GODAVARI INSTITUTE OF ENGINEERING & TECHNOLOGY

Department of Mechanical Engineering

COURSE STRUCTURE

B. Tech. Mechanical Engineering

IV Year **I Semester**

S. No.	Subject Title	Periods per week			C	Scheme of Examination Maximum Marks		
		T	P	D		Int.	Ext.	Total
1.	Power Plant Engineering	4	-	-	3	30	70	100
2.	Finite Element Methods	4	-	-	3	30	70	100
3.	CAD/CAM	4	-	-	3	30	70	100
4.	Unconventional Machining Processes	4	-	-	3	30	70	100
5.	Open Elective	4	-	-	3	30	70	100
6.	Departmental Elective – II	4	-	-	3	30	70	100
7.	CAM and Simulation Lab.	-	3	-	2	50	50	100
8.	**Fabrication Project / Term Paper #**	-	1	-	1	50	-	50
9.	**Summer Internship****	-	-	-	3	100	-	100
10.	**IPR & Patents**	4	-	-	-	-	-	-
Total		**28**	**4**	**-**	**24**	-	-	**850**

T- THEORY P – PRACTICAL D- DRAWING C – CREDITS Int. – INTERNAL Ext. - EXTERNAL

** Student should carry **Summer Internship** during summer vacation after III B.Tech. II Sem. and it will be evaluated during IV B.Tech. I Sem.

IV Year **II Semester**

S. No.	Subject Title	Periods per week			C	Scheme of Examination Maximum Marks		
		T	P	D		Int.	Ext.	Total
1.	Management Information Systems	4	-	-	3	30	70	100
2.	Green Energy & Systems	4	-	-	3	30	70	100
3.	Departmental Elective – III	4	-	-	3	30	70	100
4.	Departmental Elective – IV	4	-	-	3	30	70	100
5.	**Project Work**	-	-	-	9	60	140	200
Total		**16**	-	-	**21**	-	-	**600**

T- THEORY P – PRACTICAL D- DRAWING C – CREDITS Int. – INTERNAL Ext. - EXTERNAL

IV Year B.Tech. (ME) – I Sem. 4-0-0-3

POWER PLANT ENGINEERING

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

Objective: To introduce basic concepts of Energy Sources and Steam Power Generation Methods with information on Basic Components of Steam Power Stations.

INTRODUCTION: Introduction to the sources of energy - resources and development of power in India – Power Generation concepts.

STEAM POWER PLANT: Plant layout, working of different circuits, fuel and handling equipments, coal handling, coal storage, ash handling systems. Coal Combustion: properties of coal - overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, advantages & disadvantages, - Ball Mills – Bowl Mills - combustion needs and draught system, cyclone furnace, design and construction, dust collectors, ESPs - cooling towers - and feed water treatment.

UNIT - II

Objective: To introduce basic idea of Power Production through - Diesel Power Plant and Gas Turbine Plant.

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

GAS TURBINE PLANT: Introduction – components of Gas Turbine - classification – Gas power plant layout with auxiliaries, combined cycle power plants and comparison.

UNIT - III

Objective: To edify the basics of Hydro Power Station with emphasis on Hydrological Cycle and Pumped Storage Plants.

HYDRO ELECTRIC POWER PLANT: Water power - hydrological cycle - / flow measurement - drainage area characteristics - hydrographs - storage and pondage - classification of dams and spill ways – Typical Hydro Electric Power Plant operation.

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

UNIT - IV

Objective: To enlighten importance of Nuclear Power, Nuclear power Generation and understanding the importance & methods of shielding radiation.

NUCLEAR POWER STATION: Nuclear Energy-Fission, Fusion Reaction 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

Objective: To pioneer basic concepts of Combined operations of Power plants and to comprehend various instruments used in power plant.

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, O_2 and CO_2 measurements, measurement of smoke and dust, measurement of moisture in carbon dioxide circuit, nuclear measurements.

UNIT - VI

Objective: To enlighten and provide knowledge in Economic and Environmental aspects of Power plants.

POWER PLANT ECONOMICS AND ENVIRONMENTAL CONSIDERATIONS: 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 calculations. Costs associated with Power Production. Effluents from power plants and their 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
3. Power Plant Engineering: P.K.Nag/ II Edition /TMH.

REFERENCES:

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

WEB REFERENCES:

1. **nptel**.ac.in/video.php?subjectId=108105058
2. **nptel**.ac.in/courses/Webcourse-contents/IIT.../Course_home-lec18.htm
3. freevideolectures.com › Electrical Engineering › IIT Kharagpur
4. http://www.authorstream.com/Presentation/annaprasad-1201748-nuclear-power-plant-dr-varaprasada-rao
5. www.ignou.ac.in/upload/Unit-2-58.pdf
6.

ACTIVITY: Industrial Visit.

A trip to Nearby power plant at Rajahmundry to understand the working of a power plant.

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 mover along with their economics and their impact on environment.

IV Year B.Tech. (ME) – I Sem. 4-0-0-3

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.

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 / Chandraputla, Ashok and Belegundu / Prentice – Hall.
2. The Finite Element Methods in Engineering / SS Rao / Pergamon.

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.

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.

IV Year B.Tech. (ME) – I Sem. 4-0-0-3

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 codes, 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, Coordinate Measuring Machine (CMM).

UNIT – VI

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

TEXT BOOKS:

1. Computer Aided Design and Manufacturing/M.M.M. SARCAR, etal/PHI Pvt.Ltd.,
2. CAD / CAM / CAE Zimmers & M.Groover/Pearson Education
3. Automation, Production Systems & Computer Integrated Manufacturing/ Groover/P.E

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.
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.

IV Year B.Tech. (ME) – I Sem. 4-0-0-3

UNCONVENTIONAL 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.

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 – IV

ELECTRON BEAM MACHINING & LASER BEAM MACHINING - Basic principle and theory, mechanics of material removal, process parameters, efficiency & accuracy, applications

UNIT-V

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

Magnetic abrasive finishing, abrasive flow finishing,

UNIT – VI

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

Comparison of various unconventional machining processes based on Material Removal Rate, surface finish, efficiency and cost.

TEXT BOOK:

1. Advanced machining processes/ VK Jain/ Allied publishers.
2. Manufacturing processes for Engineering Materials- Kalpak Jain S and Steven R Schmid-Pearson Publications, 5th Edition.
3. Fundamentals of Modern Manufacturing- Mikell P Groover-WileyPublications- 3rd Edition.

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.

IV Year B.Tech. (ME) – I Sem. 4-0-0-3

MICRO ELECTRO MECHANICAL SYSTEMS
(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 MEMS, 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.

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, fluroscence detection, calorimetric spectroscopy.

TEXT BOOK:

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.

IV Year B.Tech. (ME) – I Sem. 4-0-0-3

MATERIAL HANDLING EQUIPMENT
(OPEN ELECTIVE)

Course Objectives and Expected Outcomes: This course is designed to understand the basic concepts of materials handling, selection and design of materials handling systems, cost analysis for design of components of material handling systems, objectives of storage, bulk material handling, gravity flow of solids through slides and chutes, storage and warehouse planning and computerized warehouse planning. At the end of this course, student will be able to understand and design the various material handling systems as per requirements.

UNIT – I

ELEMENTS OF MATERIAL HANDLING SYSTEM :

Importance, terminology, objectives and benefits of better Material Handling; Principles and features of Material Handling System; Interrelationships between material handling and Plant layout, physical facilities and other organizational functions; Classification of Material Handling equipments.

UNIT – II

SELECTION OF MATERIAL HANDLING EQUIPMENTS :

Factors affecting for selection; Material Handling equation; choices of Material Handling equipment; general analysis procedures; basic analytical techniques; the unit load concept; selection of suitable types of systems for applications; activity cost data and economic analysis for design of components of Material Handling Systems; functions and parameters affecting service; packing and storage of materials.

UNIT – III

DESIGN OF MECHANICAL HANDLING EQUIPMENTS :

[A] **Design of Hoists:-** Drives for hoisting, components, and hoisting mechanisms; rail traveling components and mechanisms; hoisting gear operation during transient motion; selecting the motor rating and determining breaking torque for hoisting mechanisms.

[B] **Design of Cranes:-** Hand-propelled and electrically driven EOT overhead traveling cranes; Traveling mechanisms of cantilever and monorail cranes; design considerations for structures of rotary Cranes with fixed radius; fixed post and overhead traveling cranes; Stability of Stationary, Rotary and traveling rotary cranes.

UNIT – IV

DESIGN OF LOAD LIFTING ATTACHMENTS :

Load chains and types of ropes used in Material Handling System; Forged, Standard and Ramshorn Hooks; Crane Grabs and Clamps; Grab Buckets; Electromagnet; Design consideration for conveyor belts; Application of attachments.

UNIT – V

Study of systems and Equipments used for Material Storage :

Objectives of storage; Bulk material handling; Gravity flow of solids through slides and chutes; Storage in bins and hoppers; Belt conveyors; Bucket-elevators; Screw conveyors; Vibratory Conveyors; Cabin conveyors; Mobile racks etc.

UNIT – VI

Material Handling / Warehouse Automation and Safety considerations :

Storage and warehouse planning and design; computerized warehouse planning; Need, Factors and Indicators for consideration in warehouse automation; Levels and Means of Mechanizations. Safety and design; Safety regulations and discipline.

TEXT BOOKS:

1. Material Handling Equipments, N. Rudenko, Peace Publishers.
2. Material Handling System Design, James M. Apple, John-Willey and Sons Publication.
3. Material Handling, John R. Immer, McGraw Hill Co. Ltd.
4. Material Handling in Machine Shops, Colin Hardi, Machinery Publication Co. Ltd.
5. Material Handling Equipment, M .P. Nexandrn, MIR Publishers.
6. Conveying Machines - Volumes I and II, Spivakovsy A.O. and Dyachkov V.K., MIR Publishers.
7. Design Data Book, PSG.

REFERENCE BOOKS:

1. Bulk Solid Handling, C. R. Cock and J. Mason, Leonard Hill Publication

http://www.ise.ncsu.edu/kay/Material_Handling_Equipment.pdf

IV Year B.Tech. (ME) – I Sem. 4-0-0-3

NANO TECHNOLOGY
(OPEN ELECTIVE)

Course objective

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

CHARECTERIZATION 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. Application of nano crystalling diamond. films, grapheme, 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 fins, applications of quantum dots.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

Course outcomes:

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

Identify the essential concepts used in nanotechnology. Identify the materials, properties, syntheses and fabrication, characterization and applications in various fields.

IV Year B.Tech. (ME) – I Sem. 4-0-0-3

REFRIGERATION & AIR CONDITIONING
(Refrigeration and Psychrometric tables and charts are allowed)

(DEPARTMENTAL ELECTIVE – II)

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.

VCR SYSTEM COMPONENTS: Compressors – general classification – comparison – advantages and disadvantages. condensers – classification – working principles evaporators – classification – working principles expansion devices – types – working principles.

UNIT IV

VAPOR ABSORPTION SYSTEM: Calculation of maximum COP –description and working of NH_3 – 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: Psychometric 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.

UNIT – VI

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

TEXT BOOKS:

1. Refrigeration and Air Conditioning / CP Arora / TMH.
2. A Course in Refrigeration and Air conditioning / SC Arora & Domkundwar / Dhanpatrai.
3. A Textbook of Refrigeration and Air Conditioning / R. S. Khurmi, J. K. Gupta/ S Chand & C. Ltd.

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 air conditioning.

IV Year B.Tech. (ME) – I Sem. 4-0-0-3

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AUTOMATION IN MANUFACTURING
(DEPARTMENTAL ELECTIVE – II)

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.

TEXT BOOK:

1. Automation, Production Systems and Computer Integrated Manufacturing : M.P. Groover./ PE/PHI.

REFERENCES:

1. Computer Control of Manufacturing Systems by Yoram Coren.
2. CAD / CAM/ CIM by Radhakrishnan.
3. Automation by W. Buekinsham.

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.

IV Year B.Tech. (ME) – I Sem. 4-0-0-3

INDUSTRIAL HYDRAULICS AND 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- comparision-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 by S. Ilango and V. Soundararajan, PHI , New Delhi.
2. Applied hydraulics and pneumatics-T. Sunder Selwyn & R.Jayendiran, Anuradha Publications.

REFERENCE BOOKS:

1. Oil Hydraulic Systems, S.R .Majumdar, McGrawHill Companies.
2. Pneumatic Systems : Principles and Maintenance, Majumdar, Mc Graw Hill.

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. The course describes the various types of Hydraulic / Pneumatic equipment as well as the different types of Seals used in such equipment.
3. Understand advantage of fluid power, it provides examples of applications.
4. Understand the operation of hydraulics & pneumatics circuits and components typically used in industry.

IV Year B.Tech. (ME) – I Sem. 4-0-0-3

TOTAL QUALITY MANAGEMENT
(DEPARTMENTAL ELECTIVE – II)

UNIT- I

Concepts of TQM: Philosophy of TQM, Customer focus, Organization, Top management commitment, Team work, Quality philosophies of Deming, Crossby and Muller.

UNIT- II

TQM process: QC tools, Problem solving methodologies, New management tools, Work habits, Quality circles, Bench marking, Strategic quality planning.

UNIT- III

TQM systems: Quality policy deployment, Quality function deployment, Standardization, Designing for quality, Manufacturing for quality.

UNIT- IV

Quality system: Need for ISO 9000 system, Advantages, Clauses of ISO 9000, Implementation of ISO 9000, Quality costs, Quality auditing, Case studies.

UNIT- V

STATISTICAL PROCESS CONTROL AND PROCESS CAPABILITY

Meaning and significance of statistical process control (SPC) – construction of control charts for variables and attributed.

Process capability – meaning, significance and measurement – Six sigma concepts of process capability.

UNIT- VI

Reliability concepts – definitions, reliability in series and parallel, product life characteristics curve.Total productive maintenance (TMP) – relevance to TQM

Implementation of TQM: Steps, KAIZEN, 5S, JIT, POKAYOKE, Taguchi methods, Case studies.

TEXT BOOKS :

1. Total Quality Management by Rose, J.E., Kogan Page Ltd., 1993.
2. The Essence of Total Quality Management by John Bank, PHI, 1993.
3. Dale H.Besterfield et al, Total Quality Management, Third edition, Pearson Education
4. S. Kumar, "Total Quality Management", Firewall Media, 2006

REFERENCES :

1. John Bank, "The Essence of Total Quality Management", Prentice Hall of India, 1993.
2. Beyond Total Quality Management by Greg Bounds, Lyle Yorks et al, McGraw Hill, 1994.
3. The Asian Productivity Organization by Takashi Osada, 1991.
4. KAIZEN by Masaki Imami, McGraw Hill, 1986.

IV Year B.Tech. (ME) – I Sem. 0-3-0-2

CAM AND SIMULATION 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 ued 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 andisometric. 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.

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.

Packages to be provided to cater to drafting, modeling & analysis from the following:
Auto CAD, Micro Station, CATIA, Pro-E, I-DEAS, ANSYS, NISA, CAEFEM, Gibbs CAM, Master CAM etc.

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.

IV Year B.Tech. (ME) – II Sem. 4-0-0-3

MANAGEMENT INFORMATION SYSTEMS

Course Objectives:
The course is aimed at providing knowledge of Management Information Systems and to familiarize with the process of Information Processing. The course also aimed at solving business problems with information systems and to provide basic insights into select contemporary Management Information Systems along with understanding through various case studies.

UNIT-I
Objective: To introduce basic concept of Information and its need in decision making with the understanding of various channels of Information.

Organization & Types, Decision Making, Data & information, Characteristics & Classification of information, Cost & value of information, various channels of information & MIS.

UNIT-II

Objective: To edify the basics of Information System and Solving Business Problems with Information System.

Foundation of Information System: Introduction to Information System in Business Fundamentals of Information System, Solving Business Problems with Information System, Concept of Balanced MIS, Effectiveness & Efficiency Criteria. Tool and Techniques of MIS-dataflow diagram, flow chart etc.

UNIT-III

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Objective: To familiarize with the business application of Information technology and getting the knowledge of the use of Information System in Decision Making.

Business application of information technology: electronic commerce Internet, Intranet, Extranet & Enterprise Solutions, Information System for Business Operations, Information system for managerial Decision Support, Information System for Strategic Advantage.

UNIT-IV

Objective: To understand Managing Information technology and to familiarize with Global Systems and Information Security.

Managing Information Technology, Enterprise & Global Management, Security & Ethical Challenges, Planning & Implementing Change. Reports: Various types of MIS reports, GUI & Other Presentation tools.

UNIT-V

Objective: To study advanced concepts of Information System and to impart knowledge of ERP, SCM, CRM and PMS

Advanced concepts in information system: Enterprise Resource Planning: introduction, various modules like Human Resources, Finance, Accounting, Production & Logistics. Supply Chain Management, CRM, Procurement Management System.

UNIT-VI

Objective: To explain various Management Perspectives of MIS, to know about pitfalls in MIS Development and understanding of MIS in Various functional Areas.

Management perspectives: Evolution of MIS in an organization (Nolan's state model), System development life cycle model. Pitfalls in 'MIS' development - MIS in various functional areas.

Text Books:
1. O.Brian, “Introduction to Information System”, McGraw Hill.

References Books:

1. Management Information Systems: Managing the Digital Firm -Kenneth C. Laudon, Jane P. Laudon, Pearson Education
2. Alter, “Information Systems: A Management Perspective”, Addison Wesley.
3. Arora & Bhatia, “Information Systems for Managers”, Excel
4. Bansal, “Information System Analysis & Design”, TMH.

Web References

Coursera

NPTEL Course from IIT Madras - www.nptel.ac.in/courses/122105022/

nptel.ac.in/video.php?subjectId=122105022freevideolectures.com › Business Management › IIT Kharagpur

Moocs Courses from Edex.

IV Year B.Tech. (ME) – II Sem. 4-0-0-3

GREEN ENERGY & SYSTEMS

Course Objective:
The course aims to highlight the significance of the renewable sources of energy, the Solar System and other 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 and long lasting.

UNIT-I
Objective: To introduce basic concepts of Renewable Energy Sources especially the Solar Energy- Solar radiation and Solar Energy Collection Methods.

INTRODUCTION: Role and potential of new and renewable sources
SOLAR ENERGY: 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, Solar Radiation, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems. Photo voltaic energy conversion - types of PV cells.
SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT - II

Objective: To edify the basic concepts of Solar Energy Storage and imparting knowledge of Wind Energy Systems and wind energy harnessing through wind mills.

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

Objective: To enlighten and provide knowledge in Bio-Mass, Geothermal Energy Systems and Oceanic energy systems.

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

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

OCEANIC ENERGY: OTEC, Principles of utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques.

UNIT -IV

Objective: To enlighten importance of Energy Efficient Electrical and Mechanical system.

ENERGY EFFICIENT SYSTEMS:

(A) ELECTRICAL SYSTEMS: Energy efficient motors, energy efficient lighting and control, selection of luminaries, variable voltage variable frequency drives (adjustable speed drives), controls for HVAC (heating, ventilation and air conditioning).

(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**.**

UNIT-V

Objective: To ascertain the knowledge of basic concepts of Energy Efficient Processes

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

Objective: To pioneer basic concepts of Green Buildings and Environmental friendly Building materials.

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.

TEXT BOOKS:

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

REFERENCES:

1. Principles of Solar Energy / Frank Krieth & John F Kreider.
2. Non Conventional Energy / Ashok V Desai /Wiley Eastern.
3. Renewable Energy Technologies /Ramesh & Kumar /Narosa
4. Renewable Energy Technologies/ G.D Roy
5. Use, Operation and Maintenance of Renewable Energy Systems - Experiences and Future Approaches – Miguer A -Springer

Web References:

1. https:// www.docfoc.com › Documents/ Dr. Manda Varaprasada Rao GIET
2. https://www.coursera.org/learn/energy-101
3. https://www.coursera.org/course/globalenergy
4. nptel.ac.in/courses/112105051
5. https://www.scribd.com/user/181814916/Varaprasad-Rao

IV Year B.Tech. (ME) – II Sem. 4-0-0-3

NON-DESTRUCTIVE TESTING METHODS

(DEPARTMENTAL ELECTIVE – III)

Course Objectives

- The students are to be exposed to the concepts of various NDT 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: Radiographic test**,** Sources of X and Gamma Rays and their interaction with Matter, Radiographic equipment, Radiographic Techniques, Safety Aspects of Industrial Radiography

UNIT – II

Ultrasonic 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 – III

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

UNIT – IV

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 – V

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

UNIT – VI

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

TEXT BOOKS:

1. Non-destructive test and evaluation of Materials, J Prasad, GCK Nair, TMH Publishers.
2. Ultrasonic testing by Krautkramer and Krautkramer.
3. Non-destructive testing, Warress, JMc Gonmade.

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.

IV Year B.Tech. (ME) – II Sem. 4-0-0-3

MACHINE VISION & ITS APPLICATIONS
(DEPARTMENTAL ELECTIVE – III)

OBJECTIVE:
To understand and apply the basic concepts of optics in imaging. To learn the various hardware components of an imaging system for machine vision applications. To understand the various image processing and image analysis algorithms and the issues involved in applying them to various machine vision applications. To expose students to various applications of vision and challenges involved in each.

UNIT I

INTRODUCTION : Human vision – Machine vision and Computer vision – Benefits of machine vision – Block diagram and function of machine vision system implementation of industrial machine vision system – Physics of Light – Interactions of light – Refraction at a spherical surface – Thin Lens Equation.

UNIT II

IMAGE ACQUISITION : Scene constraints – Lighting parameters – Lighting sources, Selection – Lighting Techniques – Types and Selection – Machine Vision Lenses and Optical Filters, Specifications and Selection – Imaging Sensors – CCD and CMOS, Specifications – Interface Architectures – Analog and Digital Cameras – Digital Camera Interfaces – Camera Computer Interfaces, Specifications and Selection – Geometrical Image formation models – Camera Calibration.

UNIT III

IMAGE PROCESSING : Machine Vision Software – Fundamentals of Digital Image – Image Acquisition Modes – Image Processing in Spatial and Frequency Domain – Point Operation, Thresholding, Grayscale Stretching – Neighborhood Operations, Image Smoothing and Sharpening – Edge Detection – Binary Morphology – Color image processing.

UNIT IV

IMAGE ANALYSIS : Feature extraction – Region Features, Shape and Size features – Texture Analysis – Template Matching and Classification – 3D Machine Vision Techniques – Decision Making.

UNIT V

VISION-BASED CONTROL : Position based visual servoing, Image based visual servoing: camera and image motion, controlling feature motion, depth, performance issues, line and circle features.

UNIT VI

MACHINE VISION APPLICATIONS : Machine vision applications in manufacturing, electronics, printing, pharmaceutical, textile, applications in non-visible spectrum, metrology and gauging, OCR and OCV, vision guided robotics – Field and Service Applications – Agricultural, and Bio medical field, augmented reality, surveillance, bio-metrics.

TEXT BOOKS :

1. EmanueleTrucco, Alessandro Verri, "Introductory Techniques For 3D Computer Vision", First
Edition, 2009
2. Davies, E.R., Machine Vision: Theory, Algorithms, Practicalities, Academic Press, London, 1990.
3. Peter Corke,Robotics, Vision and Control: Fundamental Algorithms in MATLAB (Springer Tracts in Advanced Robotics)

REFERENCES :

1. Rafael C.Gonzales, Richard.E.Woods, "Digital Image Processing Publishers", Third Edition, 2007
2. Alexander Hornberg, "Handbook of Machine Vision", First Edition,2006
3. Eugene Hecht, A.R. Ganesan "Optics", Fourth Edition, 2001

IV Year B.Tech. (ME) – II Sem. 4-0-0-3

GAS DYNAMICS & JET PROPULSION
(DEPARTMENTAL ELECTIVE – III)

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- chocking- convergent nozzle - performance of a nozzle under decreasing back pressure -De lavel 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.
2. Fundamentals of compressible flow with aircraft and rocket propulsion- S. M. Yahya.
3. Fundamental of Gas dynamics, 2nd edition– Zucker- Wiley publishers.

REFERENCES

1. Elements of gas dynamics - Liepman & Roshko.
2. Aircraft & Missile propulsion - Zucrow.
3. Gas dynamics - M.J. Zucrow & Joe D.Holfman.

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.

IV Year B.Tech. (ME) – II Sem. 4-0-0-3

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

UNIT-II

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

UNIT-III

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-IV

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.

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, System response. Process Controllers – Digital Controllers, Programmable Logic Controllers, Design of mechatronics systems & future trends.

TEXT BOOK:

MECHATRONICS Integrated Mechanical Electronics Systems/KP Ramachandran, GK Vijaya Raghavan & MS Balasundaram/WILEY India Edition.

REFERENCES:

1 Mechatronics – Smaili A, Mrad F, Oxford Higher Education, OxfordUniversity Press.

2 Mechatronics Source Book by Newton C Braga, ThomsonPublications, 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, Pearson, 2012 W. Bolton.

7 Mechatronics – Principles and Application Godfrey C. Onwubolu, Wlsevier, 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.

IV Year B.Tech. (ME) – II Sem. 4-0-0-3

PRODUCTION PLANNING AND CONTROL

(DEPARTMENTAL ELECTIVE – IV)

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 optimise/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 quantitive 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.

Introduction to 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.
2. Manufacturing, Planning and Control, Partik Jonsson Stig-Arne Mattsson, Tata Mc Graw Hill.

REFERENCES:

1. Inventory Control Theory and Practice / Martin K. Starr and David W.Miller.
2. Production Planning and Control, Mukhopadyay, PHI.
3. Production Control A Quantitative Approach / John E. Biegel.
4. Production Control / Moore.

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.

IV Year B.Tech. (ME) – II Sem. 4-0-0-3

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- the 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, by S.S.Rao, Wiley Eastern Limited, New Delhi.

REFERENCES:

1. Engineering Optimization By Kalyanmanai Deb, Prentice Hall of India, New Delhi.
2. Optimization Techniques, C.Mohan, Kusum Deep.
3. Operations Research by S.D.Sharma.

Course Out comes:

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

IV Year B.Tech. (ME) – II Sem. 4-0-0-3

COMPUTATIONAL FLUID DYNAMICS
(DEPARTMENTAL ELECTIVE – IV)

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 convention – 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.

TEXT BOOKS:

1. Numerical heat transfer and fluid flow / Suhas V. Patankar- Butter-worthPublishers.
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, 3rd edition/Wendt/Springer publishers

Course Outcomes:

After undergoing the course the student shall be able to apply various numerical tools like finite volume, finite difference etc for solving the different fluid flow problems.

IV Year B.Tech. (ME) – II Sem. 4-0-0-3

TOOL DESIGN
(DEPARTMENTAL ELECTIVE – IV)

UNIT I

Blanking and Piercing Dies: Basic blanking and piercing operations, Introduction to various parts of Blanking and Piercing Dies, Shearing Theory, Analysis of cutting force and stripping force, calculation of press tonnage, Designing of dies and punches, Method of reducing the cutting force, Die shear, Function of screw hole and dowel holes, Die and Punch life, Selection of Presses, Types of Die Sets, Selection of Springs, Material selection used for above referred parts.

UNIT II

Presses, Compound Dies & Inverted Dies: Press Working Terminologies, Types of presses, Computation of press capacity, mechanical and automatic feed, Introduction to Inverted Dies, function of various parts of Inverted dies, Compound dies, function of various parts of compound dies, Design of compound and Inverted Dies. Definition of Progressive dies, introduction to the progressive dies, Types of Progressive Dies, concept of Design of progressive Dies.

UNIT III

Design of Bending Dies: Basics of bending, bending stress, bend allowance curve,estimating Flat Blank lengths, Introduction to Bending Dies to produce V,L and U shaped Bend components,Grain direction, Spring back effect and its compensation, calculation of bending force and pad force, Design of Bending Dies.

UNIT IV

Drawing Dies and Forming Dies: Difference between drawing and other forming operations, Introduction to Draw Dies, Selection of material for Draw Dies, Inverted Draw Dies, Deep drawing process, Drawability, Effects of Anisotropy, Redraw and reverse redraw dies, Draw force analysis, Wrinkling, Erickson test, Defects in drawing, Forming limit diagram, Failures in forming and drawing, Analysis and Remedies. Manufacturing methods of forming and Drawing Dies.

UNIT V

Cutting Tool Design: General considerations, Study of angles of single point cutting tool and their effect on cutting force, Different cutting tool materials and their important characteristics, Geometry of a drill, Basic principles of design of single point and multiple point tools i.e milling cutters,broaches and twist drills.

UNIT VI

Jigs & Fixtures: Important considerations in jigs and fixture design. Main principles of designing of jigs & fixtures, elements of Jigs and fixtures, Different devices and methods of locations. Different types of clamps used in jigs & fixtures, Applications.

Text Books:

1. Ostergaard, “Basic Die Making”, MGH, New York, 1993.
2. P.H. Joshi, “Press Tool Design and Construction”, Wheeler Publishing, Delhi, 2000.
3. P. H. Joshi” Jigs and Fixtures”, 2nd Edition TMH
4. Design Data Hand Book, Delhi Institute of Tool Engineering, Delhi

Reference Books:

1. Joshi, “Machine Tools Handbook : Design and Operation”, McGraw Hill, 2008
2. J.R.Paquin, Die Design Fundamental", Industrial Press, Inc. New York, NY, USA, 2005
3. Vukota Boljanovic,"Sheet Metal Stamping Dies: Die Design and Die-Making Practice", Industrial Press, Inc. New York, NY, USA

Open Electives:

1. Micro Electro Mechanical Systems
2. Material Handling Equipment
3. Nanotechnology

Department Elective 1:

1. Automobile Engineering
2. Methods Engineering and Work Design
3. Quality and Reliability Engineering
4. Advanced Foundry and Welding Technology

Department Elective 2:

1. Refrigeration & Air Conditioning
2. Automation in Manufacturing
3. Industrial Hydraulics & Pneumatics
4. Total Quality Management

Department Elective 3:

1. Non-destructive Testing Methods
2. Machine Vision & its Applications
3. Gas Dynamics & Jet Propulsion
4. Mechatronics

Department Elective 4:

1. Production Planning and Control
2. Advanced Optimization Techniques
3. Computational Fluid Dynamics
4. Tool Design