JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
HYDERABAD

B.TECH. MECHANICAL ENGINEERING

II Year **Semester II**

COURSE STRUCTURE

CODE	SUBJECT	T	P/D	C
	Probability and Statistics	4+1*	0	4
	Kinematics of Machinery	4+1*	0	4
	Thermal Engineering -I	4+1*	0	4
	Fluid Mechanics and Hydraulic Machinery	4+1*	0	4
	Machine Drawing	0	6	4
	Environmental Studies	4+1*	0	4
	Production Technology Lab	0	3	2
	Mechanics of Solids and Metallurgy Lab	0	3	2
	Total	**25**	**12**	**28**

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PROBABILITY AND STATISTICS

UNIT-I

Probability: Sample space and events – Probability – The axioms of probability – Some
Elementary theorems - Conditional probability – Baye's theorem.

UNIT-II
Random variables – Discrete and continuous – Distribution – Distribution function. Distribution

UNIT-III
Binomial and poison distributions Normal distribution – related properties.

UNIT-IV
Sampling distribution: Populations and samples - Sampling distributions of mean (known and unknown) proportions, sums and differences.

UNIT-V
Estimation: Point estimation – interval estimation - Bayesian estimation.

UNIT-VI
Test of Hypothesis – Means– Hypothesis concerning one and two means– Type I and Type II errors. One tail, two-tail tests.

UNIT-VII

Tests of significance – Student's t-test, F-test, χ^2 test. Estimation of proportions.

UNIT-VIII
Queuing Theory: Pure Birth and Death Process M/M/1 Model and Simple Problems.

Text Books:

1. Probability & Statistics, T. K. V. Iyengar, B. Krishna Gandhi and Others, S. Chand & Company.
2. A text book of Probability & Statistics, Shahnaz Bathul, V. G. S. Book Links.

References:

1. Probability & Statistics, Arnold O. Allen, Academic Press.
2. Probability & Statistics for Engineers, Miller and John E. Freund, Prentice Hall of India.
3. Probability & Statistics, Mendan Hall, Beaver Thomson Publishers.
4. Probability & Statistics, D. K. Murugeson & P. Guru Swamy, Anuradha Publishers.

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KINEMATICS OF MACHINERY

UNIT – I
MECHANISMS : Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully constrained and incompletely constrained .
MACHINES : Mechanism and machines – classification of machines – kinematic chain – inversion of mechanism – inversion of mechanism – inversions of quadric cycle, chain – single and double slider crank chains.

UNIT - II
STRAIGHT LINE MOTION MECHANISMS : Exact and approximate copiers and generated types – Peaucellier, Hart and Scott Russul – Grasshopper – Watt T. Chebicheff and Robert Mechanisms and straight line motion, Pantograph.

UNIT – III
KINEMATICS : Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration diagrams – Graphical method – Application of relative velocity method four bar chain.
Analysis of Mechanisms : Analysis of slider crank chain for displacement , velocity and acceleration of slider – Acceleration diagram for a given mechanism, Kleins construction, Coriolis acceleration, determination of Coriolis component of acceleration.
Plane motion of body : Instantaneous center of rotation, centroids and axodes – relative motion between two bodies – Three centres in line theorem – Graphical determination of instantaneous centre, diagrams for simple mechanisms and determination of angular velocity of points and links.

UNIT – IV
STEERING Mechanisms : Conditions for correct steering – Davis Steering gear, Ackermans steering gear – velocity ratio.
HOOKE'S JOINT : Single and double Hooke's joint – Universial coupling – application – problems.

UNIT – V
CAMS : Definitions of cam and followers – their uses – Types of followers and cams – Terminology – Types of follower motion - Uniform velocity – Simple harmonic motion and uniform acceleration. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases.
Analysis of motion of followers : Roller follower – circular cam with straight, concave and convex flanks.

UNIT – VI
Higher pairs, friction wheels and toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion, Form of teeth: cycloidal and involute profiles. Velocity of sliding – phenomena of interferences – Methods of interference.
Condition for minimum number of teeth to avoid interference, expressions for arc of contact and path of contact – Introduction to Helical, Bevel and worm gearing.

