, and queues
- To learn different sorting and searching algorithms
- To understand Tree and Graph data structures

UNIT I  ALGORITHM ANALYSIS, LIST ADT

UNIT II STACKS AND QUEUES

UNIT III SEARCHING AND SORTING ALGORITHMS

UNIT IV TREES

UNIT V GRAPHS

TOTAL: 45 PERIODS

OUTCOMES:
At the end of this course, the students should be able to:
• Implement linear data structures and solve problems using them.
• Implement and apply trees and graphs to solve problems.
• Implement the various searching and sorting algorithms.

TEXT BOOKS:

REFERENCES:

OME751 DESIGN OF EXPERIMENTS L T P C
3 0 0 3

OBJECTIVE:
• To impart knowledge on various types of experimental designs conduct of experiments and data analysis techniques.

UNIT I FUNDAMENTALS OF EXPERIMENTAL DESIGNS
Hypothesis testing – single mean, two means, dependant/ correlated samples – confidence intervals, Experimentation – need, Conventional test strategies, Analysis of variance, F-test,
terminology, basic principles of design, steps in experimentation – choice of sample size – Normal and half normal probability plot – simple linear and multiple linear regression, testing using Analysis of variance.

UNIT II SINGLE FACTOR EXPERIMENTS
Completely Randomized Design- effect of coding the observations- model adequacy checking- estimation of model parameters, residuals analysis- treatment comparison methods-Duncan’s multiple range test, Newman-Keuel’s test, Fisher’s LSD test, Tukey’s test-testing using contrasts- Randomized Block Design – Latin Square Design- Graeco Latin Square Design –Applications.

UNIT III FACTORIAL DESIGNS
Main and Interaction effects - Two and three factor full factorial designs- Fixed effects and random effects model - Rule for sum of squares and Expected Mean Squares- $2^K$ Design with two and three factors- Yate’s Algorithm- fitting regression model - Randomized Block Factorial Design - Practical applications.

UNIT IV SPECIAL EXPERIMENTAL DESIGN
Blocking and Confounding in $2^K$ Designs- blocking in replicated design- $2^K$ Factorial Design in two blocks- Complete and partial confounding- Confounding $2^K$ Design in four blocks- Two level Fractional Factorial Designs- one-half fraction of $2^K$ Design, design resolution, Construction of one-half fraction with highest design resolution, one-quarter fraction of $2^K$ Design

UNIT V TAGUCHI METHODS
Design of experiments using Orthogonal Arrays, Data analysis from Orthogonal experiments- Response Graph Method, ANOVA- attribute data analysis- Robust design- noise factors, Signal to noise ratios, Inner/outer OA design.

TOTAL: 45 PERIODS

OUTCOME:
- Able to apply experimental techniques to practical problems to improve quality of processes / products by optimizing the process / product parameters.

TEXT BOOK:

REFERENCES:

OCE751 ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

OBJECTIVE:
- To impart the knowledge and skills to identify, assess and mitigate the environmental and social impacts of developmental projects

UNIT I INTRODUCTION

UNIT II ENVIRONMENTAL ASSESSMENT
Screening and Scoping in EIA – Drafting of Terms of Reference, Baseline monitoring, Prediction and Assessment of Impact on land, water, air, noise, flora and fauna - Matrices – Networks – Checklist Methods - Mathematical models for Impact prediction.

UNIT III ENVIRONMENTAL MANAGEMENT PLAN

UNIT IV SOCIO ECONOMIC ASSESSMENT
Baseline monitoring of Socio economic environment – Identification of Project Affected Personal – Rehabilitation and Resettlement Plan- Economic valuation of Environmental impacts – Cost benefit Analysis-

UNIT V CASE STUDIES

TOTAL: 45 PERIODS

OUTCOMES:
The students completing the course will have ability to

- carry out scoping and screening of developmental projects for environmental and social assessments
- explain different methodologies for environmental impact prediction and assessment
- plan environmental impact assessments and environmental management plans
- evaluate environmental impact assessment reports

TEXTBOOKS:

REFERENCES:
UNIT I ENVIRONMENTAL IMPLICATIONS OF BUILDINGS

UNIT II IMPLICATIONS OF BUILDING TECHNOLOGIES EMBODIED ENERGY OF BUILDINGS

UNIT III COMFORTS IN BUILDING

UNIT IV UTILITY OF SOLAR ENERGY IN BUILDINGS

UNIT V GREEN COMPOSITES FOR BUILDINGS

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
3. Fundamentals of Integrated Design for Sustainable Building By Marian Keeler, Bill Burke

OBJECTIVES:
- To understand the fundamentals of hospital administration and management.
- To know the market related research process
- To explore various information management systems and relative supportive services.
- To learn the quality and safety aspects in hospital.
UNIT I  OVERVIEW OF HOSPITAL ADMINISTRATION  
Distinction between Hospital and Industry, Challenges in Hospital Administration – Hospital Planning- Equipment Planning – Functional Planning

UNIT II  HUMAN RESOURCE MANAGEMENT IN HOSPITAL  
Principles of HRM – Functions of HRM – Profile of HRD Manager –Human Resource Inventory – Manpower Planning.

UNIT III  RECRUITMENT AND TRAINING  
Different Departments of Hospital, Recruitment, Selection, Training Guidelines – Methods of Training – Evaluation of Training – Leadership grooming and Training, Promotion – Transfer.

UNIT IV  SUPPORTIVE SERVICES  
Medical Records Department – Central Sterilization and Supply Department – Pharmacy – Food Services - Laundry Services.

UNIT V  COMMUNICATION AND SAFETY ASPECTS IN HOSPITAL  

TOTAL : 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:

• Explain the principles of Hospital administration.
• Identify the importance of Human resource management.
• List various marketing research techniques.
• Identify Information management systems and its uses.
• Understand safety procedures followed in hospitals

TEXT BOOKS:

REFERENCES:
OBJECTIVE:

- To introduce the basic concepts, laws, parts of robots, end effectors, sensors, programming methods, various applications of robots, justification and implementation of robot.

UNIT I INTRODUCTION

UNIT II ROBOT END EFFECTORS

UNIT III SENSORS

UNIT IV ROBOT PROGRAMMING
Robot Languages- Classification of robot language-Computer control and robot software-Val system and Languages.

UNIT V FIELD APPLICATIONS OF ROBOTICS
Material transfer, Machine loading, Assembly, inspection, processing operations and service robots, Delivery Robots – Intelligent vehicles – Survey and inspection robots – Space Robots – Autonomous aircrafts – Underwater Inspection – Agriculture and Forestry – Military robots

TOTAL : 45 PERIODS

OUTCOMES:
Upon Completion of the course, the students will be able to:

CO1: Express the basic concepts, laws, components and parameters of robots

CO2: Explain the types of grippers and its functions.

CO3: Summarize and determine various types of sensors involved in controlling the robots.

CO4: Describing the various programming techniques used in industrial robots

CO5: Use of robots in various field of applications

TEXT BOOKS:

REFERENCES:
OME754 INDUSTRIAL SAFETY L T P C
3 0 0 3

OBJECTIVES:

• To impart knowledge on safety engineering fundamentals and safety management practices.

UNIT I INTRODUCTION 9
Evolution of modern safety concepts – Fire prevention – Mechanical hazards – Boilers, Pressure vessels, Electrical Exposure.

UNIT II CHEMICAL HAZARDS 9
Chemical exposure – Toxic materials – Ionizing Radiation and Non-ionizing Radiation - Industrial Hygiene – Industrial Toxicology.

UNIT III ENVIRONMENTAL CONTROL 9
Industrial Health Hazards – Environmental Control – Industrial Noise - Noise measuring instruments, Control of Noise, Vibration, - Personal Protection.

UNIT IV HAZARD ANALYSIS 9
System Safety Analysis –Techniques – Fault Tree Analysis (FTA), Failure Modes and Effects Analysis (FMEA), HAZOP analysis and Risk Assessment

UNIT V SAFETY REGULATIONS 9

TOTAL : 45 PERIODS

OUTCOMES:

• Students must be able to identify and prevent chemical, environmental mechanical, fire hazard through analysis and apply proper safety techniques on safety engineering and management.

TEXT BOOK:

REFERENCES:
OBJECTIVE:
- To introduce the students to the interdisciplinary analysis of water and conceptual design of intervention strategies.
- To develop a knowledge-base on capacity building on IWRM.

