JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE STRUCTURE

For UG – R20

B. TECH - MECHANICAL ENGINEERING

(Applicable for batches admitted from 2020-2021)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
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II YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	BSC-5	Vector Calculus, Fourier Transforms and PDE(M-III)	3	0	0	3
2	PCC-1	Mechanics of Solids	3	0	0	3
3	PCC-2	Fluid Mechanics & Hydraulic Machines	3	0	0	3
4	PCC-3	Production Technology	3	0	0	3
5	PCC-4	Kinematics of Machinery	3	0	0	3
6	PCC-L1	Computer Aided Engineering Drawing Practice	0	0	3	1.5
7	PCC-L2	Fluid Mechanics & Hydraulic Machines Lab	0	0	3	1.5
8	PCC-L3	Production Technology Lab	0	0	3	1.5
9	SOC-1	Drafting and Modeling Lab	0	0	4	2
10	MC-3	Essence of Indian Traditional Knowledge	2	0	0	0
		Total Credits				**21.5**

II YEAR II SEMESTER

S. No	Course Code	Course Title	L	T	P	Credits
1	ESC-6	Material Science & Metallurgy	3	0	0	3
2	BSC-6	Complex Variables and Statistical Methods	3	0	0	3
3	PCC-5	Dynamics of Machinery	3	0	0	3
4	PCC-6	Thermal Engineering-I	3	0	0	3
5	HSC-2	Industrial Engineering and Management	3	0	0	3
6	ESC-L4	Mechanics of Solids and Metallurgy Lab	0	0	3	1.5
7	PCC-L6	Machine Drawing Practice	0	0	3	1.5
8	PCC-L7	Theory of Machines Lab	0	0	3	1.5
9	SOC-2	Python Programming Lab	1	0	2	2
		Total Credits				**21.5**
	Honors/Minor courses		**4**	**0**	**0**	**4**

* At the end of II Year II Semester, students must complete summer internship spanning between 1 to 2 months (Minimum of 6 weeks), @ Industries/ Higher Learning Institutions/ APSSDC.

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SUBJECTS FOR B. Tech. (MINOR) in MECHANICAL ENGINEERING

B. Tech. (MINOR) in MECHANICAL ENGINEERING		Pre-requisites
1.	Basic Thermodynamics	NIL
2.	Manufacturing Processes	NIL
3.	Materials Science and Engineering	NIL
4.	Basic Mechanical Design	NIL
5.	Optimization Techniques	NIL
6.	Power Plant Engineering	Basic Thermodynamics
7.	Automobile Engineering	Basic Thermodynamics
8.	Industrial Engineering and Management	NIL
9.	Product Design & Development	NIL
10.	Smart Manufacturing	NIL
11.	Mechanical Measurements	NIL
12.	Industrial Robotics	Engineering Mechanics
13.	Mechatronics	NIL

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SUBJECTS FOR B. Tech. (HONORS) IN MECHANICAL ENGINEERING

HONORS IN MECHANICAL ENGINEERING		Pre-requisites
POOL – 1 (in II-II)		
1.	Advanced Mechanics of Fluids	Fluid Mechanics
2.	Green Manufacturing	Production Technology
3.	Analysis and Synthesis of Mechanisms	Kinematics of Machinery
4.	Alternative Fuels Technologies	Basic Thermodynamics
5.	Gear Engineering	Kinematics of Machinery
POOL-2 (in III-I)		
1.	Experimental Methods in Fluid Mechanics	Fluid Mechanics
2.	Advanced Optimization Techniques	Operations Research
3.	Micro Electro Mechanical Systems	Nil
4.	Tribology	Nil
5.	Statistical Design in Quality Control	Nil
POOL-3 (in III-II)		
1.	Advanced Computational Fluid Dynamics	Fluid Mechanics
2.	Material Characterization Techniques	Material Science and Metallurgy
3.	Product Design	Nil
4.	Electric & Hybrid Vehicles	Thermal Engineering
5.	Mechanical Vibrations & Acoustics	Nil
POOL-4 (in IV-I)		
1.	Advanced Thermodynamics	Nil
2.	Design for Manufacturing and Assembly	Production Technology
3.	Robotics and Control	Kinematics of Machinery
4.	Turbo Machines	FM&HM
5.	Materials Technology	Nil

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II Year - I Semester		L	T	P	C
		3	0	0	3
VECTOR CALCULUS FOURIER TRANSFORMS and PDE (M-III)					

Course Objectives:
- To familiarize the techniques in partial differential equations
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

Course Outcomes: At the end of the course, the student will be able to

- interpret the physical meaning of different operators such as gradient, curl and divergence (L5)
- estimate the work done against a field, circulation and flux using vector calculus (L5)
- apply the Laplace transform for solving differential equations (L3)
- find or compute the Fourier series of periodic signals (L3)
- know and be able to apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms (L3)
- identify solution methods for partial differential equations that model physical processes (L3)

UNIT –I: Vector calculus: (10hrs)
Vector Differentiation: Gradient– Directional derivative – Divergence– Curl– Scalar Potential.
Vector Integration: Line integral – Work done – Area– Surface and volume integrals – Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof) and problems on above theorems.

UNIT –II: Laplace Transforms: (10 hrs)
Laplace transforms – Definition and Laplace transforms of some certain functions– Shifting theorems – Transforms of derivatives and integrals – Unit step function –Dirac's delta functionPeriodic function – Inverse Laplace transforms– Convolution theorem (with out proof).
Applications: Solving ordinary differential equations (initial value problems) using Laplace transforms.

UNIT –III: Fourier series and Fourier Transforms: (10 hrs)
Fourier Series: Introduction– Periodic functions – Fourier series of periodic function –Dirichlet's conditions – Even and odd functions –Change of interval– Half-range sine and cosine series.

Fourier Transforms: Fourier integral theorem (without proof) – Fourier sine and cosine integrals – Sine and cosine transforms – Properties (article-22.5 in text book-1)– inverse transforms – Convolution theorem (without proof) – Finite Fourier transforms.

UNIT –IV: PDE of first order: (8hrs)
Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations.

UNIT – V: Second order PDE and Applications: (10 hrs)
Second order PDE: Solutions of linear partial differential equations with constant coefficients –Non-homogeneous term of the type e^{ax+by}, $\sin(ax+by)$, $\cos(ax+by)$, $x^m y^n$.

Applications of PDE: Method of separation of Variables– Solution of One dimensional Wave, Heat and two-dimensional Laplace equation.

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Text Books:

1. **B. S. Grewal,** Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
2. **B. V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:

1. **Erwin Kreyszig,** Advanced Engineering Mathematics, 10th Edition, Wiley-India.
2. **Dean. G. Duffy,** Advanced Engineering Mathematics with MATLAB, 3rd Edition, CRC Press.
3. **Peter O' Neil,** Advanced Engineering Mathematics, Cengage.
4. **Srimantha Pal, S C Bhunia,** Engineering Mathematics, Oxford University Press.

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II Year - I Semester		L	T	P	C
		3	0	0	3
MECHANICS OF SOLIDS					

Course Objectives: The students completing this course are expected to understand the basic terms like stress, strain, poissons ratio…etc and different stresses and deflections induced in beams, thin cylinders, thick cylinders, and columns. Further, the student shall be able to understand the shear stresses due to torsion in circular shafts.

UNIT – I
SIMPLE STRESSES &STRAINS : Elasticity and plasticity – Types of stresses & strains– Hooke'slaw – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Bars of varying section – composite bars – Temperature stresses-Complex Stresses Stresses on an inclined plane under different uniaxial and biaxial stress conditions - Principal planes and principal stresses - Mohr's circle - Relation between elastic constants, Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT – II
SHEAR FORCE AND BENDING MOMENT : Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, u.d.l, uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of abeam.

UNIT – III
FLEXURAL STRESSES : Theory of simple bending – Assumptions – Derivation of bending equation: $M/I = f/y = E/R$ Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Designof simple beam sections.
SHEAR STRESSES: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T anglesections.

UNIT – IV
DEFLECTION OF BEAMS : Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, - U.D.L uniformly varying load. Mohr's theorems – Moment area method – application to simple cases including overhanging beams, Statically indeterminate Beams and solutionmethods.
TORSION: Introduction-Derivation- Torsion of Circular shafts- Pure Shear-Transmission of power by circular shafts, Shafts in series, Shafts in parallel.

UNIT – V
THIN AND THICK CYLINDERS: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in dia, and volume of thin cylinders – Riveted boiler shells – Thin spherical shells. Wire wound thin cylinders. Lame's equation – cylinders subjected to inside & outside pressures –compoundcylinders.

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COLUMNS: Buckling and Stability, Columns with Pinned ends, Columns with other support Conditions, Limitations of Euler's Formula, Rankine's Formula,

TEXT BOOKS:

1. Strength of materials /GH Ryder/ Mc Millan publishers IndiaLtd.
2. Strength of materials by B.C. Punmia-lakshmi publications pvt.Ltd, NewDelhi.

REFERENCES:

1. Mechanics of Materials by Gere &Timeshenko
2. Strength of Materials -By Jindal, UmeshPublications.
3. Strength of Materials by S.Timshenko- D. VAN NOSTRAND Company- PHIPublishers
4. Strength of Materials by Andrew Pytel and Ferdinond L. Singer Longman-HarpercollinsCollege Division
5. Solid Mechanics, byPopov-
6. Mechanics of Materials/Gere and Timoshenko, CBS Publishers

Course outcomes:

On the completion of the course the student will able to

CO1: Model & Analyze the behavior of basic structural members subjected to various loading and support conditions based on principles of equilibrium.

CO2: Understand the apply the concept of stress and strain to analyze and design structural members and machine parts under axial, shear and bending loads, moment and torsional moment.

CO3: Students will learn all the methods to analyze beams, columns, frames for normal, shear, and torsion stresses and to solve deflection problems in preparation for the design of such structural components. Students are able to analyse beams and draw correct and complete shear and bending moment diagrams forbeams.

CO4: Students attain a deeper understanding of the loads, stresses, and strains acting on a structure and their relations in the elastic behavior

CO5: Design and analysis of Industrial components like pressure vessels.

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II Year - I Semester		L	T	P	C
		3	0	0	3
	FLUID MECHANICS & HYDRAULIC MACHINES				

Course Objectives: The students completing this course are expected to understand the properties of fluids, its kinematic and dynamic behavior through various laws of fluids like continuity, Euler's, Bernoulli's equations, energy and momentum equations. Further, the student shall be able to understand the theory of boundary layer, working and performance characteristics of various hydraulic machines like pumps and turbines.

UNIT I
Objective: After studying this unit student will know the concept of fluid and its properties, manometry, hydrostatic forces acting on different surfaces and also problem solving techniques.

Fluid statics: Dimensions and units: physical properties of fluids - specific gravity, viscosity and its significance, surface tension, capillarity, vapor pressure. Atmospheric, gauge and vacuum pressure, Measurement of pressure – Manometers - Piezometer, U-tube, inverted and differential manometers. Pascal's & hydrostatic laws.
Buoyancy and floatation: Meta center, stability of floating body. Submerged bodies. Calculation of metacenter height. Stability analysis and applications.

UNIT II
Objective: In this unit student will be exposed to the basic laws of fluids, flow patterns, viscous flow

through ducts and their corresponding problems.
Fluid kinematics: Introduction, flow types. Equation of continuity for one dimensional flow, circulation and vorticity, Stream line, path line and streak lines and stream tube. Stream function and velocity potential function, differences and relation between them. Condition for irrotational flow, flow net, source and sink, doublet and vortexflow.

Fluid dynamics: surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its applications, force on pipebend.
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.

UNIT III
Objective: At the end of this unit student will be aware of the concepts related to boundary layer **theory, flow separation, basic concepts of velocity profiles, dimensionless numbers and dimensional analysis.**

Boundary Layer Theory: Introduction, momentum integral equation, displacement, momentum and energy thickness, separation of boundary layer, control of flow separation, Stream lined body, Bluff body and its applications, basic concepts of velocity profiles.
Dimensional Analysis: Dimensions and Units, Dimensional Homogeneity, Non dimensionalization of equations, Method of repeating variables and Buckingham Pi Theorem.

UNIT IV
Objective: In this unit student will know the hydrodynamic forces acting on vanes and performance **evaluation of hydraulic turbines.**
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 done and efficiency, flow

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over radialvanes.

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Hydraulic Turbines: classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design – draft tube- theory- functions andefficiency.

UNIT V
Objective: After studying this unit student will be in a position to understand the characteristic curves of hydraulic turbines and also *evaluate the performance characteristics of hydraulic pumps.*

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. Hydraulic systems- hydraulic ram, hydraulic lift, hydraulic coupling. Fluidics – amplifiers, sensors and oscillators. Advantages, limitations and applications.
Centrifugalpumps: classification, working, work done – manometric head- losses and efficiencies-specific speed- pumps in series and parallel-performance characteristic curves, cavitation & NPSH.
Reciprocating pumps: Working, Discharge, slip, indicatordiagrams.

TEXT BOOKS:
1. Fluid Mechanics- Fundementals and Applications by Y.A. Cengel, J.M.Cimbala, 6thEdn,McGrawHill
2. Fluid Mechanics - Dixon, 7thEdn,Elesvier

REFERENCE BOOKS:
1. Hydraulics, fluid mechanics and Hydraulic machinery- Modi andSeth
2. Fluid Mechanics and Hydraulic Machines - RK Bansal- Laxmi Publications (P)Ltd.
3. Fluid Mechanics and Hydraulic Machines –Rajput
4. Fluid Mechanics and Fluid Power Engineering - D.S. Kumar, Kotaria&Sons.
5. Fluid Mechanics and Machinery - D. Rama Durgaiah, New AgeInternational.

COURSE OUTCOMES:
From this course the student is expected to learn
CO1: The basic concepts of fluid properties.
CO2: The mechanics of fluids in static and dynamic conditions.
CO3: Boundary layer theory, flow separation and dimensional analysis. CO4: Hydrodynamic forces of jet on vanes in different positions.
CO5: Working Principles and performance evaluation of hydraulic pump and turbines.

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II Year - I Semester		L	T	P	C
		3	0	0	3
	PRODUCTION TECHNOLOGY				

Course Objective:
To impart basic knowledge and understanding about the primary manufacturing processes such as casting, joining, bulk forming, sheet metal forming and powder metallurgy and their relevance in current manufacturingindustry.

UNIT – I
CASTING: Steps involved in making a casting – Advantage of casting and its applications. Patterns and Pattern making – Types of patterns – Materials used for patterns, pattern allowances and their construction, Molding – molding methods - ingredients of molding sand –. Molding materials, Properties of molding sand, Testing of molding sand. Types of molding – Hand molding – Machine molding. Core – different types of cores – materials – properties of core sand – core manufacturing.

UNIT – II
Principles of Gating, Gating ratio and design of Gating systems. Risers – Types, function and design, casting design considerations. Methods of melting and types of furnaces - cupola, electric arc, resistance and induction furnace. Solidification of castings-Solidification of pure metals and alloys-Short & long freezing range alloys. Fettling. Casting defects. Basic principles and applications of special casting processes - Centrifugal casting – True, semi and centrifuging, Die casting, Investment casting and shell molding.

UNIT – III
Welding :Classification of welding processes, types of welded joints and their characteristics, Gas welding, Different types of flames and uses, Oxy – Acetylene Gas cutting. Basic principles of Arc welding, power characteristics, Manual metal arc welding, Submerged arc welding, TIG & MIG welding. Electro – slag welding.
Resistance welding, Friction welding, Friction stir welding, Forge welding, Explosive welding; Thermit welding, Plasma Arc welding, Laser welding, electron beam welding, Soldering & Brazing.
Heat affected zones in welding; pre & post heating, Weldability of metals, welding defects – causes and remedies – destructive and nondestructive testing of welds.

UNIT – IV
Plastic deformation in metals and alloys-recovery, recrystallization and grain growth. Hot working and Cold working-Strain hardening and Annealing. Bulk forming processes: Forging - Types of Forging, Smith forging, Drop Forging, Roll forging, Forging hammers, Rotary forging, forging defects; Rolling – fundamentals, types of rolling mills and products, Forces in rolling and power requirements. Extrusion and its characteristics. Types of extrusion, Impact extrusion, Hydrostatic extrusion; Wire drawing and Tube drawing

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UNIT – V

Sheet metal forming - Blanking and piercing, Forces and power requirement in these operations, Deep drawing, Stretch forming, Bending, Spring back and its remedies, Coining, Spinning, Types ofpresses and presstools.

High energy rate forming processes: Principles of explosive forming, electromagnetic forming, Electro hydraulic forming, rubber pad forming, advantages and limitations.

TEXT BOOKS:

1. Manufacturing Processes for Engineering Materials – Kalpakjian S and Steven RSchmid- Pearson Publ , 5thEdn.
2. Manufacturing Technology -Vol I- P.N. Rao-TMH

REFERENCES:

1. Manufacturing Science – A.Ghosh&A.K.Malik – East West Press Pvt.Ltd
2. Process and materials of manufacture- Lindberg-PHI
3. Production Technology- R.K. Jain-Khanna
4. Production Technology-P C Sharma-S.Chand
5. Manufacturing Processes- H.S. Shaun-Pearson
6. Manufacturing Processes- J.P. Kaushish-PHI
7. Workshop Technology -WAJ Chapman/CBS Publishers&DistributorsPvt.Ltd.
8. Production Technology-HMT- TataMcGrawHill

Course Outcomes:

CO1: Able to design the patterns and core boxes for metal casting processes
CO2: Able to design the gating system for different metallic components
CO3: Know the different types of manufacturing processes
CO4: Be able to use forging, extrusion processes
CO5: Learn about the different types of welding processes used for special fabrication.

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		3	0	0	3
	KINEMATICS OF MACHINERY				

Course objective: The students completing this course are expected to understand the nature and role of the kinematics of machinery, mechanisms and machines. The course includes velocity and acceleration diagrams, analysis of mechanisms joints, Cams and their applications. It exposes the students to various kinds of power transmission devices like belt, rope, chain and gear drives and their working principles and their merits and demerits.

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.
Grashoff'slaw , Degrees of freedom ,Kutzbachcriterian for planar mechanisms, Mechanism and machines – classification of machines – kinematic chain – inversion of mechanism – inversions of quadric cycle chain – single and double slider crankchains.

UNIT – II
LOWER PAIR MECHANISM: Exact and approximate copiers and generated types – Peaucellier, Hart and Scott Russul – Grasshopper – Watt T. Chebicheff and Robert Mechanisms and straight line motion, Pantograph.
Conditions for correct steering – Davis Steering gear, Ackermans steering gear – velocity ratio; Hooke's Joint: Single and double – Universal coupling–application–problems.

UNIT – III
KINEMATICS: Velocity and acceleration – Motion of a link in machine – Determination of Velocity and acceleration diagrams – Graphical method – Application of relative velocity method four bar chain. Velocity and acceleration analysis of for a given mechanism, Klein's construction, 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
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 and retardation. Maximum velocity and maximum acceleration during outward and return strokes in the above 3cases.
Analysis of motion of followers: Roller follower – circular cam with straight, concave and convex flanks.

BELT 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.

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UNIT – V

GEARS: 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.

GEAR TRAINS: Introduction to gear Trains, 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 Mechanisms & Machines by Jagadeesh lal, Metropolitan Pvt. Ltd.
2. Theory of Machines by Thomas Bevan/ CBS Publishers

REFERENCES:

1. Theory of Machines – S. S Rattan- TMH Publishers
2. Theory of machines and Machinery-Vickers - Oxford.
3. Theory of Mechanisms and machines – A.Ghosh&A.K.Malik – East West Press Pvt.Ltd.
4. Kinematics and dynamics of Machinery- R.L Norton- TATAMcGraw-Hill

Course outcomes:

The student should be able to

CO1: Contrive a mechanism for a given plane motion with single degree of freedom.

CO2: Suggest and analyze a mechanism for a given straight line motion and automobile steering motion. CO3: Analyze the motion (velocity and acceleration) of a plane mechanism.

CO4: Suggest and analyze mechanisms for a prescribed intermittent motion like opening and closing of IC engine valves etc.

CO5: Select a power transmission system for a given application and analyze motion of different transmission systems

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II Year - I Semester		L	T	P	C
		0	0	3	1.5
COMPUTER AIDED ENGINEERING DRAWING PRACTICE					

Course Objective: To enhance the student's knowledge and skills in engineering drawing and to introduce drafting packages and commands for computer aided drawing andmodeling.

UNIT-I:
Objective: The knowledge of projections of solids is essential in 3D modeling and animation. The student will be able to draw projections of solids. The objective is to enhance the skills they already acquired in their earlier course in drawing ofprojection.
PROJECTIONS OF SOLIDS: Projections of Regular Solids inclined to both planes – Auxiliary Views.

UNIT-II:
The knowledge of sections of solids and development of surfaces is required in designing and manufacturing of the objects. Whenever two or more solids combine, a definite curve is seen at their intersection.
SECTIONS OF SOLIDS: Sections and Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views.
DEVELOPMENT AND INTERPENETRATION OF SOLIDS: Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid, Cone and their parts.

UNIT-III:
The intersection of solids also plays an important role in designing and manufacturing. The objective is to impart this knowledge through this topic. A perspective view provides a realistic 3D View of an object. The objective is to make the students learn the methods of Iso and Perspective views.
INTERPENETRATION OF RIGHT REGULAR SOLIDS: Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs Cone, Prism Vs Cone.

PERSPECTIVE PROJECTIONS: Perspective View: Points, Lines, Plane Figures and Simple Solids, Vanishing Point Methods (General Method only).
In part B computer aided drafting is introduced.

UNIT IV:
The objective is to introduce various commands in AutoCAD to draw the geometric entities and to create 2D and 3D wire frame models.
INTRODUCTION TO COMPUTER AIDED DRAFTING: Generation of points, lines, curves, polygons, dimensioning. Types of modeling : object selection commands – edit, zoom, cross hatching, pattern filling, utility commands, 2D wire frame modeling, 3D wire frame modeling,.

UNIT V:
By going through this topic the student will be able to understand the paper-space environment thoroughly.
VIEW POINTS AND VIEW PORTS: view point coordinates and view(s) displayed, examples to exercise different options like save, restore, delete , joint , single option.

UNIT VI:

The objective is to make the students create geometrical model of simple solids and machine parts and display the same as an Isometric, Orthographic or Perspective projection.

COMPUTER AIDED SOLID MODELING: Isometric projections, orthographic projections of isometric projections, Modeling of simple solids, Modeling of Machines & Machine Parts.

TEXT BOOKS:

1. Engineering drawing by N.D Bhatt ,Charotarpublications.
2. Engineering Graphics, K.C. john, PHIPublications

REFERENCES:

1. Mastering Auto CAD 2013 and Auto CAD LT 2013 – George Omura,Sybex
2. Auto CAD 2013 fundamentals- Elisemoss, SDCPubl.
3. Engineering Drawing and Graphics using Auto Cad – T Jeyapoovan,vikas
4. Engineering Drawing + AutoCAD – K Venugopal, V. Prabhu Raja, NewAge
5. Engineering Drawing – RK Dhawan, SChand
6. Engineering Drawing – MB Shaw, BC Rana,Pearson
7. Engineering Drawing – KL Narayana, P Kannaiah,Scitech
8. Engineering Drawing – Agarwal and Agarwal, Mc GrawHill
9. Engineering Graphics – PI Varghese, Mc GrawHill
10. Text book of Engineering Drawing with auto-CAD ,K.venkatareddy/B.S .publications.
11. Engineering Drawing with Auto CAD/ James D Bethune/Pearson Publications
12. Engineering Graphics with Auto CAD/Kulkarni D.M, Rastogi A.P, Sarkar A.K/PHI Publications

End Semester examination shall be conducted for **Four** hours with the followingpattern:
a) Two hours - Conventionaldrawing
b) Two hours – Computer AidedDrawing

Course outcomes:

1. Student get exposed on working of sheet metal with help of development ofsurfaces.
2. Student understands how to know the hidden details of machine components with the help of sections and interpenetrations ofsolids.
3. Student shall exposed to modeling commands for generating 2D and 3D objects using computer aided drafting tools which are useful to create machine elements for computeraidedanalysis.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

DEPARTMENT OF MECHANICAL ENGINEERING

II Year - I Semester		**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**
FLUID MECHANICS & HYDRAULIC MACHINERY LAB					

Course Objective: To impart practical exposure on the performance evaluation methods of various flow measuring equipment and hydraulic turbines and pumps.

1. Impact of jets onVanes.
2. Performance Test on PeltonWheel.
3. Performance Test on FrancisTurbine.
4. Performance Test on KaplanTurbine.
5. Performance Test on Single Stage CentrifugalPump.
6. Performance Test on Multi Stage CentrifugalPump.
7. Performance Test on ReciprocatingPump.
8. Calibration ofVenturimeter.
9. Calibration of Orificemeter.
10. Determination of friction factor for a given pipeline.
11. Determination of loss of head due to sudden contraction in apipeline.
12. Turbine flowmeter.

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DEPARTMENT OF MECHANICAL ENGINEERING

		L	**T**	**P**	**C**
II Year - I Semester		**0**	**0**	**3**	**1.5**
	PRODUCTION TECHNOLOGY LAB				

Course Objective: To impart hands-on practical exposure on manufacturing processes and equipment.

1. Design and making ofpattern
   - i. Single piecepattern
   - ii. Splitpattern
2. Sand propertiestesting
   - i. Sieve analysis (drysand)
   - ii. Clay contenttest
   - iii. Moisture contenttest
   - iv. Strength test (Compression test & Sheartest)
   - v. Permeabilitytest
3. Mouldpreparation
   - i. Straightpipe
   - ii. Bentpipe
   - iii. Dumbleiv.Gearblank
4. Gas cutting andwelding
5. Manual metal arcwelding
   - i. Lapjoint
   - ii. Buttjoint
6. InjectionMolding
7. Blow Molding
8. Simple models using sheet metaloperations
9. Study of deep drawing and extrusionoperations
10. Study of Basic powder compaction andsintering
11. Study of TIG/MIGWelding
12. Study of Resistance SpotWelding
13. Study of Brazing andsoldering
14. Study of Plastic MouldingProcess.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

DEPARTMENT OF MECHANICAL ENGINEERING

II Year - I Semester		**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**
	DRAFTING AND MODELING LAB				

1. **DRAFTING:** Development of part drawings for various components in the form of orthographic and isometric. Representation of dimensioning and tolerances, Study of DXE, IGES files.
2. **SURFACE MODELING** - Generation of various Surfaces using surface modeling.

A) DRAFTING: Development of part drawings for various components in the form of orthographic and isometric. Representation of dimensioning and tolerances, Study of DXE, IGES files.

B) SURFACE MODELING - Generation of various Surfaces using surface modeling.

C) The following contents to be done by any 3D software package:

(i) PART MODELING: Generation of various 3D models through Pad, revolve, shell, sweep, parent child relation, Boolean operations and various standard translators.

(ii) Assembly drawings: (Any four of the following using solid model software) Generation of various Parts/assemblies: like Screw Jack, Oldham's Coupling, Foot step bearing, Couplings, knuckle and cotter joints, Crankshaft, Connecting Rod, Piston and Cylinder.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

DEPARTMENT OF MECHANICAL ENGINEERING

		L	T	P	C
II Year - I Semester		**2**	**0**	**0**	**0**
	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE				

Course Objectives:

To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system

- The course aim of the importing basic principle of third process reasoning and inference sustainability is at the course of Indian traditional knowledge system
- To understand the legal framework and traditional knowledge and biological diversity act 2002 and geographical indication act2003
- The courses focus on traditional knowledge and intellectual property mechanism of traditional knowledge and protection
- To know the student traditional knowledge in different sector

Course Outcomes:

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

- Understand the concept of Traditional knowledge and itsimportance
- Know the need and importance of protecting traditionalknowledge
- Know the various enactments related to the protection of traditionalknowledge
- Understand the concepts of Intellectual property to protect the traditionalknowledge

UNIT I

Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge

UNIT II

Protection of traditional knowledge: the need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

UNIT III

Legal framework and TK: A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmers Rights Act, 2001 (PPVFR Act);B:The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.Geographical indications act 2003.

UNIT IV

Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MECHANICAL ENGINEERING

UNIT V

Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK.

<u>**REFERENCE BOOKS:**</u>

1. Traditional Knowledge System in India, by Amit Jha,2009.
2. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, PratibhaPrakashan2012.
3. Traditional Knowledge System in India by Amit Jha Atlantic publishers,2002
4. "Knowledge Traditions and Practices of India" Kapil Kapoor, MichelDanino

<u>*e-Resources:*</u>

1) https://www.youtube.com/watch?v=LZP1StpYEPM
2) http://nptel.ac.in/courses/121106003/