UNIT – VII
Belt Rope and Chain Drives : Introduction, Belt and rope drives, selection of belt drive- types of belt drives,V-belts, materials used for belt and rope drives, velocity ratio of belt drives, slip of belt, creep of belt, tensions for flat belt drive, angle of contact, centrifugal tension, maximum tension of belt, Chains- length, angular speed ratio, classification of chains.

UNIT – VIII
GEAR TRAINS: Introduction – Train value – Types – Simple and reverted wheel train – Epicyclic gear Train. Methods of finding train value or velocity ratio – Epicyclic gear trains.
Selection of gear box-Differential gear for an automobile.

TEXT BOOKS :
1.   Theory of Machines and Mechanisms-S.S.Rattan, Tata McGraw Hill Publishers
2.   Theory of Machines R.S Khurmi & J.K Gupta

REFERENCES :
1. Theory of Machines by Thomas Bevan/ CBS
2. Theory of Machines / R.K Bansal
3. Theory of Machines Sadhu Singh Pearsons Edn
4. Mechanism and Machine Theory / JS Rao and RV Dukkipati / New Age
5. The theory of Machines /Shiegley/ Oxford.
6. Theory of machines – PL. Balaney/khanna publishers.

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THERMAL ENGINEERING - I

UNIT – I
Actual Cycles and their Analysis: Introduction, Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust Blowdown-Loss due to Gas exchange process, Volumetric Efficiency. Loss due to Rubbing Friction, Actual and Fuel-Air Cycles Of CI Engines.

UNIT-II
I.C. ENGINES : Classification - Working principles, Valve and Port Timing Diagrams, Air – Standard, air-fuel and actual cycles - Engine systems – Fuel, Carburetor, Fuel Injection System, Ignition, Cooling and Lubrication.

UNIT – III
Combustion in S.I. Engines : Normal Combustion and abnormal combustion – Importance of flame speed and effect of engine variables – Type of Abnormal combustion, pre-ignition and knocking (explanation of) – Fuel requirements and fuel rating, anti knock additives – combustion chamber – requirements, types.

UNIT IV
Combustion in C.I. Engines : Four stages of combustion – Delay period and its importance – Effect of engine variables – Diesel Knock– Need for air movement, suction, compression and combustion induced turbulence – open and divided combustion chambers and nozzles used – fuel requirements and fuel rating.

UNIT – V
Testing and Performance : Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and indicated power – Performance test – Heat balance sheet and chart.

UNIT – VI
COMPRESSORS – Classification –positive displacement and roto dynamic machinery – Power producing and power absorbing machines, fan, blower and compressor – positive displacement and dynamic types – reciprocating and rotary types.

Reciprocating : Principle of operation, work required, Isothermal efficiency volumetric efficiency and effect of clearance, stage compression, undercooling, saving of work, minimum work condition for stage compression.

UNIT VII
Rotary (Positive displacement type) : Roots Blower, vane sealed compressor, Lysholm compressor – mechanical details and principle of working – efficiency considerations.
Dynamic Compressors : Centrifugal compressors: Mechanical details and principle of operation – velocity and pressure variation. Energy transfer-impeller blade shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient – velocity diagrams – power.

UNIT-VIII
Axial Flow Compressors : Mechanical details and principle of operation – velocity triangles and energy transfer per stage degree of reaction, work done factor - isentropic efficiency- pressure rise calculations – Polytropic efficiency.

TEXT BOOKS:
1. I.C. Engines / V. GANESAN- TMH
2. Thermal Engineering / Rajput / Lakshmi Publications.

REFERENCES:
1. IC Engines – Mathur & Sharma – Dhanpath Rai & Sons.
2. Engineering fundamentals of IC Engines – Pulkrabek / Pearson /PHI
3. Thermal Engineering / Rudramoorthy - TMH
4. Thermodynamics & Heat Engines / B. Yadav/ Central Book Depot., Allahabad
5. I.C. Engines / Heywood /McGrawHIll.
6. Thermal Engineering – R.S. Khurmi & J.K.Gupta – S.Chand
7. IC Engines/ Ramalingam/ Scietech publishers
8. Thermal engineering data book-B.Srinivasulu Reddy/JK International Pub.

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	4+1*	0	4

FLUID MECHANICS AND HYDRAULIC MACHINERY

UNIT I
Fluid statics : Dimensions and units: physical properties of fluids- specific gravity, viscosity surface tension- vapor pressure and their influence on fluid motion- atmospheric gauge and vacuum pressure – measurement of pressure- Piezometer, U-tube and differential manometers.

UNIT II
Fluid kinematics : Stream line, path line and streak lines and stream tube, classification of flows-steady & unsteady, uniform, non uniform, laminar, turbulent, rotational, and irrotational flows-equation of continuity for one dimensional flow.
Fluid dynamics : Surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its application on force on pipe bend.

UNIT III
Closed conduit flow: Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line.
Measurement of flow: pilot tube, venturimeter, and orifice meter, Flow nozzle, Turbine flow meter (Ref.4)

UNIT IV
Basics of turbo machinery : Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work don and efficiency, flow over radial vanes.

UNIT V
Hydroelectric power stations : Elements of hydro electric power station-types-concept of pumped storage plants-storage requirements, mass curve (explanation only) estimation of power developed from a given catchment area; heads and efficiencies.

UNIT VI
Hydraulic Turbines : Classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies , hydraulic design –draft tubetheory-functions and efficiency.

UNIT VII
Performance of hydraulic turbines : Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

UNIT VIII
Centrifugal pumps : Classification, working, work done – manomertic head- losses and efficienciesspecific speed- pumps in series and parallel-performance characteristic curves, NPSH.
Reciprocating pumps : Working, Discharge, slip, indicator diagrams.

TEXT BOOKS :
1. Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH.
2. Fluid Mechanics and Hydraulic Machines by Rajput.
REFERENCES :
1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria & Sons.
2. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International.
3. Hydraulic Machines by Banga & Sharma, Khanna Publishers.
4. Instrumentation for Engineering Measurements by James W. Dally, William E. Riley ,John Wiley & Sons Inc. 2004 (Chapter 12 – Fluid Flow Measurements).

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MACHINE DRAWING

Machine Drawing Conventions :

   Need for drawing conventions – introduction to IS conventions
   a) Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.
   b) Types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.
   c) Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.
   d) Title boxes, their size, location and details - common abbreviations & their liberal usage
   e) Types of Drawings – working drawings for machine parts.

I. Drawing of Machine Elements and simple parts

Selection of Views, additional views for the following machine elements and parts with every drawing proportions.
   a) Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
   b) Keys, cottered joints and knuckle joint.
   c) Rivetted joints for plates
   d) Shaft coupling, spigot and socket pipe joint.
   e) Journal, pivot and collar and foot step bearings.

II. Assembly Drawings:

Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.
   a) Engine parts – stuffing boxes, cross heads, Eccentrics, Petrol Engine connecting rod, piston assembly.
   b) Other machine parts - Screws jacks, Machine Vices Plummer block, Tailstock.
   c) Valves : Steam stop valve, spring loaded safety valve, feed check valve and air cock.

NOTE : First angle projection to be adopted. The student should be able to provide working drawings of actual parts.

TEXT BOOKS :
   1. Machine Drawing – Dhawan, S.Chand Publications
   2. Machine Drawing –K.L.Narayana, P.Kannaiah & K. Venkata Reddy / New Age/ Publishers

REFERENCES :
   1. Machine Drawing – P.S.Gill.
   2. Machine Drawing – Luzzader
   3. Machine Drawing - Rajput

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ENVIRONMENTAL STUDIES

UNIT - I
Multidisciplinary nature of Environmental Studies: Definition, Scope and Importance – Need for Public Awareness.

