## V Semester

### Open Elective - I

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<th>SL. No.</th>
<th>Course Code</th>
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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 INRODUCTION
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 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-
Ignition system - Electronic ignition system - Transistorized ignition system, capacitive discharge
ignition system.

UNIT II VEHICLE FRAMES AND STEERING SYSTEM 9
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 9
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 9
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 9
Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and
Hydrogen in Automobiles- Engine modifications required – Performance, Combustion and
Emission Characteristics of SI and CI engines with these alternate fuels - Electric and Hybrid
Vehicles, Fuel Cell. Turbo chargers - Engine emission control by three way catalytic converter
system.

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:
   Delhi, 2002.
   New Delhi, 1997.
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 L T P C
3 0 0 3

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:

OIT551 DATABASE MANAGEMENT SYSTEMS L T P C 3 0 0 3

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 L T P C 3 0 0 3

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 9
Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. sets

UNIT V ECONOMICS 9
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:

OAI551                           ENVIRONMENT AND AGRICULTURE            L T P C
                                           3 0 0 3

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  8
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  9
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        8

UNIT IV   ECOLOGICAL DIVERSITY AND AGRICULTURE 10

UNIT V    EMERGING ISSUES       10
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.,

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:
2. Polymers and Polymer Composites in Construction by L.C. Holleway, 1990

OCE552 GEOGRAPHIC INFORMATION SYSTEM

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

OUTCOMES:
This course equips the student to
- Have basic idea about the fundamentals of GIS.
- Understand the types of data models.
- Gain knowledge about data input and topology.
- Gain knowledge on data quality and standards.
- Understand data management functions and data output

TOTAL: 45 PERIODS
TEXT BOOKS:

REFERENCE:

OME553 INDUSTRIAL SAFETY ENGINEERING L T P C
3 0 0 3

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 9
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 9
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 9
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, Cupola, 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 9
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 9
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.

TOTAL:45 PERIODS
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:
7. Dr. Vincent Matthew Ciriello (Prediction of the maximum acceptable weight of lift from the frequency of lift, journal of industrial ergonomics,( 2014), pg .225–237

OAT552                INTERNAL COMBUSTION ENGINES       L    T    P    C
                          3  0  0  3

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
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
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
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
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:

OML551  INTRODUCTION TO NANOTECHNOLOGY   L T P C
                                      3 0 0 3

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)--Metalbased 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

OIM552 LEAN MANUFACTURING

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.
OBJECTIVE:
To introduce the basic concepts of metallurgy, metallurgical structures and mechanical properties, testing of metals

UNIT I  CONSTITUTION OF ALLOYS

UNIT II  PHASE DIAGRAMS

UNIT III  HEAT TREATMENT

UNIT IV  FERROUS AND NON FERROUS METALS

UNIT V  MECHANICAL PROPERTIES AND TESTING
Mechanism of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – hardness tests (Brinell, Vickers and Rockwell) micro and nano hardness test impact test, Izod and charpy, fatigue and creep mechanisms.

OUTCOMES:
Upon the completion of the course, students will be able to
1. Analyze the role of various constituents and phases in metals and alloys.
2. Understand the importance of heat treatment in ferrous and non ferrous metals and alloys.
3. Categorize the ferrous and nonferrous metals and alloys based on the constituents.
4. Understand the procedure involved in mechanical testing of metals and alloys.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
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  9

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:

OML552 MICROSCOPY

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:

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 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 9
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 9
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 9
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 9
Rate of drying for food products; design parameters of different type of dryers; properties of air-water mixtures. Psychrometric chart, freezing and cold storage. freeze concentration, dehydro-freezing, freeze drying, IQF; calculation of refrigeration load, design of freezers and cold storages.

UNIT V NON-THERMAL METHODS 9
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  9

UNIT II  MACHINING  9
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  9

UNIT IV  ADVANCED MANUFACTURING PROCESS  9
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  9

TOTAL: 45 PERIODS

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 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

UNIT II MOTION, PROXIMITY AND RANGING SENSORS

UNIT III FORCE, MAGNETIC AND HEADING SENSORS

UNIT IV OPTICAL, PRESSURE AND TEMPERATURE SENSORS

UNIT V SIGNAL CONDITIONING and DAQ SYSTEMS

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 9
Formulation of state variable model, non-uniqueness, controllability, observability, stability.

UNIT II STATE VARIABLE DESIGN 9
Modes, controllability of modes - effect of state and output Feedback- pole placement Design

UNIT III STATE ESTIMATION 9
Need for state estimation- design of state Observers- full and reduced order – disturbance estimation-separation principle

UNIT IV OPTIMAL CONTROL 9
Introduction - Time varying optimal control – LQR steady state optimal control – Solution of Ricatti’s equation – Application examples.

UNIT V OPTIMAL ESTIMATION 9
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:

OIM551 WORLD CLASS MANUFACTURING L T P C 3 0 0 3

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 an 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 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 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

TOTAL: 45 PERIODS

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

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

UNIT II NETWORK REDUCTION AND THEOREMS FOR DC CIRCUITS

UNIT III AC CIRCUITS
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
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

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:
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  9

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

OGI751 CLIMATE CHANGE AND ITS IMPACT L T P C
3 0 0 3

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

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:

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
Tree ADT – tree traversals - Binary Tree ADT – expression trees – binary search tree ADT –
applications of trees. Heap – applications of heap. Implementation of Binary search tree and its
operations, tree traversal methods, finding height of the tree using C. Implementation of heap and
heap sorting using arrays in C.

UNIT V    GRAPHS
Definition – Representation of Graph – Breadth-first traversal - Depth-first traversal – Dynamic
programming Technique – Warshall’s and Floyd’s algorithm – Greedy method - Dijkstra's
algorithm – applications of graphs. Implementation of graph, graph traversal methods, finding
shortest path using Dijkstra's algorithm in C

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:
3. Byron Gottfried, Jitender Chhabra, “Programming with C” (Schaum's Outlines Series), Mcgraw

OML752    ELECTRONIC MATERIALS

OBJECTIVE:
- Understanding the various materials and its properties contribution towards electrical and
  electronics field. This course covers the properties of materials behind the electronic
  applications.

UNIT I    INTRODUCTION
Structure: atomic structures and bonding, types of bonding, band formation. Defects and
imperfections in solids: Point, Line and Planer defects; Interfacial defects and volume defects.
Classification of materials based on bonding: conductors, semiconductors and insulators.

UNIT II    CONDUCTING MATERIALS
Introduction, factors affecting the conductivity of materials, classification based on conductivity of
materials, temperature dependence of resistivity, Low resistivity materials (graphite, Al, Cu and
steel) and its applications, high resistivity materials (manganin, constantin, nichrome, tungsten) and
their applications. Superconductors: Meissner effect, classification and applications.

UNIT III    SEMICONDUCTING AND MAGNETIC MATERIALS
Semiconductors: Introduction, types of semiconductors, temperature dependence of
semiconductors, compound semiconductors, basic ideas of amorphous and organic
semiconductors. Magnetic Materials: classification of magnetic materials, ferromagnetism-B-H
curve (Qualitative), hard and soft magnetic materials, magneto materials applications.
UNIT IV  DIELECTRIC AND INSULATING MATERIALS

UNIT V  OPTOELECTRONIC AND NANO ELECTRONIC MATERIALS

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
UNIT IV SOCIO ECONOMIC ASSESSMENT

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

TEXT BOOKS:

REFERENCES:

OAE751 FUNDAMENTALS OF COMBUSTION

OBJECTIVE:
To make the student understand the fundamentals of combustion and to teach them combustion in different regions like basic flame to gas turbine engines to rocket engines and finally how it is done in supersonic speeds.

UNIT I INTRODUCTION TO COMBUSTION
Thermo-chemical equations –Heat of formation –Activation energy -Multi-step reactions - Heat of reaction -first order, second order and third order reactions – Calculation of adiabatic flame temperature

UNIT II BASICS OF CHEMICAL KINETICS AND FLAMES
UNIT III  COMBUSTION IN GAS TURBINE ENGINES  9

UNIT IV  COMBUSTION IN ROCKETS  9

UNIT V  SUPERSONIC COMBUSTION (Qualitative Treatment only)  9

OUTCOMES:
- The student will be in a position to understand the detailed mechanism of Aerospace Vehicles and Aircraft Engines.
- The student will be able to analyse and impart the combustion processes that occur in Aircraft Engines and Rocket Vehicles.

TEXT BOOK:

REFERENCES:

OGI752  FUNDAMENTALS OF PLANETARY REMOTE SENSING  L T P C
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  9

UNIT II  SATELLITE ORBIT  9
Equation of 2 body motion: Energy, orbits and energy – Circular Orbits-EOS Terra-Geosynchronous satellite orbit- orbital elements. Launching Satellites and space probes –
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:
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 L T P C 3 0 0 3

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 9

UNIT II EMBEDDED NETWORKING 9

UNIT III EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT 9
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 9
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, uC/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:
1. 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
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

UNIT III      SIX SIGMA METHODOLOGIES
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
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

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

OAE752 PRINCIPLES OF FLIGHT MECHANICS

OBJECTIVE:
- To make the student understand the performance of airplanes under various flight conditions like take off, cruise, landing, climbing, gliding, turning and other maneuvers.

UNIT I GENERAL CONCEPTS
International Standard atmosphere, IAS, EAS, TAS, Propeller theory- Froude momentum and blade element theories, Propeller co-efficients, Use of propeller charts, Performance of fixed and variable pitch propellers, High lift devices, Thrust augmentation

UNIT II DRAG OF BODIES
Streamlined and bluff body, Types of drag, Effect of Reynold’s number on skin friction and pressure drag, Drag reduction of airplanes, Drag polar, Effect of Mach number on drag polar. Concept of sweep- effect of sweep on drag.

UNIT III STEADY LEVEL FLIGHT
General equation of motion of an airplane. Steady level flight, Thrust required and Power required, Thrust available and Power available for propeller driven and jet powered aircraft, Effect of altitude, maximum level flight speed, conditions for minimum drag and minimum power required, Effect of drag divergence on maximum velocity, Range and Endurance of Propeller and Jet aircrafts. Effect of wind on range and endurance.

UNIT IV GLIDING AND CLIMBING FLIGHT
Shallow and steep angles of climb, Rate of climb, Climb hodograph, Maximum Climb angle and Maximum Rate of climb- Effect of design parameters for propeller jet and glider aircrafts, Absolute and service ceiling, Cruise climb, Gliding flight, Glide hodograph
UNIT V ACCELERATED FLIGHT
Estimation of take-off and landing distances, Methods of reducing landing distance, level turn, minimum turn radius, maximum turn rate, bank angle and load factor, Constraints on load factor, SST and MSTR. Pull up and pull down maneuvers, V-n diagram.

TOTAL: 45 PERIODS

OUTCOMES:
Students will be able to
• Understand concepts of take-off, climb, cruise, turn, descent and landing performance.
• Understand the performance characteristics of the different types of power plants.
• Understand and predict the behavior of fixed wing aircraft undertaking a typical flight profile.
• Understand the factors that influence aircraft design and limit aircraft performance.

TEXT BOOKS:

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
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:

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,
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 Flight,
Range Finders, Laser Range Meters, Touch Sensors, binary Sensors, Analog Sensors, Wrist
Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing
Image Data- Signal Conversion, Image Storage, Lighting Techniques, Image Processing and
Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other

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.

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:
7. Surender Kumar, “Industrial Robots and Computer Integrated Manufacturing”, Oxford and
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

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
Radiographic test, Eddy current test, Ultrasonic test, Acoustic emission- Principles, Techniques, Methods, Advantages and Limitations, Applications.

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:
2. ASM Metals Handbook, "Non-Destructive Evaluation and Quality Control”, American Society of Metals, Metals Park, Ohio, USA.

OAT752 VEHICLE STYLING AND DESIGN L T P C
UNIT I INTRODUCTION TO VEHICLE DESIGN: 9

UNIT II VEHICLE BODY DESIGN: 9
The styling process - Working environment and structure - Product planning - Concept sketching and package related sketching - Full sized tape drawing - Clay modelling.

UNIT III  NOISE AND VIBRATION:  9

UNIT IV  CRASHWORTHINESS AND ERGONOMIC APPROACH:  9

UNIT V  VEHICLE CONTROL SYSTEMS  9
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  9
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  9
Principles of tappet, dobbay and jacquard shedding mechanisms, positive and negative shedding mechanisms, electronic dobbay and jacquard mechanism, tappet design.

UNIT III  PICKING-I  9
Mechanism of picking in shuttle looms, components of picking system, design of shuttle, multi shuttle mechanism.

UNIT IV  PICKING-II  9
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 shuttleless 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:


OMV751 MARINE VEHICLES

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

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

Introduction – Types, design considerations, safety – operation and controls, precaution during bunkering

UNIT III REMOTELY OPERABLE VEHICLE (ROV), UMS SHIPS

UNIT IV SUBMERSIBLES AND AUTONOMOUS UNDERWATER VEHICLE (AUV)


UNIT V MANNED AND UN MANNED SUBMERSIBLE


TOTAL : 45 PERIODS

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