FLUID MECHANICS

COURSE INFORMATION SHEET

PROGRAMME: MECHANICAL ENGINEERING	**DEGREE: BTECH**
COURSE: FLUID MECHANICS	**SEMESTER: 3 CREDITS: 4**
COURSECODE:BTME301-18 **REGULATION:2018**	**COURSE TYPE: CORE**
COURSE AREA/DOMAIN: FLUID MECHANICS	**CONTACT HOURS: 3(L) + 1(T) +0(P) hours/Week.**

SYLLABUS:

UNIT	DETAILS	HOURS
I	**Fundamentals of Fluid Mechanics**: Introduction; Applications; Concept of fluid; Difference between solids, liquids and gases; Concept of continuum; Ideal and real fluids; Fluid properties: density, specific volume, specific weight, specific gravity, viscosity (dynamic and kinematic), vapour pressure, compressibility, bulk modulus, Mach number, surface tension and capillarity; Newtonian and non-Newtonian fluids.	2
II	**Fluid Statics:** Concept of static fluid pressure; Pascal's law and its engineering applications; Hydrostatic paradox; Action of fluid pressure on a plane submerged surface (horizontal, vertical and inclined): resultant force and centre of pressure; Force on a curved surface due to hydrostatic pressure; Buoyancy and flotation; Stability of floating and submerged bodies; Metacentric height and its determination; Periodic time of oscillation; Pressure distribution in a liquid subject to: (i) constant acceleration along horizontal, vertical and inclined direction (linear motion), (ii) constant rotation.	6
III	**Fluid Kinematics:** Classification of fluid flows; Lagrangian and Euler flow descriptions; Velocity and acceleration of fluid particle; Local and convective acceleration; Normal and tangential acceleration; Path line, streak line, streamline and timelines; Flow rate and discharge mean velocity; One dimensional continuity equation; Continuity equation in Cartesian (x,y,z), polar (r,θ) and cylindrical (r,θ,z) coordinates; Derivation of continuity equation using the Lagrangian method in Cartesian coordinates; Rotational flows: rotation, vorticity and circulation; Stream function and velocity potential function, and relationship between them; Flow net.	7
IV	**Fluid Dynamics:** Derivation of Euler's equation of motion in Cartesian coordinates, and along a streamline; Derivation of Bernoulli's equation using principle of conservation of energy and equation of motionand its applications to steady state ideal and real fluid flows; Representation of energy changes in fluid system (hydraulic and energy gradient lines); Impulse momentum equation; Kinetic energy and momentum correction factors; Flow along a curved streamline; Free and forced vortex motions.	7
V	**Dimensional Analysis and Similitude:** Need of dimensional analysis; Fundamental and derived units; Dimensions and dimensional homogeneity; Rayleigh's and Buckingham's π - method for dimensional analysis; Dimensionless numbers (Reynolds, Froude, Euler, Mach, and Weber) and their significance; Need of similitude; Geometric, kinematic and dynamic similarity; Model and prototype studies; Similarity model laws.	4
VI	**Internal Flows:** Laminar and Turbulent Flows: Reynolds number, critical velocity, critical Reynolds number, hydraulic diameter, flow regimes; Hagen – Poiseuille equation; Darcy equation; Head losses in pipes and pipe fittings; Flow through pipes in series and parallel; Concept of equivalent pipe; Roughness in pipes, Moody's chart.	6
VII	**Pressure and Flow Measurement:** Manometers; Pitot tubes; Various hydraulic coefficients; Orifice meters; Venturi meters; Borda mouthpieces; Notches (rectangular, V and Trapezoidal) and weirs; Rotameters.	4

TEXT/REFERENCE BOOKS:

S.NO	BOOK TITLE/AUTHORS/PUBLICATION
1	S.K. Som, G. Biswas and S. Chakraborty, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill Publications, 3rd edition, 2011.
2	D.S. Kumar, "Fluid Mechanics and Fluid Power Engineering", S.K. Kataria and Sons Publishers, 1st Edition, 2009.
3	C.S.P. Ojha, R. Berndtsson and P.N. Chandramouli, "Fluid Mechanics and Machinery", Oxford University Press,1st Edition, 2010.
4	Y.A. Cengel and J.M. Cimbala, "Fluid Mechanics - Fundamentals and Applications", Tata McGraw Hill Publications, 3rd Edition, 2013.

T/R	BOOK TITLE SUGGESTED BY FACULTY
1	Dr. R K Bansal, "A Text Book of Fluid Mechanics and Hydraulic Machines", Laxmi Publication, Revised Ninth Edition 2019.
2	R C Hibbeler, "Fluid Mechanics in SI Units",Pearson Education, 2019

DELIVERY/INSTRUCTIONAL METHODOLOGIES/ TEACHING PEDAGOGY:

Chalk & Talk
Small Group Instruction.
Presentations

E- content used:

NPTEL

Additional topics:

1. **Boundary Layer Analysis-** Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness, laminar and turbulent boundary layers on a flat plate; Laminar sublayer, smooth and rough boundaries. Local and average friction coefficients. Separation and Control.
2. **Compressible Flow:** Basic equations for one dimensional compression, Pressure wavepropagation, sound velocity in fluid, Mach number, Stagnation properties.

COURSE OBJECTIVES: The course enables the student;

1. To explain the fundamental aspects of fluid flow behavior, this is used in the application of Hydraulics, Aerodynamics, and Marine Engineering etc.
2. To give fundamental knowledge of fluid, its properties and behavior under various conditions of internal and external flows.
3. To develop understanding about hydrostatic law, principle of buoyancy and stability of a floating body and application of mass, momentum and energy equation in fluid flow.
4. To imbibe basic laws and equations used for analysis of static and dynamic fluids.
5. To inculcate the importance of fluid flow measurement and its applications in Industries.
6. To determine the losses in a flow system, flow through pipes, boundary layer flow and flow past immersed bodies

.**COURSE PRE-REQUISITES:** Concepts of Engineering mechanics, basic physics, Newton's Laws

COURSE OUTCOMES:

S.NO	DESCRIPTION	Bloom's Level (B.L)
CO1	***State*** the Newton's Law of viscosity and ***Explain*** the concepts of momentum and energy in engineeringapplications	1,2
CO2	***Develop*** basic understanding of the fundamental equations of fluid mechanics.	2
CO3	**Analyze** hydrostatic forces in submerged bodies.	4
CO4	***Apply*** the Bernoulli equation to solve problems in fluid flows.	3
CO5	***Identify*** and ***Analyse*** the laminar and turbulent boundary layer	1, 4
CO6	***Create*** prototypes with the help of dimensional analysis.	6

PROGRAME SPECIFIC OUTCOMES:

S.NO	DESCRIPTION
PSO1	Graduates of Mechanical Engineering will be engineering professionals and innovators in core engineering, service industries or pursue higher studies
PSO2	Graduates of Mechanical Engineering will be team players who are equipped to provide sustainable solutions for complex interdisciplinary problems using modern tools.
PSO3	Graduates of Mechanical Engineering will be able to engage in professional activities ethically and thereby enhance the knowledge and contribution towards the society through lifelong learning.

CO –PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	2	1	-	-	-	-	-	-	-	1	1	2	-
CO3	2	3	2	1	1	1	-	-	-	-	-	1	2	2	-
CO4	2	3	2	2	2	1	-	-	-	-	-	2	2	2	-
CO5	3	3	2	2	-	2	1	-	-	-	-	1	2	0	-
CO6	2	1	3	-	3	1	1	-	-	-	-	3	2	3	-

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THEORY OF MACHINES –I

COURSE INFORMATION SHEET

PROGRAMME: ENGINEERING	**DEGREE: BTECH**
COURSE: THEORY OF MACHINES –I	**SEMESTER: 3 CREDITS: 5**
COURSECODE: BTME302-18 **REGULATION:2018**	**COURSE TYPE:** **CORE**
COURSE AREA/DOMAIN: **THEORY OF MACHINES –I**	**CONTACT HOURS:** **3(L) + 1 (T) + 2 (P) hours/Week.**
CORRESPONDING LAB COURSE CODE : **BTME307-18**	**LAB COURSE NAME:** **THEORY OF MACHINES –I**

SYLLABUS:

UNIT	DETAILS	HOURS
I	**Basic Concept of machines:** Link, Mechanism, Kinematic Pair and Kinematic Chain,Principles ofInversion,Inversion of a Four Bar Chain, Slider-Crank-Chain andDoubleSlider-Crank-Chain. Graphical and Analytical methods for finding: Displacement, Velocity,andAcceleration ofmechanisms includingCorliolis Components.	6
II	**Lower and higher Pairs:** Universal Joint, Calculation of maximum Torque, Steering Mechanisms including Ackerman and Davis approximate steering mechanism, Engine Indicator, Pentograph, Straight Line Mechanisms, Introduction to Higher Pairs with examples.	5
III	**Belts, Ropes and Chains:** Material & Types of belt, Flat and V-belts, Rope & Chain Drives, Idle Pulley, Intermediate or Counter Shaft Pulley, Angle and Right Angle Drive, Quarter Turn Drive, Velocity Ratio, Crowning of Pulley, Loose and fast pulley, stepped or cone pulleys, ratio of tension on tight and slack side of belts, Length of belt, Power transmitted by belts including consideration of Creep and Slip, Centrifugal Tensions and its effect on power transmission.	5
IV	**Cams:** Types of cams and follower, definitions of terms connected with cams. Displacement, velocity and acceleration diagrams for cam followers. Analytical and Graphical design of cam profiles with various motions (SHM, uniform velocity, uniform acceleration and retardation, cycloidal Motion). Analysis of follower motion for circular, convex and tangent cam profiles.	5
V	**Friction Devices:** Concepts of friction and wear related to bearing and clutches. Types of brakes function of brakes. Braking of front and rear tyres of a vehicle. Determination of braking capacity, Types of dynamometers, (absorption, and transmission).	6
VI	**Flywheels:** Turningmomentandcrankeffortdiagramsforreciprocatingmachines'Fluctuations of speed, coefficient of fluctuation of speed and energy, Determination of massanddimensionsofflywheelusedfor enginesandpunchingmachines.	3
VII	**Governors:** Function, types and characteristics of governors. Watt, Porter and Proell governors. Hartnell and Willson-Hartnell spring loaded governors. Numerical problems related to these governors. Sensitivity, stability, isochronisms and hunting of governors. Governor effort and power, controlling force curve, effect of sleeve friction.	6

TEXT/REFERENCE BOOKS:

S.NO.	BOOK TITLE/AUTHORS/PUBLICATION
1	S.S.Rattan,Theoryof Machines,TataMcGrawHill,NewDelhi.
2	Jagdish Lal,TheoryofMechanisms&Machines, MetropolitanBookCo.
3	ThomasBeven,TheoryofMachines,Longman's Green &Co.,London.
4	W.G.Green,Theoryof Machines, Blackie &Sons, London
5	V.P.Singh, Theoryof Machines,DhanpatRai.

T/R	BOOK TITLE SUGGESTED BY FACULTY
1	Uicker, J. J., Jr., Pennock, G. R., and Shigley, J. E., Theory of Machines andMechanisms, 3rd ed., Oxford University Press, 2003.
2	Rao, J.S. and Dukkipati, R.Y., Mechanism and Machine Theory, 2nd ed., Wiley Eastern Ltd., 1995.

DELIVERY/INSTRUCTIONAL METHODOLOGIES/ TEACHING PEDAGOGY:

Chalk & Talk
Small Group Instruction.
Making real world connections
Presentations

E- content used:

https://www.youtube.com/watch?v=RYzE6EXTGB0&list=PLiSPNzs4fD9v3sQhMMuihEDothsOAKJ-a

Additional topics:

Introduction to different aspects of friction and wear properties of material

COURSE OBJECTIVES:

The aim and objective of the course on Theory of Machines –Iis to introduce the students of B. Tech. class to the formal structure of Theory of Machines –I so that they can use these in Engineering as per their requirement.

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION
BTME302-18	Higher secondary Education	Introduction to solid mechanics desirable

COURSE OUTCOMES:

S.NO.	DESCRIPTION	Bloom's Level (B.L)
1	Understand constructional and working features of important machine elements	2
2	Understand the function of brakes, dynamometers, flywheel and governors	2
3	Identify different Cam and follower pairs for different applications and construct cam profile for required follower motion	4
4	Determine the static and dynamic forces for mechanical systems and flywheels	5
5	Design belt, rope and chain drives for transmission of motion from one shaft to another	6
6	Design gear mechanisms for a given motion or a given input/output motion or force relationship	6

CO MAPPING WITH PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			2	2		3				2	2	2			1
CO2	2						2		2	2	2	2		2	
CO3	2	3		2	2		2	2	2	2		2	2		1
CO4	2		3		3	3	2		2		2	2			
CO5	2			3	2		2		2		2	2	2		1
CO6			2							2		2		2	

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MACHINE DRAWING

COURSE INFORMATION SHEET

PROGRAMME: ENGINEERING	**DEGREE: B.TECH**
COURSE: MACHINE DRAWING	**SEMESTER: 3 CREDITS: 4**
COURSECODE:BTME303-18 **REGULATION:2018**	**COURSE TYPE: CORE**
COURSE AREA/DOMAIN: MACHINE DRAWING	**CONTACT HOURS: 6(P) + 1 (L) hours/Week.**
CORRESPONDING LAB COURSE CODE	**LAB COURSE NAME:**

SYLLABUS:

UNIT	DETAILS	HOURS
I	**Introduction:** Classification of drawings, Principles of drawing, Requirements of machine Drawing, sectional views and conventional representation, dimensioning, concept of limits, fits & tolerances and their representation, machining symbols, various types of screw threads, types of nuts and bolts, screw fasteners, welded joints and riveted joints, introduction and familiarization of code SP 46:2003 by Bureau of Indian Standards	**15**
II	**Free hand sketches of :** Couplings: solid and rigid couplings, protected type flange coupling, pin type flexible coupling, muff coupling. b. Knuckle and cotter joints. c. Pipe and Pipe fittings: Flanged joints, spigot and socket joint, union joint, hydraulic and expansion joint.	**15**
III	**Assembly of :** IC Engine Parts: piston and connecting rod. b. Boiler Mountings: Steam stop valve, blow off cock, feed check valve and spring loaded safety valve. c. Bearing: Swivel bearing, Plummer Block and Foot Step bearing. d. Miscellaneous: Screw jack, Tail Stock and crane hook.	**20**
IV	Practice using Computer Aided Drafting (CAD) tools for**:** Machine components, screw fasteners, Keys cotters and joint, shaft couplings, Pipe joints and fittings, riveted joints and welded Joints. (b) Assemblies: - Bearings (Plumber Block, Footstep, Swivel), boiler mountings, screw jack, Exercise in computer Plots of drawing (c) Case studies in computer plots and industrial blueprint	**10**

TEXT/REFERENCE BOOKS:

S.NO	BOOK TITLE/AUTHORS/PUBLICATION
1	P.S Gill, "Machine Drawing S K Kataria and sons, 18th edition, 2017 reprint.
2	N.D.Bhatt, "Machine Drawing". Charotar publications, 49th edition, 2014
3	Ajeet Singh, "Machine Drawing (including Auto CAD)", Tata McGraw Hill, 2nd edition,2012
4	G. Pohit, "Machine Drawing with Auto CAD", Pearson Education Asia, 2007.
5	IS code SP 46(2003): Engineering Drawing Practice for schools and colleges by Bureau of Indian Standards.

T/R	BOOK TITLE SUGGESTED BY FACULTY
1	Machine drawing – T.Jones.
2	Machine Drawing by K.L Narayana , P.Kannaiah , K. Venketa Reddy

DELIVERY/INSTRUCTIONAL METHODOLOGIES/ TEACHING PEDAGOGY:
Chalk & Talk
Small Group Instruction.
Making real world connections
Presentatons

E- content used:
https://www.youtube.com/watch?v=_2h0N-b2Lm4

Additional topics:
Introduction to Computer Aided software such as Auto CAD and Solid Edge

COURSE OBJECTIVES:
The aim and objective of the course on Machine Drawing is to introduce the students of B. Tech. class to the formal structure of Machine Drawing so that they can use these in Engineering as per their requirement.

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	
BTME303-03-18	Higher secondary Education	Introduction to Engineering & Drawing	

COURSE OUTCOMES:

S.NO	DESCRIPTION	Bloom's Level (B.L)
CO1	Read, draw and interpret the machine drawings and related parameters	1
CO2	Ability to apply standards used in machine drawings of machine components and assemblies	2
CO3	Learn the concept of limits, fits and tolerances in various mating parts	3
CO4	Recognize machining and surface finish symbols.	4
CO5	Ability to validate the drawing of machine components and assemblies using CAD tools	5
CO6	Visualize and generate different views of a component in the assembly	6

CO MAPPING WITH PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1			2			3					2	2		
CO2									2	2	2	2		2
CO3	2	3		2	2			2	2	3		2	2	2
CO4	2		3		3	3			2		2	2		2
CO5	2			3	2				2	2	2	2	2	
CO6			2							2		2		2

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STRENGTH OF MATERIALS
COURSE INFORMATION SHEET

PROGRAMME: ENGINEERING	**DEGREE: BTECH (MECHANICAL ENGINEERING)**
COURSE: STRENGTH OF MATERIALS-I	**SEMESTER: 3rd CREDITS: 4**
COURSE CODE: BTME304-18 **REGULATION: 2018**	**COURSE TYPE: CORE**
COURSE AREA/DOMAIN: STRENGTH OF MATERIALS	**CONTACT HOURS: 3(L) + 1 (T) hours/Week.**
CORRESPONDING LAB COURSE CODE : BTME306-18	**LAB COURSE NAME: STRENGTH OF MATERIALS LAB**

SYLLABUS:

UNIT	DETAILS	HOURS
I	**SIMPLE, COMPOUND STRESSES AND STRAINS:** Stress and Strain and their types, Hook's law, longitudinal and lateral strain, Poisson's ratio, stress-strain diagram for ductile and brittle materials, extension of a bar due to without and with self weight, bar of uniform strength, stress in a bar, elastic constants and their significance, relation between elastic constants, Young's modulus of elasticity, modulus of rigidity and bulk modulus. Temperature stress and strain calculation due to axial load and variation of temperature in single and compound bars. Two-dimensional stress system, stress at a point on a plane, principal stresses and principal planes, Mohr's circle of stress. Generalized Hook's law, principal stresses related to principal strains.	**8**
II	**Bending Moment (B.M) and Shear Force (S.F) Diagrams:** S.F and B.M definitions; relation between load, shear force and bending moment; B.M and S.F diagrams for cantilevers, simply supported beams with or without overhangs, and calculation of maximum B.M and S.F and the point of contra flexure under different loads: Concentrated loads, Uniformity distributed loads over the whole span or part of span, Combination of concentrated and uniformly distributed load, Uniformly varying loads and Application of moments.	**6**
III	**Bending Stresses in Beams:** Assumptions in the simple bending theory; derivation of formula and its application to beams of rectangular, circular and channel, I and T- sections. Combined direct and bending stresses in afore-mentioned sections, composite / flitched beams.	**5**
IV	**Torsion:** Derivation of torsion equation and its assumptions and its application to the hollow and solid circular shafts. Torsional rigidity, combined torsion and bending of circular shafts; principal stress and maximum shear stresses under combined loading of bending and torsion	**5**
V	**Columns and struts:** Introduction, failure of columns, Euler's formula, Rankine-Gordon's formula, Johnson's empirical formula for axially loaded columns and their applications.	**5**

VI	**Slope and deflection:** Relationship between moment, slope and deflection; method of integration, Macaulay's method, moment area method and use of these methods to calculate slope and deflection for: Cantilevers, Simply supported beams with or without overhang, Under concentrated loads, uniformly distributed loads or combination of concentrated &uniformly distributed loads	**7**

TEXT/REFERENCE BOOKS:

S.NO	BOOK TITLE/AUTHORS/PUBLICATION
1	Timoshenko and Gere, "Mechanics of Materials", CBS Publishers and Distributors, New Delhi.
2	Pytel & Kiusalaas, "Mechanics of Materials", Cengage Learning, New Delhi.
3	S. S. Rattan, "Strength of Materials", Tata McGraw Hill, New Delhi.
4	R. K. Bansal, "A Text Book of Strength of Materials", Laxmi Publications, New Delhi.
5	D. K. Singh, "Strength of Materials", Ane Books Pvt. Ltd., New Delhi.
6	Sadhu Singh, Strength of Materials, Khanna Publishers, Delhi.

T/R	BOOK TITLE SUGGESTED BY FACULTY
1	Strength of Materials', R. Subramanian, Oxford University Press, New Delhi.
2	An Introduction to the Mechanics of Solids', Crandall, S. H., N. C. Dahl, and T. J. Lardner, McGraw Hill.

DELIVERY/INSTRUCTIONAL METHODOLOGIES/ TEACHING PEDAGOGY:

Chalk & Talk

Presentations

Small Group Instruction.

E- content used:

https://nptel.ac.in/courses/112107146

Additional topics:

Centre of Gravity and Moment of Inertia : Centre of Gravity, Centroid, Area moment of Inertia, Radius of Gyration, Theorem of the perpendicular Axis, Theorem of the Parallel Axis, Mass Moment of Inertia, Principal Moment of Inertia

COURSE OUTCOMES:

S.NO	DESCRIPTION	Bloom's Level (B.L)
1	**Explain** the basic concepts of Engineering Mechanics, simple stresses and strains in simple and compound members.	2

2	**Compute** the Shear force and bending moment for different types of beams with various load condition and also sketch the SF and BM diagram	4
3	**Calculate** load carrying capacity of columns and struts and their buckling strength	4
4	**Evaluate** the slope and deflection of beams subjected to loads.	5
5	**Apply** the concept of Mohr's circle in the stress/strain calculations.	3
6	**Determine** principal stresses, maximum shearing stress and their angles, and the stresses acting on any arbitrary plane within a structural element.	4

PROGRAME SPECIFIC OUTCOMES:

S.NO	DESCRIPTION
PSO1	Graduates of Mechanical Engineering will be engineering professionals and innovators in core engineering, service industries or pursue higher studies
PSO2	Graduates of Mechanical Engineering will be team players who are equipped to provide sustainable solutions for complex interdisciplinary problems using modern tools.
PSO3	Graduates of Mechanical Engineering will be able to engage in professional activities ethically and thereby enhance the knowledge and contribution towards the society through lifelong learning.

CO MAPPING WITH PO-PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	1	1	-	-	-	-	-	-	-	-	-	-
CO2	1	1	1	3	-	-	-	-	-	-	-	-	1	-
CO3	1	2	2	2	-	-	-	-	-	-	-	-	1	
CO4	-	1	2	2	-	-	-	-	-	-	-	-	-	-
CO5	2	1	1	1	-	-	-	-	-	-	-	-	-	-
CO6	-	2	1	1	-	-	-	-	-	-	-	-	1	-

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BASIC THERMODYNAMICS

COURSE INFORMATION SHEET

PROGRAMME: ENGINEERING	**DEGREE: BTECH**
COURSE: BASIC THERMODYNAMICS	**SEMESTER: 3 CREDITS:4**
COURSECODE:BTME-305-18 **REGULATION: 2021**	**COURSE TYPE: CORE**
COURSE AREA/DOMAIN:	**CONTACT HOURS: 3(L) + 1 (T) hours/Week.**
CORRESPONDING LAB COURSE CODE :	**LAB COURSE NAME:**

SYLLABUS:

UNIT	DETAILS	HOURS
I	**Basic Concepts:** Definition of thermodynamics, Concept of Thermodynamic System and of thermodynamic equilibrium, Boundary and Surroundings; Open, Closed and Isolated Systems. Property, state, path, process and cycle; dot/point functions and path functions, Phase and pure substances, Equation of State, reversible, Quasi-static and irreversible processes; Energy and its forms, Energy transfer across the System boundaries. Types of work transfer, heat and work; sign conventions for heat and work interaction, Concept of temperature and heat, microscopic and macroscopic approach, Concept of continuum, Zeroth law of thermodynamics. Concept of thermal equilibrium and principles of thermometry. Ideal gas and characteristic gas equation.	04
II	**First Law of Thermodynamics:** Concept of First law of thermodynamics, essence and corollaries of First law; internal energy and enthalpy, analysis of non flow and flow processes for an ideal gas for constant volume(isochoric), constant pressure (isobaric), constant temperature(isothermal), adiabatic and polytropic processes. Changes in various properties, work done and heat exchange during these processes, free expansion and throtting process and its applications in Engineering processes; Steady Flow Energy Equation and its application to various thermodynamic Systems (ie, in engineering devices)	08
III	**Second Law of Thermodynamics:** Limitations of First law of thermodynamics, concept of Kelvin Plank and Clausius statements of the Second law and their equivalence and their application to Refrigerator, Heat Pump and Heat Engine. Thermodynamic temperature scale, Efficiency and philosophy of Carnot cycle and its consequences, Carnot Engine and Carnot theorem; Carnot refrigerator, Heat Pump and Heat Engines. Clausius theorem; Clausius inequality; concept of entropy, principle of increase in entropy, representation of various processes on T-S coordinates and change in entropy for different processes, concept of entropy generation in Closed and Open systems, high grade and low grade energy, available and unavailable energy; availability and unavailability, Second law efficiency and energy analysis of Thermodynamic Systems, Third law of Thermodynamics (definition only).	08

IV	**Gas Power Cycles:** Air-standard efficiency, Nomenclature of Piston-Cylinder arrangement w.r.t. swept volume; clearance volume, compression ratio and mean effective pressure; Analysis and philosophy of Air-Standard Cycles i.e. Otto Cycle, Diesel Cycle and Dual Cycle; their compression ratio, mean effective pressure, power output and Efficiency; Comparison between the three Cycles.	**09**
V	**Internal Combustion Engines:** Classification and application, constructional and working details of two stroke and four stroke cycle engines.	**04**
VI	**Properties of Steam:** Pure Substance; steam formation at constant pressure and the properties of steam; use of steam tables, constant volume, constant pressure and isentropic process, simple Ranking cycle. Construction, working, classification and applications of gas turbines, comparison of gas turbines with steam turbines and IC engines, performance analysis of constant pressure gas turbine cycle (Brayton cycle), thermal refinements like regeneration, inter-cooling and reheating, selection	**06**

TEXT/REFERENCE BOOKS:

	BOOK TITLE/AUTHORS/PUBLICATION
1	Nag P.K., Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd.
2	R. Yadav, Sanjay and Rajay, Applied Thermodynamics, Central Publishing House.
3	Sonntag R. E, Borgnakke C. and Van Wylen G. J., Fundamentals of Thermodynamics, Wiley India Pvt. Ltd.
4	Jones, J. B. and Duggan R. E., Engineering Thermodynamics, Prentice-Hall of India.
5	Moran M. J. and Shapiro H. N., Fundamentals of Engineering Thermodynamics, John Wiley and Sons.
6	Mahesh Rathore, Thermal Engineering, McGraw-Hill Education (India) Pvt. Ltd.

T/R	BOOK TITLE SUGGESTED BY FACULTY
1	Onkar Singh, Applied Thermodynamics, New Age International Publishers.
2	R. K Rajput, Engineering Thermodynamics, Laxmi Publications (P) Ltd.

DELIVERY/INSTRUCTIONAL METHODOLOGIES/ TEACHING PEDAGOGY:
Chalk & Talk
Small Group Instruction.
Presentations

E- content used: https://nptel.ac.in/courses/112105123

Additional topics:

- The Concept of Non-Equilibrium as the Basis of the Second Law of Thermodynamics
- Exposition of the thermodynamic properties of the van der Waal'sfluid

COURSE OBJECTIVES:

The course has been designed to cover the interconversion of heat energy into work energy and vice versa; balance of energy between the System and its Surroundings; to learn about thev application of First and Second law to various thermodynamic Systems, to learn about gas power cycles and IC Engines, to learn about steam formation and its properties, to learn about vapor power cycles.

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEM
	Higher secondary Education	Basic knowledge of laws of thermodynamics secondary level education	

COURSE OUTCOMES:

S.NO	DESCRIPTION	Bloom's Level (B.L.)
1	**Understand** and **explain** basic concepts of thermodynamics and its applications.	1,2
2	**Apply** energy balance to Systems and Control Volumes in situations involving heat and work interactions.	3
3	**Evaluate** changes in thermodynamic properties of substances.	5
4	**Evaluate** performance of energy conversion devices.	5
5	**Explain** and **apply** various gas power and vapor power cycles.	2,3
6	**Analyze** various heat engine cycles and understand construction and working of IC engines.	4

PROGRAME SPECIFIC OUTCOMES:

S.NO	DESCRIPTION
PSO1	Graduates of Mechanical Engineering will be engineering professionals and innovators in core engineering, service industries or pursue higher studies
PSO2	Graduates of Mechanical Engineering will be team players who are equipped to provide sustainable solutions for complex interdisciplinary problems using modern tools.
PSO3	Graduates of Mechanical Engineering will be able to engage in professional activities ethically and thereby enhance the knowledge and contribution towards the society through lifelong learning.

CO MAPPING WITH PO AND PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	-	-	-	1	-	-	-	-	-	-	-	2	1	-	1
CO2	-	2	2	3	-	-	-	-	-	-	-	2	-	-	
CO3	1	2	2	3	-	-	-	-	-	-	-	-	-		
CO4	1	2	2	3	-	-	-	-	-	-	-	2	-	-	
CO5	1	-	-	-	-	-	-	-	-	-	-	1	-	-	
CO6	1	1	2	3	-	-		-	-	-	-	2	-	-	

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HOD

BTME306-18 STRENGTH OF MATERIAL LAB

SYLLABUS:

• To perform tensile and compression test in ductile and brittle materials and to draw stress-strain curve and to determine various mechanical properties.
• To perform compression test on Cast Iron
• To perform any hardness tests (Any one from Rockwell, Brinell &Vicker's test).
• To perform impact test to determine impact strength
• To perform torsion test and to determine various mechanical properties.
• To perform Fatigue test on circular test piece.
• To perform bending test on beam and to determine the Young's modulus and modulus of rupture.
• Determination of Bucking loads of long columns with different end conditions.
• To evaluate the stiffness and modulus of rigidity of helical coil spring

T

TEXT/REFERENCE BOOKS:

S. No.	BOOK TITLE/AUTHORS/PUBLICATION
1	Laboratory Manual of Testing Materials, William Kendrick Hall.

COURSE OUTCOMES:

S.NO	DESCRIPTION	Bloom's Level
1	**Evaluate** the values of yield stress, breaking stress and ultimate stress of the given specimen under tension test.	5
2	**Conduct** the torsion test to determine the modulus of rigidity of given specimen	3
3	**Justify** the Rockwell hardness test over with Brinell hardness and **measure** the hardness of the given specimen	2,5
4	**Examine** the stiffness of the open coil and closed coil spring and grade them	3
5	**Understand** the behaviour of column and struts under axial loading	2
6	**Evaluate** the fatigue strength of given specimen	5

PROGRAME SPECIFIC OUTCOMES:

S.NO	DESCRIPTION
PSO1	Graduates of Mechanical Engineering will be engineering professionals and innovators in core engineering, service industries or pursue higher studies
PSO2	Graduates of Mechanical Engineering will be team players who are equipped to provide sustainable solutions for complex interdisciplinary problems using modern tools.
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CO MAPPING WITH PO-PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	3	-	-	-	-	2	2	-	-	1	1	1
CO2	2	-	-	-	-	-	-	-	1	1	-	-	2	-	1
CO3	2	2	3	3	-	-	-	-	2	2	-	-	1	1	1
CO4	2	-	-	-	-	-	-	-	2	2	-	-	-	-	1
CO5	2	-	-	-	-	-	-	-	1	1	-	-	-	-	2
CO6	2	2	2	3	-	-	-	-	2	2	-	-	1	-	-

THEORY OF MACHINES –I

SYLLABUS:

LIST OF PRACTICAL
• To draw displacement, velocity & acceleration diagram of slider - crank and four bar mechanism.
• To study the various inversions of kinematic chains
• Conduct experiments on various types of governors and draw graphs between height and equilibrium speed of a governor
• Determination of gyroscopic couple (graphical method).
• Balancing of rotating masses (graphical method).
• Cam profile analysis (graphical method)
• Determination of gear- train value of compound gear trains and epicyclic gear trains.
• To draw circumferential and axial pressure profile in a full journal bearing.
• To study the magnetic field of a circular coil carrying current.To determine coefficient of friction for a belt-pulley material combination.
• Determination of moment of inertia of flywheel.

COURSE OBJECTIVES:

The aim and objective of the Lab course on Theory of Machines–I is to introduce the students of B.Tech class to the formal structure of Theory of Machines –I so that they can use these in Engineering as per their requirement.

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION
BTPH-104-18	**Higher secondary Education**	**Theory of Machines-I**

COURSE OUTCOMES:

S.NO.	DESCRIPTION	Bloom's Taxonomy	Bloom's Level(B.L)
1	Determine gyroscopic couple	Evaluate	5
2	Determine gear- train value of compound gear trains	Evaluate	5
3	Determine gear- train value of epicyclic gear trains	Evaluate	5
4	Determine balancing of rotating masses	Evaluate	5
5	Determine Cam profile analysis	Evaluate	5
6	Determine the moment of inertia of a flywheel.	Evaluate	5

CO MAPPING WITH PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			2	2		3					2	2			2
CO2							2		2	2	2	2		2	
CO3	2	3		2	2		2	2	2	3		2	2		
CO4			3		3	3	2		2		2	2			
CO5				3	2		2		2	2	2	2	2		2
CO6			2							2		2		2	

Preparedby

Approved By

HOD

FLUID MECHANICS LAB

COURSE INFORMATION SHEET

PROGRAMME: MECHANICAL ENGINEERING	**DEGREE: BTECH**
COURSE: FLUID MECHANICS LAB	**SEMESTER: 3 CREDITS: 1**
COURSECODE:BTME308-18 **REGULATION:2018**	**COURSE TYPE: CORE**
COURSE AREA/DOMAIN: FLUID MECHANICS	**CONTACT HOURS: 0(L) + 0(T) +2 (P) hours/Week.**

SYLLABUS:

UNIT	LIST OF PRACTICAL	HOURS
I	To determine the metacentric height of a floating vessel under loaded and unloaded conditions.	**2**
II	To study the flow through a variable area duct and verify Bernoulli's energy equation.	**2**
III	To determine the coefficient of discharge for an obstruction flow meter (venturi meter/ orifice meter.	**2**
IV	To determine the discharge coefficient for a V- notch or rectangular notch.	**2**
V	To study the transition from laminar to turbulent flow and to ascertain the lower critical Reynolds number.	**2**
VI	To determine the hydraulic coefficients for flow through an orifice.	**2**
VII	To determine the friction coefficients for pipes of different diameters.	**2**
VIII	To determine the head loss in a pipe line due to sudden expansion/ sudden contraction/ bend.	**2**
IX	To determine the velocity distribution for pipeline flow with a pitot static probe.	**2**
X	Experimental evaluation of free and forced vortex flow	**2**

TEXT/REFERENCE BOOKS:

S.NO	BOOK TITLE/AUTHORS/PUBLICATION
1	S.K. Som, G. Biswas and S. Chakraborty, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill Publications, 3rd edition, 2011.
2	D.S. Kumar, "Fluid Mechanics and Fluid Power Engineering", S.K. Kataria and Sons Publishers, 1st Edition, 2009.
3	C.S.P. Ojha, R. Berndtsson and P.N. Chandramouli, "Fluid Mechanics and Machinery", Oxford University Press,1st Edition, 2010.
4	Y.A. Cengel and J.M. Cimbala, "Fluid Mechanics - Fundamentals and Applications", Tata McGraw Hill Publications, 3rd Edition, 2013.
5	V.L. Streeter, E.B. Wylie and K.W. Bedford, "Fluid Mechanics", McGraw Hill Book Company, New York, 9th Edition, 1998.
6	Frank M. White, "Fluid Mechanics", Tata Mc Graw Hill Publications, 5th Edition, 2012.
7	S.K. Som, G. Biswas and S. Chakraborty, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill Publications, 3rd edition, 2011.
8	D.S. Kumar, "Fluid Mechanics and Fluid Power Engineering", S.K. Kataria and Sons Publishers, 1st Edition, 2009.

T/R	BOOK TITLE SUGGESTED BY FACULTY
1	Hydraulics and Fluid Mechanics, P M Modi and S M Seth, Standard Book House
2	Dr. R K Bansal, "A Text Book of Fluid Mechanics and Hydraulic Machines", Laxmi Publication, Revised Ninth Edition 2019.

DELIVERY/INSTRUCTIONAL METHODOLOGIES/ TEACHING PEDAGOGY:

Chalk & Talk
Small Group Instruction.
Making real world connections
Presentatons

E- content used:

http://fm-nitk.vlabs.ac.in/

Additional topics:

1. To study of pressure measuring devices as peizometer, U-tube manometer, and pressure gauges.

COURSE OBJECTIVES:

1Students can practically aply the concept to solve the problems related to statics, dynamics and kinematics of fluids.

2 students can understand various pressure and flow measurement devices and its application in solving fluid mechanics problem

.**COURSE PRE-REQUISITES:** Concepts of Engineering mechanics, basic physics, Newton's Laws

C.CODE	COURSE NAME	DESCRIPTION	SEM
BTPHXX-18	Physics	Concepts of Engineering mechanics, basic physics, Newton's Laws	1

COURSE OUTCOMES:

S.NO	DESCRIPTION	Bloom's Level (B.L)
CO1	**Determine** the stability of a floating body.	5
CO2	**Select** appropriate pressure measuring device under different condition of flow.	5
CO3	**Understand** and **apply** Bernoulli's theorem practically.	1,2
CO4	**Able** to find discharge of fluid through pipe, orifices and in open channel.	2
CO5	**Estimate** the major and minor losses in pipe due to friction losses.	5
CO6	The students will be **able** to **determine** the hydraulic coefficient for flow through an orifice and friction coefficients for pipes of different diameters.	5

PROGRAME SPECIFIC OUTCOMES:

S.NO	DESCRIPTION
PSO1	Graduates of Mechanical Engineering will be engineering professionals and innovators in core engineering, service industries or pursue higher studies
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CO –PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	2	1	-	-	-	-	-	-	-	1	1	2	-
CO3	2	3	2	1	1	1	-	-	-	-	-	1	2	2	-
CO4	2	3	2	2	2	1	-	-	-	-	-	2	2	2	-
CO5	3	3	2	2	-	2	1	-	-	-	-	1	2	0	-
CO6	2	1	3	-	3	1	1	-	-	-	-	3	2	3	-

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HOD

APPLIED THERMODYNAMICS
COURSE INFORMATION SHEET

PROGRAMME: ENGINEERING	**DEGREE: BTECH**
COURSE: APPLIED THERMODYNAMICS	**SEMESTER: 4 CREDITS:4**
COURSECODE:BTME-401-18 **REGULATION: 2021**	**COURSE TYPE: CORE**
COURSE AREA/DOMAIN:	**CONTACT HOURS: 3(L) + 1 (T) hours/Week.**
CORRESPONDING LAB COURSE CODE :	**LAB COURSE NAME:**

SYLLABUS:

UNIT	DETAILS	HOURS
I	**Reciprocating Air Compressors:-:** Single stage single acting reciprocating compressor(*with* and *without clearance volume*) construction, operation, work input and best value of index of compression, heat rejected to cooling medium, isothermal, overall thermal, isentropic, polytropic and mechanical efficiency, Clearance volumetric efficiency, Overall volumetric efficiency, effect of various parameters on volumetric efficiency, free air delivery; Multistage compressors: purpose and advantages, construction and operation, work input, heat rejected in intercoolers, minimum work input, optimum pressure ratio; isothermal, overall thermal, isentropic, polytropic and mechanical efficiencies; Performance curves.	**05**
II	**Thermodynamics of Combustion in Boilers and IC Engines:** Principle of Combustion; Stoichio-metric and non-stoichiometeric combustion; Combusion Problems in boilers & IC Engines; Calculations of air fuel ratio: Analysis of products of combustion, conversion of volumetric analysis into gravimetric analysis and vice versa, Actual weight of air supplied,use of mols. For solution of combustion problems; Heat of formation; Enthalpy of formation; Enthalpy of reaction/combustion and it's evaluation; first law analysis of reacting system: steady flow and Closed Systems, adiabatic flame temperature and its determination. Various stages of combustion in IC Engines.	**05**
III	**Steam:** Properties of Steam Pure substance ; Steam and its formation at constant pressure: wet, dry and super-heated(*super-saturated*) steam; Sensible heat*(sensible enthalpy)*, latent heat(*latent enthalpy*) and total/stagnation heat(*total/stagnation enthalpy*) of steam; dryness fraction and its determination; degree of superheat and degree of sub-cool; Entropy and Internal energy of steam; Use of Steam Tables and Mollier Charts; Basic thermodynamic processes with steam(isochoric, isobaric, isothermal, isentropic and adiabatic processes) and their representation on T-S Charts and Mollier Charts(**h-s** diagrams), significance of Mollier Charts.	**05**

IV	**Vapour Power Cycle::** Carnot Cycle and its limitations; Rankine steam power cycle, Ideal and actual; Mean temperature of heat addition; Effect of pressure, temperature and vacuum on Rankine Efficiency; Rankine Cycle Efficiency and methods of improving Rankine efficiency: Reheat cycle, Bleeding(*feed-water-heating*), Regenerative Cycle, Combined reheat-regenerative cycle; Ideal working fluid; Binary vapour cycle, Combined power and heating cycles.	**05**
V	**SteamNozzles:** Definition, types and utility of nozzles; Flow of steam through nozzles; Condition for maximum discharge through nozzle; Critical pressure ratio, its significance and its effect on discharge; Areas of throat and at exit for maximum discharge; Effect of friction Nozzle efficiency; Convergent and Convergent-divergent nozzles. Calculation of Nozzle dimensions (length and diameters of throat and exit); Supersaturated (or metastable) flow through nozzle.	**05**
VI	**Steam Turbines(Impulse Turbine**): Introduction; Classification; Impulse v/s Reaction turbines. Simple impulse/De Level turbine: Pressure and velocity variation, Compounding of impulse turbines: purpose types; pressure and velocity variation, velocity diagrams/triangles; Combined velocity diagram/triangles and calculations for force, axial thrust, work, power, blade efficiency, stage efficiency, maximum work and maximum efficiency, overall efficiency and relative efficiency, effect of blade friction on velocity diagram, effect of speed ratio on blade efficiency, condition for axial discharge.	**05**
VII	**Reaction Turbine**: Pressure and velocity variation, velocity diagrams/triangles, Degree of reaction, combined velocity diagram/triangles and calculations for force, axial thrust, work, power, blade efficiency, stage efficiency, overall efficiency and relative efficiency, maximum work and maximum efficiency; Calculations of blade height; Multistaging: Overall efficiency and relative efficiency; Reheating, Reheat factor and condition curve; Losses in steam turbines; Back pressure and extraction Turbines ; Co-generation; Economic assessment; Governing of steam turbines.	**05**
VIII	**Steam Condensers:** Function; Elements of condensing unit; Types of condensers; Dalton's law of partial pressures applied to the condenser problems; Condenser and vacuum efficiencies; Cooling water calculations; Effect of air leakage; Method to check and prevent air infiltration; Description of air pump and calculation of its capacity; **Cooling towers**: function, types and their operation.	**05**

TEXT/REFERENCE BOOKS:

S.NO	BOOK TITLE/AUTHORS/PUBLICATION
1	R. Yadav, "Applied Thermodynamics", Central Publishing House , Allahabad.
2	D.S. Kumar and V.P. Vasandani, "Heat Engineering", Metropolitan Book Co. Pvt. Ltd.
3	G Rogers and Y.Mayhew , "Engineering Thermodynamics", Pearson, Wesley Longman (Singapore) Pte, 482 F.I.E Patparganj, Delhi-110 092.
4	P.K.Nag, "Basic & Applied Thermodynamics", Tata McGraw Hill Education Pvt. Ltd.,
5	E.F. Obert, "Concepts of Thermodynamics", Tata McGraw Hill Education Pvt. Ltd., 7 West Patel Nagar, New Delhi-110 008.
6	C.P. Arora, "Thermodynamics", Tata McGraw Hill Education Pvt. Ltd., 7 West Patel

T/R	BOOK TITLE SUGGESTED BY FACULTY
1	Onkar Singh, Applied Thermodynamics, New Age International Publishers.
2	R. K Rajput, Engineering Thermodynamics, Laxmi Publications (P) Ltd.

DELIVERY/INSTRUCTIONAL METHODOLOGIES/ TEACHING PEDAGOGY:
Chalk & Talk
Small Group Instruction.
Presentations

E- content used: https://nptel.ac.in/courses/112105123

Additional topics:

- Combined cycle power plants
- Energy conservation in domestic refrigerators.

COURSE OBJECTIVES:

The course has been designed to provide theoretical and thermodynamic background for steam and gas power cycle, refrigeration cycle, psychometric principles, internal combustion engine and gas turbine engine cycles, aircraft and rocket propulsion cycles.

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEM
	Basic Thermodynamics	Basic knowledge of laws of thermodynamics secondary level education	3

COURSE OUTCOMES:

S.NO	DESCRIPTION	Bloom's Level (B.L)
1	**Explain** the functioning and performance evaluation of reciprocating air compressors.	2
2	**Analyze** the combustion phenomenon in boilers and I.C. engines.	4
3	**Apply** the concept of entropy and internal energy of steam to e**valuate** vapour power cycle problems using Steam Tables and Mollier Chart	3,5
4	**Explain** the constructional features and working of steam power plants and to **evaluate** their performance.	2,5
5	**Analyze, Evaluate** and **Design** of steam nozzle and steam turbine.	4,5,6
6	**Understand** the types and **solve** the problems related to steam condensers.	2,4

PROGRAME SPECIFIC OUTCOMES:

S.NO	DESCRIPTION
PSO1	Graduates of Mechanical Engineering will be engineering professionals and innovators in core engineering, service industries or pursue higher studies
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CO MAPPING WITH PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	-	-	-	1	-	-	-	-	-	-	-	2	1	-	1
CO2	-	2	2	3	-	-	-	-	-	-	-	2	-	-	
CO3	1	2	2	3	-	-	-	-	-	-	-	-	-		
CO4	1	2	2	3	-	-	-	-	-	-	-	2	-	-	
CO5	1	-	-	-	-	-	-	-	-	-	-	1	-	-	
CO6	1	1	2	3	-	-		-	-	-	-	2	-	-	

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FLUID MACHINES

COURSE INFORMATION SHEET

PROGRAMME: MECHANICAL ENGINEERING	**DEGREE: BTECH**
COURSE: FLUID MACHINES	**SEMESTER: 4 CREDITS: 4**
COURSECODE:BTME402-18 **REGULATION:2018**	**COURSE TYPE: CORE**
COURSE AREA/DOMAIN:HYDRAULIC MACHINES	**CONTACT HOURS: 3(L) + 1(T) + 0(P) hours/Week.**

SYLLABUS:

UNIT	DETAILS	HOURS
I	**General Concepts:** Impulse momentum principle; jet impingement on stationary and moving flat plates; and on stationary or moving vanes with jet striking at the centre and tangentially at one end of the vane; calculations for force exerted; work done and efficiency of jet. Basic components of a turbo machine and its classification on the basis of purpose; fluid dynamic action; operating principle; geometrical features; path followed by the fluid. Euler's equation for energy transfer in a turbo machine and specifying the energy transfer in terms of fluid and rotor kinetic energy changes.	7
II	**Pelton Turbine:** Component parts and operation; velocity triangles; work output; Effective head; available power and efficiency; design aspects such as mean diameter of wheel; jet ratio; number of jets; number of buckets with working proportions; governing of Pelton turbine.	5
III	**Francis and Kaplan Turbines:** Component parts and operation velocity triangles and work output; working proportions and design parameters for the runner; Degree of reaction; Draft tubes - its function and types. Function and brief description of commonly used surge tanks; governing of reaction turbines.	6
IV	**Centrifugal Pumps:** Layout and installation; Main elements and their functions; Various types and classification; Pressure changes in a pump; Heads of a pump - suction; delivery; static; manometric; total; net positive suction head and Euler's head; vane shape and its effect on head-capacity relationships; Departure from Euler's theory and losses; pump output and efficiency; Minimum starting speed and impeller diameters at the inner and outer periphery; model testing and Priming and priming devices; Multistage pumps - series and parallel arrangement; submersible pumps. Construction and operation; Axial and mixed flow pumps; Trouble shooting - field problems; causes and remedies.	6
V	**Similarity Relations and Performance Characteristics:** Unit quantities; specific speed and model relationships; scale effect; Cavitation and Thomas's cavitation number; Concept of Net PositiveSuction Head (NPSH) and its application.	4
VI	**Reciprocating Pumps:** Introduction to single acting and double acting reciprocating pumps; their components; and parts and working; pressure variations due to piston acceleration; acceleration effects in suction and delivery pipes; work done against friction; maximum permissible vacuum during suction stroke; Functions of Air vessels.	5
VII	**Hydraulic Devices and Systems:** Construction; operation and utility of simple and differential accumulator; intensifier; fluid coupling and torque converter; Air lift and jet pumps; gear; vane and piston pumps; Hydraulic Ram; Hydraulic lift; Hydraulic crane and Hydraulic press.	3

TEXT/REFERENCE BOOKS:

S.NO	BOOK TITLE/AUTHORS/PUBLICATION
1	R.L. Daughaty, Hydraulic Turbines, McGraw Hill
2	Jagdish Lal, Hydraulic Machines by Metropolitan Book Co
3	D.S. Kumar, Fluid Mechanics and Fluid Power Engineering, SK Kataria and Sons,
4	R.K. Purohit., Hydraulic Machines, Scientific Publishers
5	K. Subramaniam, Hydraulic Machines, Tata Mc Graw Hill

T/R	BOOK TITLE SUGGESTED BY FACULTY
1	C.S.P.Ojha, R.Berndtsson, P.Chandramouli, "Fluid Mechanics and Machinery", Oxford University Press, 2010
2	R.K Bansal, "A Textbook of Fluid Mechanics and Hydraulic Machines" Laxmi Publication

DELIVERY/INSTRUCTIONAL METHODOLOGIES/ TEACHING PEDAGOGY:

Chalk & Talk
Small Group Instruction.
Making real world connections
Presentatons

E- content used:

NPTEL/ Swayam

Additional topics:

1. Advance hydraulic systems : Electro-hydraulics systems, Proportional valve techniques, Continuously operating valve techniques.

COURSE OBJECTIVES:

The main objectives of this course is to demonstrate the applications of theories of basic hydraulic machines and to provide a more intuitive and physical understanding of the theory.

.COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEM
BTME-302-18	FLUID MECHANICS	Concept of fluid flow basic Principle of Impulse Momentum and Newton law of fluid flow.	3

COURSE OUTCOMES:

S.NO	DESCRIPTION	Bloom's Level (B.L)
CO1	**Formulate** Learn the benefits and limitations of fluid power Engineering.	6
CO2	**Understand** the operation and use of different hydraulic machines.	2
CO3	**Formulate and Analyze** models of hydraulic device.	4,6
CO4	**Evaluate** characteristics curve of hydraulic machines.	5
CO5	**Design and predict** the performance of fluid power components.	5,6
CO6	**Calculate** the forces produced by Impact of water jet.	5

PROGRAME SPECIFIC OUTCOMES:

S.NO	DESCRIPTION
PSO1	Graduates of Mechanical Engineering will be engineering professionals and innovators in core engineering, service industries or pursue higher studies
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CO –PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO3	-	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CO4	1	1	-	-	1	-	-	-	-	-	-	-	2	1	-
CO5	1	1	3	-	-	-	-	-	1	-	-	1	2	1	-
CO6		1	1	-	-	-	-	-	2	1	-	1	2	1	-

Prepared by

Approved By

HOD

STRENGTH OF MATERIALS – II
COURSE INFORMATION SHEET

PROGRAMME: ENGINEERING	**DEGREE: BTECH**
COURSE: Strength of Materials-II	**SEMESTER: 4th CREDITS: 4**
COURSE CODE: BTME403-18 **REGULATION: 2018**	**COURSE TYPE: CORE**
COURSE AREA/DOMAIN: Strength of Materials	**CONTACT HOURS: 3(L) + 1 (T) hours/Week.**
CORRESPONDING LAB COURSE CODE : NA	**LAB COURSE NAME: NA**

SYLLABUS:

UNIT	DETAILS	HOURS
I	**Strain Energy:** Introduction to strain energy, energy of dilation and distortion. Resilience, stress due to suddenly applied loads. Castigliano's and Maxwell's theorem of reciprocal deflection.	5
II	**Theories of Failure:** Maximum principal stress theory, maximum shear stress theory, maximum principal strain theory, total strain energy theory, shear strain energy theory. Graphical representation and derivation of equation for these theories and their application to problems related to two-dimensional stress systems.	5
III	**Springs:** Open and closed coiled helical springs under the action of axial load and/or couple. Flat spiral springs- derivation of formula for strain energy, maximum stress and rotation. Leaf spring deflection and bending stresses.	5
IV	**Thin Cylinders and Spheres:** Calculation of Hoop stress, longitudinal stress in a cylinder, effects of joints, change in diameter, length and internal volume. Principal stresses in sphere, change in diameter and internal volume.	5
V	**Thick Cylinders:** Derivation of Lame's equations, calculation of radial, longitudinal and hoop stresses and strains due to internal pressure in thick cylinders, compound cylinders, hub shrunk on solid shafts, shrinkage allowance and shrinkage stress.	5

VI	**Bending of Curved Beams:** Calculation of stresses in cranes or chain hooks, rings of circular and trapezoidal section, and chain links with straight sides.	**4**
VII	**Shear Stresses in Beams:** Shear stress distribution in rectangular, circular, I, T and channel section; built up beams. Shear centre and its importance.	**4**
VIII	**Rotational Discs:** Stresses in rotating discs and rims of uniform thickness; disc of uniform strength.	**3**

TEXT/REFERENCE BOOKS:

S.NO	BOOK TITLE/AUTHORS/PUBLICATION
1	S. S. Rattan, "Strength of Materials", Tata McGraw Hill, New Delhi.
2	R. K. Bansal, "A Text Book of Strength of Materials", Laxmi Publications, New Delhi.
3	Sadhu Singh, Strength of Materials, Khanna Publishers, Delhi.
4	Kirpal Singh, "Mechanics of Materials", Standard Publishers, New Delhi
5	R.S. Lehri, "Strength of Materials", Katson Publishers, New Delhi.

T/R	BOOK TITLE SUGGESTED BY FACULTY
1	'Strength of Materials', R. Subramanian, Oxford University Press, New Delhi.
2	'An Introduction to the Mechanics of Solids', Crandall, S. H., N. C. Dahl, and T. J. Lardner, McGraw Hill.

DELIVERY/INSTRUCTIONAL METHODOLOGIES/ TEACHING PEDAGOGY:

Chalk & Talk
Presentations
Small Group Instruction.

E- content used:

https://nptel.ac.in/courses/112107146
https://nptel.ac.in/courses/105105108

Additional topics:

- Leaf Springs , Riveted Joint, Impact load

COURSE OUTCOMES:

S.NO	DESCRIPTION	Bloom's Level (B.L)
1	**Explain** the basic concepts of Engineering Mechanics, M.O.I. for the different types of shapes.	2
2	**Calculate** the strain energy, stress distribution & deformation in spring and shaft.	4
3	**Determine** the different types of stresses involved in thick cylinders & thin cylinders	4
4	**Obtain** the solution for advanced bending problems	3
5	**Analyze** the theories of failures and its relevance in engineering design	4
6	**Evaluate** the Shear Stresses in different Section.	5

PROGRAME SPECIFIC OUTCOMES:

S.NO	DESCRIPTION
PSO1	Graduates of Mechanical Engineering will be engineering professionals and innovators in core engineering, service industries or pursue higher studies
PSO2	Graduates of Mechanical Engineering will be team players who are equipped to provide sustainable solutions for complex interdisciplinary problems using modern tools.
PSO3	Graduates of Mechanical Engineering will be able to engage in professional activities ethically and thereby enhance the knowledge and contribution towards the society through lifelong learning.

CO MAPPING WITH PO-PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	1	-	-	-	-	-	-	-	-	1	-	-
CO2	-	2	2	2	-	-	-	-	-	-	-	-	1	-	-
CO3	1	2	2	-	-	-	-	-	-	-	-	-	1	-	-
CO4	2	1	-	1	-	-	-	-	-	-	-	-	-	-	-
CO5	1	2	2	2	-	-	-	-	-	-	-	-	1	-	-
CO6	-	2	2	3	-	-	-	-	-	-	-	-	1	-	-

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MATERIALS ENGINEERING

COURSE INFORMATION SHEET

PROGRAMME: ENGINEERING	**DEGREE: B.TECH**
COURSE: MATERIALS ENGINEERING	**SEMESTER: 4 CREDITS: 3**
COURSECODE:BTME404-18 **REGULATION:2018**	**COURSE TYPE: CORE**
COURSE AREA/DOMAIN: MATERIAL ENGINEERING	**CONTACT HOURS: 3(L) hours/Week.**
CORRESPONDING LAB COURSE CODE : BTPH-114-18	**LAB COURSE NAME: MATERIAL ENGINEERING**

SYLLABUS:

UNIT	DETAILS	HOURS
I	**Crystallography :** Atomic structure of metals, atomic bonding in solids, crystal structures, crystallattice of body centered cubic, face centered cubic, closed packed hexagonal; crystalline and noncrystalline materials; crystallographic notation of atomic planes; polymorphism and allotropy; imperfection in solids: theoretical yield strength, point defects, line defects and dislocations, interfacial defects, bulk or volume defects. Diffusion: diffusion mechanisms, steady-state and nonsteady-state diffusion, factors affecting diffusion. Theories of plastic deformation, recovery,re-crystallization**.**	**12**
II	**Phase Transformation :** General principles of phase transformation in alloys, phase rule andequilibrium diagrams, Equilibrium diagrams of Binary systems. Iron carbon equilibrium diagramand various phase transformations. Time temperature transformation curves (TTT curves): fundamentals, construction and applications.	**09**
III	**Heat Treatment :** Principles and applications. Processes viz. annealing, normalizing, hardening, tempering. Surface hardening of steels: Principles of induction and oxyacetylene flame hardening.Procedure for carburising, nitriding and cyaniding. Harden-ability: determination of harden-ability.Jominy end-quench test. Defects due to heat treatment and their remedies; effects produced byalloying elements. Composition of alloy steels.	**09**
IV	**Ferrous Metals and Their Alloys :** Introduction, classification, composition of alloys, effect ofalloying elements (Si, Mn, Ni, Cr, Mo, W, Al) on the structures and properties of steel	**06**

TEXT/REFERENCE BOOKS:

S.NO	BOOK TITLE/AUTHORS/PUBLICATION
1	B. Zakharov, Heat Treatment of Metals, University Press.
2	Ben G. Streetman: Solid State Electronics Devices, Pearson Prentice Hall
3	Sidney H Avner, Introduction to Physical Metallurgy, Tata Mcgraw-Hil
4	. V. Raghavan, Physical Metallurgy: Principles and Practice, PHI Learning. 5. Y. Lakhin , Engineering Physical Metallurgy, Mir Publishers

T/R	BOOK TITLE SUGGESTED BY FACULTY
1	Engineering Materials by S.C. Rangwala

DELIVERY/INSTRUCTIONAL METHODOLOGIES/ TEACHING PEDAGOGY:
Chalk & Talk
Small Group Instruction.
Making real world connections
Presentatons

E- content used:
https://youtu.be/_7AS-QfKdLY

Additional topics:
Introduction to Advance materials such as composites and high entropy materials.

COURSE OBJECTIVES:

The aim and objective of the course on Material Engineering is to introduce the students of B. Tech. class to the formal structure of Material Engineering so that they can use these in Engineering as per their requirement.

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEM
BTME404-18	**B.Tech.**	**Introduction to Material Science desirable**	**1 & 2**

COURSE OUTCOMES:

S.NO	DESCRIPTION	Bloom's Level (B.L)
CO1	Understand the significance of structure-property-correlation for engineering materials including ferrous and nonferrous.	2
CO2	Understand basics of metallographic and processes of the metallographic.	2
CO3	Understand Basic Principle involved in the working of various types of Material characterization techniques	2
CO4	Explain the use and importance of various heat treatment processes used for engineering materials and their practical applications	3
CO5	Ability to analyze the various structural changes occurred in metals with respect to time temperature transformations	4
CO6	Ability to predict the structure and properties of materials by using the Fe-C and TTT diagram .	5

CO MAPPING WITH PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PS 3
CO1						3					2	2			1
CO2							2		2	2	2	2		2	1
CO3					2		2	2	2	3		2	2		2
CO4	3		3		3	3	2		2		2	2			
CO5	2			3	2		2		2	2	2	2	2		
CO6			2							2		2		2	

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THEORY OF MACHINES –II

COURSE INFORMATION SHEET

PROGRAMME: ENGINEERING	**DEGREE: BTECH**
COURSE: THEORY OF MACHINES –II	**SEMESTER: 4 CREDITS: 4**
COURSECODE: BTME405-18 **REGULATION: 2018**	**COURSE TYPE:** **CORE**
COURSE AREA/DOMAIN: **THEORY OF MACHINES –II**	**CONTACT HOURS:** **3(L) + 1 (T) hours/Week.**
CORRESPONDING LAB COURSE CODE :	**LAB COURSE NAME:**

SYLLABUS:

UNIT	DETAILS	HOURS
I	**Static force analysis:** Concept of force and couple, free body diagram, condition of equilibrium, static equilibrium of mechanism, methods of static force analysis of simple mechanisms. Power transmission elements, considerations of frictional forces.	5
II	**Dynamic force analysis:** Determination of forces and couples for a crank, inertia of reciprocating parts, dynamically equivalent system, analytical and graphical method, inertia force analysis of basic engine mechanism, torque required to overcome inertia and gravitational force of a four-bar linkage.	5
III	**Balancing:** Necessity of balancing, static and dynamic balancing, balancing of single and multiple rotating masses, partial unbalanced primary force in an engine, balancing of reciprocating masses,and condition of balance in multi cylinder in line V-engines, concept of direct and reverse crank, balancing of machines, rotors, reversible rotors.	6
IV	**Gears:** Toothed gears, types of toothed gears and its terminology. Path of contact, arc of contact, conditions for correct gearing, forms of teeth, involutes and its variants, interference and methods of its removal. Calculation of minimum number of teeth on pinion/wheel for involute rack, helical, spiral, bevel and worm gears. Center distance for spiral gears and efficiency of spiral gears.	7
V	**Gear Trains:** Types of gear trains, simple, compound and epicyclic gear trains, problems involving their applications, estimation of velocity ratio of worm and worm wheel.	5
VI	**Gyroscopic motion and couples:** Effect on supporting and holding structures of machines. stabilization of ships and planes, Gyroscopic effect on two and four wheeled vehicles.	3
VII	**Kinematic synthesis of Mechanism:** Freudenstien equation, Function generation errors in synthesis, two- and three-point synthesis Transmission angles, least square technique.	5

TEXT/REFERENCE BOOKS:

S.NO.	BOOK TITLE/AUTHORS/PUBLICATION
1	S.S.Rattan,Theoryof Machines,TataMcGrawHill,NewDelhi.
2	John, Gordon, and Joseph, Theory of Machines and Mechanisms, Oxford University Press.
3	Hams Crone and Roggers, Theory of Machines.
4	Shigley, Theory of Machines, Mc Graw Hill.
5	V.P.Singh, Theoryof Machines,DhanpatRai.

T/R	BOOK TITLE SUGGESTED BY FACULTY
1	Ballaney, P.L. – Theory of Machines, Khanna Publishers, New Delhi.
2	Rao, J.S. and Dukkipati, R.Y., Mechanism and Machine Theory, 2nd ed., Wiley Eastern Ltd., 1995.

DELIVERY/INSTRUCTIONAL METHODOLOGIES/ TEACHING PEDAGOGY:
Chalk & Talk
Small Group Instruction.
Making real world connections
Presentations

E- content used:
https://www.youtube.com/watch?v=oLM6uCNlihA&list=PLelAq9xzEDXCpJbs5K6kN9LyA9TDHiLed

Additional topics:

COURSE OBJECTIVES:

The aim and objective of the course on Theory of Machines –IIis to introduce the students of B. Tech. class to the formal structure of Theory of Machines –IIso that they can use these in Engineering as per their requirement.

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION
BTME405-18	Higher secondary Education	Introduction to Theory of Machines-I desirable

COURSE OUTCOMES:

S.NO.	DESCRIPTION	Bloom's Level (B.L)
1	Understand the basic concepts of inertia forces & couples applied to reciprocating parts of a machine	2
2	Understand the concept and application of gyroscopic effect	2
3	Gain knowledge of kinematic synthesis	2
4	Understand balancing of rotating and reciprocating parts of machines	2
5	To make the student conversant with synthesis of the mechanism.	3
6	Select suitable type of gears for different application and analyse the motion of different elements of gear trains	4

CO MAPPING WITH PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			2	2		3				2	2	2			1
CO2	2						2		2	2	2	2		2	
CO3	2	3		2	2		2	2	2	2		2	2		1
CO4	2		3		3	3	2		2		2	2			
CO5	2			3	2		2		2		2	2	2		1
CO6			2							2		2		2	

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APPLIED THERMODYNAMICS LAB

COURSE INFORMATION SHEET

PROGRAMME: MECHANICAL ENGINEERING	**DEGREE: BTECH**
COURSE: APPLIED THERMODYNAMICS LAB	**SEMESTER: 4 CREDITS: 1**
COURSECODE:BTME406-18 **REGULATION:2018**	**COURSE TYPE: CORE**
COURSE AREA/DOMAIN: FLUID MECHANICS & MACHINES	**CONTACT HOURS: 0(L) + 0(T) + 2(P) hours/Week.**

SYLLABUS:

UNIT	DETAILS	HOURS
I	Study of construction and operation of 2 stroke and 4 stroke Petrol and Diesel engines using actual engines or models.	**2**
II	To plot actual valve timing diagram of a 4 stroke petrol and diesel engines and study its impact on the performance of engine.Study of working, construction, mountings and accessories of various types of boilers.	**2**

III	Study of working, construction, mountings and accessories of various types of boilers.	**2**
IV	To perform a boiler trial to estimate equivalent evaporation and efficiency of a fire tube/ water tube boiler.	**2**
V	Determination of dryness fraction of steam and estimation of brake power, Rankine efficiency, relative efficiency, generator efficiency, and overall efficiency of an impulse steam turbine and to plot a Willian's line.	**2**
VI	Determine the brake power, indicated power, friction power and mechanical efficiency of a multi cylinder petrol engine running at constant speed (Morse Test).	**2**
VII	Performance testing of a Petrol and Diesel engine from no load to full load (at constant speed) for a single cylinder/ multi- cylinder engine in terms of brake power, indicated power, mechanical efficiency and specific fuel consumption and to measure the exhaust emission. Draw/obtain power consumption and exhaust emission curves. Also make the heat balance sheet.	**2**
VIII	Performance testing of a petrol engine from no load to full load (at constant speed) for a single cylinder/ multi- cylinder engine in terms of brake power, indicated power, mechanical efficiency and specific fuel consumption and to measure the exhaust emissions. Also draw/obtain power consumption and exhaust emission curves.	**2**
IX	Study of construction and operation of various types of steam condensers and cooling towers.	**2**

S.NO	**BOOK TITLE/AUTHORS/PUBLICATION**
1	R. Yadav, "Applied Thermodynamics", Central Publishing House , Allahabad.
2	D.S. Kumar and V.P. Vasandani, "Heat Engineering", Metropolitan Book Co. Pvt. Ltd.
3	G Rogers and Y.Mayhew , "Engineering Thermodynamics", Pearson, Wesley Longman (Singapore) Pte, 482 F.I.E Patparganj, Delhi-110 092.
4	P.K.Nag, "Basic & Applied Thermodynamics", Tata McGraw Hill Education Pvt. Ltd.,
5	E.F. Obert, "Concepts of Thermodynamics", Tata McGraw Hill Education Pvt. Ltd., 7 West Patel Nagar, New Delhi-110 008.
6	C.P. Arora, "Thermodynamics", Tata McGraw Hill Education Pvt. Ltd., 7 West Patel

T/R	**BOOK TITLE SUGGESTED BY FACULTY**
1	Onkar Singh, Applied Thermodynamics, New Age International Publishers.
2	R. K Rajput, Engineering Thermodynamics, Laxmi Publications (P) Ltd.

DELIVERY/INSTRUCTIONAL METHODOLOGIES/ TEACHING PEDAGOGY:

Chalk & Talk
Small Group Instruction.
Making real world connections
Presentatons

E- content used:

Additional topics:

COURSE OBJECTIVES:

1.

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.**COURSE PRE-REQUISITES:**

C.CODE	COURSE NAME	DESCRIPTION	SEM
BTME401-18	Applied Thermodynamics		4

COURSE OUTCOMES:

S.NO	DESCRIPTION	Bloom's Level (B.L)
CO1	Understand the working of IC engines	2
CO2	Understand the construction of IC engines	2
CO3	Understand the concept of draught and design the Chimney	2
CO4	Identify the various types of boilers	4
CO5	Identify the various types of condensers	4
CO6	Evaluate the performance of IC engines	5

PROGRAME SPECIFIC OUTCOMES:

S.NO	DESCRIPTION
PSO1	Graduates of Mechanical Engineering will be engineering professionals and innovators in core engineering, service industries or pursue higher studies
PSO2	Graduates of Mechanical Engineering will be team players who are equipped to provide sustainable solutions for complex interdisciplinary problems using modern tools.
PSO3	Graduates of Mechanical Engineering will be able to engage in professional activities ethically and thereby enhance the knowledge and contribution towards the society through lifelong learning.

CO –PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			2	2		3					2	2			1
CO2	2						2		2	2	2	2		2	
CO3	3	3		2	2		2	2	2	3		2	2		
CO4			3		3	3	2		2		2	2			
CO5	2			3	2		2		2	2	2	2	2		2
CO6	2		2							2		2		2	

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FLUID MACHINES LAB

COURSE INFORMATION SHEET

PROGRAMME: MECHANICAL ENGINEERING	**DEGREE: BTECH**
COURSE: FLUID MACHINES LAB	**SEMESTER: 4 CREDITS: 1**
COURSECODE:BTME407-18 **REGULATION:2018**	**COURSE TYPE: CORE**
COURSE AREA/DOMAIN: FLUID MECHANICS & MACHINES	**CONTACT HOURS: 0(L) + 0(T) + 2(P) hours/Week.**

SYLLABUS:

UNIT	DETAILS	HOURS
I	Determination of various efficiencies of Hydraulic Ram	**2**
II	To draw characteristics of Francis turbine/Kaplan Turbine	**2**
III	To study the constructional features of reciprocating pump and to perform test on it for determination of pump performance	**2**
IV	To draw the characteristics of Pelton Turbine	**2**
V	To draw the various characteristics of Centrifugal pump	**2**

VI	Determine the effect of vane shape and vane angle on the performance of centrifugal fan/Blower	**2**

TEXT/REFERENCE BOOKS:

S.NO	BOOK TITLE/AUTHORS/PUBLICATION
1	R.L. Daughaty, Hydraulic Turbines, McGraw Hill
2	Jagdish Lal, Hydraulic Machines by Metropolitan Book Co
3	D.S. Kumar, Fluid Mechanics and Fluid Power Engineering, SK Kataria and Sons,
4	R.K. Purohit., Hydraulic Machines, Scientific Publishers

T/R	BOOK TITLE SUGGESTED BY FACULTY
1	K. Subramaniam, Hydraulic Machines, Tata Mc Graw Hill
2	R.K Bansal, "A Textbook of Fluid Mechanics and Hydraulic Machines" Laxmi Publication

DELIVERY/INSTRUCTIONAL METHODOLOGIES/ TEACHING PEDAGOGY:

Chalk & Talk
Small Group Instruction.
Making real world connections
Presentatons

E- content used:

Vitual Lab : http://fmc-nitk.vlabs.ac.in/

Additional topics:

1. Determine the Impact of jets on vanes.

COURSE OBJECTIVES:

1. Conduct experiments on scaled down models or on actual size hydraulic machines and evaluate results in terms of unit or specific quantities for comparison purpose.
2. Understand the working of various hydraulic machines (turbines and pumps) and can suggest remedial solutions for various faults.

.**COURSE PRE-REQUISITES:**

C.CODE	COURSE NAME	DESCRIPTION	SEM
BTME302-18	FLUID MECHANICS	Concept of fluid flow basic Principle of Impulse Momentum and Newton law of fluid flow.	3

COURSE OUTCOMES:

S.NO	DESCRIPTION	Bloom's Level (B.L)
CO1	**Develop** procedure for standardization of experiments	6
CO2	**Calculate** the efficiency of various turbines	5
CO3	**Able** to **determine compare** the characteristics of various turbines	4,5
CO4	**Analyse** the various characteristics of pumps	5
CO5	**Evaluate** the vane shape and vane angle effect on centrifugal pumps.	6
CO6	**Understand** the working and **Evaluate** various efficiency of hydraulic ram	1,5

PROGRAME SPECIFIC OUTCOMES:

S.NO	DESCRIPTION
PSO1	Graduates of Mechanical Engineering will be engineering professionals and innovators in core engineering, service industries or pursue higher studies
PSO2	Graduates of Mechanical Engineering will be team players who are equipped to provide sustainable solutions for complex interdisciplinary problems using modern tools.
PSO3	Graduates of Mechanical Engineering will be able to engage in professional activities ethically and thereby enhance the knowledge and contribution towards the society through lifelong learning.

CO –PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	1	-	-	-	-	-	-	-	1	-	1
CO2	-	-	-	-	1	-	-	-	-	-	-	-	1	-	1
CO3	-	-	-	-	2	-	-	-	-	-	-	-	2	2	-
CO4	-	-	-	-	1	-	-	-	-	-	-	-	2	1	1
CO5	-	-	-	-	2	-	-	-	1	-	-	1	2	1	1
CO6	-	-	-	-	2	-	-	-	2	1	-	1	2	1	

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MATERIAL ENGINEERING LAB

PROGRAMME: MECHANICAL ENGINEERING	**DEGREE: BTECH**
COURSE: MATERIAL ENGINEERING LAB	**SEMESTER: 4 CREDITS: 1**
COURSECODE:BTME408-18 **REGULATION:2018**	**COURSE TYPE: CORE**
COURSE AREA/DOMAIN: MECHANICS OF MATERIAL	**CONTACT HOURS: 0(L) + 0(T) + 2(P) hours/Week.**

SYLLABUS:

List of Practicals
• Preparation of models/charts related to atomic/crystal structure of metals
• Annealing the steel specimen and study the effect of annealing time and temperature on hardness of steel.

• Hardening the steel specimen and study the effect of quenching medium on hardness of steel
• Practice of specimen preparation (cutting, mounting, polishing, etching) of mild steel, Aluminum and hardened steel specimens.
• Study of the microstructure of prepared specimens of Mild Steel, Aluminum and hardened steel.
• Identification of ferrite and pearlite constituents in given specimen of mildsteel..
• Determination of harden ability of steel by Jominy End Quench Test

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T	Engineering Practical Book Vol-II: Basic Mechanics and Science of Materials By Farrukh Hafeez , Mohd Arif

COURSE OBJECTIVES:

The aim and objective of the Lab course on Material Science is to introduce the students of B.Tech. class to the formal structure of Material Sciense.
so that they can use these in Engineering as per their requirement.

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	
BTME408-18	Higher secondary Education	Introduction to Material Engineering	

COURSE OUTCOMES:

S.NO	DESCRIPTION	Bloom's Taxonomy	Bloom's Level (B.L)
1	Explore the effect of heat treatment on various engineering materials by analysing its microstructure	Apply	3
2	Analyse the microstructure of different non-ferrous samples	Apply	3
3	Explore the effect of heat treatment on various engineering materials by analysing its hardness	Analyze	4
4	Design and conduct experiments, acquire data, analyze and interpret data	Analyze	4
5	Analyse the microstructure of different ferrous samples	Analyze	4
6	Determine the grain size and microstructure in different Ferrous alloys by means of experiments.	Evaluate	5

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PS O2	PS O3
CO1	3		2	2		3					2	2			3
CO2				2			2		2	2	2	2		2	
CO3		3			2		2	2	2	3		2	2		
CO4	3		3	2	3	3	2		2		2	2			
CO5				2	2		2		2	2	2	2	2		
CO6			2							2		2		2	

CO MAPPING WITH PO

HEAT TRANSFER

COURSE INFORMATION SHEET

PROGRAMME: ENGINEERING	**DEGREE: B.TECH**
COURSE: HEAT TRANSFER	**SEMESTER: 5 CREDITS: 5**
COURSECODE:BTME501-18 **REGULATION:2018**	**COURSE TYPE: CORE**
COURSE AREA/DOMAIN: HEAT TRANSFER	**CONTACT HOURS: 4(L) 1 (T) 2 (P) hours/Week.**
CORRESPONDING LAB COURSE CODE : BTME-505-18	**LAB COURSE NAME: HEAT TRANSFER**

SYLLABUS:

UNIT	DETAILS	HOURS
I	**Introduction to Heat Transfer** : : Thermodynamics and Heat Transfer. Modes of Heat Transfer: Conduction, convection and radiation. Effect of temperature on thermal conductivity of materials; Introduction to combined heat transfer mechanism. Conduction: Fourier's law of heat conduction. Coefficient of thermal conductivity. Effect of temperature and pressure on thermal conductivity of solids, liquids and gases. Three-dimensional general conduction equations in rectangular, cylindrical and spherical coordinates. Steady State one-dimensional Heat conduction-I: Deduction of one-dimensional steady state heat conduction equation in rectangular; cylindrical and spherical coordinates with and without internal heat generation for uniform thermal conductivity of material. Concept of variable thermal conductivity. Steady State one-dimensional Heat conduction-II: Electrical network analysis for heat transfer through composite/multilayer material. Application of heat conduction with internal heat generation in case of piston crown and in nuclear fuel rod with/ without cladding. Concept of equivalent area. Conduction shape factor. Conduction through edges and corners of walls. Critical thickness of insulation layers on electric wires and pipes carrying hot fluids.	12
II	**One Dimensional Transient Conduction Heat Transfer**: Systems with negligible internal resistance – Significance of Biot and Fourier Numbers –Infinite bodies- Chart solutions of transient conduction systems- Concept of Semi-infinite body. Theory of Fins: Concept of fin. Classification of fins and their applications. Straight fins of uniform cross-section. Individual and total fin effectiveness and efficiency. Application of fins in temperature measurement of flow through pipes and determination of error in its measurement.	09
III	**Convection:** Classification of systems based on causation of flow, condition of flow, configuration of flow and medium of flow. Dimensional analysis as a tool for experimental investigation. Buckingham Pi Theorem and method. Application for developing semi-empirical, non-dimensional correlation for convection heat transfer, Significance of non-dimensional numbers. Concepts of continuity, momentum and energy Equations. Forced convection: External Flows: Concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer. -Flat plates and Cylinders. Internal Flows: Concepts about Hydrodynamic and Thermal Entry Lengths Division of internal flow based on this Use of empirical relations for Horizontal Pipe Flow and annulus flow. Natural Convection: Physical mechanism of natural convection. Buoyant force. Empirical	09

	heat transfer relations for natural convection over vertical planes and cylinders, horizontal plates and cylinders, and sphere. Combined free and forced convection	
IV	**Heat Exchanger:** Types of heat exchangers; Fouling factors; Overall heat transfer coefficient; Logarithmic mean temperature difference (LMTD) method; Effectiveness-NTU method; Compact heat exchangers. 3 Condensation and Boiling Boiling: Definition and types of boiling. Different regimes and heat transfer during pool boiling of a liquid. Nucleation and different theories accounting for increased heat transfer coefficient during nucleate phase of boiling. Condensation: Definition and types of condensation, film wise condensation on a vertical and inclined surface.	**06**
V	**Thermal Radiation:** Process of heat flow due to radiation. Definition of emissivity, absorptivity, reflectivity and transmissivity. Concept of black and grey bodies. Plank's law of non chromatic radiation. Wien's displacement law. Kirchoff's law. Stefan Boltzmann's law. Lambert's Cosine law. Definition of intensity of Radiation, irradiation and radiosity. Geometric/ configuration factor and its use in heat exchange between two black bodies. Electrical network analysis for radiation exchange between two, three or four bodies (e.g. boiler or other furnaces). Simplification of electrical network analysis for its application to simple bodies like two parallel surfaces, concentric cylinders/spheres and a body enveloped by another body. Use of radiation shields	

TEXT/REFERENCE BOOKS:

S.NO	BOOK TITLE/AUTHORS/PUBLICATION
1	Incropera F.P. and De Witt D.P., "Fundamentals of Heat and Mass transfer", John Wiley, 7th Edition, 2011.
2	Cengel, A. Yunus, "Heat and Mass Transfer", Tata McGraw Hills Education Private Ltd, 4 th Edition, 2013.
3	Kumar, D.S. "Fundamentals of Heat and Mass Transfer", S K Kataria & Sons, 7th Edition, 2013
4	Chapman. A. J, "Heat Transfer", McGraw Hill, 7th Edition, 1990. 5. Holman, J.P. "Heat Transfer", Tata McGraw-Hill Publishing Company Ltd, 9th Edition, 2009.

T/R	BOOK TITLE SUGGESTED BY FACULTY
1	P. K. Nag's Heat and Mass Transfer 3rd Edition

DELIVERY/INSTRUCTIONAL METHODOLOGIES/ TEACHING PEDAGOGY:

Chalk & Talk
Small Group Instruction.
Making real world connections
Presentations

E- content used:
https://youtu.be/qa-PQOjS3zA

Additional topics:

Introduction to Advance applications of Heat Transfer in different fields.

COURSE OBJECTIVES:

To provide knowledge about application of conduction, convection and radiation heat transfer concepts to different practical applications

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	Sem
BTME501-18	B.Tech.	Introduction to Heat Transfer	1 &2

COURSE OUTCOMES:

S.NO	DESCRIPTION	Bloom's Level (B.L)
CO1	To teach students the basic principles of conduction, radiation, and convection heat transfer. Students will demonstrate an understanding of the basic concepts of conduction, radiation, and convection heat transfer.	2
CO2	. To extend the basic principle of conservation of energy to systems that involve conduction, radiation, and heat transfer. Students will demonstrate an understanding of the concept of conservation of energy and its application to problems involving conduction, radiation, and/or convection heat transfer. This principle will be used to formulate appropriate mathematical models and associated thermal boundary conditions.	2
CO3	To train students to identify, formulate, and solve engineering problems involving conduction heat transfer. Students will demonstrate the ability to formulate practical conduction heat transfer problems by transforming the physical system into a mathematical model, selecting an appropriate solution technique, and evaluating the significance of results.	4
CO4	To train students to identify, formulate, and solve engineering problems involving forced convection heat transfer, natural convection heat transfer, and heat exchangers. Students will demonstrate the ability to formulate practical forced and natural conduction heat transfer problems by transforming the physical system into a mathematical model, selecting an appropriate solution technique, and evaluating the significance of results. Students will also demonstrate an ability to analyze the performance of heat exchangers	4

CO5	To train students to identify, formulate, and solve engineering problems involving radiation heat transfer among black surfaces and among diffuse gray surfaces. Students will demonstrate the ability to formulate practical radiation heat transfer problems by transforming the physical system into a mathematical model, selecting an appropriate solution technique, and evaluating the significance of results.	4
CO6	Explain the basic modes and laws of heat transfer.	5

CO MAPPING WITH PO

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2		2	2		3					2	2			
CO2	2						2		2	2	2	2		2	1
CO3	2	3		2	2		2	2	2	3		2	2		
CO4			3		3	3	2		2		2	2			
				3	2		2		2	2	2	2	2		1
CO5	2		2							2		2		2	

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DESIGN OF MACHINE ELEMENTS

COURSE INFORMATION SHEET

PROGRAMME: MECHANICAL ENGINEERING	**DEGREE: BTECH**
COURSE: DESIGN OF MACHINE ELEMENTS	**SEMESTER: 5 CREDITS: 5**
COURSECODE:BTME502-18 **REGULATION:2018**	**COURSE TYPE: CORE**
COURSE AREA/DOMAIN:MACHINE DESIGN	**CONTACT HOURS: 4(L) + 1(T) + 0(P) hours/Week.**

SYLLABUS:

UNIT	DETAILS	HOURS
I	. **Introduction** Meaning of design with special reference to machine design, general design considerations, concept of tearing, bearing, shearing, crushing, bending and fracture.	3
II	**Design for Fatigue** Soderberg, Goodman and Gerber design Criteria. **Design of shaft** Design of shafts under static and fatigue loadings, Design of solid and hollow shafts for transmission of torque, bending moments and axial forces, Design of shaft for rigidity.	7
III	**Design of Bearings** Slider: Principle of hydrodynamic lubrication, modes of lubrication, bearing performance parameters, slider bearing design.	7
IV	. **Roller:** Types, selection guidelines, static and dynamic load carrying capacity, Stribeck's equation, equivalent bearing load, load life relationship.	6
V	**Design of Transmission Drives** Belt drives: Design of Flat belt, V-belt, Design of the pulley for the same. Chain Drives: Roller chains, polygonal effect, power rating. Selection from the manufacturer's catalogue. Gear drives: Standard system of gear tooth and gear module, gear tooth failure, strength of gear tooth, terminology of spur, helical, bevel, worm and worm wheel, Design of spur, helical, straight bevel gears, worm and worm wheel	8
VI	. **Design of Springs** Design of springs: helical compression, tension, torsional and leaf springs	5
VII	**Design of clutches and brakes** Design of contact clutches i.e. plate, multi-disc, cone and centrifugal clutches, Design of band, disc, block with shoe and internal expanding brakes.	5
VIII	**Design of joints:** Threaded fasteners, pre-loaded bolts and welded joints. **Design, Analysis and Applications of Power screws and flexible coupling**.	5

TEXT/REFERENCE BOOKS:

S.NO	BOOK TITLE/AUTHORS/PUBLICATION
1	Joseph E. Shigley, Charles Russell Mischke, Richard Gordon Budynas, Mechanical Engineering Design, McGraw-Hill
2	Robert L. Norton, Machine Design; An Integrating Approach, Pearson Publication.
3	Robert C. Juvinall Fundamentals of machine component design, JohnWiley Eastern
4	V.K Jadon, Analysis and design of machine elements, I.K. International

T/R	BOOK TITLE SUGGESTED BY FACULTY
1	V.B Bhandari, Design of Machine elements, Tata Mc-Graw. Hill
2	R.S.Khurmi, A Text Book of Machine Design, S. Chand

DELIVERY/INSTRUCTIONAL METHODOLOGIES/ TEACHING PEDAGOGY:

Chalk & Talk
Small Group Instruction.
Making real world connections
Presentatons

E- content used:

NPTEL/ Swayam

Additional topics:

COURSE OBJECTIVES:

To provide knowledge of design procedure for simple components like keys, cotters, fasteners, shafts, couplings, pipe joints and levers under static and fatigue loading. Objective of this course is to make the tudents capable of designing mechanical systems consisting of wide range of machine elements.

.**COURSE PRE-REQUISITES:**

C.CODE	COURSE NAME	DESCRIPTION	SEM
BTME304-18	Strength of Materials-I		3
BTME305-18	Basic Thermodynamics		3
BTME403-18	Strength of Materials-II		4
BTME404-18	Materials Engineering		4

COURSE OUTCOMES:

S.NO	DESCRIPTION	Bloom's Level (B.L)
CO1	Demonstrate recalling and applying knowledge of Basic Sciences, Graphics & Drawing, Basic Manufacturing Processes and Material Science, for design procedures of various Mechanical components	3
CO2	Comprehend the effect of different stresses and strains under various loading conditions on the mechanical components and identify the mechanism/mode of failure	4
CO3	Synergize forces, moments and strength information to develop ability to analyze, design and/or select machine elements aiming for safety, reliability, and sustainability	4
CO4	Analyse the transmission shafts and keys under different loading conditions.	4
CO5	Examine and solve design problems involving machine elements on the basis of various theories of failure	6
CO6	Analyse the design problems related to the design of springs under different loading conditions.	6

PROGRAME SPECIFIC OUTCOMES:

S.NO	DESCRIPTION
PSO1	Graduates of Mechanical Engineering will be engineering professionals and innovators in core engineering, service industries or pursue higher studies
PSO2	Graduates of Mechanical Engineering will be team players who are equipped to provide sustainable solutions for complex interdisciplinary problems using modern tools.
PSO3	Graduates of Mechanical Engineering will be able to engage in professional activities ethically and thereby enhance the knowledge and contribution towards the society through lifelong learning.

CO –PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	2	2	-	3	-	-	-	-	2	2	-	-	2
CO2	2	-	-	-	-	-	2	-	2	2	2	2	-	2	2
CO3	2	3	-	2	2	-	2	2	2	3	-	2	2	-	2
CO4	-	-	3	-	3	3	2	-	2	-	2	2	-	-	-
CO5	-	-	-	3	2		2	-	2	2	2	2	2	-	2
CO6	2	-	2							2		2		2	

MANUFACTURING PROCESSES
COURSE INFORMATION SHEET

PROGRAMME: ENGINEERING	**DEGREE: BTECH (MECHANICAL ENGINEERING)**
COURSE: MANUFACTURING PROCESSES	**SEMESTER: 5th CREDITS: 4**
COURSE CODE: BTME503-18 **REGULATION: 2018**	**COURSE TYPE: CORE**
COURSE AREA/DOMAIN: Strength of Materials	**CONTACT HOURS: 4(L) hours/Week.**
CORRESPONDING LAB COURSE CODE : BTME506-18	**LAB COURSE NAME: MANUFACTURING PROCESSES LAB**

SYLLABUS:

UNIT	DETAILS	HOURS
I	**Conventional Manufacturing Processes:** Casting and moulding: Metal casting processes and equipment, Heat transfer and solidification, shrinkage, riser design, casting defects and residual stresses. Introduction to bulk and sheet metal forming, plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk forming (forging, rolling, extrusion, drawing) and sheet forming (shearing, deep drawing, bending) principles of powder metallurgy. Metal cutting: Single and multi-point cutting; Orthogonal cutting, various force components: Chip formation, Tool wear and tool life, Surface finish and integrity, Machinability, Cutting tool materials, Cutting fluids, Coating; Turning, Drilling, Milling and finishing processes, Introduction to CNC machining.	**8**
II	**Additive manufacturing:** Rapid prototyping and rapid tooling	**3**
III	**Joining/fastening processes:** Physics of welding, brazing and soldering; design considerations in welding, Solid and liquid state joining processes; Adhesive bonding	**4**
IV	**Unconventional Machining Processes:** Unconventional Machining Processes: Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining, principles and	**8**

	process parameters. Electrical Discharge Machining, principle and processes parameters, MRR, surface finish, tool wear, dielectric, power and control circuits, wire EDM; Electro-chemical machining (ECM), etchant & maskant, process parameters, MRR and surface finish. Laser Beam Machining (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining	
V	**Tooling for conventional and non-conventional machining processes**: Mould and die design, Press tools, Cutting tools; Holding tools: Jigs and fixtures, principles, applications and design; press tools – configuration, design of die and punch; principles of forging die design	**5**

TEXT/REFERENCE BOOKS:

S.NO	BOOK TITLE/AUTHORS/PUBLICATION
1	Rao P N, Manufacturing Technology, Foundry, Forming & Welding, Tata McGraw Hill.
2	Kalpakjian S and Steven R. Schmid, Manufacturing Engineering and Technology, Pearson Publishers.
3	Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems
4	Degarmo, Black &Kohser, Materials and Processes in Manufacturing
5	Ghosh A, & Mallik A K 1986. Manufacturing science: Ellis Horwood.
6	Campbell J S, Principles of manufacturing materials and processes: Tata McGraw-Hill
7	Shan H S, Manufacturing Processes, Vol. I, Pearson Publishers.
8	Little, Welding and Welding Technology, McGraw-Hill Education (India) Pvt. Ltd.

TEXT/REFERENCE BOOKS:

S. No.	BOOK TITLE SUGGESTED BY FACULTY
1	R.K. Rajput, "A Textbook of Manufacturing Technology: Manufacturing Processes", Laxmi Publication
2	Rob Thompson, Manufacturing Processes for Design Professionals, Thames & Hudson

DELIVERY/INSTRUCTIONAL METHODOLOGIES/ TEACHING PEDAGOGY:

Chalk & Talk
Presentations
Small Group Instruction.

E- content used:

https://nptel.ac.in/courses/112107144
https://nptel.ac.in/courses/112105127

Additional topics:

Lathe Machine : Components of a Lathe, defining the Lathe size, Types of Lathe, Taper and Taper Turning, Thread cutting on the Lathe, Cutting speed, Feed and depth of cut in Turning, lathe Accessories

COURSE OUTCOMES:

S.NO	DESCRIPTION	Bloom's Level (B.L)
CO1	**Explain** the fundamentals of casting processes and **evaluate** design parameters.	2, 4
CO2	**Describe** and **analysis** different metal forming processes	2, 4
CO3	**Analyze** the Material Removal rate in unconventional machining processes.	4
CO4	**Understand** soldering processes with their applications	2
CO5	**Evaluate** design parameters of Non Conventional Machining Process.	5
CO6	**Understand** the latest technologies in Casting and Welding Processes and **create** the various Parts by modern tool technology.	2, 6

PROGRAME SPECIFIC OUTCOMES:

S.NO	DESCRIPTION
PSO1	Graduates of Mechanical Engineering will be engineering professionals and innovators in core engineering, service industries or pursue higher studies
PSO2	Graduates of Mechanical Engineering will be team players who are equipped to provide sustainable solutions for complex interdisciplinary problems using modern tools.
PSO3	Graduates of Mechanical Engineering will be able to engage in professional activities ethically and thereby enhance the knowledge and contribution towards the society through lifelong learning.

CO MAPPING WITH PO-PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	-	-	-	-	-	-	-	-	1	1	-
CO2	2	2	-	2	-	-	-	-	-	-	-	-	1	-	-
CO3	1	2	-	2	-	-	-	-	-	-	-	-	1	1	-
CO4	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO5	1	2	2	3	-	-	-	-	-	-	-	-	1	-	1
CO6	1	-	-	-	3	-	-	-	-	-	-	-	1	3	1

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MANAGEMENT AND ENGINEERING ECONOMICS
COURSE INFORMATION SHEET

PROGRAMME: ENGINEERING	**DEGREE: BTECH (MECHANICAL ENGINEERING)**
COURSE: MANAGEMENT AND ENGINEERING ECONOMICS	**SEMESTER: 5th CREDITS: 3**
COURSE CODE: BTME504-18 **REGULATION: 2018**	**COURSE TYPE: CORE**
COURSE AREA/DOMAIN: Strength of Materials	**CONTACT HOURS: 3(L) 0(T) 0(P) hours/Week.**
CORRESPONDING LAB COURSE CODE : NA	**LAB COURSE NAME: NA**

SYLLABUS:

UNIT	DETAILS	HOURS
I	**Management** Introduction: Meaning - nature and characteristics of Management, Scope and Functional areas of management - Management as a science, art of profession - Management & Administration - Roles of Management, Levels of Management, Development of Management Thought early management approaches – Modern management approaches. **Planning:** Nature, importance and purpose of planning process Objectives -Types of plans (Meaning Only).Decision making Importance of planning -steps in planning & planning premises - Hierarchy of plans.	**8**
II	**Organizing and Staffing** Nature and purpose of organization Principles of organization - Types of organization - Departmentation Committees- Centralization Vs Decentralization of authority and responsibility - Span of control - MBO and MBE (Meaning Only) Nature and importance of staffing: Process of Selection & Recruitment (in brief). **Directing & Controlling:** Meaning and nature of directing Leadership styles, Motivation Theories, Communication - Meaning and importance - coordination, meaning and importance and Techniques of Co Ordination. Meaning and steps in controlling - Essentials of a sound control system - Methods of establishing control (in brief)	**8**
III	**Introduction** Engineering and economics, Problem solving and decision making, Laws of demand and supply, Difference between Microeconomics & Macroeconomics, equilibrium between demand & supply, elasticity of demand, price elasticity, income elasticity. Law of Returns, Interest and interest factors, simple and compound interest, Cash flow diagrams, personal loans and EMI payment calculation with flexible interest rates, Discussion and problems	**8**
IV	**Present, future and annual worth and rate of returns** Basic present worth comparisons, Present worth-equivalence, Assets with unequal lives and infinites lives, future worth comparisons, payback comparisons, Equivalent annual worth comparisons, situations for annual worth comparisons. Asset life, Rate of return, minimum acceptable rate of return, IRR anomalies and misconceptions, Cost of capital, comparisons of all present future and annual worth with IRR, product costing, Discussions and problems	**7**
V	**Unit-V**: **Costing and Depreciation :** Components of costs, estimation of selling price, marginal cost, first cost, all kinds of overheads, indirect cost estimation with depreciation, mensuration and estimation of material cost, cost estimation of mechanical process, idling time. Product costing (approaches to product costing), causes of depreciation, methods of computing depreciation charges, straight line method, declining balance method, sum of years method, sinking fund method, service output methods, taxation concepts, personal income taxes and corporate taxes, Discussions and problems.	**7**

TEXT/REFERENCE BOOKS:

S.NO	BOOK TITLE/AUTHORS/PUBLICATION
1	Principles of Management by Tripathy and Reddy
2	Mechanical estimation and costing, T.R. Banga & S.C. Sharma, 17th edition 2015
3	Engineering Economy, Riggs J.L. McGraw Hill, 2002
4	Management Fundamentals- Concepts, Application, Skill Development - RobersLusier – Thomson

TEXT/REFERENCE BOOKS:

S. No.	BOOK TITLE SUGGESTED BY FACULTY
1	Engineering Economy, Thuesen H.G. PHI , 2002
2	Basics of Engineering Economy, Leland Blank & Anthony Tarquin, McGraw Hill Publication (India) Private Limited
3	Engineering Economics, R.Paneerselvam, PHI publication

DELIVERY/INSTRUCTIONAL METHODOLOGIES/ TEACHING PEDAGOGY:

Chalk & Talk
Presentations
Small Group Instruction.

E- content used:

NPTEL/ Swayam

Additional topics: NA

Course Objectives

1.Acquire knowledge of economics to facilitate the process of economic decision making

2. Acquire knowledge on basic management aspects

COURSE OUTCOMES:

S.NO	DESCRIPTION	Bloom's Level (B.L)
CO1	Understand the necessity of good leadership, communication and coordination for establishing effective control in an organization	2
CO2	Understand engineering economics demand supply and its importance in economics decision making and problem solving	2
CO3	Understand the procedure involved in estimation of cost for a simple component, product costing and depreciation, its methods	2
CO4	Comprehend the process and role of effective planning, organizing and staffing for the development of an organization	3
CO5	Calculate present worth, annual worth and IRR for different alternatives in economic decision making	4
CO6	Explain the development of management and the role it plays at different levels in an organization	5

PROGRAME SPECIFIC OUTCOMES:

S.NO	DESCRIPTION
PSO1	Graduates of Mechanical Engineering will be engineering professionals and innovators in core engineering, service industries or pursue higher studies
PSO2	Graduates of Mechanical Engineering will be team players who are equipped to provide sustainable solutions for complex interdisciplinary problems using modern tools.
PSO3	Graduates of Mechanical Engineering will be able to engage in professional activities ethically and thereby enhance the knowledge and contribution towards the society through lifelong learning.

CO MAPPING WITH PO-PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2		2	2		3					2	2			
CO2	2						2		2	2	2	2		2	3
CO3	2	3		2	2		2	2	2	3		2	2		2
CO4			3		3	3	2		2		2	2			3
CO5				3	2		2		2	2	2	2	2		2
CO6	2		2							2		2		2	2

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Heat Transfer LAB

PROGRAMME: ENGINEERING	**DEGREE: BTECH (MECHANICAL ENGINEERING)**
COURSE: HEAT TRANSFER LAB	**SEMESTER: 5th CREDITS: 1**
COURSE CODE: BTME505-18 **REGULATION: 2018**	**COURSE TYPE: CORE PRACTICAL**
COURSE AREA/DOMAIN: Strength of Materials	**CONTACT HOURS: 2(P) hours/Week.**
CORRESPONDING THEORY COURSE CODE : BTME501-18	**THEORY COURSE NAME: HEAT TRANSFER**

SYLLABUS:

List of Practicals
• Composite Slab Apparatus – Overall heat transfer co-efficient
• Heat transfer through lagged pipe
• Heat Transfer through a Concentric Sphere
• Thermal Conductivity of given metal rod
• Heat transfer in pin-fin
• Experiment on Transient Heat Conduction
• Heat transfer in forced convection apparatus.
• