MECHANICAL ENGINEERING

FOR

B.TECH FOUR YEAR DEGREE COURSE
(Applicable for the batches admitted from 2012-2013)
COURSE STRUCTURE AND
DETAILED SYLLABUS

MECHANICAL ENGINEERING

FOR
B.TECH FOUR YEAR DEGREE COURSE
(Applicable for the batches admitted from 2012-2013)

ANURAG GROUP OF INSTITUTIONS
(AUTONOMOUS)
(Formerly CVSR College of Engineering)
Venkatapur, Ghatkesar, Hyderabad – 500 088.
www.cvsr.ac.in
## COURSE STRUCTURE AND SYLLABUS

### IV YEAR I SEMESTER

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject Name</th>
<th>Lectures</th>
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# ANURAG GROUP OF INSTITUTIONS  
(Autonomous)

## IV YEAR II SEMESTER  

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**T** – Tutorial  
**P** – Practical  
**D** – Drawing
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IV Year B.Tech. MECH – I Sem  L  T/P  C
4  1/-  4

OPERATIONS RESEARCH

Course Outcomes:
After completion of this course, the student must be able to use these optimization techniques in all the following areas:
1. Solve linear programming problems by simplex method and other techniques including dynamic programming.
2. Transportation problems and assignment problems including travelling salesman problems
3. Sequencing of jobs on various machines and decides optimum replacement time for machines
5. Application of several simulation techniques in solving inventory and queuing problems.

UNIT – I
INTRODUCTION: Development – Definition – Characteristics and phases – Types of operation Research models – applications. Allocation:

UNIT – II

UNIT – III

UNIT – IV
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.
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 – Single period model.

UNIT – V
Simulation: Definition – Types of simulation models – phases of simulation – applications of simulation – inventory and Queuing problems – Advantages and Disadvantages – Brief introduction of simulation languages.

TEXT BOOKS:
2. Operations Research / J.K. Sharma 4e / MacMilan

REFERENCES:
3. Introduction to O.R / Taha 8e / PHI
5. O.R / Wayne L.Winston / Thomson Brooks / cole
6. Introduction to O.R / Hiller & Libermann (TMH)
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IV Year B.Tech. MECH – I Sem

L T/P C
3 1/- 3

POWER PLANT ENGINEERING

This subject deals with different types of power plants like steam power plant, Diesel power plant, Gas Turbine power plant, hydro Electrical power plant, Conventional & Non-conventional sources of power plants and Nuclear power stations its Economics & Environmental considerations.

Course Out Comes:
After completion of this course the student must be able to:
1. Understanding the concepts of Generation of power by using various types of fuels & Conventional, Non-Conventional resources.
2. Understand the Layout of power plant its circuits, coal, Fuel, Ash handling equipments and properties of coals, types of Furnaces & stokers.
3. Understand the Diesel power plant, Construction, plant lay out with Auxiliaries and lubrication system, fuel supply system and Cooling system, its equipments.
4. Understand the Direct energy Conversion, Solar energy, Wind energy and its types like HAMT, VAWT, MHD Generation and utilization solar collectors.
5. Understand the Nuclear power plant, types of Reactors its operations, Nuclear fuel sand its properties, advantages, disadvantages & Applications.
6. Understand the Power plant Economic & Environmental considerations, controlling of environmental conditions from pollutants also determine the performance of power plant by using cost analysis.

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

UNIT – II

UNIT III

UNIT – IV

UNIT – V
Direct energy conversion: solar energy, Fuel cells, Thermo electric and thermo ionic, MHD generation.
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 numerical exercises, Effluents from power plants and impact on environment – pollutants and pollution standards – Methods of Power plant Pollution control.

TEXTBOOKS:
REFERENCES:
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                                                   4  1/-  4

CAD/CAM

This subject deals with the basic concepts of computer hardware and software, product cycle of CAD/CAM, and computer graphics. The knowledge of this subject is essential for geometric modeling, programming, quality control and design. This subject is the basis for AUTO CAD, CIM, CAPP and ANSYS.

Course Outcomes.
After completion of this course, the average student is expected to be able to:
1. Understand the basic structure of computer.
2. Understand the basic geometric commands by using solid modeling and surface modeling to design a component.
3. Find coding and classification of various types of elements.
4. Understand the CNC part programming for manufacturing the elements.

UNIT – I
INTRODUCTION: 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, 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
Group Technology: Part family, coding and classification, production flow analysis, advantages and limitations, Computer Aided Orocesses Panning, Retrieval type and Generative type

UNIT – IV
Computer aided Quality Control: Terminology in quality control, the computer in QC, contact inspection methods, noncontact inspection methods – optical, noncontact, inspection methods – non-optical, computer aided testing, integration of CAQC with CAD/CAM.

UNIT – V
Computer integrated manufacturing systems: Types of Manufacturing systems, Machine tools and related equipment, material handling systems, computer control systems, human labor in the manufacturing systems, CIMS benefits.

TEXT BOOKS:
1. CAD / CAM A Zimmers & P. Groover /PE /PHI
2. CAD / CAM Theory and Practice / Ibrahim Zeid / TMH
REFERENCES:
1. Automation, Production systems & Computer integrated Manufacturing / Groover / P.E
3. CAD / CAM / CIM / Radhakrishnan and Subramanian / New Age
4. Principles of Computer Aided Design and Manufacturing / Farid Amrrouche / Pearson
5. CAD / CAM : Concepts and Applications / Alavala / PHI
MECHANICAL MEASUREMENTS AND INSTRUMENTATION

This subject deals with the basic concepts of displacements, temperature, speed, humidity, and flow measurements. The knowledge of this subject is essential for control systems of an element. This subject provides insight into the different mechanical measurement systems, working and testing procedures. This subject is the basis for Mechatronics and Fluid measurements.

Course Outcomes
After completion of this course, the average student is expected to be able to:
1. Understand the basic principles of mechanical measurements.
2. Understand the concept of generalized configuration and functional description of measuring instruments.
3. Finding different types of errors in various types of mechanical measuring instruments.

UNIT – I
Measurement of Displacement: Theory and construction of various transducers to measure displacement – Piezo electric, inductive capacitance, resistance, ionization and Photo electric transducers Calibration procedures.

UNIT – II
UNIT – III

UNIT – IV

UNIT – V

TEXT BOOKS:
2. Instrumentation, measurement & analysis by B.C.Nakra & K.K.Choudhary, TMH

REFERENCE BOOKS:
1. Instrumentation and Control systems / S.Bhaskar / Anuradha Agencies
2. Experimental Methods for Engineers / Holman
4. Mechanical Measurements / Sirohi and Radhakrishna / New Age
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IV Year B.Tech. MECH – I Sem  

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ROBOTICS  
(ELECTIVE – I)

**Course Outcomes:**

After completion of this course the student must be able to:

1. Understand and Analysis of Forward and Inverse kinematics of Robots, Including representations, Transformations, Position and Orientation analysis, and D-H representation of Robot kinematics
2. Analyze Robot dynamics and Forces. Lagragian mechanics is used as the primary method of analysis and development
3. Understand the methods of path and trajectory planning, both in joint-space and Cartesian-space
4. Analysis of Hydraulic, pneumatic and Electrical motors such as DC Servo motors and stepper motors
5. A Large number of Internal and External sensors used with special emphasis being given to the practical aspect of several, including the optical encoder, and different types of Gripper selection and Design.
6. Analysis of Various components of Machine Vision system, as well as a number of Image recognition Techniques.

**UNIT – I**

INTRODUCTION: Automation and Robotics – An over view of Robotics – classification by coordinate system and control systems – Components of the industrial Robotics: Degrees of freedom – End effectors; Mechanical gripper – Magnetic – Vacuum cup and other types of grippers – General consideration on gripper selection and design.

**UNIT – II**

UNIT-III

UNIT-IV

UNIT-V

TEXTBOOKS:
1. Industrial Robotics / Groover M.P / Pearson Edu.

REFERENCES:
5. Robotics and control / Mittal R.K & Nagrath I.J / TMH.
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IV Year B.Tech. MECH – I Sem  L T/P C  
3 1/- 3

MECHANICAL VIBRATIONS  
(ELECTIVE-1)

Course Outcomes:  
After completion of this course, the average student is expected to be able to:  
1. Understand the need and importance of vibration analysis in mechanical design of machine parts that operate in vibratory conditions  
2. Analyze the mathematical model of a linear vibratory system to determine its response  
3. Determine vibratory responses of SDOF and MDOF systems to harmonic, periodic and non-periodic excitation  
4. Understand the General notion on frequency and time response of vibratory systems

UNIT – I  
Single degree of Freedom systems – I: Undamped and damped free vibrations, forced vibrations coulomb damping; Response to excitation; rotating unbalance and support excitation; vibration isolation and transmissibility.  
Single degree of Freedom systems – II: Response to Non Periodic Excitations; unit impulse, unit step and unit Ramp functions; response to arbitrary excitations, The Convolution integral; shock spectrum; System response by the Laplace Transformation method.

UNIT – II  
Two degree freedom systems: Principle modes – undamped and damped free and forced vibrations; undamped vibration absorbers;

UNIT – III  
Multi degree freedom systems: Matrix formulation, stiffness and flexibility influence coefficients; Eigen value problem, normal modes and their properties  
Free and forced vibration by Modal analysis; Method of matrix inversion;  
Torsion vibrations of multi – rotor systems and geared systems; Discrete – Time systems.
UNIT – IV

UNIT – V
Critical speeds of shafts: Critical speeds without and with damping, secondary critical speed.

TEXTBOOKS:
1. Elements of Vibration Analysis by Meirovitch, TMH.2001

REFERENCES:
1. Mechanical Vibrations by S.S Rao, Pearson, 2009, Ed 4,
5. Mechanical Vibrations – S. Graham Kellyk, Schaum’s outlines.
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IV Year B.Tech. MECH – I Sem  
L T/P C  
3 1/- 4  

MECHATRONICS  
(ELECTIVE – 1)

Course Outcomes:
After completion of this course, the average student is expected to be able to:
1. Develop a simulation model for simple physical systems and explain mechatronics design process.
2. Outline appropriate sensors and actuators for an engineering application.
3. Write simple microcontroller programs.
4. Explain linearization of nonlinear systems and elements of data acquisition.
5. Explain various applications of design of mechatronic systems

UNIT – I
Introduction: Definition – Trends – Control Methods; Stand alone, PC Based (Real Time Operating Systems, Graphical User interface, simulation) – Applications; SPM, Robot, CNC, FMS, CIM.

UNIT – II

UNIT – III

UNIT – IV
Microcontrollers Overview: 8051 Microcontroller, micro processor structure – Digital interfacing – Analog interfacing – Digital to analog convertors – Analog to Digital convertors – Applications, Programming – Assembly, C ( LED Blinking, Voltage measurement using ADC)
Programmable Logic Controllers: Basic structure programming; Ladder diagram – Timers internal Relays and counters – Shift registers – Master and jump controls – Data handling – Analog input / output – PLC Selection – Application.

UNIT – V

TEXT BOOKS:
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IV Year B.Tech. MECH – I Sem

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3 1/- 3

COMPOSITE MATERIALS
(ELECTIVE-1)

Course Outcomes.
After completion of this course, the average student is expected to be able to:
1. Predict elastic properties of long fiber and short fiber composites
2. Predict hygrothermal properties of long fiber composite materials
3. Design of a laminate for a given load condition
4. Describe fundamental fabrication processes for polymer matrix, metal matrix, and ceramic matrix composites

Unit-I

UNIT – II
Manufacturing methods: Autoclave, tape production, moulding methods, filament winding, man lay up, pultrusion, RTM.

UNIT – III
Hookes Law for a Two-Dimensional Angle Lamina, Engineering constants of an Angle Lamina. Invariant Form of Stiffness and compliance Matrices for an Angle Lamina Strength Failure. Envelops, Maximum Strain Failure Theory,

**Unit – IV**

**Unit – V**
Failure Analysis and Design of Laminates: Introduction Special Cases of Laminates, Failure Criterion for a Laminate, Design of a Laminated Composite, Other Mechanical Design Issues

**TEXTBOOKS:**

**REFERENCES:**
ANURAG GROUP OF INSTITUTIONS
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IV Year B.Tech. MECH – I Sem

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UNCONVENTIONAL MACHINING PROCESSES
(ELECTIVE – II)

This subject deals with the advanced manufacturing considerations for machining process, the course gives the metal cutting for hard and soft material with precision cutting and also maintain good accuracy in surface finish by dissipating high energy of heat.

COURSE OUT COMES:
After completion of this course the student must be able to:
1. Understand different types of metal removal machining like ultrasonic machining, abrasive jet machining and water jet machining processes
2. Understand the electrochemical machining process for tool design, surface finishing and economical accuracy.
3. Understand the thermal metal removal process like EDM, Wire EDM and Electron Discharge Grinding machining process.
4. Understand about some advanced metal cutting process like Plasma Arc machining process, Laser beam machining process and electron beam machining process.
5. Understand the Advanced drilling and finishing operations like Electro stream drilling, STEM, Abrasive flow finishing and magnetic abrasive finishing with merits and application.

UNIT – I
Ultrasonic machining – Elements of the process, mechanics of metal removal process parameters, economic considerations, applications and limitations, recent development.
UNIT – II
Abrasive jet machining, water jet machining and abrasive water jet machine:
Basic principles, equipments process variables, mechanics of metal removal,
MRR, application and limitations.
Magnetic abrasive finishing, Abrasive flow finishing, electro stream drilling,
shaped tube electrolytic machining.

UNIT – III
Electro – chemical Processes: Fundamentals of electro chemical machining,
electromechanical 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, principle – maskants – etchants,
advantages and applications.

UNIT – IV
Thermal Metal Removal Processes: General Principle and applications of
Electric Discharge Machining, Electric discharge grinding and electric discharge
wire cutting processes – Power circuits for EDM, mechanics of metal removal in
EDM, Process parameters, selection of tool electrode and dielectric fluids,
methods surface finish and machining accuracy, characteristics of spark eroded
surface and machine tool selection, wire EDM, principle applications.

UNIT – V
Electron Beam Machining: Generation and control electron beam for machining
theory of electron beam machining, comparison of thermal and non-thermal
processes. General principle and application of laser beam machining – thermal
features, cutting speed and accuracy of cut.
Application of plasma for machining, metal removal mechanism, process
parameters, accuracy and surface finish and other applications of plasma in
manufacturing industries.
Powder Metallurgy Technology: Concepts of PM Technology, Production
process & Applications.

TEXT BOOKS:
1. Advanced machining processes / VK Jain/ Allied publishers.
2. Manufacturing engineering and Technology, serope kalpakjian and steven R. Schmid, Ed-4,

REFERANCES:
1. Modern machining process / Pandey P.C and shah H.S / TMH
3. Unconventional Machining Processes / C. Elanchezhian, B.vijaya Ramnath and M. vijayan/
   Anuradha publications / 2005.
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IV Year B.Tech. MECH – I Sem  
L T/P C  
3 1/- 3

CNC TECHNOLOGIES  
(ELECTIVE – II)

Course Outcomes:  
After completion of this course, the average student is expected to be able to:
1. Identify different axes, machine zero, home position, systems and controls 
   CNC machines.
2. Select, mount and set cutting tools and tool holders on CNC.
3. Prepare part programmes for given simple components.
4. Interface software application for auto part programming.
5. Apply maintenance practices for CNC machines and Applications of PLC.

UNIT – I
Features of NC Machines: fundamentals of numerical control, advantage of 
NC systems, classification of NC systems, point to point, NC and CNC, 
incremental and absolute, open and closed loop systems, features of NC 
machine tools, design consideration of NC machine tool, methods of 
improving accuracy.
CNC Machines and elements: Machine structure – guide ways – feed drives – 

UNIT – II
Tooling for CNC machines: interchangeable tooling system, preset and 
qualified tools, coolant fed tooling system, modular fixturing, quick change 
tooling system, automatic head changers.
NC Part Programming: Manual programming – Basic concepts, point to point 
contour programming, canned cycles, parametric programming.

UNIT – III
Compute – Aided Programming: General information, APT programming, 
Examples Apt programming problems (2D machining only). NC 
programming on CAD/CAM systems, the design and implementation of post 
processor s, introduction to CAD/CAM software, Automatic Tool Path 
generation.

UNIT – IV
Micro controllers: introduction, Hardware components, I/O pins, ports external memory, counters, timers and serial data I/O interrupts, selection of micro controllers, embedded controllers, Applications and programming of micro controllers.

UNIT – V
Programming logic controllers (PLC’s): introduction, hardware components of PLC, system, basic structure, principle of operations, Programming mnemonics timers, internal relays and counters applications of PLC’s in CNC Machines.

TEXTBOOKS:
2. CAD/CAM – Michel P.Groover, TMH

REFERENCES:
2. Mechatronics - HMT, TMH.
ANURAG GROUP OF INSTITUTIONS
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IV Year B.Tech. MECH – I Sem

L T/P C
3 1/- 4

AUTOMATION IN MANUFACTURING
(ELECTIVE – II)

Course Outcomes.
After completion of this course, the average student is expected to be able to:
1. Illustrate the basic concepts of automation in machine tools.
2. Analyze various automated flow lines.
3. Interpret knowledge on assembly system and line balancing methods.
4. Explain the importance of automated material handling and storage systems.
5. Describe adaptive control systems.
6. Discuss the concepts of BPE, CE and techniques of RP.

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 transfer the automation.
Automated flow lines: Methods or work part transport transfer Mechanical buffer storage control function, design and fabrication consideration.

UNIT – II
Analysis of Automated flow lines: General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines.
Assembly system and line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT – III
Automated material handling: Types of equipment, functions, analysis and design of material handling systems conveyor systems, automated guided vehicle systems.
Automated storage systems, Automated storage and retrieval systems, work in progress storage, interfacing handling and storage with manufacturing.

**UNIT – IV**
Fundamentals of industrial controls: Review of control theory, logic controls, sensors and actuators, Data communication and LAN in Manufacturing.

**UNIT – V**
Business process Re-engineering: introduction to BPE logistics, ERP, Software configuration of BPE, concurrent Engineering, Techniques of rapid Prototyping.

**TEXT BOOK:**
1. Automation, Production systems and computer integrated manufacturing: M.P.Groover 3e / PE / PHI, 2009

**REFERENCES:**
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IV Year B.Tech. MECH – I Sem

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DESIGN FOR MANUFACTURING
(ELECTIVE – II)

Course Outcomes:
After completion of this course, the average student is expected to be able to:
1. Illustrate the appropriate design for economical production and select the materials
2. Select between various machining and metal joining processes
3. Apply a systematic understanding of knowledge in the field of metal casting and forging
4. Prepare basic parts and assemblies using powered and non-powered machine shop equipment in conjunction with mechanical documentation
5. Integrate the knowledge of compliance analysis and interference analysis for assembly and also use of DFA methodology

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 Process: 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 tolerances – use of solidification simulation in casting design – Product design rules for sand casting.

UNIT – IV

UNIT – V

TEXT BOOKS:

REFERENCES
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IV Year B.Tech. MECH – I Sem   
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COMPUTER AIDED DESIGN AND MANUFACTURING LAB

Course Outcomes:
After completion of this course, the average student is expected to be able to:
1. Understand the softwares associated with designing and manufacturing.
2. Model the components by using various design softwares.
3. Use finite element analysis software to perform static analysis of 2D and 3D trusses, static and dynamic analysis of beams, steady state heat transfer.
4. Use the simulation of NC programming for doing milling and turning operation.

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.


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 , 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) Determination of CNC part program for turning components and milling components.
(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.
Any Six Software Packages from the following: Use of Auto CAD Micro Station, CATIA, Pro-E, I-DEAS, ANSYS, NISA CAEFEM, Gibbs CAM, Master CAM etc.
Note: Minimum 10 exercises are to be conducted
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IV Year B.Tech. MECH – I Sem

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PRODUCTION DRAWING PRACTICE AND INSTRUMENTATION LAB

Course Outcomes:
After completion of this course, the average student is expected to be able to:
1. Understand basic drawing concepts of manufacturing process.
2. Calibrate the pressure and temperature instruments.
3. Use the magnetic & speed pickups for the speed measurement.
4. Calibrate of flow measurement by rotameter.

a) Production Drawing Practice

PRACTICE – I

PRACTICE – II
Limits and Fits: Types of fits, exercises involving selection / interpretation of fits and estimation of limits from tables.

PRACTICE – III
Form and Positional Tolerances: introduction and indication of the tolerances of from and position on drawings, deformation of runout and total runout and their indication.

PRACTICE – IV
Surface roughness and its indication: Definitions – finishes obtainable from various manufacturing processes, recommended surface roughness on mechanical components.

PRACTICE – V
Heat treatment and surface treatment symbol used on drawings.
PRACTICE – VI
Detailed and Part drawings: Drawing of parts from assembly drawings with indications of size, tolerances, roughness, from and position errors etc.

PRACTICE – VII
Part drawing using computer aided drafting by CAD software.

TEXT BOOKS:
1. Production drawing – K.L.Narayana & P.Kannaiah / New Age

REFERENCES:
   (b) INSTRUMENTATION LAB
   1. Calibration of pressure gauges
   2. Calibration of transducer for temperature measurement.
   3. Study and calibration of LVDT transducer for displacement measurement.
   4. Calibration of strain gauge for temperature measurement.
   5. Calibration of thermocouple for temperature measurement.
   7. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
   8. Calibration of resistance temperature detector for temperature measurement.
   9. Study and calibration of a rotameter for flow measurement.
   10. Study and use of a seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
   11. Study and calibration of Mcleod gauge for low pressure.

Note: Any 7 experiments are to be conducted from instrumentation lab.
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IV Year B.Tech. MECH – II Sem  

PRODUCTION PLANNING AND CONTROL  

This subject deals with the methodology of planning production keeping men, materials, money, and machines in view. It also deals with various techniques to be applied to control the production process.  

Course Outcomes:  
After completion of this course, the student will be able to know:  
1. The objectives and functions of production planning and control; organization of production planning and control.  
2. Types of forecasting and forecasting techniques,  
3. Inventory management, ABC analysis, VED analysis, EOQ models  
4. The need for material requirement planning, enterprise resource planning, line of balance, just in time technique etc  

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

UNIT – II  
Introduction to MRP And ERP, LOB (Line of balance), JIT inventory, Japanese concepts.  

UNIT – III  
UNIT – IV
Scheduling policies – techniques, standard scheduling methods – job shop, flow shop.
Line balancing, aggregate planning – methods for aggregate planning – Chase planning, expediting, control aspects.

UNIT – V
Dispatching – Activities of dispatcher – Dispatching procedure – follow up – definition – reasons for existence of functions – types of follow up, applications of computer in production planning control.

TEXT BOOKS:
2. Production Planning and Control Jain & Jain – Khanna publications

REFERENCE BOOKS:
1. Production Planning and Control – Text & cases /SK Mukhopadhyaya.
3. Operations Management by Chase /phi
5. Operations Management – Heizer – Pearson
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IV Year B.Tech. MECH – II Sem

ARTIFICIAL NEURAL NETWORKS
(ELECTIVE-III)

Course Outcomes:
After completion of this course, the average student is expected to be able to:
1. Understand and explain strengths and weaknesses of the neural-network algorithms discussed in class
2. Determine under which circumstances neural networks are useful in real applications
3. Distinguish between supervised and unsupervised learning and explain the key principles of the corresponding algorithms
4. Efficiently and reliably implement the algorithms introduced in class on a computer, interpret the results of computer simulations
5. Describe principles of more general optimization algorithms
6. Write well-structured technical reports in English presenting and explaining analytical calculations and numerical results
7. Communicate results and conclusions in a clear and logical fashion

UNIT – I
LEARNING PROCESS – error Correction learning, Credit Assignment, Problem, Memory, Adaption, Statistical nature of the learning process.

UNIT – II
SINGLE LAYER PERCEPTRONS – Adaptive filtering problem, Unconstrained Organization Techniques, Linear least square filters, least mean square algorithm, learning curves, Learning rate annealing techniques, perception – convergence theorem, Relation between preceptor and Bayes classifier for a Gaussian Environment.
MULTI LAYER PERCEPTRON – Back propagation algorithm XOR problem,
Heuristics, Output representation and decision rule, Computer experiment feature detection.

UNIT – III
BACK PROPAGATION – back propagation and differentiation, Hessian matrix, Generalization, Cross validation, Network pruning Techniques, Virtues and limitations of back propagation learning, Accelerated convergence, supervised learning.

UNIT – IV
SELF ORGANIZATION MAPS – Two basic feature mapping models, self organization map, SOM algorithm, properties of feature map, computer simulations, learning vector quantization, Adaptive patter classification.

UNIT – V
NEURO DYNAMICS – Dynamical systems, stability of equilibrium states, attractors, neuro dynamical models, manipulation of attractors as a recurrent network paradigm. Hopfield models – Hopfield models, computer experiment.

TEXTBOOK:
1. Neural networks; A comprehensive foundation, Simon Haykin, PHI edition

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RELIABILITY ENGINEERING  
(ELECTIVE – III)

Course Outcomes:
After completion of this course, the average student is expected to be able to:
1. Summarize reliability engineering and its management throughout the product life cycle.
2. Perform reliability engineering analysis.
3. Compare the characteristics and differences in common Life Testing methodologies.
5. Apply the course objectives in an open-ended project including a formal design review.

UNIT – I

UNIT – II
Component Reliability And Hazard Models: introduction, component reliability from test data, mean time to failure, Time – dependent hazard models, stress – Dependent hazard models, Derivation of reliability function using markov, Treatment of field data.
UNIT – III

UNIT – IV

UNIT – V

TEXT BOOKS:
1. Reliability engineering – Balaguruswamy – TMHILL
2. Reliability engineering – L.S.Srinath

REFERENCE BOOK:
1. Reliability engineering – Patrick DTO-Wiley Conor-india
2. Reliability engineering and life testing – Naikan - PHI
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MAINTENANCE AND SAFETY ENGINEERING
(ELECTIVE III)

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

Course Outcomes:
After completion of this course, the average student is expected to be able to:
1. Recognize troubles in mechanical elements.
2. Assemble, dismantle and align mechanisms in sequential order.
3. Carry out plant maintenance using tribology, corrosion and preventive maintenance.
4. Understanding of Industrial Maintenance, safety measurements in Engineering.

UNIT – I

UNIT – II
UNIT – III
Inventory Control in Maintenance: Inventory Control Objectives and Basic inventory Decisions, ABC inventory Control Models Two – Bin inventory Control and Safety Stock, spares Determination Factors spares calculation methods.

UNIT – IV

UNIT – V

TEXTBOOKS
1. Reliability, Maintenance and Safety Engineering by Dr. A.K Guptha / Laxmi Publications.
2. Industrial Safety Management by L.M.Deshmukh / TMH

REFERENCES:
1. Maintenance Engineering & Management by R.C.Mishra / PHI
2. Reliability Engineering by Elsayed / Pearson
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PLANT LAYOUT AND MATERIAL HANDLING
(ELECTIVE – III)

Course Outcomes:
After completion of this course, the average student is expected to be able to:
1. Understand and be able to complete the following charts with regard to a specific product: assembly chart, route sheet, operations process chart, from-to chart, and activity relationship chart
2. Identify equipment requirements for a specific process
3. Understand the benefit of an efficient material handling system
4. Understand what effect process layout has on the material handling system
5. Recommend improvements to existing plant layouts from the standpoint of material handling and product flow
6. Design flexibility into a plant layout to accommodate changes in product volume or product line
7. Integrate concepts and techniques learned through this course in order to design and efficient plant layout in a team environment

UNIT – I
Introduction: Classification of Layout, Advantages and Limitations of different layouts, Layout design procedures, Overview of the plant layout.

UNIT – II
Process layout & Product layout; Selection, specification, implementation and follow up, comparison of product and process layout.

UNIT – III
Heuristics for plant layout – ALDEP, CORELAP, CRAFT
Group Layout, Fixed position layout – Quadratic assignment model, Branch and bound method

UNIT – IV
Introduction, Material Handling systems, Material Handling principles, Classification of Material Handling Equipment, Relationship of material handling to plant layout.
Basic Material Handling systems, Selection, Material Handling method – path, Equipment, function oriented systems.

UNIT – V
Methods to minimize cost of material handling – Maintenance of Material Handling Equipments, Safety in Handling.
Ergonomics of Material Handling equipment, Design, Miscellaneous equipments.

TEXTBOOKS:
1. Operations Management / PB Mahapatra / PHI
2. Aspects of Material Handling / Dr. KC Arora & Shinde, Lakshmi publications.

REFERENCES:
1. Facility Layout & Location an analytical approach / RL Francis / LF Mc Linnis Jr. White / PHI
2. Production and operations Management / R. Paneerelvam / PHI
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RENEWABLE ENERGY SOURCES  
(ELECTIVE – IV)

Course Outcomes.
After completion of this course, the average student is expected to be able to:
1. Describe the fundamentals and main characteristics of renewable energy sources and their differences compared to fossil fuels
2. Explain the technological basis for harnessing renewable energy sources
3. Compare different renewable energy technologies and choose the most appropriate based on local conditions
4. Perform simple techno-economical assessments of renewable energy systems
5. Perform and compare basic environmental assessments of renewable energy systems and conventional fossil fuel systems
6. Design renewable/hybrid energy systems that meet specific energy demands

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

UNIT – II
SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.
SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, Sensible, latent heat and stratified storage, solar ponds Solar Applications – solar heating / cooling technique, solar distillation and drying, photovoltaic energy conversion.
UNIT – III
WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria.

UNIT – IV
GEO THERMAL ENERGY: Resources, types of wells, methods of harnessing the energy, potential in India.
OCEAN ENERGY: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles, Tidal and wave energy, Potential and conversion techniques, mini – hydel power plants and their economics.

UNIT – V
DIRECT ENERGY CONVERSION: Need for DEC, Carnot Cycle, Limitations, principles of DEC, Thermo – electric generators, seebeck, peltier and joule – Thomson effects, Figure of merit, materials, applications, MHD generators, principle, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD Engine, power generation systems, electron gas dynamic conversion, economic aspects, Fuel cells, principles, faraday’s law’s, thermodynamic aspects, selection of fuels and operating conditions.

TEXT BOOKS:
1. Renewable energy resources / Tiwari and Ghosal / Narosa.

REFERENCES:
1. Renewable Energy Sources / Twidell & Weir
2. Solar Energy / Sukhatme
5. Non-Conventional Energy / Ashok V.Desai / Wiley Eastern
7. Renewable Energy Technologies / Ramesh & Kumar / Narosa
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JET PROPULSION AND ROCKET ENGINEERING  
(ELECTIVE – IV)

Course Outcomes:
After completion of this course, the average student is expected to be able to:
1. Determine the thrust and fuel consumption of gas turbine and turboprop engines
2. Understand advantages/disadvantages of turbojet, turboprop, turbofan, and ramjet air breathing propulsion systems
3. Understand the thermodynamics of the Brayton cycle and how they contribute to overall propulsion system performance
4. Understand the role and fundamental performance of gas turbine components

UNIT – I
JET PROPULSION: Historical sketch-reaction principle – essential features of propulsion devices – Thermal Engines, Classification of – Energy flow thrust, Thrust power and propulsion efficiency – need for thermal jet Engines and applications.

UNIT – II
Turboprop and Turbojet-I: Thermo dynamic cycles, plant layout essential components, principles of operation – performance evaluation.
Turboprop and Turbojet-II: Thrust Augmentation and Thrust reversal – Contrasting with piston Engine Propeller plant.

UNIT – III
UNIT-IV
Rocket Engines: Need for applications – Basic principles of operation and parameter’s of performance – classification, solid and liquid propellant rocket engines, advantages, domains of application – propellants – comparison of propulsion systems.

UNIT-V
Rocket Technology-II: Testing & instrumentation – Need for Cryogenics – Advanced propulsion systems, elementary treatment of electrical nuclear and plasma arc propulsion.

TEXTBOOKS:

REFERENCE BOOKS:
1. Rocket propulsion – Sutton
2. Gas Turbines / Cohen, Rogers & Sarvana Muttoo / Addison Wesley & Longman
3. Gas Turbines – V.Ganeshan / TMH
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COMPUTATIONAL FLUID DYNAMICS  
(ELECTIVE – IV)

Course Outcomes:
After completion of this course, the average student is expected to be able to:
1. Understand the applications of finite volume and finite element methods to solve Navier-Stokes equations.
2. Understand Fundamental fluid dynamic principles and their applications.
3. Solve different solution algorithms for Navier-Stokes equations. In particular numerical schemes for velocity-pressure splitting (pressure implicit splitting operation, incremental pressure correction).

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 for instability, computational methods for error estimation, convergence of sequences.

UNIT – II
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 – III
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 – IV
Introduction to first order wave equation, stability of hyperbolic and elliptic equations, fundamentals of fluid flow modeling, conservative property, the upwind scheme.
UNIT – V

TEXTBOOKS:
2. Computational fluid flow and heat transfer / Muralidharan – Narosa Publications

REFERENCES:
Course Outcomes:
After completion of this course, the average student is expected to be able to:
1. Formulate and solve problems in one-dimensional steady compressible flow including: isentropic nozzle flow, constant area flow with friction (Fanno flow) and constant area flow with heat transfer (Rayleigh flow).
2. Derive the conditions for the change in pressure, density and temperature for flow through a normal shock.
3. Determine the strength of oblique shock waves on wedge shaped bodies and concave corners.
4. Determine the change in flow conditions through a Prandtl-Meyer expansion wave.
5. Complete a numerical analysis to solve an unsteady one-dimensional flow problem.

UNIT – I
Introduction: Concept of continuum and control volume, continuity equation, streamline, steady, one dimensional dynamic equation of a fluid flow with and without friction, energy equation.

UNIT – II

UNIT – III
Isentropic flow: Stagnation enthalpy, density, pressure and temperature, local acoustic speed, maximum speed, variation of Compressibility with mach number.
Variable area flow, criteria for acceleration and deceleration, critical condition, nozzle discharge co-efficient, nozzle efficiency, operation of nozzles under varying backpressures.
UNIT – IV
Flow in constant area duct: Adiabatic and isothermal – flow calculation of pressure, temperature, density, Mach number relationships, Limiting length of duct for adiabatic and isothermal flow. Fanno line.
Diabatic flow: flow of perfect gases in constant area duct with heat exchange, density temperature, pressure and much number relationships, Limiting conditions. Rayleigh line.

UNIT – V

TEXT BOOKS:
2. Zoeb Hussain, “Gas dynamics through problems”, WILEY EASTERN LTD.

REFERENCES: