### OPEN ELECTIVES (Offered by Other Branches)

#### V SEMESTER

**OPEN ELECTIVE - I**

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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

UNIT III  CONTROL OF PARTICULATE CONTAMINANTS

UNIT IV  CONTROL OF GASEOUS CONTAMINANTS

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:
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
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
Vehicle construction and different Chassis layouts - classifications of chassis- types of frames- frameless chassis construction -articulated vehicles- vehicle body - Vehicle aerodynamics-various resistances and its effects - steering system –conventional – sophisticated vehicle- and types of steering gear box-Power Steering- Steering geometry-condition for true rolling motion-Ackermann’s- Devi’s steering system - types of stub axle – Types of rear axles.

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.

UNIT V 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:

OBM551 BIO CHEMISTRY

OBJECTIVE:
- To study the structural and functional properties of carbohydrates, proteins, lipids and nucleic acids
- To discuss the impairments in metabolism of the above, including inborn errors of metabolism.

UNIT I BIOLOGICAL PRINCIPLE
Composition & properties of the cell membrane, membrane transports, permeability Coefficient & partition coefficient, body fluids, electrolytes, acid-base balance, blood viscosity and Newtonian nature, colloids, filtration, diffusion, osmosis, dialysis, ultrafiltration, ultracentrifugation, cellular fractionation, electrophoresis, radioimmunoassay, Photochemical reaction, law of photochemistry, fluorescence and phosphorescence.

UNIT II MACROMOLECULES
Classification and functions of carbohydrates, glycolysis, TCA cycle, Blood Sugar analysis and glucose tolerance test, Classification and functions of proteins, architecture of proteins, Classification of amino acids, Oxidative and non oxidative deamination, transamination, decarboxylation, urea cycle, Purification/separation of proteins, Classification and functions of lipids, biosynthesis of long chain fatty acids, oxidation and degradation of fatty acids.

UNIT III ENZYMES
Chemical Nature, General Properties, Spectrophotometric measurement of enzymes, Isolation techniques, Diagnostic enzymes.


UNIT IV METABOLIC DISORDER
Diabetes mellitus, Diabetic ketoacidosis, lactose intolerance, Glycogen storage disorders, Lipid storage disorders, obesity, atherosclerosis, Plasma proteins in health and disease, Inborn error of amino acid metabolism, Disorders associated with abnormalities in the metabolism of bilirubin – Jaundice.

UNIT V

TOTAL: 45 PERIODS

OUTCOMES:
After the successful completion of this course, the students will be able to,
- Explain the fundamentals of biochemistry
- Have in-depth knowledge about the classification, structures and properties of carbohydrates, lipid, protein and amino acid.
- Demonstrate about the mechanism of actions of enzymes and co-enzymes, clinical importance of enzymes, hormonal assay and significance.
TEXT BOOKS:

REFERENCES:

OIC551 BIOMEDICAL INSTRUMENTATION

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
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

UNIT III ELECTRICAL PARAMETERS MEASUREMENT AND ELECTRICAL SAFETY

UNIT IV IMAGING MODALITIES AND BIO-TELEMETRY

UNIT V LIFE ASSISTING AND THERAPEUTIC DEVICES

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:

OIT552 CLOUD COMPUTING

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

UNIT II VIRTUALIZATION

UNIT III CLOUD ARCHITECTURE, SERVICES AND STORAGE

UNIT IV RESOURCE MANAGEMENT AND SECURITY IN CLOUD

UNIT V CASE STUDIES

TOTAL: 45 PERIODS

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:**

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**OIT551 DATABASE MANAGEMENT SYSTEMS**

**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**

9


**UNIT II  DATABASE QUERYING**

11


**UNIT III  DATABASE PROGRAMMING**

7

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**

9


**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

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

UNIT II ELECTRICAL SYSTEMS

UNIT III THERMAL SYSTEMS

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

TOTAL: 45 PERIODS
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:

OA1551          ENVIRONMENT AND AGRICULTURE          L T P C
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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

OPT551 FIBRE REINFORCED PLASTICS

OBJECTIVES:
To enable the students
- To introduce the various materials for composite structure.
- To equip with the knowledge of sandwich structure technology.
- To provide knowledge in fracture mechanics of composites.
- To impart knowledge in fatigue and damping capacity of composite materials.
- To provide understanding of various manufacturing/fabricating techniques for composite structures

UNIT 1
Introduction: Definition, Reason for composites, Classifications of composites, Thermosets - Epoxy; Unsaturated polyester resin; vinyl ester, polyimides etc., preparation, properties, and uses.

UNIT II
Reinforcements: Types, Properties, chemistry and applications of fillers such as silica, titanium oxide, talc, mica etc., Manufacturing process, Properties, structure and uses of Glass fiber-, Carbon, Aramid, Boron, jute, sisal, cotton

UNIT III
Fabrications of Thermoset composites – Hand lay up method, compression and transfer moulding, pressure and vacuum bag process, filament winding, protrusion, reinforced RIM, RRIM, Injection moulding, of thermosets, SMC and DMC, Advantages and disadvantages of each method.

UNIT IV
Testing of composites - destructive and non-destructive tests; Destructive - tensile, compression, flexural, impact strength, Hardness - Fatigue - toughness HDT, basic concepts of fracture mechanisms

UNIT V
Applications of composites – aerospace, land transport, marine, structural, chemical plants and corrosion resistant products, mechanical engineering and energy applications sports, electrical, electronic and communication applications, biomedical applications, repairs and maintenance etc.,

TOTAL: 45 PERIODS
OUTCOMES:
Upon completion of this course, the students will be able to
- Select various materials for designing composite structures.
- Apply knowledge of fracture mechanics of composites during designing of composite structures.
- Analyze critically the damping capacity of composite materials.
- Correlate various manufacturing/fabricating techniques for composite structures based on design.

REFERENCES:
8. Composite applications – the future is now, Thomas J. Drozdr, (Eds), Published by Society of Manufacturing Engineers, Michigan, 1989.

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
GIS Applicant - Natural Resource Management - Engineering - Navigation - Vehicle tracking and fleet management - Marketing and Business applications - Case studies. 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:
OBJECTIVES:

- To provide in depth knowledge in Principles of Environmental safety and its applications in various fields.
- To provide the knowledge of air and water pollution and their control.
- To expose the students to the basics in hazardous waste management.

UNIT I SAFETY IN METAL WORKING AND WOOD WORKING MACHINES

General safety rules, principles, maintenance, Inspections of turning machines, boring machines, milling machine, planning machine and grinding machines, CNC machines, Wood working machinery, types, safety principles, electrical guards, work area, material handling, inspection, standards and codes- saws, types, hazards. Inspection of material handling equipments.

UNIT II SAFETY IN WELDING AND GAS CUTTING

Gas welding and oxygen cutting, resistances welding, arc welding and cutting, common hazards, personal protective equipment, training, safety precautions in brazing, soldering and metalizing – explosive welding, selection, care and maintenance of the associated equipment and instruments – safety in generation, distribution and handling of industrial gases-colour coding – flashback arrestor – leak detection-pipe line safety-storage and handling of gas cylinders.

UNIT III SAFETY IN COLD FORMING AND HOT WORKING OF METALS

Cold working, power presses, point of operation safe guarding, auxiliary mechanisms, feeding and cutting mechanism, hand or foot-operated presses, power press electric controls, power press set up and die removal, inspection and maintenance-metal sheers-press brakes - Hot working safety in forging, hot rolling mill operation, safe guards in hot rolling mills – hot bending of pipes, hazards and control measures - Safety in Gas Furnace Operation, Cupula, Crucibles, Ovens, Foundry Health Hazards, Work Environment, Material Handling in Foundries, Foundry Production Cleaning And Finishing Foundry Processes.

UNIT IV SAFETY IN FINISHING, INSPECTION AND TESTING

Heat treatment operations, Electro Plating, Paint Shops, Sand And Shot Blasting, Safety In Inspection And Testing, Dynamic Balancing, Hydro Testing, Valves, Boiler Drums And Headers, Pressure Vessels, Air Leak Test, Steam Testing, Safety In Radiography, Personal Monitoring Devices, Radiation Hazards, Engineering And Administrative Controls, Indian Boilers Regulation.

UNIT V INDUSTRIAL SAFETY

Advances in Industrial Ergonomics and safety, Work and protective clothing, Theory and practice of Industrial safety, Industrial Noise and Vibration, Machine Guarding and Industrial machine safety, Manual material handling, Modeling for safety and health.

OUTCOMES:

Students will be able to
1. Illustrate and familiarize the basic concepts and scope of engineering safety.
2. Understand the standards of professional conduct that are published by professional safety organizations and certification bodies.
3. Illustrate the importance of safety of employees while working with machineries.

REFERENCES:

OAT552  INTERNAL COMBUSTION ENGINES  L T P C

OBJECTIVE:
- To impart the basic fundamental knowledge on IC engines and its working along with some of the recent trends in IC engine

UNIT I  INTRODUCTION IC ENGINE  9
Introduction, Types of IC engines, Constructional details IC engine, working, principles – 2 & 4 stroke engines, Cycles – Air standard cycles, Fuel air cycles and actual cycles, Actual Indicator diagram for four stroke and two stroke engines, General fuel properties, ignition properties – octane and cetane rating, Materials for engine components

UNIT II  PETROL ENGINES  9
Working and constructional details of petrol engines, Carburetor – constructional and working, types of carburetors, additional features in modern carburetor, A/F ratio calculation, Petrol Injection - introduction, Ignition – introduction and requirements, Battery and magneto coil ignition system, Electronic ignition system, Stages of combustion in petrol engines, Combustion chambers for petrol engine, formation of knock in petrol engine

UNIT III  DIESEL ENGINES  9
Working and constructional details of diesel engines, fuel injection – requirements, types of injection systems – inline, distributor pumps, unit injector, Mechanical and pneumatic governors. Fuel injector, Types of injection nozzles, Spray characteristics. Injection timing, Split and multiple injection, Stages of combustion in Diesel engines, direct and indirect combustion chambers for diesel engine, knocking in diesel engine, Introduction on supercharging and turbocharging

UNIT IV  COOLING AND LUBRICATION  9
Requirements, Types- Air cooling and liquid cooling systems, forced circulation cooling system, pressure and Evaporative cooling systems, properties of coolants for IC engine. Need of lubrication, Lubricants for IC engines - Properties of lubricants, Types of lubrication – Mist, Wet and dry sump lubrication systems.

UNIT V  MODERN TECHNOLOGIES IN IC ENGINES  9
HCCI Engines – construction and working, CRDI injection system, GDI Technology, E - Turbocharger, Variable compression ratio engines, variable valve timing technology, Fuel cell, Hybrid Electric Technology

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
Make the students to understand about the nanomaterials, synthesis and its characterization.

UNIT I  BASICS AND SCALE OF NANOTECHNOLOGY  9

UNIT II  DIFFERENT CLASSES OF NANOMATERIALS  9
Classification based on dimensionality-Quantum Dots,Wells and Wires- Carbon- based nano materials (buckyballs, nanotubes, graphene)–Metal based nano materials (nanogold, nanosilver and metal oxides) -Nanocomposites- Nanopolymers –Nanoglasses –Nano ceramics -Biological nanomaterials.

UNIT III  SYNTHESIS OF NANOMATERIALS  9

UNIT IV  FABRICATION AND CHARACTERIZATION OF NANOSTRUCTURES  9

UNIT V  APPLICATIONS  9
Solar energy conversion and catalysis - Molecular electronics and printed electronics - Nanoelectronics -Polymers with aspecial architecture - Liquid crystalline systems - Linear and nonlinear optical and electro-optical properties, Applications in displays and other devices - Nanomaterials for data storage - Photonics, Plasmonics- Chemical and biosensors -Nanomedicine and Nanobiotechnology –Nanotoxicology challenges.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
OBJECTIVES:
- To study the various tools for lean manufacturing (LM).
- To apply the above tools to implement LM system in an organization.

UNIT I INTRODUCTION TO LEAN MANUFACTURING

UNIT II CELLULAR MANUFACTURING, JIT, TPM
Cellular Manufacturing – Types of Layout, Principles of Cell layout, Implementation. JIT – Principles of JIT and Implementation of Kanban. TPM – Pillars of TPM, Principles and implementation of TPM.

UNIT III SET UP TIME REDUCTION, TQM, 5S, VSM
Set up time reduction – Definition, philosophies and reduction approaches. TQM – Principles and implementation. 5S Principles and implementation - Value stream mapping - Procedure and principles.

UNIT IV SIX SIGMA
Six Sigma – Definition, statistical considerations, variability reduction, design of experiments – Six Sigma implementation

UNIT V CASE STUDIES
Various case studies of implementation of lean manufacturing at industries.

TOTAL: 45 PERIODS

OUTCOMES:
The students will be able to identify waste in any process, reduce the waste using proper kaizens and other methods thereby improving the productivity of the organisation using LM tools.

REFERENCES:
3. Rother M. and Shook J, 1999 ‘Learning to See: Value Stream Mapping to Add Value and Eliminate Muda’, Lean Enterprise Institute, Brookline, MA.
UNIT II  ULTRASOUND IN MEDICINE  9

UNIT III  PRINCIPLES OF RADIOACTIVE NUCLIDES AND DECAY  9

UNIT IV  INTERACTION OF RADIATION WITH MATTER  9

UNIT V  RADIATION EFFECTS AND REGULATIONS  9

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

UNIT II    MICROSCOPY

UNIT III   ELECTRON MICROSCOPY

UNIT IV    SAMPLE PREPARATION FOR MICROSTRUCTURAL ANALYSIS

UNIT V    CHEMICAL ANALYSIS

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:
OBJECTIVE:

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

UNIT I  FUNDAMENTALS: SOCIOLOGY AND PARTICIPATORY APPROACH  6
Sociology – Basic concepts – Perspectives- Social Stratification – Irrigation as a Socio technical Process - Participatory concepts– Objectives of participatory approach

UNIT II  UNDERSTANDING FARMERS PARTICIPATION  10

UNIT III  ISSUES IN WATER MANAGEMENT  9

UNIT IV  PARTICIPATORY WATER CONSERVATION  10

UNIT V  PARTICIPATORY WATERSHED DEVELOPMENT  10
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.

OUTCOMES:
The students will be able to

- Gain knowledge on various processes involved in participatory water resource management.
- Understand farmers 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:
OBJECTIVES

- To understand the overall view of the chemical engineering subjects

UNIT I
Chemistry, Chemical Engineering and Chemical Technology; Chemical process industries: History and their role in Society; Role of Chemical Engineer; History and Personalities of Chemical Engineering; Greatest achievements of Chemical Engineering.

UNIT II
Components of Chemical Engineering: Role of Mathematics, Physics, Chemistry and Biology; Thermodynamics, Transport Phenomena, Chemical Kinetics and Process dynamics, design and control.

UNIT III
Concept of Unit Processes and Unit Operations; Description of different Unit Processes and Unit Operations; Designing of equipments; Flowsheet representation of process plants, Evolution of an Industry – Sulphuric acid and Soda ash manufacture. Demonstration of simple chemical engineering experiments; Plant visit to a chemical industry

UNIT IV
Role of Computer in Chemical Engineering; Chemical Engineering Software; Visit to Process Simulation Lab; Relation between Chemical Engineering and other engineering disciplines; Traditional vs. modern Chemical Engineering; Versatility of Chemical Engineering: Role of Chemical Engineers in the area of Food, Medical, Energy, Environmental, Biochemical, Electronics etc. Plant visit to an allied industry.

UNIT V
Paradigm shifts in Chemical Engineering; Range of scales in Chemical Engineering; Opportunities for Chemical Engineers; Future of Chemical Engineering.

TOTAL : 45 PERIODS

OUTCOMES

- On completion of the course, students will attain knowledge in fluid behavior and solid properties.
- Understand the concept of chemical engineering principles

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
- The course aims to introduce the students to the area of Food Preservation. This is necessary for effective understanding of a detailed study of food processing and technology subjects.

UNIT I FOOD PRESERVATION AND ITS IMPORTANCE  
Introduction to food preservation. Wastage of processed foods; Shelf life of food products; Types of food based on its perishability. Traditional methods of preservation

UNIT II METHODS OF FOOD HANDLING AND STORAGE  
Nature of harvested crop, plant and animal; storage of raw materials and products using low temperature, refrigerated gas storage of foods, gas packed refrigerated foods, sub atmospheric storage, Gas atmospheric storage of meat, grains, seeds and flour, roots and tubers; freezing of raw and processed foods. retort pouch packing, Aseptic packaging.

UNIT III THERMAL METHODS  
Newer methods of thermal processing; batch and continuous; In container sterilization- canning; application of infra-red microwaves; ohmic heating; control of water activity; preservation by concentration and dehydration; osmotic methods

UNIT IV DRYING PROCESS FOR TYPICAL FOODS  
Rate of drying for food products; design parameters of different type of dryers; properties of air-water mixtures. Psychrometric chart, freezing and cold storage. dehydro-freezing, freeze drying, IQF; calculation of refrigeration load, design of freezers and cold storages.

UNIT V NON-THERMAL METHODS  
Super Critical Technology for Preservation - Chemical preservatives, preservation by ionizing radiations, ultrasonics, high pressure, fermentation, curing, pickling, smoking, membrane technology. Hurdle technology,

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course the students are expected to
- Be aware of the different methods applied to preserving foods.

TEXT BOOKS:

REFERENCES:
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 (9)

UNIT II  CONCEPT GENERATION AND SELECTION (9)

UNIT III  PRODUCT ARCHITECTURE (9)

UNIT IV  INDUSTRIAL DESIGN (9)

UNIT V  DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT (9)

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:
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 able to apply the different manufacturing process and use this in industry for component production.

TEXTBOOKS:

REFERENCES:
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

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

Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT III SOLAR ENERGY STORAGE AND APPLICATIONS

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


UNIT V GEOTHERMAL ENERGY:

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.

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:

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
OBJECTIVES:
- To provide knowledge on design in state variable form
- To study the design of optimal controller.
- To study the design of optimal estimator including Kalman Filter

UNIT I STATE FORMULATION
Formulation of state variable model, non-uniqueness, controllability, observability, stability.

UNIT II STATE VARIABLE DESIGN
Modes, controllability of modes - effect of state and output feedback - pole placement Design

UNIT III STATE ESTIMATION
Need for state estimation - design of state Observers - full and reduced order – disturbance estimation-separation principle

UNIT IV OPTIMAL CONTROL
Introduction - Time varying optimal control - LQR steady state optimal control - Solution of Ricatti’s equation – Application examples.

UNIT V OPTIMAL ESTIMATION
Optimal estimation – Kalman Bucy Filter-Solution by duality principle-Discrete systems-Kalman Filter- Application examples..

TOTAL : 45 PERIODS

OUTCOMES:
- Ability to apply advanced control theory to practical engineering problems.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To understand the concept of network management standards.
- To design the common management information service element model.
- To understand the various concept of information modelling.
- To analyze the concept of SNMPv1 and SNMPv2 protocol.
- To analyze the concept of examples of network management.

UNIT I  FOUNDATIONS


UNIT II  COMMON MANAGEMENT INFORMATION SERVICE ELEMENT


UNIT III  INFORMATION MODELING FOR TMN

Rationale for information modeling–management information model–object oriented modeling paradigm– structure of management information–managed object class definition–management information base.

UNIT IV  SIMPLE NETWORK MANAGEMENT PROTOCOL


UNIT V  NETWORK MANAGEMENT EXAMPLES


OUTCOMES:

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

- Design and analyze of fault management.
- Analyze the common management information protocol specifications.
- Design and analyze of management information model.
- Design the simple network management protocol.
- Design the various types of network management tools.

TEXT BOOKS:


REFERENCES:

OBJECTIVES

• Understanding of the concept and importance of strategy planning for manufacturing industries
• To apply principles and techniques in the identifiable formulation and implementation of manufacturing strategy for competitive in global context.

UNIT I INDUSTRIAL DECLINE AND ASCENDANCY 9
Manufacturing excellence - US Manufacturers - French Manufacturers - Japan decade – American decade - Global decade

UNIT II BUILDING STRENGTH THROUGH CUSTOMER – FOCUSED PRINCIPLES 9
Customer - Focused principles - General principles - Design - Operations - Human resources - Quality and Process improvement - Promotion and Marketing

UNIT III VALUE AND VALUATION 9
Product Costing - Motivation to improve - Value of the enterprises QUALITY - The Organization: Bulwark of stability and effectiveness - Employee stability – Quality Individuals Vs. Teams - Team stability and cohesiveness - Project cohesiveness and stability

UNIT IV STRATEGIC LINKAGES 9
Product decisions and customer service - Multi-company planning - Internal manufacturing planning - Soothing the demand turbulence

UNIT V IMPEDIMENTS 9
Bad plant design - Mismanagement of capacity - Production Lines - Assembly Lines – Whole Plant Associates - Facilitators - Teamsmanship - Motivation and reward in the age of continuous Improvement

TOTAL: 45 PERIODS

OUTCOMES:

• Able to understand the concept and the importance of manufacturing strategy for industrial enterprise competitiveness.
• Apply appropriate techniques in the analysis and devaluation of company’s opportunities for enhancing competitiveness in the local regional and global context.
• Identify formulation and implement strategies for manufacturing and therefore enterprise competitiveness.

TEXT BOOKS:
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  9
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  9

UNIT III  FINANCIAL INSTITUTIONS  9
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  9
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 Vaithiyathan 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 cooperatives: LAMPS and FSS: Objectives, role and functions - National Cooperative Development Corporation (NCDC) and National Federation of State Cooperative Banks Ltd., (NAFSCOB) - Objectives and Functions.

UNIT V  BANKING AND INSURANCE  9

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:

OEE751 BASIC CIRCUIT THEORY L T P C
3 0 0 3

OBJECTIVES:
- To introduce electric circuits and its analysis
- To impart knowledge on solving circuit equations using network theorems
- To introduce the phenomenon of resonance in coupled circuits.
- To introduce Phasor diagrams and analysis of three phase circuits

UNIT I BASIC CIRCUITS ANALYSIS 9

UNIT II NETWORK REDUCTION AND THEOREMS FOR DC CIRCUITS 9

UNIT III AC CIRCUITS 9
Introduction to AC circuits , inductance reactance, capacitive reactance, Phasor diagrams, real power, reactive power, apparent power, power factor, R-L R-C , RLC networks, Network reduction: voltage and current division, source transformation –mesh and node analysis, Thevenins and Norton Theorems – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem – Millman's theorem.

UNIT IV THREE PHASE CIRCUITS 9
A.C. circuits – Average and RMS value - Phasor Diagram – Power, Power Factor and Energy.- Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents – power measurement in three phase circuits.

UNIT V RESONANCE AND COUPLED CIRCUITS 9

TOTAL: 45 PERIODS

OUTCOMES:
- Ability to introduce electric circuits and its analysis
- Ability to impart knowledge on solving circuit equations using network theorems
- Ability to introduce the phenomenon of resonance in coupled circuits.
- Ability to introduce Phasor diagrams and analysis of three phase circuits

TEXT BOOKS:
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: 9

UNIT II  ATMOSPHERIC DYNAMICS: 9

UNIT III  GLOBAL CLIMATE 9

UNIT IV  CLIMATE SYSTEM PROCESSES 9

**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

**TEXT BOOKS:**


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**OCS751 DATA STRUCTURES AND ALGORITHMS**

**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  GRAPHES

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:
UNIT IV   DIELECTRIC AND INSULATING MATERIALS


UNIT V   OPTOELECTRONIC AND NANO ELECTRONIC MATERIALS


TOTAL : 45 PERIODS

OUTCOME:
• With the basis, students will be able to have clear concepts on electronic behaviors of materials

TEXT BOOKS:

REFERENCES:
2. Eugene A. Irene, Electronic Materials Science, Wiley, 2005

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
Plan for mitigation of adverse impact on water, air and land, water, energy, flora and fauna – 
Environmental Monitoring Plan – EIA Report Preparation – Public Hearing-Environmental 
Clearance

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
EIA case studies pertaining to Infrastructure Projects – Roads and Bridges – Mass Rapid 
Transport Systems - Airports - Dams and Irrigation projects - Power plants.

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

TEXT BOOKS:
Delhi,1995.
“Environmental Impact Assessment for Developing Countries in Asia”, Volume 1 – Overview, 
3. Peter Morris, Riki Therivel “Methods of Environmental Impact Assessment”, Routledge 

REFERENCES:
4. Ministry of Environment and Forests EIA Notification and Sectoral Guides, Government of 
India, New Delhi, 2010.

OGI752  FUNDAMENTALS OF PLANETARY REMOTE SENSING  3 0 0 3

OBJECTIVES:
• To provide an insight to the basics of planetary Remote Sensing
• To demonstrate how the Remote Sensing technique is applied to explore the surface 
characteristics of the planets and its environ.

UNIT I  PLANETARY SCIENCE
History and inventory of solar system – planet-definition –properties – Formation of solar system.
Planetary Atmospheres: composition - thermal structure – clouds – meteorology – photo chemistry 
– Eddy Diffusion. Surfaces and Interiors: Mineralogy and Petrology – Planetary interiors – surface 
morphology. Terrestrial planets and the Moon: The moon & Mercury – surface – Atmosphere – 
Interior – Magnetic Field.
UNIT II  SATELLITE ORBIT

UNIT III  PROPERTIES OF EMR

UNIT IV  RADIOMETRY AND SCATTEROMETRY

UNIT V PLANETARY APPLICATION
Planetary Imaging Spectroscopy- USGS Tetracoder and Expert system - Mars Global Surveyor Mission (MGS) – Digital Elevation Model(DEM) of Mars – Mars Orbiter Camera (MOC) – Stereo and photoclinometric techniques for DEM.

OUTCOMES:
On completion of the course, the students have
- Exposure to fundamentals of planetary science or orbital mechanics
- The principles of observing the planets
- Knowledge of Remote Sensing methods for determining surface elevation and mapping of planets.

REFERENCES:

OEN751  GREEN BUILDING DESIGN  L T P C
3  0  0  3

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

OAI752  INTEGRATED WATER RESOURCES MANAGEMENT  
L T P C 3 0 0 3

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:

OEI751 INTRODUCTION TO EMBEDDED SYSTEMS

OBJECTIVES:
- To introduce the Building Blocks of Embedded System
- To Educate in Various Embedded Development Strategies
- To Introduce Bus Communication in processors, Input/output interfacing.
- To impart knowledge in Various processor scheduling algorithms.
- To introduce Basics of Real time operating system and example tutorials to discuss on one real-time operating system tool

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS

UNIT II EMBEDDED NETWORKING

UNIT III EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT
Embedded Product Development Life Cycle- objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model.

UNIT IV RTOS BASED EMBEDDED SYSTEM DESIGN
Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication-shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance, comparison of Real time Operating systems: Vx Works, μC/OS-II, RT Linux.
UNIT V  
EMBEDDED SYSTEM APPLICATION DEVELOPMENT  
Case Study of Washing Machine- Automotive Application- Smart card System Application.  
TOTAL: 45 PERIODS  

OUTCOMES:  
- Ability to understand and analyse, linear and digital electronic circuits.  

TEXT BOOKS:  

REFERENCES:  

OMF751  
LEAN SIX SIGMA  
L T P C  
3 0 0 3  

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  

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

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:
3. Fred Soleimannejed, Six Sigma, Basic Steps and Implementation, AuthorHouse, 2004

OAN751 LOW COST AUTOMATION

OBJECTIVES
• To give basic knowledge about automation
• To understand the basic hydraulics and pneumatics systems for automation
• To understand the assembly automation

UNIT I AUTOMATION OF ASSEMBLY LINES
Concept of automation - mechanization and automation - Concept of automation in industry - mechanization and automation - classification, balancing of assembly line using available algorithms - Transfer line-monitoring system (TLMS) using Line Status - Line efficiency - Buffer stock Simulation in assembly line

UNIT II AUTOMATION USING HYDRAULIC SYSTEMS
Design aspects of various elements of hydraulic systems such as pumps, valves, filters, reservoirs, accumulators, actuators, intensifiers etc. - Selection of hydraulic fluid, practical case studied on hydraulic circuit design and performance analysis - Servo valves, electro hydraulic valves, proportional valves and their applications.

UNIT III AUTOMATION USING PNEUMATIC SYSTEMS

UNIT IV AUTOMATION USING ELECTRONIC SYSTEMS
Introduction - various sensors – transducers - signal processing - servo systems - programming of microprocessors using 8085 instruction - programmable logic controllers
UNIT V ASSEMBLY AUTOMATION

Types and configurations - Parts delivery at workstations - Various vibratory and non vibratory devices for feeding - hopper feeders, rotary disc feeder, centrifugal and orientation - Product design for automated assembly.

OUTCOMES:
- Upon completion of this course, the students can able to do low cost automation systems
- Students can do some assembly automation

TEXT BOOKS:

REFERENCES

OMT751 MEMS AND NEMS L T P C 3 0 0 3

OBJECTIVE:
To develop the basic knowledge about the MEMS system and to know about the concepts and principles of MEMS & NEMS with various applications.

UNIT I INTRODUCTION

UNIT II MICRO FABRICATION AND MANUFACTURING TECHNIQUES

UNIT III MECHANICS FOR MICRO SYSTEM DESIGN AND APPLICATIONS
Basic concepts – Bending of thin plates – Mechanical vibration – Thermo mechanics - Fracture mechanics – Fluid mechanics at micro systems- Design considerations - Process design-mask layout design – Mechanical design-Applications of micro system in automotive industry, bio medical, aerospace and telecommunications.

UNIT IV NANO ELECTRONICS
UNIT V  ARCHITECTURE AND APPLICATIONS  
TOTAL :45PERIODS

OUTCOMES:  
CO1: Understand the Fundamentals and working principles of microsystems and microelectronics  
CO2: Knowledge on both micro fabrication and manufacturing techniques  
CO3: Acquiring knowledge about micro system design and its various applications  
CO4: Study about the basic concepts of Nano electronics with various devices and also discusses with its applications  
CO5: Realizing the various application of NEMS and Architecture of MEMS

TEXT BOOKS:  

REFERENCES  

ORO751  NANO COMPUTING  L T P C  3 0 0 3

OBJECTIVES:  
The student should be made to:  
• Learn nano computing challenges  
• Be familiar with the imperfections  
• Be exposed to reliability evaluation strategies  
• Learn nano scale quantum computing  
• Understand Molecular Computing and Optimal Computing

UNIT I  NANOCOMPUTING-PROSPECTS AND CHALLENGES  

UNIT II  NANOCOMPUTING WITH IMPERFECTIONS  

UNIT III  RELIABILITY OF NANOCOMPUTING  
UNIT IV  NANOSCALE QUANTUM COMPUTING  

UNIT V  QCADESIGNER SOFTWARE AND QCA IMPLEMENTATION  

OUTCOMES: 
Upon completion of the course, the student should be able to: 
- Discuss nano computing challenges. 
- Handle the imperfections. 
- Apply reliability evaluation strategies. 
- Use nano scale quantum computing. 
- Utilize Molecular Computing and Optimal Computing. 

TEXT BOOK: 

REFERENCES: 

OEC755  PHOTONIC NETWORKS  

OBJECTIVES: 
- To enable the student to understand the importance of the backbone infrastructure for our present and future communication needs and familiarize them with the architectures and the protocol stack in use 
- To enable the student to understand the differences in the design of data plane and the control plane and the routing, switching and the resource allocation methods and the network management and protection methods in vogue 
- To expose the student to the advances in networking and switching domains and the future trends 

UNIT I  OPTICAL SYSTEM COMPONENTS  
Light Propagation in optical fibers – Loss & bandwidth, System limitations, Non Linear effects; Solitons; Optical Network Components – Couplers, Isolators & Circulators, Multiplexers & Filters, Optical Amplifiers, Switches, Wavelength Converters. 

UNIT II  OPTICAL NETWORK ARCHITECTURES  
Introduction to Optical Networks; SONET / SDH, Metropolitan - Area Networks, Layered Architecture ; Broadcast and Select Networks – Topologies for Broadcast Networks, Media-Access Control Protocols, Wavelength Routing Architecture.
UNIT III  WAVELENGTH ROUTING NETWORKS
The optical layer, Optical Network Nodes, Routing and wavelength assignment, Traffic Grooming in Optical Networks, Architectural variations- Linear Light wave networks, Logically Routed Networks.

UNIT IV  PACKET SWITCHING AND ACCESS NETWORKS

UNIT V  NETWORK DESIGN AND MANAGEMENT

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student would be able to:
- Use the backbone infrastructure for our present and future communication needs
- Analyze the architectures and the protocol stack
- Compare the differences in the design of data plane, control plane, routing, switching, resource allocation methods, network management and protection methods in vogue

REFERENCES:

OCH751  PROCESS MODELING AND SIMULATION

OBJECTIVE:
- To give an overview of various methods of process modeling, different computational techniques for simulation.

UNIT I  INTRODUCTION
Introduction to modeling and simulation, classification of mathematical models, conservation equations and auxiliary relations.

UNIT II  STEADY STATE LUMPED SYSTEMS
Degree of freedom analysis, single and network of process units, systems yielding linear and non-linear algebraic equations, flow sheeting – sequential modular and equation oriented approach, tearing, partitioning and precedence ordering, solution of linear and non-linear algebraic equations.

UNIT III  UNSTEADY STATE LUMPED SYSTEMS
Analysis of liquid level tank, gravity flow tank, jacketed stirred tank heater, reactors, flash and distillation column, solution of ODE initial value problems, matrix differential equations, simulation of closed loop systems.
UNIT IV  STEADY STATE DISTRIBUTED SYSTEM
Analysis of compressible flow, heat exchanger, packed columns, plug flow reactor, solution of ODE boundary value problems.

UNIT V  UNSTEADY STATE DISTRIBUTED SYSTEM & OTHER MODELLING APPROACHES

TOTAL : 45 PERIODS

OUTCOME:
- Upon completing the course, the student should have understood the development of process models based on conservation principles and process data and computational techniques to solve the process models.

TEXT BOOKS:

REFERENCES:

OAT751  PRODUCTION OF AUTOMOTIVE COMPONENTS

OBJECTIVES:
- To study in detail about the modern casting, forging, molding and machining processes followed in automotive components.
- To enhance the knowledge of the students in the field of non–ferrous materials, emerging metallic and non-metallic materials like polymers, fiber reinforced plastics (FRP), engineering ceramics, metal matrix composites (MMCs) and its manufacturing methods, selection criteria, properties and applications for automotive components.

UNIT I  ENGINE COMPONENTS
UNIT II  TRANSMISSION COMPONENTS  9

UNIT III  BODY COMPONENTS  9

UNIT IV  CHASSIS COMPONENTS  9

UNIT V  TYRES AND ADVANCED MATERIALS MANUFACTURING  9
Tire and tube manufacturing, spray painting, powder coating, Prototype Manufacturing -RPT,3-D Printing, chemical vapour deposition, physical vapour deposition, cryogenic grinding of powders, sealants, sound proof materials, structural adhesives, MMC liners – Selection of materials for Auto components.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of this course the student should

- Will be able to select an appropriate manufacturing process for particular Automotive Components.
- Have in-depth knowledge of various engineering materials used in automobile engineering and the corresponding manufacturing processes for the same.

TEXT BOOKS:

REFERENCES:
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

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

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


UNIT IV  ROBOT KINEMATICS AND ROBOT PROGRAMMING

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

RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

TOTAL: 45 PERIODS

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

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

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:
OBJECTIVE:
- To introduce system engineering concepts to design the manufacturing system for optimum utilization of source for effective functioning.

UNIT I INTRODUCTION
Definitions of Systems Engineering, Systems Engineering Knowledge, Life cycles, Life-cycle phases, logical steps of systems engineering, Frame works for systems engineering.

UNIT II SYSTEMS ENGINEERING PROCESSES
Formulation of issues with a case study, Value system design, Functional analysis, Business Process Reengineering, Quality function deployment, System synthesis, Approaches for generation of alternatives.

UNIT III ANALYSIS OF ALTERNATIVES- I
Cross-impact analysis, Structural modeling tools, System Dynamics models with case studies, Economic models: present value analysis – NPV, Benefits and costs over time, ROI, IRR; Work and Cost breakdown structure,

UNIT IV ANALYSIS OF ALTERNATIVES–II
Reliability, Availability, Maintainability, and Supportability models; Stochastic networks and Markov models, Queuing network optimization, Time series and Regression models, Evaluation of large scale models

UNIT V DECISION ASSESSMENT
Decision assessment types, Five types of decision assessment efforts, Utility theory, Group decision making and Voting approaches, Social welfare function; Systems Engineering methods for Systems Engineering Management,

TOTAL : 45 PERIODS

OUTCOMES:
- The Student must be able to apply systems engineering principles ot make decision for optimization.
- Hence an understanding of the systems engineering discipline and be able to use the core principles and processes for designing effective system.

TEXT BOOK:
UNIT II  MECHANICAL TESTING  9
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  9

UNIT IV  MATERIAL CHARACTERIZATION TESTING  9
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  9

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:
UNIT II  VEHICLE BODY DESIGN:

UNIT III  NOISE AND VIBRATION:

UNIT IV  CRASHWORTHINESS AND ERGONOMIC APPROACH:

UNIT V  VEHICLE CONTROL SYSTEMS
Automotive application of sensors - Chassis control systems - Anti-lock braking systems, Traction control systems, Electronically controlled power-assisted steering - Vehicle safety and security systems - Air-bag and seat belt pre-tensioner systems, Remote keyless entry and vehicle immobilization, Introduction to On-board navigation systems.

TEXT BOOK:

REFERENCES:

OTT751  WEAVING MECHANISMS  L T P C
3 0 0 3

OBJECTIVE:
- To enable the students to understand the preparation for weaving and various functions of weaving machine.

UNIT I  INTRODUCTION
Types of winding drums - Design of winder drums; various motions for automatic weaving—primary, secondary and auxiliary motions; Driving plain power loom; timing of motions.

UNIT II  SHEDDING
Principles of tappet, dobbý and jacquard shedding mechanisms, positive and negative shedding mechanisms, electronic dobbý and jacquard mechanism, tappet design.

UNIT III  PICKING-I
Mechanism of picking in shuttle looms, components of picking system, design of shuttle, multi shuttle mechanism.
UNIT IV  PICKING-II  
Principles of weft insertions in shuttle less looms; weft feeder, mechanism of weft insertion by projectile, gripper cycle; rapier loom-classification, rapier drive mechanisms, devices timings; Water jet weft insertion; Air jet weft insertion.

UNIT V  OTHER MECHANISMS  
Shuttle and shuttleless terry mechanisms; Let-off and take-up mechanism; selvedge mechanism in shuttle less loom, warp weft, stop motions, warp protector mechanism

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the students shall,
- Understand the concepts of preparation of weaving process
- Understand different motions of loom in fabric formation.

TEXT BOOKS:

REFERENCES:

OPR751  BASICS IN MANUFACTURING AND METAL CUTTING PROCESS  L T P C
3 0 0 3

OBJECTIVES:
- To impart the knowledge on basic concepts of various machining processes and machine tools.
- To impart the knowledge on basic concepts of mechanics in metal cutting process.
- To impart the mechanism involved in tool wear.

UNIT I  LATHE  
UNIT II  SHAPER  9
Purpose of shaping – block diagram – functions of each part, work holding devices in shaper - Quick return mechanism in shaper – mechanical and hydraulic – cross feed mechanism – simple problems to calculate the velocity – speed, feed and depth of cut.

UNIT III  DRILLING  9

UNIT IV  MECHANICS OF METAL CUTTING  9

UNIT V  TOOL MATERIAL, TOOL WEAR, TOOL LIFE AND MACHINABILITY  9

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the students will be able to:
1. Understand the constructional features and working principles of Lathe, work holding devices and also understands the concepts of mechanics of metal cutting.
2. Understand the constructional features and working principles of shaper, work holding devices and various machining operations performed.
3. Understand the constructional features and working principles of drilling machine and its types.
4. To apply the principles of metal cutting and mechanics in machining process.
5. To select tool materials based on requirement.

TEXT BOOKS

REFERENCES

OPR752  PROCESSING OF POLYMER AND COMPOSITES  L T P C
3 0 0 3

OBJECTIVES
To understand the characteristics of different reinforcement matrix materials
• To develop composite materials for different application.
• To know the different process used for polymer matrix composites, metal matrix composites and ceramics matrix composites
UNIT I INTRODUCTION

UNIT II POLYMER MATRIX COMPOSITES

UNIT III METAL MATRIX COMPOSITES

UNIT IV CERAMICS MATRIX COMPOSITES

UNIT V ADVANCES IN POLYMERS & COMPOSITES

OUTCOMES
• Ability to select suitable matrix, reinforce materials for polymer matrix composites, metal matrix composites and ceramics matrix composites

TEXT BOOKS:

REFERENCES:
5. Brydson, Hand book of plastic processing
OBJECTIVES:

- To provide the students a basic knowledge about various types of marine vehicles
- To provide the students basic theory behind the design and development of marine vehicles

UNIT I  MARINE VEHICLES  6
Types – general – by function – commercial marine vehicles- passenger ship, cargo ships, oil and chemical tankers, cattle carriers, harbor crafts, off shore platform, container ships

UNIT II  REEFERS AND GAS CARRIERS  9
Introduction – Types, design considerations, safety – operation and controls, precaution during bunkering

UNIT III  REMOTELY OPERABLE VEHICLE (ROV), UMS SHIPS  9

UNIT IV  SUBMERSIBLES AND AUTONOMOUS UNDERWATER VEHICLE (AUV)  9

UNIT V  MANNED AND UN MANNED SUBMERSIBLE  12

OUTCOMES:

- Students will be able understand the types of marine vehicles
- Students should get a preliminary knowledge in marine vehicle design, construction and its components

TEXT BOOKS:

1. Jonathan M. Ross, human factors for naval marine vehicle design and operation
3. R. Frank Busby, Manned Submersibles, Office of the oceanographer of the Navy, 1976

REFERENCES