UNIT I IWRM FRAMEWORK
Definition – Objectives – Principles - Evolution of IWRM - IWRM relevance in water resources management – Paradigm shift : Processes and prospective outcomes

UNIT II CONTEXTUALIZING IWRM
UN formulations - SDG goals - IWRM in Global, Regional and Local water partnership – Institutional transformation - Bureaucratic reforms - Inclusive development

UNIT III EMERGING ISSUES IN WATER MANAGEMENT
Emerging Issues — Drinking water management in the context of climate change - IWRM and irrigation - Flood – Drought – Pollution – Linkages between water, health and poverty

UNIT IV IWRM AND WATER RESOURCES DEVELOPMENT IN INDIA
Rural Development - Ecological sustainability - Watershed development and conservation - Ecosystem regeneration – Wastewater reuse - Sustainable livelihood - Food security

UNIT V ASPECTS OF INTEGRATED DEVELOPMENT
Capacity building - Conceptual framework of IWRM – Problems and policy issues - Solutions for effective integrated water management - Case studies

TOTAL: 45 PERIODS

OUTCOMES:
The students will be able to
- Understand objectives, principles and evolution of integrated water resources management.
- Have an idea of contextualizing IWRM
- Gain knowledge in emerging issues in water management, flood, drought, pollution and poverty.
- Understand the water resources development in India and wastewater reuse.
- Gain knowledge on integrated development of water management.

TEXTBOOKS:

REFERENCES:
OBJECTIVE:
- To gain insights about the importance of lean manufacturing and six sigma practices.

UNIT I LEAN & SIX SIGMA BACKGROUND AND FUNDAMENTALS 9
- Historical Overview
- Definition of quality
- What is six sigma
- TQM and Six sigma
- lean manufacturing and six sigma
- six sigma and process tolerance
- Six sigma and cultural changes
- six sigma capability
- six sigma need assessments
- implications of quality levels
- Cost of Poor Quality (COPQ)
- Cost of Doing Nothing
- assessment questions

UNIT II THE SCOPE OF TOOLS AND TECHNIQUES 9
- Tools for definition
- IPO diagram, SIPOC diagram
- Flow diagram
- CTQ Tree
- Project Charter
- Tools for measurement
- Check sheets
- Histograms
- Run Charts
- Scatter Diagrams
- Cause and effect diagram
- Pareto charts
- Control charts
- Process Capability Measurement
- Tools for analysis
- Process Mapping
- Regression analysis
- RU/CS analysis
- SWOT
- PESTLE
- Five Whys
- interrelationship diagram
- overall equipment effectiveness
- TRIZ innovative problem solving
- Tools for improvement
- Affinity diagram
- Normal group technique
- SMED
- 5S
- mistake proofing
- Value stream Mapping
- forced field analysis
- Tools for control
- Gantt chart
- Activity network diagram
- Radar chart
- PDCA cycle
- Milestone tracker diagram
- Earned value management

UNIT III SIX SIGMA METHODOLOGIES 9
- Design For Six Sigma (DFSS)
- Design For Six Sigma Method - Failure Mode Effect Analysis (FMEA)
- FMEA process - Risk Priority Number (RPN)
- Six Sigma and Leadership
- committed leadership
- Change Acceleration Process (CAP)
- Developing communication plan
- Stakeholder

UNIT IV SIX SIGMA IMPLEMENTATION AND CHALLENGES 9
- Tools for implementation
- Supplier Input Process Output Customer (SIPOC)
- Quality Function Deployment or House of Quality (QFD)
- alternative approach –implementation – leadership training
- close communication system
- project selection – project management and team
- champion training
- customer quality index
- challenges
- program failure
- CPQ vs six sigma
- structure the deployment of six sigma
- cultural challenge
- customer/internal metrics

UNIT V EVALUATION AND CONTINUOUS IMPROVEMENT METHODS 9
- Evaluation strategy
- the economics of six sigma quality
- Return on six Sigma (ROSS)
- ROI
- poor project estimates
- continuous improvement
- lean manufacturing
- value
- customer focus
- Perfection
- focus on waste
- overproduction
- waiting
- inventory in process (IIP)
- processing waste
- transportation
- motion
- making defective products
- underutilizing people
- Kaizen
- 5S

TOTAL: 45 PERIODS

OUTCOME:
- The student would be able to relate the tools and techniques of lean sigma to increase productivity

REFERENCES:
OBJECTIVES:
- To introduce the concepts of micro and nano electromechanical devices
- To know the fabrication process of Microsystems
- To know the design concepts of micro sensors and micro actuators
- To introduce the concepts of quantum mechanics and nano systems

UNIT I INTRODUCTION TO MEMS AND NEMS
Introduction to Design of MEMS and NEMS, Overview of Nano and Microelectromechanical Systems, Applications of Micro and Nanoelectromechanical systems, Materials for MEMS and NEMS: Silicon, silicon compounds, polymers, metals.

UNIT II MEMS FABRICATION TECHNOLOGIES
Photolithography, Ion Implantation, Diffusion, Oxidation, CVD, Sputtering Etching techniques, Micromachining: Bulk Micromachining, Surface Micromachining, LIGA.

UNIT III MICRO SENSORS
MEMS Sensors: Design of Acoustic wave sensors, Vibratory gyroscope, Capacitive Pressure sensors, Case study: Piezoelectric energy harvester

UNIT IV MICRO ACTUATORS

UNIT V NANO DEVICES
Atomic Structures and Quantum Mechanics, Shrodinger Equation, ZnO nanorods based NEMS device: Gas sensor.

OUTCOMES:
On successful completion of this course, the student should be able to:
- Interpret the basics of micro/nano electromechanical systems including their applications and advantages
- Recognize the use of materials in micro fabrication and describe the fabrication processes including surface micromachining, bulk micromachining and LIGA.
- Analyze the key performance aspects of electromechanical transducers including sensors and actuators
- Comprehend the theoretical foundations of quantum mechanics and nanosystems

REFERENCES:
OCS752 INTRODUCTION TO C PROGRAMMING L T P C 3 0 0 3

OBJECTIVES
- To develop C Programs using basic programming constructs
- To develop C programs using arrays and strings
- To develop applications in C using functions and structures

UNIT I INTRODUCTION
Structure of C program – Basics: Data Types – Constants – Variables – Keywords – Operators: Precedence and Associativity – Expressions – Input/Output statements, Assignment statements – Decision-making statements – Switch statement – Looping statements – Pre-processor directives – Compilation process – Exercise Programs: Check whether the required amount can be withdrawn based on the available amount – Menu-driven program to find the area of different shapes – Find the sum of even numbers
Text Book: Reema Thareja (Chapters 2,3)

UNIT II ARRAYS
Introduction to Arrays – One dimensional arrays: Declaration – Initialization – Accessing elements – Operations: Traversal, Insertion, Deletion, Searching – Two dimensional arrays: Declaration – Initialization – Accessing elements – Operations: Read – Print – Sum – Transpose – Exercise Programs: Print the number of positive and negative values present in the array – Sort the numbers using bubble sort – Find whether the given is matrix is diagonal or not.
Text Book: Reema Thareja (Chapters 5)

UNIT III STRINGS
Introduction to Strings - Reading and writing a string - String operations (without using built-in string functions): Length – Compare – Concatenate – Copy – Reverse – Substring – Insertion – Indexing – Deletion – Replacement – Array of strings – Introduction to Pointers – Pointer operators – Pointer arithmetic - Exercise programs: To find the frequency of a character in a string - To find the number of vowels, consonants and white spaces in a given text - Sorting the names.
Text Book: Reema Thareja ( Chapters 6 & 7)

UNIT IV FUNCTIONS
Introduction to Functions – Types: User-defined and built-in functions - Function prototype - Function definition - Function call - Parameter passing: Pass by value - Pass by reference - Built-in functions (string functions) – Recursive functions – Exercise programs: Calculate the total amount of power consumed by ‘n’ devices (passing an array to a function) – Menu-driven program to count the numbers which are divisible by 3, 5 and by both (passing an array to a function) – Replace the punctuations from a given sentence by the space character (passing an array to a function)
Text Book: Reema Thareja (Chapters 4)

UNIT V STRUCTURES
Introduction to structures – Declaration – Initialization – Accessing the members – Nested Structures – Array of Structures – Structures and functions – Passing an entire structure – Exercise programs: Compute the age of a person using structure and functions (passing a structure to a function) – Compute the number of days an employee came late to the office by considering his arrival time for 30 days (Use array of structures and functions)
Text Book: Reema Thareja (Chapters 8)

TOTAL:45 PERIODS

OUTCOMES
Upon completion of this course, the students will be able to
- Develop simple applications using basic constructs
- Develop applications using arrays and strings
- Develop applications using functions and structures

TEXT BOOK

REFERENCES:

OIE751 ROBOTICS L T P C
3 0 0 3

OBJECTIVES:
- To understand the functions of the basic components of a Robot.
- To study the use of various types of End of Effectors and Sensors
- To impart knowledge in Robot Kinematics and Programming
- To learn Robot safety issues and economics.

UNIT I FUNDAMENTALS OF ROBOT 6
Robot - Definition - Robot Anatomy - Co ordinate Systems, Work Envelope Types and Classification- Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load- Robot Parts and their Functions-Need for Robots-Different Applications.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS 9
Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers,
Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT III SENSORS AND MACHINE VISION 12
Requirements of a sensor, Principles and Applications of the following types of sensors- Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING 13
Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems. Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs.

UNIT V IMPLEMENTATION AND ROBOT ECONOMICS 5
RGV, AGV; Implementation of Robots in Industries-VARIOUS steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

OUTCOME:
• Upon completion of this course, the students can able to apply the basic engineering knowledge for the design of robotics

TEXT BOOKS:

REFERENCES:

OML753 SELECTION OF MATERIALS 3

OBJECTIVES:
• The subject exposes students to the basics parameter for selection of materials and different classes of materials, manufacturing processes and their properties, applications of materials.

UNIT I ENGINEERING MATERIALS 9

UNIT II MATERIAL PROPERTIES

UNIT III MANUFACTURING PROCESSING AND ECONOMIC ANALYSIS

UNIT IV MATERIALS SELECTION CHARTS AND TESTING

UNIT V APPLICATIONS AND USES

TOTAL : 45 PERIODS

OUTCOMES:
- Understand different types of availability materials
- Easy and effective way to select required materials
- Ability to identify the material properties

TEXT BOOKS:

REFERENCES:

OME752 SUPPLY CHAIN MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:
- To provide an insight on the fundamentals of supply chain networks, tools and techniques.
UNIT I  INTRODUCTION  9
Role of Logistics and Supply chain Management: Scope and Importance- Evolution of Supply Chain - Decision Phases in Supply Chain - Competitive and Supply chain Strategies – Drivers of Supply Chain Performance and Obstacles.

UNIT II  SUPPLY CHAIN NETWORK DESIGN  9

UNIT III  LOGISTICS IN SUPPLY CHAIN  9

UNIT IV  SOURCING AND COORDINATION IN SUPPLY CHAIN  9
Role of sourcing supply chain supplier selection assessment and contracts- Design collaboration - sourcing planning and analysis - supply chain co-ordination - Bull whip effect – Effect of lack of co-ordination in supply chain and obstacles – Building strategic partnerships and trust within a supply chain.

UNIT V  SUPPLY CHAIN AND INFORMATION TECHNOLOGY  9
The role IT in supply chain- The supply chain IT frame work Customer Relationship Management – Internal supply chain management – supplier relationship management – future of IT in supply chain – E-Business in supply chain.

TOTAL: 45 PERIODS

OUTCOME:
- The student would understand the framework and scope of supply chain networks and functions.

TEXTBOOK:

REFERENCES:

OML751  TESTING OF MATERIALS  L  T  P  C  3 0 0 3

OBJECTIVE:
- To understand the various destructive and non destructive testing methods of materials and its industrial applications.

UNIT I  INTRODUCTION TO MATERIALS TESTING  9
Overview of materials, Classification of material testing, Purpose of testing, Selection of material, Development of testing, Testing organizations and its committee, Testing standards, Result Analysis, Advantages of testing.

UNIT II MECHANICAL TESTING
Introduction to mechanical testing, Hardness test (Vickers, Brinell, Rockwell), Tensile test, Impact test (Izod, Charpy) - Principles, Techniques, Methods, Advantages and Limitations, Applications. Bend test, Shear test, Creep and Fatigue test - Principles, Techniques, Methods, Advantages and Limitations, Applications.

UNIT III NON DESTRUCTIVE TESTING

UNIT IV MATERIAL CHARACTERIZATION TESTING
Macroscopic and Microscopic observations, Optical and Electron microscopy (SEM and TEM) - Principles, Types, Advantages and Limitations, Applications. Diffraction techniques, Spectroscopic Techniques, Electrical and Magnetic Techniques- Principles, Types, Advantages and Limitations, Applications.

UNIT V OTHER TESTING

TOTAL: 45 PERIODS

OUTCOMES:
- Identify suitable testing technique to inspect industrial component
- Ability to use the different technique and know its applications and limitations

TEXT BOOKS:

REFERENCES: