

2013-14

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

III Year B.Tech. – II Sem.

OPERATIONS RESEARCH

Course Objectives:

To learn the importance of Operations Research in the design, planning, scheduling, manufacturing and business applications and to use the various techniques of Operations Research in solving such problems.

UNIT – I

Development – definition– characteristics and phases – types of operation research models – applications.

ALLOCATION: Linear programming problem formulation – graphical solution – simplex method – artificial variables techniques -two–phase method, big-M method – duality.

UNIT – II

TRANSPORTATION PROBLEM: Formulation – optimal solution, unbalanced transportation problem – degeneracy.

ASSIGNMENT PROBLEM: Formulation – optimal solution - variants of assignment problem- traveling salesman problem.

UNIT – III

SEQUENCING – Introduction – flow –shop sequencing – n jobs through two machines – n jobs through three machines – job shop sequencing – two jobs through ‘ m ’ machines.

REPLACEMENT: Introduction – replacement of items that deteriorate with time – when money value is not counted and counted – replacement of items that fail completely, group replacement.

UNIT – IV

THEORY OF GAMES: Introduction – mini. max (max. mini) – criterion and optimal strategy – solution of games with saddle points – rectangular games without saddle points – 2×2 games – dominance principle – $m \times 2$ & $2 \times n$ games -graphical method.

WAITING LINES: Introduction – queuing system - poisson arrivals – exponential service times – queue discipline – customer behavior – single channel –multi channel - infinite population and finite population models.

UNIT – V

INVENTORY : Introduction – single item – deterministic models – purchase inventory models with one price break and multiple price breaks – shortages are not allowed – stochastic models – demand may be discrete variable or continuous variable – instantaneous production. Instantaneous demand and continuous demand and no set up cost. ABC & VED Analysis.

UNIT – VI

DYNAMIC PROGRAMMING: Introduction – Bellman’s principle of optimality – applications of dynamic programming- capital budgeting problem – shortest path problem – linear programming problem.

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

SIMULATION: Definition – types of simulation models – phases of simulation– applications of simulation – inventory and queuing problems – advantages and disadvantages – simulation languages.

TEXT BOOKS:

1. Operations Research / H.A Taha / Pearson Education
2. Operations Research –Theory & publications / S.D.Sharma-Kedarnath/McMillan publishers India Ltd

REFERENCES:

1. Introduction to O.R/Hiller & Libermann/TMH
2. Operations Research / R.Pannerselvam/ PHI Publications.
3. Operations Research / Wagner/ PHI Publications.
4. Operation Research /J.K.Sharma/MacMilan Publ.
5. Operations Research/ Pai/ Oxford Publications
6. Operations Research / Ravindran, Philips, Solberg / Wiley publishers

Course Outcomes:

After completion of the course, the student will be able to:

To solve the LP and DP problems

To solve the Transportation, assignment, game, inventory, replacement, sequencing, queuing and simulation problems.

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

III Year B.Tech. – II Sem.

INTERACTIVE COMPUTER GRAPHICS

Course objectives:

This course allows the students to:

1. Understand the fundamental concepts and theory of computer graphics
2. Understand modeling, and interactive control of 3D computer graphics applications
3. The underlying parametric surface concepts be understood

UNIT-I

INTRODUCTION: Application areas of computer graphics, overview of graphic system, video-display devices, raster-scan systems, random scan systems, graphics monitors and work stations and input devices.

UNIT-II

OUTPUT PRIMITIVES: Points and lines, line drawing algorithms, mid-point circle algorithm, Filled area primitives: scan-line polygon fill algorithm, boundary-fill and flood-fill algorithm.

2-D GEOMETRICAL TRANSFORMATIONS: Translation, scaling, rotation, reflection and shear transformation matrix representations and homogeneous co-ordinates, composite transformations, transformations between coordinates

UNIT -III

2-D VIEWING : The viewing pipe-line, viewing coordinate reference frame, window to view-port co-ordinate transformations, viewing function, Cohen-Sutherland and Cyrus-beck line clipping algorithms, Sutherland-Hodgeman polygon clipping algorithm

UNIT -IV

3-D OBJECT REPRESENTATION: spline representation, Hermite curve, Bezier curve and B-spline curve, Polygon surfaces, quadric surfaces, Solid modeling Schalars – wire frame, CSG, B-rep. Bezier and B-spline surfaces, Basic illumination models, shading algorithms

UNIT -V

3-D GEOMETRIC TRANSFORMATIONS: Translation, rotation, scaling, reflection and shear transformation and composite transformations. Visible surface detection methods: Classification, back-face detection, depth-buffer, scan-line, depth sorting

UNIT-VI

COMPUTER ANIMATION: Design of animation sequence, general computer animation functions, raster animation, computer animation language, key frame system, motion specification

TEXT BOOKS:

1. Computer Graphics C version/ Donald Hearn and M. Pauline Baker/Pearson/PHI
2. Computer Graphics Principles & practice-second edition in C/ Foley, VanDam, Feiner and Hughes/Pearson Education

REFERENCES:

1. Computer Graphics Second edition/ Zhigand xiang, Roy Plastock, Schaum's outlines/Tata Mc-Graw hill edition.
2. Procedural elements for Computer Graphics/David F Rogers/Tata Mc Graw hill, 2nd edition.
3. Principles of Interactive Computer Graphics/ Neuman and Sproul/TMH.
4. Computer Graphics/ Steven Harrington/TMH

2013-14

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

Course outcomes:

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

1. Use the principles and commonly used paradigms and techniques of computer graphics
2. Write basic graphics application programs including animation
3. Design programs to display graphic images to given specifications
4. Possess in-depth knowledge of display systems, image synthesis, shape modeling, and interactive control of 3D computer graphics applications

2013-14

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

III Year B.Tech. – II Sem.

DESIGN OF MACHINE MEMBERS– II

Course Objectives:

- This course gives the insight of slider and roller bearings and the life prediction.
- Learn to design I.C engine parts
- Design the mechanical systems for power transmission elements such as gears, belts, ropes, chains, keys and levers

UNIT – I

BEARINGS: Classification of bearings- applications, types of journal bearings – lubrication – bearing modulus – full and partial bearings – clearance ratio – heat dissipation of bearings, bearing materials – journal bearing design – ball and roller bearings – static loading of ball & roller bearings, bearing life.

UNIT – II

ENGINE PARTS: Connecting Rod: Thrust in connecting rod – stress due to whipping action on connecting rod ends – cranks and crank shafts, strength and proportions of over hung and center cranks – crank pins, crank shafts.

UNIT –III

Piston, forces acting on piston – construction, design and proportions of piston, cylinder, cylinder liners.

UNIT – IV

Design of curved beams: introduction, stresses in curved beams, expression for radius of neutral axis for rectangular, circular, trapezoidal and T-section, design of crane hooks, c –clamps.

UNIT – V

POWER TRANSMISSION SYSTEMS, PULLEYS: Transmission of power by belt and rope drives , transmission efficiencies, belts – flat and v types – ropes - pulleys for belt and rope drives, materials, chain drives

DESIGN OF POWER SCREWS: Design of screw, square, ACME, buttress screws, design of nut, compound screw, differential screw, ball screw- possible failures.

UNIT – VI

SPUR & HELICAL GEAR DRIVES: Spur gears- helical gears – load concentration factor – dynamic load factor, surface compressive strength – bending strength – design analysis of spur gears – estimation of centre distance, module and face width, check for plastic deformation, check for dynamic and wear considerations.

MACHINE TOOL ELEMENTS: Levers and brackets: design of levers – hand levers-foot lever – cranked lever – lever of a lever loaded safety valve- rocker arm straight – angular- design of a crank pin – brackets- hangers- wall boxes.

TEXT BOOKS:

1. Machine Design/V.Bandari/TMH Publishers
2. Machine Design PSG Data hand book
3. Machine Design/ NC Pandya & CS Shaw/ Charotar publishers

REFERENCES:

1. Machine Design: An integrated Approach / R.L. Norton / Pearson Education
2. Data Books : (I) P.S.G. College of Technology (ii) Mahadevan
3. Mech. Engg. Design / JE Shigley/Tata McGraw Hill education

2013-14

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

Course outcomes:

At the end of the course

1. The student will be able to select the suitable bearings based on the application of the loads and predict the life of the bearing
2. Design power transmission elements such as gears, belts, chains, pulleys, ropes, levers and power screws.
3. Design of various IC Engines parts.

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

III Year B.Tech. – II Sem.

ROBOTICS

Course Objectives:

1. To give students practice in applying their knowledge of mathematics, science, and Engineering and to expand this knowledge into the vast area of robotics.
2. The students will be exposed to the concepts of robot kinematics , Dynamics, Trajectory planning.
3. Mathematical approach to explain how the robotic arm motion can be described.
4. The students will understand the functioning of sensors and actuators.

UNIT-I

INTRODUCTION: Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – present and future applications – classification by coordinate system and control system.

UNIT – II

COMPONENTS OF THE INDUSTRIAL ROBOTICS: Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, determination of the end effectors, comparison of Electric, Hydraulic and Pneumatic types of locomotion devices.

UNIT – III

MOTION ANALYSIS: Homogeneous transformations as applicable to rotation and translation – problems.

MANIPULATOR KINEMATICS: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics – problems.

UNIT – IV

Differential transformation and manipulators, Jacobians – problems

Dynamics: Lagrange – Euler and Newton – Euler formulations – Problems.

UNIT V

General considerations in path description and generation. Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion –straight line motion – Robot programming, languages and software packages-description of paths with a robot programming language..

UNIT VI

ROBOT ACTUATORS AND FEED BACK COMPONENTS:

Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors.

Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors.

ROBOT APPLICATIONS IN MANUFACTURING: Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

2013-14

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

TEXT BOOKS:

1. Industrial Robotics / Groover M P /Pearson Edu.
2. Robotics and Control / Mittal R K & Nagrath I J / TMH.

REFERENCES:

1. Robotics / Fu K S/ McGraw Hill.
2. Robotic Engineering / Richard D. Klafter, Prentice Hall
3. Robot Analysis and Control / H. Asada and J.J.E. Slotine / BSP Books Pvt.Ltd.
4. Introduction to Robotics / John J Craig / Pearson Edu.

Course outcomes:

Upon successful completion of this course you should be able to:

1. Identify various robot configuration and components,
2. Select appropriate actuators and sensors for a robot based on specific application
3. Carry out kinematic and dynamic analysis for simple serial kinematic chains
4. Perform trajectory planning for a manipulator by avoiding obstacles.

2013-14

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

III Year B.Tech. – II Sem.

HEAT AND MASS TRANSFER
(Heat transfer data book allowed)

Course Objectives:

This course is intended to impart knowledge of principles of heat transfer and analyze the heat exchange process in various modes for the evaluation of rate of heat transfer and the temperature distribution in different configurations.

UNIT – I

INTRODUCTION: Modes and mechanisms of heat transfer – basic laws of heat transfer –General discussion about applications of heat transfer.

CONDUCTION HEAT TRANSFER: Fourier rate equation – general heat conduction equation in cartesian, cylindrical and Spherical coordinates. Steady, unsteady and periodic heat transfer – initial and boundary conditions.

ONE DIMENSIONAL STEADY STATE CONDUCTION HEAT TRANSFER: Homogeneous slabs, hollow cylinders and spheres – overall heat transfer coefficient – electrical analogy – critical radius of insulation- Variable thermal conductivity – systems with heat sources or heat generation, extended surface (fins) heat Transfer – long fin, fin with insulated tip and short fin, application to error measurement of temperature.

UNIT-II

ONE DIMENSIONAL TRANSIENT CONDUCTION HEAT TRANSFER: Systems with negligible internal resistance – significance of biot and fourier numbers - chart solutions of transient conduction systems

CONVECTIVE HEAT TRANSFER: Classification of convective heat transfer – dimensional analysis as a tool for experimental investigation – Buckingham Pi Theorem for forced and free convection, application for developing semi – empirical non- dimensional correlation for convective heat transfer – Significance of non-dimensional numbers – concepts of continuity, momentum and Energy Equations.

UNIT –III

FORCED CONVECTION

EXTERNAL FLOWS: Concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer -flat plates and cylinders.

INTERNAL FLOWS: Concepts about hydrodynamic and thermal entry lengths – division of internal flow based on this –use of empirical relations for horizontal pipe flow and annulus flow.

FREE CONVECTION: Development of hydrodynamic and thermal boundary layer along a vertical plate – use of empirical relations for vertical plates and pipes.

UNIT IV

HEAT TRANSFER WITH PHASE CHANGE

BOILING: Pool boiling – regimes- calculations on nucleate boiling, critical heat flux and film boiling.

CONDENSATION: Film wise and drop wise condensation –nusselt's theory of condensation on a vertical plate - film condensation on vertical and horizontal cylinders using empirical correlations.

HEAT EXCHANGERS:

Classification of heat exchangers – overall heat transfer coefficient and fouling factor – concepts of LMTD and NTU methods – Problems.

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

UNIT V

RADIATION HEAT TRANSFER

Emission characteristics and laws of black-body radiation – Irradiation – total and monochromatic quantities – laws of Planck, Wien, Kirchoff, Lambert, Stefan and Boltzmann– heat exchange between two black bodies – concepts of shape factor – Emissivity – heat exchange between grey bodies – radiation shields – electrical analogy for radiation networks.

UNIT VI

MASS TRANSFER

Flick's law of diffusion, equimolar counter diffusion, molecular diffusion through a stationary gas, diffusivity for gases and vapors, concentration boundary layer and mass transfer coefficient, analogy between momentum, heat and mass transfer, forced convection mass transfer in laminar flow in a tube, mass transfer by convection in turbulent flow, evaluation of mass transfer coefficient by dimensional analysis, analogy of heat and mass transfer, mass transfer in boundary layer flow over a flat plate

TEXT BOOKS:

1. Heat Transfer /JP HOLMAN/TMH
2. Heat Transfer /P.K.Nag/ TMH
3. Principles of Heat Transfer /Frank Kreith, RM Manglik & MS Bohn/Cengage learning publishers

REFERENCE BOOKS:

1. Heat and Mass Transfer /Arora and Domkundwar/Dhanpatrai & sons
2. Fundamentals of Engg. Heat and Mass Transfer / R.C.Sachdeva / New Age International
3. Heat and Mass Transfer /Cengel/McGraw Hill.
4. Heat and Mass Transfer /D.S.Kumar / S.K.Kataria & Sons
5. A Text book on Heat Transfer-4th Edition/ S.P Sukhatme/Universities Press

Course outcomes:

The student after undergoing this course is expected to know the principles of heat transfer and be able to apply to practical situations where in heat exchange takes place through various modes of heat transfer including phase change.

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

III Year B.Tech. – II Sem.

INDUSTRIAL ENGINEERING & MANAGEMENT

Course Objectives:

1. To impart fundamental knowledge and skill sets required in the Industrial Management and Engineering profession, which include the ability to apply basic knowledge of mathematics, probability and statistics, and the domain knowledge of Industrial Management and Engineering
2. To produce graduates with the ability to adopt a system approach to design, develop, implement and innovate integrated systems that include people, materials, information, equipment and energy.
3. To enable students to understand the interactions between engineering, business, technological and environmental spheres in the modern society.
4. To enable students to understand their role as engineers and their impact to society at the national and global context.

Unit – I

INTRODUCTION: Definition of industrial engineering (I.E), development, applications, role of an industrial engineer, differences between production management and industrial engineering, quantitative tools of IE and productivity measurement. concepts of management, importance, functions of management, scientific management, Taylor's principles, theory X and theory Y, Fayol's principles of management.

Unit – II

PLANT LAYOUT: Factors governing plant location, types of production layouts, advantages and disadvantages of process layout and product layout, applications, quantitative techniques for optimal design of layouts, plant maintenance, preventive and breakdown maintenance.

Unit – III

OPERATIONS MANAGEMENT: Importance, types of production, applications, workstudy, method study and time study, work sampling, PMTS, micro-motion study, rating techniques, MTM, work factor system, principles of Ergonomics, flow process charts, string diagrams and Therbligs,

Unit – IV

STATISTICAL QUALITY CONTROL: Quality control, its importance, SQC, attribute sampling inspection with single and double sampling, Control charts – \bar{X} and R – charts \bar{X} AND S charts and their applications, numerical examples.

TOTAL QUALITY MANAGEMENT: Zero defect concept, quality circles, implementation, applications, ISO quality systems. six sigma – definition, basic concepts

Unit – V

RESOURCE MANAGEMENT: Concept of human resource management, personnel management and industrial relations, functions of personnel management, Job-evaluation, its importance and types, merit rating, quantitative methods, wage incentive plans, types.

Unit - VI

VALUE ANALYSIS: Value engineering, implementation procedure, enterprise resource planning and supply chain management.

2013-14

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

PROJECT MANAGEMENT: PERT, CPM – differences & applications, critical path, determination of floats, importance, project crashing, smoothing and numerical examples.

TEXT BOOKS:

1. Industrial Engineering and management / O.P Khanna/Khanna Publishers.
2. Industrial Engineering and Production Management/Martand Telsang/S.Chand & Company Ltd. New Delhi

Reference Books:

1. Industrial Management / Bhattacharya DK/Vikas publishers
2. Operations Management / J.G Monks/McGrawHill Publishers.
3. Industrial Engineering and Management Science/ T. R. Banga, S. C. Sharma, N. K. Agarwal/Khanna Publishers
4. Principles of Management /Koontz O' Donnel/McGraw Hill Publishers.
5. Statistical Quality Control /Gupta/Khanna Publishers
6. Industrial Engineering and Management /NVS Raju/Cengage Publishers

Course outcome:

Upon successful completion of this course you should be able to:

- 1.Design and conduct experiments, analyse, interpret data and synthesise valid conclusions
2. Design a system, component, or process, and synthesise solutions to achieve desired needs
3. Use the techniques, skills, and modern engineering tools necessary for engineering practice with appropriate considerations for public health and safety, cultural, societal, and environmental constraints
4. Function effectively within multi-disciplinary teams and understand the fundamental precepts of effective project management

2013-14

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

III Year B.Tech. – II Sem.

**REFRIGERATION & AIR CONDITIONING
(DEPARTMENTAL ELECTIVE – I)
(Refrigeration and Psychrometric tables and charts allowed)**

Course objectives:

The course is to understand the basic cycles of various refrigerating systems, their performance evaluation along with details of system components and refrigerant properties. The course is also aimed at imparting knowledge of psychrometric properties, processes which are used in airconditioning systems for comfort and industrial applications.

UNIT – I

INTRODUCTION TO REFRIGERATION: Necessity and applications – unit of refrigeration and C.O.P. – Mechanical refrigeration – types of ideal cycles of refrigeration. air refrigeration: bell coleman cycle - open and dense air systems – refrigeration systems used in air crafts and problems.

UNIT – II

VAPOUR COMPRESSION REFRIGERATION: Working principle and essential components of the plant – simple vapour compression refrigeration cycle – COP – representation of cycle on T-S and p-h charts – effect of sub cooling and super heating – cycle analysis – actual cycle influence of various parameters on system performance – use of p-h charts – numerical problems.

UNIT III

REFRIGERANTS – Desirable properties – classification - refrigerants used – nomenclature – ozone depletion – global warming

VAPOR COMPRESSION REFRIGERATION SYSTEM COMPONENTS: Compressors – general classification – comparison – advantages and disadvantages, Condensers – general classification – comparison – advantages and disadvantages, Evaporators – general classification – comparison – advantages and disadvantages – classification –expansion devices – general classification – comparison – advantages and disadvantages

UNIT IV

VAPOR ABSORPTION SYSTEM: Calculation of maximum COP – description and working of NH₃ – water system and Li Br –water (Two shell & Four shell) System, principle of operation three fluid absorption system, salient features.

STEAM JET REFRIGERATION SYSTEM: Working Principle and basic components. principle and operation of (i) thermoelectric refrigerator (ii) vortex tube.

UNIT – V

INTRODUCTION TO AIR CONDITIONING: Psychrometric charts, properties & processes – characterization of sensible and latent heat loads — need for ventilation, consideration of infiltration – load concepts of RSHF, GSHF- problems, concept of ESHF and ADP temperature.

Requirements of human comfort and concept of effective temperature- comfort chart –comfort air conditioning – requirements of industrial air conditioning, air conditioning load calculations.

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

UNIT – VI

AIR CONDITIONING SYSTEMS: Classification of equipments, processes - cooling, heating, humidification and dehumidification, filters, grills and registers, fans and blowers, heat pump – heat sources – different heat pump circuits.

TEXT BOOKS:

1. A Course in Refrigeration and Air conditioning / SC Arora & Domkundwar / Dhanpatrai
2. Refrigeration and Air Conditioning / CP Arora / TMH.

REFERENCES:

1. Refrigeration and Air Conditioning / Manohar Prasad / New Age.
2. Principles of Refrigeration /Dossat / Pearson Education.
3. Basic Refrigeration and Air-Conditioning / Ananthanarayanan / TMH

Course outcomes: At the end of the course the students should be able to:

After undergoing the course the student should be in a position to analyze various refrigerating cycles and evaluate their performance. The student also should be able to perform cooling load calculations and select the appropriate process and equipment for the required comfort and industrial airconditioning.

2013-14

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

III Year B.Tech. – II Sem.

**AUTOMATION IN MANUFACTURING
(DEPARTMENTAL ELECTIVE – I)**

Course objective:

1. To study the types and strategies and various components in Automated Systems.
2. To understand the automated flow lines, line balancing, material storage and retrieval and inspection

UNIT-I

INTRODUCTION: Types and strategies of automation, pneumatic and hydraulic components, circuits, automation in machine tools, mechanical feeding and tool changing and machine tool control.

UNIT – II

AUTOMATED FLOW LINES: Methods of part transport, transfer mechanism, buffer storage, control function, design and fabrication considerations.

Analysis of automated flow lines - General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines.

UNIT – III

ASSEMBLY SYSTEM AND LINE BALANCING: Assembly process and systems, assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT – IV

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

UNIT – V

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

UNIT – VI

AUTOMATED INSPECTION: Fundamentals, types of inspection methods and equipment, Coordinate Measuring Machines, Machine Vision.

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

TEXT BOOK:

1. Automation, Production Systems and Computer Integrated Manufacturing/ M.P. Groover./ Prentice Hall

REFERENCES:

1. Computer Control of Manufacturing Systems / Yoram Coren/Tata McGraw-Hill edition
2. CAD / CAM/ CIM /P. Radhakrishnan,S.Subrahmanyam,V.Raju/New Age international Publishers
3. Automation / W. Buekinsham, 3rd Edition/PHI Publications

Course outcomes:

Upon successful completion of this course student should be able to:

Solve the line balancing problems in the various flow line systems with and without use buffer storage

Understand the different automated material handling, storage and retrieval systems and automated inspection systems.

Use of Adaptive Control principles and implement the same online inspection and control

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

III Year B.Tech. – II Sem.

CONDITION MONITORING
(DEPARTMENTAL ELECTIVE – I)

Course Objectives:

- This course is designed to introduce the benefits and opportunities of health Monitoring and covers a range of techniques
- The students will be exposed to a range of techniques from Vibration based methods, Thermography, Oil conditions, Debris and ultrasonic monitoring
- Using overall vibration, vibration limit zones, broadband vibration bandwidth, alert levels, typical severity guidelines, recording overall vibration, using overall vibration for fault finding, trending overall vibration.

Identifying Resonance, Hammer Test, Self Excitation, Exciter Testing. Reducing Resonance -
Effects of Frequency, Stiffness, Mass, Damping, Isolation

UNIT-I

BASICS OF VIBRATION: Basic motion: amplitudes, period, frequency, basic parameters: displacement, velocity, acceleration, units (including dB scales) and conversions, Mass, spring and damper concept, Introduction to SDOF and MDOF systems, Natural frequencies and resonance, Forced response.

UNIT-II

VIBRATION MEASUREMENTS AND ANALYSIS: Transducers and mounting methods, data acquisition using instrumentation recorders/data loggers, time domain signal analysis, orbit analysis, Filters, Frequency domain analysis (Narrow band FFT analysis), Nyquist criteria, Sampling, aliasing, windowing and averaging.

VIBRATION MEASUREMENT AND ANALYSIS: Use of phase; bode, polar and water fall plots, constant percentage band width analysis (1/3 and 1/1 Octave analysis), envelope detection /spike energy analysis, cepstral analysis, advances in analysis (PC based and portable instruments for vibration analysis).

UNIT-III

Fault Diagnosis, Interpreting vibration measurements for common machine faults , imbalance, misalignment, mechanical looseness, bearing and gearing faults, faults in induction motors, resonance, some case studies, static and dynamic balancing, international standards for vibration condition monitoring.

UNIT-IV

THERMOGRAPHY: The basics of infrared thermography, differences in equipment and specific wave length limitations, application of IR to: electrical inspection, mechanical inspection, energy conservation, how to take good thermal images, hands-on demonstrations focusing on proper camera settings and image interpretation, analysis of thermal images and report generation, study of thermo graphy applications

UNIT-V

OIL AND WEAR DEBRIS ANALYSIS: Basics of oil analysis, monitoring condition of oil, lubricant analysis, physio – chemical properties, moisture, tan tbn, wear debris analysis, particle counting, spectroscopy, uses & limitations, ferrography wear particle analysis, concept of ferrography, principle particle classification, size, shape, composition, concentration, analysis procedure, sampling & analytical ferrography equipments, severity rating.

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

UNIT-VI

ULTRASONIC MONITORING AND ANALYSIS: Ultrasonic monitoring (leak, crack and thickness) basics of ultrasonic monitoring , ultrasonic theory, test taking philosophy, ultrasonic theory, mathematics of ultrasound, equipment and transducers, inspection parameters and calibration, immersion theory, equipment quality control, flaw origins and inspection methods, UT Procedure familiarization, and study recommendations, application of ultrasound to: air leaks, steam trap testing, bearing lubrication, electrical inspection, case studies.

TEXT BOOKS:

1. The Vibration Analysis Handbook/J I Taylor (1994)/Vibration consultants Incorporate Publishers
2. Machinery Vibration Condition Monitoring/Lynn/Butterworth(1989)

REFERENCE BOOKS:

1. Machinery Vibration: Measurement and Analysis/Victor Wowk/Mc GrawHill Professional
2. Mechanical fault diagnosis and condition monitoring/RA Collacott(1977) /Chapman and Hall
3. The Vibration Monitoring Handbook/Charles W Reeves/Coxmoor publishing company

Course outcomes:

- Gaining invaluable insights into the benefits of Condition Monitoring
- Understanding the reasons for selecting particular maintenance strategies
- Understanding effective methodologies for implementing Condition Monitoring Techniques
- Identifying the optimum maintenance strategy for different types of equipment
- Gaining practical approaches to minimise the risk of plant and machinery breakdowns
- Awareness of International Standards covering asset management

2013-14

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

III Year B.Tech. – II Sem.

**RAPID PROTOTYPING
(DEPARTMENTAL ELECTIVE – I)**

Course Objectives:

The course aims at the importance of Rapid Prototyping, classifications, models, specifications of various Rapid Prototype Techniques. To learn the different tools, soft-wares required and the applications of Rapid Prototyping.

UNIT – I

INTRODUCTION: Prototyping fundamentals, historical development, fundamentals of rapid prototyping, advantages and limitations of rapid prototyping, commonly used terms, classification of RP process.

LIQUID-BASED RAPID PROTOTYPING SYSTEMS: Stereo lithography Apparatus (SLA): models and specifications, process, working principle, photopolymers, photo polymerization, layering technology, laser and laser scanning, applications, advantages and disadvantages, case studies. Solid Ground Curing (SGC): models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

UNIT-II

SOLID-BASED RAPID PROTOTYPING SYSTEMS: Laminated object manufacturing (LOM) - models and specifications, process, working principle, applications, advantages and disadvantages, case studies. Fused deposition modeling (FDM) - models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

UNIT – III

POWDER BASED RAPID PROTOTYPING SYSTEMS: Selective laser sintering (SLS): models and specifications, process, working principle, applications, advantages and disadvantages, case studies. three dimensional printing (3DP): models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

UNIT-IV

RAPID TOOLING: Introduction to rapid tooling (RT), conventional tooling Vs RT, Need for RT. rapid tooling classification: indirect rapid tooling methods: spray metal deposition, RTV epoxy tools, Ceramic tools, investment casting, spin casting, die casting, sand casting, 3D Keltool process. Direct rapid tooling: direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using 3DP.

UNIT – V

RAPID PROTOTYPING DATA FORMATS: STL Format, STL File Problems, consequence of building valid and invalid tessellated models, STL file Repairs: Generic Solution, other Translators, Newly Proposed Formats.

RAPID PROTOTYPING SOFTWARE'S: Features of various RP software's like Magics, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor.

2013-14

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

UNIT –VI

RP APPLICATIONS: Application in engineering, analysis and planning, aerospace industry, automotive industry, jewelry industry, coin industry, GIS application, arts and architecture. RP medical and bioengineering applications: planning and simulation of complex surgery, customized implants & prosthesis, design and production of medical devices, forensic science and anthropology, visualization of bimolecular.

TEXT BOOK:

1. Rapid prototyping: Principles and Applications /Chua C.K., Leong K.F. and LIM C.S/World Scientific publications

REFERENCE BOOKS:

1. Rapid Manufacturing / D.T. Pham and S.S. Dimov/Springer
2. Wohlers Report 2000 /Terry T Wohlers/Wohlers Associates
3. Rapid Prototyping & Manufacturing / Paul F.Jacobs/ASME Press
4. Rapid Prototyping / Chua & Liou

Course Outcomes:

The student shall be able to identify the use of Rapid Prototyping Techniques in the manufacturing of complex components that are otherwise very difficult to manufacture.

2013-14

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

III Year B.Tech. – II Sem.

HEAT TRANSFER LAB

Objectives:

The laboratory course is aimed to provide the practical exposure to the students with regard to the determination of amount of heat exchange in various modes of heat transfer including condensation & boiling for several geometries.

1. Determination of overall heat transfer co-efficient of a composite slab
2. Determination of heat transfer rate through a lagged pipe.
3. Determination of heat transfer rate through a concentric sphere
4. Determination of thermal conductivity of a metal rod.
5. Determination of efficiency of a pin-fin
6. Determination of heat transfer coefficient in forced convection
7. Determination of heat transfer coefficient in natural convection.
8. Determination of effectiveness of parallel and counter flow heat exchangers.
9. Determination of emissivity of a given surface.
10. Determination of Stefan Boltzman constant.
11. Determination of heat transfer rate in drop and film wise condensation.
12. Determination of critical heat flux.
13. Demonstration of heat pipe.
14. Study of two – phase flow.

Outcomes: The student should be able to evaluate the amount of heat exchange for plane, cylindrical & spherical geometries and should be able to compare the performance of extended surfaces and heat exchangers

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

IV Year B.Tech. – I Sem.

AUTOMOBILE ENGINEERING

Course Objectives:

The course imparts the principles of automobile systems and provides the salient features of safety, emission and service of automobiles.

UNIT – I

INTRODUCTION: Components of four wheeler automobile – chassis and body – power unit – power transmission – rear wheel drive, front wheel drive, 4 wheel drive – types of automobile engines, brief details of engine construction, oil filters, oil pumps – crank case ventilation

TRANSMISSION SYSTEM: Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel – gear boxes, types, sliding mesh, construct mesh, synchro mesh gear boxes, epicyclic gear box, over drive torque converter. propeller shaft – Hotch – Kiss drive, Torque tube drive, universal joint, differential rear axles – types – wheels and tyres.

UNIT – II

STEERING SYSTEM: Steering geometry – camber, castor, king pin rake, combined angle toein, center point steering. types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism, steering gears – types, steering linkages.

SUSPENSION SYSTEM: Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, Independent suspension system.

BRAKING SYSTEM: Mechanical brake system, hydraulic brake system, master cylinder, wheel cylinder tandem master cylinder requirement of brake fluid, pneumatic and vacuum brakes.

UNIT – III

ELECTRICAL SYSTEMS: Charging circuit, generator, current – voltage regulator – starting system, bendix drive mechanism solenoid switch, lighting systems, horn, wiper, fuel gauge – oil pressure gauge, engine temperature indicator etc.

AUTOMOTIVE ELECTRONICS: Current trends in Automobiles, open and closed loop systems-components for electronic engine management, Electronic management of chassis system, vehicle motion control.

SENSORS AND ACTUATORS: Basic sensor arrangement, types of sensor – oxygen sensors, crank angle position sensors – fuel metering / vehicle speed sensor, detonation sensor, altitude sensor, flow sensor, throttle position sensors. Solenoids, stepper motor and relays.

UNIT – IV

ENGINE SPECIFICATION AND SAFETY SYSTEMS: Introduction- engine specifications with regard to power, speed, torque, no. of cylinders and arrangement, lubrication and cooling etc.

Safety: Introduction, safety systems - seat belt, air bags, bumper, anti lock brake system (ABS), wind shield, suspension sensors, traction control, mirrors, central locking and electric windows, speed control.

UNIT – V

ENGINE EMISSION CONTROL: Introduction – types of pollutants, mechanism of formation, concentration measurement, methods of controlling-engine modification, exhaust gas treatment-thermal and catalytic converters-use of alternative fuels for emission control – National and International pollution standards

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

UNIT – VI

ENGINE SERVICE: Introduction, service details of engine cylinder head, valves and valve mechanism, piston-connecting rod assembly, cylinder block, crank shaft and main bearings, engine reassembly-precautions, engine service, reboring, decarbonisation, Nitriding of crank shaft.

TEXT BOOKS:

1. Automotive Mechanics – Vol. 1 & Vol. 2 / Kirpal Singh/standard publishers
2. Automobile Engineering / William Crouse/TMH Distributors
3. Automobile Engineering/P.S Gill/S.K. Kataria & Sons/New Delhi.

REFERENCES:

1. Automotive Engines Theory and Servicing/James D. Halderman and Chase D. Mitchell Jr./ Pearson education inc.
2. Automotive Engineering / K Newton, W.Steeds & TK Garrett/SAE
3. Automotive Mechanics : Principles and Practices/ Joseph Heitner/Van Nostrand Reinhold
4. Understanding Automotive Electronics / William B. Ribbens-5th Edition/ Butterworth 1998
5. Understanding Automotive Electronics / Bechtold / SAE 1998

Course Outcomes:

The student after undergoing the course, shall visualize the layout of an automobile and its systems like transmission, steering, suspension, braking, safety etc and should know the vehicle troubleshooting.

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

IV Year B.Tech. – I Sem.

CAD/CAM

Course Objectives:

The general objectives of the course are to enable the students to

1. Understand the basic fundamentals of computer aided design and manufacturing.
2. To learn 2D & 3D transformations of the basic entities like line, circle, ellipse etc
3. To understand the different geometric modeling techniques like solid modeling, surface modeling, feature based modeling etc. and to visualize how the components look like before its manufacturing or fabrication
4. To learn the part programming, importance of group technology, computer aided process planning, computer aided quality control
5. To learn the overall configuration and elements of computer integrated manufacturing systems.

UNIT – I

Computers in industrial manufacturing, product cycle, CAD / CAM Hardware, basic structure, CPU, memory types, input devices, display devices, hard copy devices, storage devices.

COMPUTER GRAPHICS: Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry, 3D transformations, mathematics of projections, clipping, hidden surface removal.

UNIT – II

GEOMETRIC MODELING: Requirements, geometric models, geometric construction models, curve representation methods, surface representation methods, modeling facilities desired.

DRAFTING AND MODELING SYSTEMS: Basic geometric commands, layers, display control commands, editing, dimensioning, solid modeling.

UNIT – III

PART PROGRAMMING FOR NC MACHINES: NC, NC modes, NC elements, CNC machine tools, structure of CNC machine tools, features of Machining center, turning center, CNC Part Programming: fundamentals, manual part programming methods, Computer Aided Part Programming. Direct Numerical Control, Adaptive Control.

UNIT – IV

GROUP TECHNOLOGY: Part family, coding and classification, production flow analysis, types and advantages.

Computer aided processes planning – importance, types.

UNIT – V

COMPUTER AIDED QUALITY CONTROL: Terminology used in quality control, use of computers in Quality control. Inspection methods- contact and noncontact types, computer aided testing, integration of CAQC with CAD/CAM.

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

UNIT – VI

COMPUTER INTEGRATED MANUFACTURING SYSTEMS: Types of manufacturing systems, machine tools and related equipment, material handling systems, material requirement planning, computer control systems, human labor in manufacturing systems, CIMS benefits.

TEXT BOOKS:

1. CAD / CAM / E Zimmers & M.P. Groover/Pearson Education
2. Mathematical Elements of Computer Graphics / Rogers and Adams / McGrawHill

REFERENCES:

1. CAD / CAM Theory and Practice / Ibrahim Zeid / TMH
2. Principles of Computer Aided Design and Manufacturing / Farid Amirouche / Pearson
3. Computer Numerical Control Concepts and programming / Warren S Seames / Thomson learning, Inc
4. Product manufacturing and cost estimation using CAD/CAE/ Kuang Hua Chang/Elsevier Publishers

Course Outcome:

At the end of the course the students shall be able to:

1. Describe the mathematical basis in the technique of representation of geometric entities including points, lines, and parametric curves, surfaces and solid, and the technique of transformation of geometric entities using transformation matrix
2. Describe the use of GT and CAPP for the product development
3. Identify the various elements and their activities in the Computer Integrated Manufacturing Systems.

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

IV Year B.Tech. – I Sem.

FINITE ELEMENT METHODS

Course Objectives:

1. To learn basic principles of finite element analysis procedure
2. To learn the theory and characteristics of finite elements that represent engineering structures
3. To learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses performed by others
4. Learn to model complex geometry problems and solution techniques.

UNIT-I

Introduction to finite element method, stress and equilibrium, strain – displacement relations, stress – strain relations, plane stress and plane strain conditions, variational and weighted residual methods, concept of potential energy, one dimensional problems.

UNIT – II

Discretization of domain, element shapes, discretization procedures, assembly of stiffness matrix, band width, node numbering, mesh generation, interpolation functions, local and global coordinates, convergence requirements, treatment of boundary conditions.

UNIT – III

Analysis of Trusses: Finite element modeling, coordinates and shape functions, assembly of global stiffness matrix and load vector, finite element equations, treatment of boundary conditions, stress, strain and support reaction calculations. Analysis of Beams: Element stiffness matrix for Hermite beam element, derivation of load vector for concentrated and UDL, simple problems on beams.

UNIT – IV

Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions, formulation of axisymmetric problems.

UNIT-V

Higher order and isoparametric elements: One dimensional quadratic and cubic elements in natural coordinates, two dimensional four noded isoparametric elements and numerical integration. Introduction to FEA Packages, modeling and analysis procedure.

UNIT – VI

Steady state heat transfer analysis: one dimensional analysis of a fin and two dimensional analysis of thin plate, analysis of a uniform shaft subjected to torsion. Dynamic Analysis: Formulation of finite element model, element consistent and lumped mass matrices, evaluation of eigen values and eigen vectors, free vibration analysis.

TEXT BOOKS:

1. Introduction to Finite Elements in Engineering / T.R. Chandraputla, Ashok D. Belegundu / Pearson Education
2. The Finite Element Methods in Engineering / SS Rao / Pergamon.

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

REFERENCES:

1. Finite Element Method with applications in Engineering / YM Desai, Eldho & Shah /Pearson publishers
2. An introduction to Finite Element Method / JN Reddy / McGrawHill
3. The Finite Element Method for Engineers – Kenneth H. Huebner, Donald L. Dewhirst, Douglas E. Smith and Ted G. Byrom / John Wiley & sons (ASIA) Pte Ltd.
4. Finite Element Analysis: Theory and Application with Ansys, Saeed Moaveniu, Pearson Education
5. Finite Element Methods / Chen
6. Finite Element Analysis: for students & Practicing Engineers / G.Lakshmi Narasaiah / BSP Books Pvt.Ltd.

Course outcomes:

Upon successful completion of this course you should be able to:

1. Understand the concepts behind variational methods and weighted residual methods in FEM
2. Identify the application and characteristics of FEA elements such as bars, beams, plane and isoparametric elements, and 3-D element .
3. Develop element characteristic equation procedure and generation of global stiffness equation will be applied.
4. Able to apply Suitable boundary conditions to a global structural equation, and reduce it to a solvable form.
5. Able to identify how the finite element method expands beyond the structural domain, for problems involving dynamics, heat transfer, and fluid flow.

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

IV Year B.Tech. – I Sem.

UN CONVENTIONAL MACHINING PROCESSES

Course Objectives:

- The course aims in identifying the classification of unconventional machining processes.
- To understand the principle, mechanism of metal removal of various unconventional machining processes.
- To study the various process parameters and their effect on the component machined on various unconventional machining processes.
- To understand the applications of different processes.

UNIT – I

INTRODUCTION: Need for non-traditional machining methods-classification of modern machining processes – considerations in process selection, applications.

Mechanical Removal Processes: Abrasive jet machining, Water jet machining and abrasive water jet machining: Basic principles, equipments, process variables, mechanics of material removal, MRR, application and limitations.

Ultrasonic machining – Elements of the process, mechanics of material removal, MRR process parameters, economic considerations, applications and limitations.

UNIT – II

ELECTRO – CHEMICAL MACHINING: Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, Tool design, Surface finish and accuracy, economic aspects of ECM – Simple problems for estimation of metal removal rate, fundamentals of chemical, machining, advantages and applications.

UNIT - III

THERMAL METAL REMOVAL PROCESSES: General principle and applications of Electric Discharge Machining, Electric Discharge Grinding and wire EDM – Power circuits for EDM, Mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, surface finish and machining accuracy, characteristics of spark eroded surface

UNIT – VI

Electron Beam Machining, Laser Beam Machining - Basic principle and theory, mechanics of material removal, process parameters, efficiency & accuracy, applications

UNIT-V

Plasma Machining: Application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries.

UNIT – VI

Magnetic abrasive finishing, abrasive flow finishing, Electrostream drilling, shaped tube electrolytic machining.

Chemical Milling – Equipment, process, characteristics, advantages, limitations and applications, photo chemical milling

2013-14

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

TEXT BOOK:

1. Advanced machining processes/ VK Jain/ Allied publishers.
2. Non Traditional Manufacturing Processes / Benedict /CRC Press

REFERENCES:

1. Modern Machining Process / Pandey P.C. and Shah H.S./ TMH.
2. New Technology / Bhattacharya A/ the Institution of Engineers, India 1984.

Course outcomes:

After completion of course, the student shall understand the principle of working, mechanism of metal removal in the various unconventional machining process. The student is able to identify the process parameters, their effect and applications of different processes.

2013-14

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

IV Year B.Tech. – I Sem.

**MICRO ELECTRO MECHANICAL SYSTEMS (MEMS)
(OPEN ELECTIVE)**

Course Objectives:

1. To learn basics of Micro Electro Mechanical Systems (MEMS).
2. To learn about various sensors and actuators used in MEMS
3. To learn the principle and various devices of MOEMS, Fluidic, bio and chemical systems

UNIT – I

INTRODUCTION: Definition of MEMS, MEMS history and development, micro machining, lithography principles & methods, structural and sacrificial materials, thin film deposition, impurity doping, etching, surface micro machining, wafer bonding, LIGA.

MECHANICAL SENSORS AND ACTUATORS: Principles of sensing and actuation: beam and cantilever, capacitive, piezo electric, strain, pressure, flow, pressure measurement by micro phone, MEMS gyroscopes, shear mode piezo actuator, gripping piezo actuator, Inchworm technology.

UNIT – II

THERMAL SENSORS AND ACTUATORS: Thermal energy basics and heat transfer processes, thermistors, thermo devices, thermo couple, micro machined thermo couple probe, peltier effect heat pumps, thermal flow sensors, micro hot plate gas sensors, MEMS thermo vessels, pyro electricity, shape memory alloys (SMA), U-shaped horizontal and vertical electro thermal actuator, thermally activated MEMS relay, micro spring thermal actuator, data storage cantilever.

UNIT – III

MICRO-OPTO-ELECTRO MECHANICAL SYSTEMS: Principle of MOEMS technology, properties of light, light modulators, beam splitter, micro lens, micro mirrors, digital micro mirror device (DMD), light detectors, grating light valve (GLV), optical switch, wave guide and tuning, shear stress measurement.

UNIT – IV

MAGNETIC SENSORS AND ACTUATORS: Magnetic materials for MEMS and properties, magnetic sensing and detection, magneto resistive sensor, more on hall effect, magneto diodes, magneto transistor, MEMS magnetic sensor, pressure sensor utilizing MOKE, mag MEMS actuators, by directional micro actuator, feedback circuit integrated magnetic actuator, large force reluctance actuator, magnetic probe based storage device.

UNIT – V

MICRO FLUIDIC SYSTEMS: Applications, considerations on micro scale fluid, fluid actuation methods, dielectro phoresis (DEP), electro wetting, electro thermal flow, thermo capillary effect, electro osmosis flow, opto electro wetting (OEW), tuning using micro fluidics, typical micro fluidic channel, microfluid dispenser, micro needle, molecular gate, micro pumps.

RADIO FREQUENCY (RF) MEMS: RF – based communication systems, RF MEMS, MEMS inductors, varactors, tuner/filter, resonator, clarification of tuner, filter, resonator, MEMS switches, phase shifter.

2013-14

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

UNIT - VI

CHEMICAL AND BIO MEDICAL MICRO SYSTEMS: Sensing mechanism & principle, membrane-transducer materials, chem.-lab-on-a-chip (CLOC) chemoresistors, chemocapacitors, chemotransistors, electronic nose (E-nose), mass sensitive chemosensors, fluorescence detection, calorimetric spectroscopy.

TEXT BOOK:

1. MEMS/Nitaigour Premchand Mahalik/TMH Publishing co.

REFERENCE BOOKS:

1. Foundation of MEMS/Chang Liu/Prentice Hall Ltd.
2. MEMS and NEMS/Sergey Edwrd Lyshevski/CRC Press, Indian Edition.
3. MEMS and Micro Systems: Design and Manufacture/Tai-Ran Hsu/TMH Publishers.
4. Introductory MEMS/ Thomas M Adams, Richard A Layton/Springer International Publishers.

Course outcomes:

Upon successful completion of this course the student shall be able to know the importance and various devices of MEMS and their applications.

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

IV Year B.Tech. – I Sem.

NANO TECHNOLOGY
(OPEN ELECTIVE)

Course objective

On successful completion of the course, students should be able to:

Understand the basic scientific concepts of nanoscience.

Understand the properties of nano materials, characterization of materials, synthesis and fabrication.

Understand the applications of nano technology in various science, engineering and technology fields.

UNIT-I

INTRODUCTION: History of nano science, definition of nano meter, nano materials, nano technology. Classification of nano materials. Crystal symmetries, crystal directions, crystal planes. Band structure.

UNIT-II

PROPERTIES OF MATERIALS:

Mechanical properties, electrical properties, dielectric properties, thermal properties, magnetic properties, opto electronic properties. Effect of size reduction on properties, electronic structure of nano materials.

UNIT-III

SYNTHESIS AND FABRICATION: Synthesis of bulk polycrystalline samples, growth of single crystals. Synthesis techniques for preparation of nano particle – Bottom Up Approach – sol gel synthesis, hydro thermal growth, thin film growth, PVD and CVD; Top Down Approach – Ball milling, micro fabrication, lithography. Requirements for realizing semiconductor nano structures, growth techniques for nano structures.

UNIT-IV

CHARACTERIZATION TECHNIQUES: X-Ray diffraction and Scherrer method, scanning electron microscopy, transmission electron microscopy, scanning probe microscopy, atomic force microscopy, piezoresponse microscopy, X-ray photoelectron spectroscopy, XANES and XAFS, angle resolved photoemission spectroscopy, diffuse reflectance spectra, photoluminescence spectra, Raman spectroscopy.

UNIT-V

CARBON NANO TECHNOLOGY:

Characterization of carbon allotropes, synthesis of diamond – nucleation of diamond, growth and morphology. Applications of nano crystalline diamond films, graphene, applications of carbon nano tubes.

UNIT-VI

APPLICATIONS OF NANO TECHNOLOGY:

Applications in material science, biology and medicine, surface science, energy and environment. Applications of nano structured thin films, applications of quantum dots.

2013-14

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

TEXT BOOK:

1. Nano science and nano technology / M.S Ramachandra Rao, Shubra Singh/Wiley publishers.

REFERENCE BOOKS:

1. Introduction to Nano Technology /Charles P. Poole, Jr., Frank J.Owens/Wiley publishers.
2. Nanotechnology /Jermy J Ramsden/Elsevier publishers
3. Nano Materials/A.K.Bandyopadhyay/ New Age
4. Nano Essentials/T.Pradeep/TMH
5. Nanotechnology the Science of Small / M.A Shah, K.A Shah/Wiley Publishers.
6. Principles of Nanotechnology /Phani Kumar/Scitech

Course outcomes:

Upon successful completion of this course the student shall be able to:

Grasp the essential concepts used in nanotechnology. And using them to synthesize the nano materials in various fields.

2013-14

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

IV Year B.Tech – I Sem.

ENTREPRENEURSHIP AND PROJECT MANAGEMENT
(OPEN ELECTIVE)

Course Objectives:

- To Understand entrepreneurship and entrepreneurial process and its significance in economic development
- To develop an idea of the support structure and promotional agencies assisting ethical entrepreneurship.
- To identify entrepreneurial opportunities, support and resource requirements to launch a new venture within legal and formal frame work.
- To understand the importance of projects and its phases.
- To analyze projects from marketing, operational and financial perspectives.
- To Evaluate projects based on discount and non-discount methods

UNIT – I

Entrepreneurship: Importance, Characteristics and Qualities of Entrepreneurship- Role of Entrepreneurship, Ethics and Social Responsibilities.

Role of Government Role of IDBI, NIESBUD, SISI, DIC Financial Institutions Commercial Banks, Entrepreneurial Development Institutes, Universities and other Educational Institutions offering Entrepreneurial Development Programme.

UNIT – II

Training: Designing Appropriate Training Programme to inculcate Entrepreneurial Spirit, Training for New and Existing Entrepreneurs, Feedback and Performance of Trainees. Women Entrepreneurship – Role & Importance, Profile Women Entrepreneur, Problems of Women Entrepreneurs,

UNIT – III

Creativity and Entrepreneurship Sources and Methods of Ideas Planning and Development of Programmes E-business Ventures; New Venture Management – Emerging Trends.

UNIT – IV

Planning and Evaluation of Projects: Growth of Firm - Factors inducing growth- Strategic investment – Growth rate decision - Project Feasibility Study – Cash Flow Projections – Role of study group- Rate of Return from projects- Project quality management techniques- Quality assurance.

UNIT – V

Risk in Corporate Investment Decision: Project Risk Analysis - Portfolio Risk- Risk Management in Corporate Investment Decision - Post Planning of Project- Allocation of Capital – Project Planning and Control - Post Completion Audit- Replacement Policy

UNIT –VI

International Project Management : Problems in managing International projects – Local Instaurations and culture – Geo-national issues – Project mentoring and communication – risks contingencies in International Projects, case studies

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

TEXT BOOKS:

1. Hisrich: Entrepreneurship, TMH, New Delhi, 2009
2. Rajeev Roy: Entrepreneurship, Oxford University Press, New Delhi, 2010
3. V.Gangadhar, Narsimha Chary: Entrepreneurship Development, Kalyani Publishers, New Delhi, 2007

REFERENCES:

1. Narayana Reddy: Entrepreneurship. Cengage learning, New Delhi, 2010
2. H.Nandan: Fundamentals of Entrepreneurship, PHI Learning, New Delhi, 2009
3. Prasanna Chandra: Projects, TMH, New Delhi, 2009.
4. Kathrin Koster: International Project Management, Sage Publication, New Delhi, 2010
5. Shivathanu Pillay: Project Management, University Press, New Delhi, 2009
6. K.Nagarajan: Project Management, New Age International, New Delhi, 2010
7. Jack R Meredith: Project Management, Wiley India Publishers, New Delhi, 2010

Course Outcomes:

Know the relationship between domestic entrepreneurship and international entrepreneurship, based on economic, political, legal and cultural systems
Know how to adapt domestic entrepreneurship to the global market.
Know the relationship between domestic entrepreneurship and international entrepreneurship, based on economic, political, legal and cultural systems;
Develop a framework for technical, economic and financial feasibility.
Evaluate an opportunity and prepare a written business plan to communicate business ideas effectively.

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

IV Year B.Tech. – I Sem.

MATERIAL CHARACTERIZATION TECHNIQUES
(DEPARTMENTAL ELECTIVE – II)

Course objective: The course presents the principles and methods of characterizing the structure and other aspects of materials. Various advanced characterizing techniques and their application will be studied.

UNIT -I

Introduction: Scope of subject, classification of techniques for characterization, macro and micro-characterization structure of solids.

UNIT -II

Bulk averaging techniques: Thermal analysis, DTA, DSC, TGA, dilatometry, resistivity/conductivity.

UNIT -III

Optical & X-ray spectroscopy: Atomic absorption spectroscopy, X-ray spectrometry, infrared spectroscopy and Raman spectroscopy.

UNIT -IV

Metallographic techniques: Optical metallography, image analysis, quantitative phase estimation.

UNIT -V

Diffraction methods: X-ray diffraction (crystal systems and space groups, Bravais lattices, direct and reciprocal lattice, Bragg law, powder diffraction and phase identification, single crystal diffraction, structure factor, X-ray crystal structure determination).

UNIT -VI

Electron optical methods: Scanning electron microscopy and image formation in the SEM, EDS, TEM, AFM.

TEXT BOOKS

1. The Principles of metallography laboratory practices /George L.Khel/Eurasia publishing house(Pvt Ltd)
2. Transmission electron Microscopy of metals /Garet Thomas/John Wiley and sons.

REFERENCES:

1. Modern Metallographic Techniques & their application / Victor A Phillips/Wiley Inter science, 1971
2. Physical Metallurgy, Part – I /RW Chao and P. Haasan/ Springer
3. Experimental Techniques in Physical Metallurgy /VT Cherepin and AK Mallik/Asia
4. Electron Microscopy in the study of materials –P.J.Grundy, GA Jones/Edward Arnold . Publishers

Course outcomes: At the end of the semester, the student should able to

1. analyze the microstructure of materials
2. Apply various characterization techniques like XRD, SEM TEM
3. Identify the phases existing in the material
4. Analyze the image

2013-14

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

IV Year B.Tech. – I Sem.

**DESIGN FOR MANUFACTURE
(DEPARTMENTAL ELECTIVE – II)**

Course Objectives:

1. Understand the design rules and considerations with reference to various manufacturing processes
2. To discuss capabilities and limitations of each manufacturing process in relation to part design and cost
3. To examine DFM principles including how the design affects manufacturing cost, lean manufacturing, six sigma, etc.

UNIT - I

Introduction: Design philosophy-steps in design process-general design rules for manufacturability-basic principles of designing for economical production-creativity in design.

UNIT - II

Machining processes: Overview of various machining processes-general design rules for machining-dimensional tolerance and surface roughness-Design for machining – ease –redesigning of components for machining ease with suitable examples. General design recommendations for machined parts.

UNIT - III

Metal casting: Appraisal of various casting processes, selection of casting process,-general design considerations for casting-casting tolerance-use of solidification, simulation in casting design-product design rules for sand casting.

UNIT - IV

Metal joining: Appraisal of various welding processes, factors in design of weldments – general design guidelines-pre and post treatment of welds-effects of thermal stresses in weld joints-design of brazed joints. Forging: Design factors for forging – closed die forging design – parting lines of dies – drop forging die design – general design recommendations.

UNIT – V

Extrusion & Sheet metal work: Design guide lines extruded sections-design principles for punching, blanking, bending, deep drawing-Keeler Goodman forging line diagram – component design for blanking.

2013-14

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

UNIT – VI

Plastics: Visco elastic and creep behavior in plastics-design guidelines for plastic components-design considerations for injection moulding – design guidelines for machining and joining of plastics.

TEXT BOOKS:

1. Design for manufacture / John cobert / Adisson Wesley. 1995
2. Design for Manufacture / Boothroyd/CRC Press
3. Design for manufacture/ James Bralla/McGrawHill Edition

REFERENCE:

1. ASM Hand book Vol.20

Course outcomes:

Upon completion of the course, the student will be able to:

1. Design components for machining
2. Simulate the casting design and choose the best casting process for a specific product.
3. Evaluate the effect of thermal stresses in weld joints
4. Design components for sheet metal work by understanding in depth the sheet metal processes and their formation mechanisms
5. Design plastic components for machining and joining and selecting a proper processes for different joining cases

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

IV Year B.Tech. – I Sem.

**COMPUTATIONAL FLUID DYNAMICS
(DEPARTMENTAL ELECTIVE – II)**

Course Objectives:

The course aims at providing required numerical and software techniques for solving various engineering problems involving fluid flow.

UNIT-I

ELEMENTARY DETAILS IN NUMERICAL TECHNIQUES: Number system and errors, representation of integers, fractions, floating point arithmetic, loss of significance and error propagation, condition and instability, computational methods for error estimation, convergence of sequences.

UNIT – II

APPLIED NUMERICAL METHODS: Solution of a system of simultaneous linear algebraic equations, iterative schemes of matrix inversion, direct methods for matrix inversion, direct methods for banded matrices.

REVIEW OF EQUATIONS GOVERNING FLUID FLOW AND HEAT TRANSFER:

Introduction, conservation of mass, Newton's second law of motion, expanded forms of navier-stokes equations, conservation of energy principle, special forms of the navier-stokes equations.

UNIT - III

Steady flow, dimensionless form of momentum and energy equations, stokes equation, conservative body force fields, stream function - vorticity formulation.

Finite difference applications in heat conduction and convection – heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, finite difference application in convective heat transfer, closure.

UNIT - IV

Finite differences, discretization, consistency, stability, and fundamentals of fluid flow modeling: introduction, elementary finite difference quotients, implementation aspects of finite-difference equations, consistency, explicit and implicit methods.

UNIT - V

Introduction to first order wave equation, stability of hyperbolic and elliptic equations, fundamentals of fluid flow modeling, conservative property, the upwind scheme.

UNIT -VI

FINITE VOLUME METHOD: Approximation of surface integrals, volume integrals, interpolation and differentiation practices, upwind interpolation, linear interpolation and quadratic interpolation.

2013-14

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

TEXT BOOKS:

1. Numerical heat transfer and fluid flow / Suhas V. Patankar/Butter-worth Publishers
2. Computational fluid dynamics - Basics with applications /John. D. Anderson / Mc Graw Hill.

REFERENCES:

1. Computational Fluid Flow and Heat Transfer/ Niyogi/Pearson Publications
2. Fundamentals of Computational Fluid Dynamics /Tapan K. Sengupta / Universities Press.
3. Computational fluid dynamics: An introduction, 3rd edition/John.F Wendt/Springer publishers

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

IV Year B.Tech. – I Sem.

INDUSTRIAL HYDRAULICS & PNEUMATICS
(DEPARTMENTAL ELECTIVE – II)

Course objective

1. Understand the underlying principles of Industrial Hydraulics & Pneumatic System
2. Analyze circuits and Enumerate the functions & characteristics of circuit elements
3. Attend to troubleshooting in fluid power systems
4. identify and describe the basic operation of Hydraulic / Pneumatic systems, the various equipment used in their operation

UNIT – I

Fundamentals of Fluid Power Systems-Introduction-types advantages, disadvantages & applications-fluid characteristics-terminologies used in fluid power-hydraulic symbols-hydraulic systems and components-sources-pumping theory-gear, vane & piston pumps.

UNIT-II

Fluid Power Actuators: Introduction-hydraulic actuators-hydraulic cylinders-types, construction, specifications and special types. hydraulic motors- working principle-selection criteria for various types-hydraulic motors in circuits- formulae-numerical problems

UNIT-III

Hydraulic elements in the design of circuits- Introduction-control elements-direction control valve-check valve-pressure control valve-relief valve-throttle valve-temperature & pressure compensation-locations of flow control valve

UNIT-IV

Accumulators & intensifiers-types, size &function of accumulators-application & circuits of accumulators- intensifiers-circuit & applications.

Design & drawing of hydraulic circuits-Introduction-case study & specifications-method of drawing a hydraulic circuit-hydraulic cylinder-quick return of a hydraulic cylinder

UNIT-V

Pneumatic systems-Introduction-symbols used-concepts & components- comparison-types & specifications of compressors-arrangement of a complete pneumatic system-compressed air behaviour- understanding pneumatic circuits-direction control valves

Electro pneumatics- Introduction-Pilot operated solenoid valve-electrical connections to solenoids-electro pneumatic circuit switches-relays-solenoids-P.E converter-concept of latching

UNIT-VI

Applications-servo systems-introduction-closed loop, hydro-mechanical and electro hydraulic – conventional and proportional valves-characteristics of proportional and servo valves- PLC applications in fluid power – selected pneumatic / electro pneumatic circuit problems – failure and trouble shooting in fluid power systems.

TEXT BOOKS:

1. Introduction to Hydraulics and Pneumatics / S. Ilango and V. Soundararajan/PHI , New Delhi
2. Applied hydraulics and pneumatics/T. Sunder Selwyn & R. Jayendiran/Anuradha Publications.

2013-14

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

REFERENCE BOOKS:

1. Oil Hydraulic Systems/S.R .Majumdar/McGrawHill Companies
2. Pneumatic Systems: Principles and Maintenance/SR Majumdar/Tata McGrawHill

Course outcome:

Upon successful completion of this course student should be able to:

1. understand the general concepts associated with Hydraulic and Pneumatic equipment as found in industry today.
2. Describe the various types of Hydraulic / Pneumatic equipment as well as the different types of Seals used in such equipment
3. Understand advantages of fluid power, applications
4. Understand the operation of hydraulics & pneumatic circuits and components typically used in industry

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

IV Year B.Tech. – I Sem.

CAD/CAM LAB

Course Objectives:

1. To impart the fundamental knowledge on using various analytical tools like ANSYS, FLUENT, etc., for Engineering Simulation
2. To know various fields of engineering where these tools can be effectively used to improve the output of a product.
3. To impart knowledge on how these tools are used in Industries by solving some real time problems using these tools.
1. **DRAFTING:** Development of part drawings for various components in the form of orthographic and isometric representation of dimensioning and tolerances scanning and plotting. study of script, DXE and IGES files.
2. **PART MODELING:** Generation of various 3D models through protrusion, revolve, shell sweep. creation of various features, study of parent child relation, feature based and boolean based modeling surface and assembly modeling, study of various standard translators, design simple components.
3. a). Determination of deflection and stresses in 2D and 3D trusses and beams.
 b). Determination of deflections component and principal and Von-mises stresses in plane stress, plane strain and Axisymmetric components.
 c). Determination of stresses in 3D and shell structures (at least one example in each case)
 d). Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.
 e). Steady state heat transfer Analysis of plane and Axisymmetric components.
 f). Computational fluid flow dynamic problems.
4. a). Development of process sheets for various components based on tooling Machines.
 b). Development of manufacturing and tool management systems.
 c). Study of various post processors used in NC Machines.
 d). Development of NC code for free form and sculptured surfaces using CAM packages.
 e). Machining of simple components on NC lathe and Mill by transferring NC Code / from a CAM package through RS 232.
 f) Quality Control and inspection.

Course outcomes:

Upon successful completion of this course student should be able to:

- 1.The student will be able to appreciate the utility of the tools like ANSYS or FLUENT in solving real time problems and day to day problems.
2. Use of these tools for any engineering and real time applications
3. Acquire knowledge on utilizing these tools for a better project in their curriculum as well as they will be prepared to handle industry problems with confidence when it matters to use these tools in their employment

2013-14

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

IV Year B.Tech. – I Sem.

DESIGN / FABRICATION PROJECT

Objective:

To develop the ability to conceptualize a product, apply standard/innovative design techniques and realize the product through fabrication with focus on design-manufacturing integration.

Course content:

Identification of possible improvements in an existing product, conceptualization of a new product/part, design of the part using design methodologies, selection of material(s), preparation of process flow chart for manufacturing, fabrication of the part using the available in-house facilities, assembly, testing of the functionality of the product.

The students should come up with their own original and innovative ideas for product design. The task may be performed by student teams/groups.

Course Outcome:

Through this course the student is expected to learn realization of a product, conceptualized and designed by him. The student gets hand on experience of the entire chain of manufacturing steps with an understanding of design-manufacturing integration.

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

IV Year B.Tech. – II Sem.

PRODUCTION PLANNING AND CONTROL

Course objectives:

This subject provides students with

1. An understanding of the concepts of production and service systems;
2. The ability to apply principles and techniques in the design, planning and control of these systems to optimize /make best use of resources in achieving their objectives.
3. Identify different strategies employed in manufacturing and service industries to plan production and control inventory.
4. Measure the effectiveness, identify likely areas for improvement, develop and implement improved planning and control methods for production systems.

UNIT – I

Introduction: Definition – objectives and functions of production planning and control – elements of production control – types of production – organization of production planning and control department – internal organization of department.

UNIT – II

Forecasting – importance of forecasting – types of forecasting, their uses – general principles of forecasting – forecasting techniques – qualitative methods and quantitative methods.

UNIT – III

Inventory management – functions of inventories – relevant inventory costs – ABC analysis – VED analysis – EOQ model – Inventory control systems – P-Systems and Q-Systems
MRP I, MRP II, ERP, LOB (Line of Balance), JIT and KANBAN system.

UNIT – IV

Routing – definition – routing procedure –route sheets – bill of material – factors affecting routing procedure, schedule –definition – difference with loading

UNIT – V

Scheduling policies – techniques, standard scheduling methods.

Line Balancing, aggregate planning, chase planning, expediting, controlling aspects.

UNIT – VI

Dispatching – activities of dispatcher – dispatching procedure – follow up – definition – reason for existence of functions – types of follow up, applications of computer in production planning and control.

TEXT BOOKS:

1. Elements of Production Planning and Control / Samuel Eilon/Universal Book Corp.
2. Manufacturing, Planning and Control/Partik Jonsson Stig-Arne Mattsson/TataMcGrawHill

REFERENCES:

1. Inventory Control Theory and Practice / Martin K. Starr and David W. Miller/Prentice-Hall
2. Production Planning and Control/Mukhopadyay/PHI.
3. Production Control A Quantitative Approach / John E. Biegel/Prentice-Hall
4. Production Control / Franklin G Moore & Ronald Jablonski/ Mc-GrawHill

2013-14

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

Course outcome:

Upon completion of the subject, students will be able to

1. Apply the systems concept for the design of production and service systems;
2. Make forecasts in the manufacturing and service sectors using selected quantitative and qualitative techniques
3. Apply the principles and techniques for planning and control of the production and service systems to optimize/make best use of resources;
4. Understand the importance and function of inventory and to be able to apply selected techniques for its control and management under dependent and independent demand circumstances.

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

IV Year B.Tech. – II Sem.

GREEN ENGINEERING SYSTEMS

Course Objective:

The course aims to highlight the significance of alternative sources of energy, green energy systems and processes and provides the theory and working principles of probable sources of renewable and green energy systems that are environmental friendly.

UNIT-I

INTRODUCTION:

SOLAR RADIATION: Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on tilted surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems. Photo voltaic energy conversion – types of PV cells, I-V characteristics

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

UNIT – II

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, solar cookers, central power tower concept and solar chimney.

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement.

UNIT – III

BIO-MASS: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, bio fuels, I.C. engine operation and economic aspects.

GEOHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy, potential in India.

OCEAN ENERGY: OTEC, Principles of utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT –IV

ENERGY EFFICIENT SYSTEMS:

- (A) **ELECTRICAL SYSTEMS:** Energy efficient motors, energy efficient lighting and control, selection of luminaire, variable voltage variable frequency drives (adjustable speed drives), controls for HVAC (heating, ventilation and air conditioning), demand site management.
- (B) **MECHANICAL SYSTEMS:** Fuel cells- principle, thermodynamic aspects, selection of fuels & working of various types of fuel cells, Environmental friendly and Energy efficient compressors and pumps.

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

UNIT-V

ENERGY EFFICIENT PROCESSES: Environmental impact of the current manufacturing practices and systems, benefits of green manufacturing systems, selection of recyclable and environment friendly materials in manufacturing, design and implementation of efficient and sustainable green production systems with examples like environmental friendly machining, vegetable based cutting fluids, alternate casting and joining techniques, zero waste manufacturing.

UNIT – VI

GREEN BUILDINGS: Definition, features and benefits. Sustainable site selection and planning of buildings for maximum comfort. Environmental friendly building materials like bamboo, timber, rammed earth, hollow blocks, lime & lime pozzolana cement, agro materials and industrial waste, Ferro cement and Ferro-concrete, alternate roofing systems, paints to reduce heat gain of the buildings. Energy management.

TEXT BOOKS:

1. Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J.K.Nayak/ TMH
2. Non-Conventional Energy Resources/ Khan B.H/ Tata McGraw Hill, New Delhi, 2006
3. Green Manufacturing Processes and Systems, Edited / J. Paulo Davim/Springer 2013

REFERENCES:

1. Alternative Building Materials and Technologies / K.S Jagadeesh, B.V Venkata Rama Reddy and K.S Nanjunda Rao/New age international
2. Principles of Solar Engineering / D.Yogi Goswami, Frank Krieth & John F Kreider / Taylor & Francis
3. Non-Conventional Energy / Ashok V Desai /New Age International (P) Ltd
4. Renewable Energy Technologies /Ramesh & Kumar /Narosa
5. Non conventional Energy Source/ G.D Roy/Standard Publishers
6. Renewable Energy Resources-2nd Edition/ J.Twidell and T. Weir/ BSP Books Pvt.Ltd
7. Fuel Cell Technology –Hand Book / Gregor Hoogers / BSP Books Pvt. Ltd.

Course outcome:

The student shall understand the principles and working of solar, wind, biomass, geo thermal, ocean energies and green energy systems and appreciate their significance in view of their importance in the current scenario and their potential future applications.

2013-14

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

IV Year B.Tech. – II Sem.

EXPERIMENTAL STRESS ANALYSIS
(DEPARTMENTAL ELECTIVE – III)

Course objectives:

Objective of the course is to measure strain through various experimental methods like strain gauges, photo elasticity techniques, brittle coatings, moiré methods and birefrigerent coatings to understand the relation between the mechanics theory and experimental stress analysis to learn usage of the experimental techniques on the practical problems

UNIT – I

Introduction: Stress, strain, Plane stress and plane strain conditions, Compatibility conditions. Problems using plane stress and plane strain conditions, stress functions, mohrs circle for stress strain, Three-dimensional stress strain relations.

UNIT – II

Strain Measurement and Recordings: Various types of strain gauges, Electrical Resistance strain gauges, semiconductor strain gauges, strain gauge circuits. Introduction, static recording and data logging, dynamic recording at very low frequencies, dynamic recording at intermediate frequencies, dynamic recording at high frequencies, dynamic recording at very high frequencies, telemetry systems.

UNIT – III

Photo elasticity: Photo elasticity – Polariscope – Plane and circularly polarized light, Bright and dark field setups, Photo elastic materials – Isochromatic fringes – Isoclinics

Three dimensional Photo elasticity : Introduction, locking in model deformation, materials for three-dimensional photo elasticity, machining cementing and slicing three-dimensional models, slicing the model and interpretation of the resulting fringe patterns, effective stresses, the shear-difference method in three dimensions, applications of the Frozen-stress method, the scattered-light method.

UNIT – IV

Brittle coatings: Introduction, coating stresses, failure theories, brittle coating crack patterns, crack detection, ceramic based brittle coatings, resin based brittle coatings, test procedures for brittle coatings analysis, calibration procedures, analysis of brittle coating data.

UNIT – V

Moire Methods: Introduction, mechanism of formation of Moire fringes, the geometrical approach to Moire-Fringe analysis, the displacement field approach to Moire-Fringe analysis, out of plane displacement measurements, out of plane slope measurements, sharpening and multiplication of Moire-Fringes, experimental procedure and techniques.

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

UNIT – VI

Birefringent Coatings

Introduction, Coating stresses and strains, coating sensitivity, coating materials, application of coatings, effects of coating thickness, Fringe-order determinations in coatings, stress separation methods.

TEXT BOOKS :

1. Theory of Elasticity /S.P.Timishenko and J.N Goodier/Tata Mc Graw Hill
2. Experimental stress analysis / Dally and Riley/Mc Graw-Hill

REFERENCES:

1. A treatise on Mathematical theory of Elasticity / Love .A.E.H / Cambridge University Press
2. Photo Elasticity /MM Frocht / Pergamon Press
3. Experimental stress analysis, Video course / K.Ramesh / NPTEL

Course Outcomes:

The intended learning outcomes are that on completion of this course the student should be able to:

1. Student should be able to chose the appropriate method for measuring strain
2. Students should be able to apply optical techniques for measurement of strain & stress
3. Analyze the results obtained from coating techniques and corroborated with theoretical results.
4. Correlate experimental and analytically derived results.

2013-14

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

IV Year B.Tech. – II Sem.

**MECHATRONICS
(DEPARTMENTAL ELECTIVE – III)**

Course Objective

The main objective of this course is to introduce the integrative nature of Mechatronics. To describe the different components and devices of mechatronics systems.

UNIT-I

Mechatronics systems – elements & levels of mechatronics system, Mechatronics design process, system, measurement systems, control systems, microprocessor-based controllers, advantages and disadvantages of mechatronics systems.

UNIT-II

Sensors and transducers: Introduction, types, displacement, position, proximity, velocity, motion, force, acceleration, torque, fluid pressure, liquid flow, liquid level, temperature and light sensors.

UNIT-III

Solid state electronic devices - PN junction diode, BJT, FET, DIAC, TRIAC and LEDs - Analog signal conditioning, operational amplifiers, noise reduction, filtering.

UNIT-IV

Hydraulic and pneumatic actuating systems - Fluid systems, Hydraulic systems, and pneumatic systems, components, control valves, electro-pneumatic, hydro-pneumatic, electro-hydraulic servo systems. Mechanical actuating systems and electrical actuating systems – basic principles and elements.

UNIT-V

System and interfacing and data acquisition – Data Acquisition Systems, Analog to Digital and Digital to Analog conversions; Digital Signal Processing – data flow in DSPs, block diagrams, typical layouts, interfacing motor drives.

UNIT -VI

Dynamic models and analogies, Digital electronics and systems, digital logic control, micro processors and micro controllers, programming, process controllers, programmable logic controllers, PLCs versus computers, application of PLCs for control, Design of mechatronics systems & future trends.

2013-14

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

TEXT BOOK:

1. MECHATRONICS Integrated Mechanical Electronics Systems/KP Ramachandran, GK Vijaya Raghavan & MS Balasundaram/WILEY India Edition
2. Electronic Control Systems in Mechanical and Electrical Engineering / W. Bolton / Pearson publishers

REFERENCES:

- 1 Mechatronics /Smaili A, Mrad F/ Oxford Higher Education, Oxford University Press
- 2 Mechatronics Source Book / Newton C Braga/Thomson Publications,Chennai.
- 3 Mechatronics – N. Shanmugam / Anuradha Agencies Publishers.
- 4 Mechatronics System Design / Devdas shetty/Richard/Thomson.
- 5 Mechatronics/M.D.Singh/J.G.Joshi/PHI.
- 6 Mechatronics – Electronic Control Systems in Mechanical and Electrical Engg. 4th Edition / W. Bolton/ Pearson, 2012
- 7 Mechatronics – Principles and Application / Godfrey C. Onwubolu/Elsevier, Indian print

Course outcomes:

After completion of this course, the student shall be able to use the various mechatronics systems devices and components in the design of electro mechanical systems.

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

IV Year B.Tech. – II Sem.

ADVANCED MATERIALS
(DEPARTMENTAL ELECTIVE – III)

Course Objectives

The objective for this course is to understand the mechanics of different materials. This understanding will include concepts such as anisotropic material behavior, constituent properties and manufacturing processes of different composites. Suitability of smart and nano materials for engineering applications.

UNIT-I

INTRODUCTION TO COMPOSITE MATERIALS: Introduction, classification: polymer matrix composites, metal matrix composites, ceramic matrix composites, carbon-carbon composites, fiber-reinforced composites and nature-made composites, and applications .

REINFORCEMENTS: Fibres- glass, silica, kevlar, carbon, boron, silicon carbide, and boron carbide fibres.

UNIT-II

polymer composites, thermoplastics, thermosetting plastics, manufacturing of PMC, MMC & CCC and their applications.

UNIT-III

MANUFACTURING METHODS: Autoclave, tape production, moulding methods, filament winding, man layup, pultrusion, RTM.

UNIT-IV

MACROMECHANICAL ANALYSIS OF A LAMINA: Introduction, generalized hooke's law, reduction of hooke's law in three dimensions to two dimensions, relationship of compliance and stiffness matrix to engineering elastic constants of an orthotropic lamina, laminate-laminate code.

UNIT-V

FUNCTIONALLY GRADED MATERIALS: Types of functionally graded materials-classification-different systems-preparation-properties and applications of functionally graded materials.

SHAPE MEMORY ALLOYS: Introduction-shape memory effect-classification of shape memory alloys-composition-properties and applications of shape memory alloys.

UNIT-VI

NANO MATERIALS: Introduction-properties at nano scales-advantages & disadvantages-applications in comparison with bulk materials (nano – structure, wires, tubes, composites). state of art nano advanced- topic delivered by student.

TEXT BOOKS:

1. Nano material /A.K. Bandyopadyay/New age Publishers
2. Material science and Technology: A comprehensive treatment/Robert W.Cahn,/VCH
3. Engineering Mechanics of Composite Materials / Isaac and M Daniel/Oxford University Press

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

REFERENCES:

1. Mechanics of Composite Materials / R. M. Jones/ Mc Graw Hill Company, New York, 1975.
2. Analysis of Laminated Composite Structures / L. R. Calcote/Van Nostrand Rainfold, NY 1969
3. Analysis and performance of fibre Composites /B. D. Agarwal and L. J. Broutman /Wiley-Interscience, New York, 1980
4. Mechanics of Composite Materials - Second Edition (Mechanical Engineering) /Autar K.Kaw / CRC Press

Course outcomes

Students who successfully complete this course will demonstrate the following:

- Properties of constituents, classification of composites and their suitability for the structural applications
- Manufacturing processes
- Smart materials and their applications
- Nano materials in comparison with bulk materials

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

IV Year B.Tech. – II Sem.

POWER PLANT ENGINEERING
(DEPARTMENTAL ELECTIVE – III)

Course Objectives:

The course is aimed at providing knowledge of power generation through different prime movers viz steam, ICGT, Hydro, nuclear and hybrid systems along with their economics and environmental considerations.

UNIT – I

Introduction to the sources of energy – resources and development of power in india.

STEAM POWER PLANT: Plant layout, working of different circuits, fuel and handling equipments, types of coals, coal handling, choice of handling equipment, coal storage, ash handling systems. Combustion: properties of coal – overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, dust collectors, cooling towers and heat rejection. corrosion and feed water treatment.

UNIT – II

INTERNAL COMBUSTION AND GAS TURBINE POWER PLANTS:

DIESEL POWER PLANT: Plant layout with auxiliaries – fuel supply system, air starting equipment, super charging.

GAS TURBINE PLANT: Introduction – classification - construction – layout with auxiliaries, combined cycle power plants and comparison.

UNIT – III

HYDRO ELECTRIC POWER PLANT: Water power – hydrological cycle / flow measurement – drainage area characteristics – hydrographs – storage and pondage – classification of dams and spill ways.

HYDRO PROJECTS AND PLANT: Classification – typical layouts – plant auxiliaries – plant operation pumped storage plants.

UNIT – IV

NUCLEAR POWER STATION: Nuclear fuel – breeding and fertile materials – nuclear reactor – reactor operation.

TYPES OF REACTORS: Pressurized water reactor, boiling water reactor, sodium-graphite reactor, fast breeder reactor, homogeneous reactor, gas cooled reactor, radiation hazards and shielding – radioactive waste disposal.

UNIT – V

COMBINED OPERATIONS OF DIFFERENT POWER PLANTS: Introduction, advantages of combined working, load division between power stations, storage type hydro-electric plant in combination with steam plant, run-of-river plant in combination with steam plant, pump storage plant in combination with steam or nuclear power plant, co-ordination of hydro-electric and gas turbine stations, co-ordination of hydro-electric and nuclear power stations, co-ordination of different types of power plants.

POWER PLANT INSTRUMENTATION AND CONTROL: Importance of measurement and instrumentation in power plant, measurement of water purity, gas analysis, O₂ and CO₂ measurements, measurement of smoke and dust, measurement of moisture in carbon dioxide circuit, nuclear measurements.

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

UNIT – VI

POWER PLANT ECONOMICS AND ENVIRONMENTAL CONSIDERATIONS: Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, load curves, load duration curve, definitions of connected load, maximum demand, demand factor, average load, load factor, diversity factor – related exercises. effluents from power plants and Impact on environment – pollutants and pollution standards – methods of pollution control.

TEXT BOOKS:

1. A course in Power Plant Engineering /Arora and Domkundwar/Dhanpatrai & Co.
2. Power Plant Engineering /P.C.Sharma / S.K.Kataria Pub

REFERENCES:

1. Power Plant Engineering: P.K.Nag/ II Edition /TMH.
2. Power station Engineering – ElWakil / McGrawHill.
3. An Introduction to Power Plant Technology / G.D. Rai/Khanna Publishers

Course outcomes:

After undergoing this course the student can understand various conventional methods of power generation and principle of operation and performance of respective prime movers along with their economics and their impact on environment.

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

IV Year B.Tech. – II Sem.

**NON - DESTRUCTIVE EVALUATION
(DEPARTMENTAL ELECTIVE – IV)**

Course Objectives

- The students are to be exposed to the concepts of various NDE techniques using radiography, ultrasonics, liquid penetrates, magnetic patches and Eddy currents
- They will learn basic principles of these methods and will be able to select a testing process
- They will understand the advantages and disadvantages of these techniques.

UNIT – I

Introduction to non destructive testing, methods, visual inspection methods, aids

Liquid Penetrant Test: Liquid Penetrant Test, Basic Concepts, Liquid Penetrant System, Test Procedure, Effectiveness and Limitations of Liquid Penetrant Testing

UNIT – II

Magnetic Particle Test: Magnetic Materials, Magnetization of Materials , Demagnetization of Materials, Principle of Magnetic Particle Test, Magnetic Particle Test Equipment, Magnetic Particle Test Procedure, Standardization and Calibration, Interpretation and Evaluation, Effective Applications and Limitations of the Magnetic Particle Test

UNIT – III

Eddy Current Test: Principle of Eddy Current, Eddy Current Test System, Applications of Eddy Current Testing Effectiveness of Eddy Current Testing

UNIT – IV

Radiographic test, Sources of X and Gamma Rays and their interaction with Matter, Radiographic equipment, Radiographic Techniques, Safety Aspects of Industrial Radiography

UNIT – V

Ultrasonics test: Principle of Wave Propagation, Reflection, Refraction, Diffraction, Mode Conversion and Attenuation, Sound Field, Piezo-electric Effect , Ultrasonic Transducers and their Characteristics, Ultrasonic Equipment and Variables Affecting Ultrasonic Test, Ultrasonic Testing, Interpretations and Guidelines for Acceptance, Rejection - Effectiveness and Limitations of Ultrasonic Testing.

UNIT – VI

Industrial Applications of NDE: Span of NDE Activities Railways, Nuclear, Non-nuclear and Chemical Industries, Aircraft and Aerospace Industries, Automotive Industries, Offshore Gas and Petroleum Projects, Coal Mining Industry, NDE of pressure vessels, castings, welded constructions

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

TEXT BOOKS:

1. Non destructive test and evaluation of Materials/J Prasad, GCK Nair/TMH Publishers
2. Ultrasonic testing of materials/ H Krautkramer/Springer
3. Non destructive testing/Warren, J Mc Gonnagle / Godan and Breach Science publishers

REFERENCES:

1. Ultrasonic inspection training for NDT/ E. A. Gingel/Prometheus Press,
2. ASTM Standards, Vol 3.01, Metals and alloys
3. Non-destructive, Hand Book – R. Hamchand

Course Outcomes

1. Comprehensive, theory based understanding of the techniques and methods of non destructive testing
2. Apply methods knowledge of non destructive testing to evaluate products of railways, automobiles, aircrafts, chemical industries etc.

2013-14

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

IV Year B.Tech. – II Sem.

**ADVANCED OPTIMIZATION TECHNIQUES
(DEPARTMENTAL ELECTIVE – IV)**

COURSE OBJECTIVES:

To enable the students learn the latest non-linear optimization techniques such as classical optimization methods, dynamic programming, integer programming etc. Provide basic knowledge and enough competence to formulate the optimization problems.

UNIT I

INTRODUCTION TO OPTIMIZATION: Engineering applications of optimization- statement of an optimization problem- classification of optimization problem- optimization techniques.

CLASSICAL OPTIMIZATION TECHNIQUES: Single variable optimization- multivariable optimization with equality constraints- multivariable optimization with inequality constraints.

UNIT-II

UNCONSTRAINED OPTIMIZATION TECHNIQUES: Pattern search method- Rosenbrock's method of rotating coordinates- Simplex method- Descent methods- Gradient of function- Steepest Descent method.

UNIT-III

CONSTRAINED OPTIMIZATION TECHNIQUES: Characteristics of a constrained problem- methods of feasible directions - basic approach in the penalty function method- interior penalty function method- convex programming problem- exterior penalty function method.

UNIT-IV

GEOMETRIC PROGRAMMING (G.P): Solution of an unconstrained geometric programming, differential calculus method and arithmetic method. primal dual relationship and sufficiency conditions. Solution of a constrained geometric programming problem (G.P.P). Complimentary geometric programming (C.G.P)

UNIT-V

DYNAMIC PROGRAMMING (D.P): Multistage decision processes. concepts of sub optimization, computational procedure in dynamic programming calculus method and tabular methods. Linear programming as a case of D.P., Continuous D.P.

UNIT-VI

INTEGER PROGRAMMING (I.P): Graphical representation. Gomory's cutting plane method. Bala's algorithm for zero-one programming problem. Integer non linear programming.

TEXT BOOK:

1. Optimization Theory and Applications/ S.S.Rao/Wiley Eastern Limited, New Delhi.

REFERENCES:

1. Engineering Optimization / Kalyanmanai Deb/Prentice Hall of India, New Delhi.
2. Optimization Techniques-Theory and applications/C.Mohan & Kusum Deep/New Age International
3. Operations Research /S.D.Sharma / MacMillan Publishers

2013-14

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

Course Out comes:

1. Students at the end of the course learn advanced optimization techniques to solve real-life problems
2. Students can able to formulate and solve various practical optimization problems in manufacturing and service organizations

2013-14

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

IV Year B.Tech. – II Sem.

GAS DYNAMICS AND JET PROPULSION
(DEPARTMENTAL ELECTIVE – IV)

Course objectives:

The purpose of this course is to provide the student with the knowledge of basic principles of gas dynamics and its importance in jet propulsion applications.

UNIT-I

Introduction to gas dynamics: control volume and system approaches acoustic waves and sonic velocity - mach number - classification of fluid flow based on mach number - mach cone-compressibility factor - general features of one dimensional flow of a compressible fluid - continuity and momentum equations for a control volume.

UNIT-II

Isentropic flow of an ideal gas: basic equation - stagnation enthalpy, temperature, pressure and density-stagnation, acoustic speed - critical speed of sound- dimensionless velocity-governing equations for isentropic flow of a perfect gas - critical flow area - stream thrust and impulse function. Steady one dimensional isentropic flow with area change-effect of area change on flow parameters-choking- convergent nozzle - performance of a nozzle under decreasing back pressure -De level nozzle - optimum area ratio effect of back pressure - nozzle discharge coefficients - nozzle efficiencies.

UNIT- III

Simple frictional flow: adiabatic flow with friction in a constant area duct-governing equations - fanno line limiting conditions - effect of wall friction on flow properties in an Isothermal flow with friction in a constant area duct-governing equations - limiting conditions.

Steady one dimensional flow with heat transfer in constant area ducts- governing equations - Rayleigh line entropy change caused by heat transfer - conditions of maximum enthalpy and entropy.

UNIT-IV

Effect of heat transfer on flow parameters: Intersection of Fanno and Rayleigh lines. Shock waves in perfect gas- properties of flow across a normal shock - governing equations - Rankine Hugoniat equations - Prandtl's velocity relationship - converging diverging nozzle flow with shock thickness - shock strength.

UNIT- V

Propulsion: Air craft propulsion: - types of jet engines - energy flow through jet engines, thrust, thrust power and propulsive efficiency turbojet components-diffuser, compressor, combustion chamber, turbines, exhaust systems.

UNIT-VI

Performance of turbo propeller engines, ramjet and pulsejet, scramjet engines. Rocket propulsion - rocket engines, Basic theory of equations - thrust equation - effective jet velocity - specific impulse - rocket engine performance - solid and liquid propellant rockets - comparison of various propulsion systems.

TEXT BOOKS:

1. Compressible fluid flow /A. H. Shapiro / Ronald Press Co., 1953
2. Fundamentals of compressible flow with aircraft and rocket propulsion/S. M. Yahya/New Age international Publishers
3. Fundamental of Gas dynamics-2nd edition/ M J Zucker/ Wiley publishers

2013-14

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

REFERENCES

1. Elements of gas dynamics / HW Liepman & A Roshko/Wiley
2. Aircraft & Missile propulsion /MJ Zucrow/Wiley
3. Gas dynamics / M.J. Zucrow & Joe D.Holfman / Krieger Publishers

Course outcomes:

Up on successful completion of this course the student should be able to analyze the gas flow in different situations with and without friction, with and without heat transfer in particular jet propulsion and rocket engineering applications.

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)

IV Year B.Tech. – II Sem.

QUALITY AND RELIABILITY ENGINEERING
(DEPARTMENTAL ELECTIVE – IV)

Course objectives:

1. The aim of this course is to provide students with a basic understanding of the approaches and techniques to assess and improve process and/or product quality and reliability.
2. The objectives are to introduce the principles and techniques of Statistical Quality Control and their practical uses in product and/or process design and monitoring
3. To understand techniques of modern reliability engineering tools.

UNIT-I

Quality engineering – quality systems – quality engineering in product design and production process – system design – parameter design – tolerance design, quality costs – quality improvement.

UNIT-II

Statistical process control \bar{X} , R, p, c charts, other types of control charts, process capability, process capability analysis, process capability index. (SQC tables can be used in the examination)

UNIT-III

Acceptance sampling by variables and attributes, design of sampling plans, single, double, sequential and continuous sampling plans, design of various sampling plans.

UNIT-IV

Loss function, tolerance design – N type, L type, S type; determination of tolerance for these types. online quality control – variable characteristics, attribute characteristics, parameter design.

Quality function deployment – house of quality, QFD matrix, total quality management concepts. quality information systems, quality circles, introduction to ISO 9000 standards.

UNIT-V

Reliability – Evaluation of design by tests - Hazard Models, Linear, Releigh, Weibull. Failure Data Analysis, reliability prediction based on weibull distribution, Reliability improvement.

UNIT-VI

Complex system, reliability, reliability of series, parallel & standby systems & complex systems & reliability prediction and system effectiveness.

Maintainability, availability, economics of reliability engineering, replacement of items, maintenance costing and budgeting, reliability testing.

TEXT BOOKS:

1. Quality Engineering in Production Systems / G Taguchi /McGraw Hill
2. Reliability Engineering/ E.Bala Guruswamy/Tata McGraw Hill,
3. Statistical Quality Control : A Modern Introduction/ Montgomery/Wiley

REFERENCE BOOKS:

1. Juran's Quality planning & Analysis/ Frank.M.Gryna Jr. / McGraw Hill.
2. Taguchi Techniques for Quality Engineering/ Philippos/ McGraw Hill,
3. Reliability Engineering / LS Srinath / Affiliated East West Pvt. Ltd.,
4. Statistical Process Control/ Eugene Grant, Richard Leavenworth / McGraw Hill.
5. Optimization & Variation Reduction in Quality / W.A. Taylor / Tata McGraw Hill
6. Quality and Performance Excellence/ James R Evans/ Cengage learning

2013-14

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

Course outcome:

Upon successful completion of this course, students should be able to:

1. Understand quality and reliability concept, beware of some basic techniques for quality improvement, and acquire fundamental knowledge of statistics and probability.
2. Apply control charts to analyze and improve the process quality
3. Design a simple sampling plan, construct its OC curve and evaluate its effectiveness on a given sampling process
4. Acquire the concepts of the reliability, *and* calculate the system reliability based on the given component connection; *calculate* the reliability based on the given failure model

2013-14

**UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)**

IV Year B.Tech. – II Sem.

PROJECT WORK

Objectives:

The aim of the course is to make the student perform a comprehensive project work that involves either or all of the following: optimum design of a mechanical component or an assembly, thermal analysis, computer aided design & analysis, cost effective manufacturing process, material selection, testing procedures or fabrication of components and prepare a detailed technical thesis report. The completed task should also take into account the significance of real time applications, energy management and the environmental affects.

Outcomes:

After completing the project work the student should learn the technical procedure of planning, scheduling and realizing an engineering product and further acquire the skills of technical report writing and data collection.

Course content:

The student should work in groups to achieve the aforementioned objectives and the outcomes.