UNIT - II
Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems - Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. - Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Case studies. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT - III
Ecosystems : Concept of an ecosystem. - Structure and function of an ecosystem. - Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession. - Food chains, food webs and ecological pyramids. - Introduction, types, characteristic features, structure and function of the following ecosystem:
    a. Forest ecosystem
    b. Grassland ecosystem
    c. Desert ecosystem
    d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT - IV
Biodiversity and its conservation : Introduction - Definition: genetic, species and ecosystem diversity. - Bio-geographical classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - . Biodiversity at global, National and local levels. - . India as a megadiversity
nation - Hot-sports of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, manwildlife conflicts. - Endangered and endemic species of India - Conservation of biodiversity: In-situ and Exsitu conservation of biodiversity.

UNIT - V
Environmental Pollution : Definition, Cause, effects and control measures of :
    a. Air pollution
    b. Water pollution
    c. Soil pollution
    d. Marine pollution
    e. Noise pollution
    f. Thermal pollution
    g. Nuclear hazards
Solid waste Management : Causes, effects and control measures of urban and industrial wastes. - Role of an individual in prevention of pollution. - Pollution case studies. - Disaster management: floods, earthquake, cyclone and landslides.

UNIT - VI
Social Issues and the Environment : From Unsustainable to Sustainable development -Urban problems related to energy -Water conservation, rain water harvesting, watershed management -Resettlement and rehabilitation of people; its problems and concerns. Case Studies -Environmental ethics: Issues and possible solutions. -Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. -Wasteland reclamation. -Consumerism and waste products. -Environment Protection Act. -Air (Prevention and Control of Pollution) Act. -Water (Prevention and control of Pollution) Act -Wildlife Protection Act -Forest Conservation Act -Issues involved in enforcement of environmental legislation. -Public awareness.

UNIT - VII
Human Population and the Environment : Population growth, variation among nations. Population explosion - Family Welfare Programme. -Environment and human health. -Human Rights. -Value Education. -HIV/AIDS. -Women and Child Welfare. -Role of information Technology in Environment and human health. -Case Studies.

UNIT - VIII
Field work : Visit to a local area to document environmental assets River /forest grassland/hill/mountain -Visit to a local polluted site-Urban/Rural/industrial/ Agricultural Study of common plants, insects, birds. -Study of simple ecosystems-pond, river, hill slopes, etc.

TEXT BOOK:
1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
2. Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE:

1 Textbook of Environmental Sciences and Technology by M. Anji Reddy, BS Publication.

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PRODUCTION TECHNOLOGY LAB

Minimum of 12 Exercises need to be performed

I. METAL CASTING LAB :
1. Pattern Design and making - for one casting drawing.
2. Sand properties testing - Exercise -for strengths, and permeability – 1
3. Moulding Melting and Casting - 1 Exercise

II WELDING LAB :
1. ARC Welding Lap & Butt Joint - 2 Exercises
2. Spot Welding - 1 Exercise
3. TIG Welding - 1 Exercise
4. Plasma welding and Brazing - 2 Exercises
   (Water Plasma Device)

III MECHANICAL PRESS WORKING :
1. Blanking & Piercing operation and study of simple, compound and progressive press tool.
2. Hydraulic Press : Deep drawing and extrusion operation.
3. Bending and other operations

IV PROCESSING OF PLASTICS
1. Injection Moulding
2. Blow Moulding

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MECHANICS OF SOLIDS AND METALLURGY LAB

(A) METALLURGY LAB :

1. Preparation and study of the Micro Structure of pure metals like Iron, Cu and Al.
2. Preparation and study of the Microstructure of Mild steels, low carbon steels, high – C steels.
3. Study of the Micro Structures of Cast Irons.
4. Study of the Micro Structures of Non-Ferrous alloys.
5. Study of the Micro structures of Heat treated steels.
6. Hardeneability of steels by Jominy End Quench Test.
7. To find out the hardness of various treated and untreated steels.

(B) MECHNICS OF SOLIDS LAB :

1. Direct tension test
2. Bending test on
a) Simple supported
b) Cantilever beam
3. Torsion test
4. Hardness test
a) Brinells hardness test
b) Rockwell hardness test
5. Test on springs
6. Compression test on cube
7. Impact test
8. Punch shear test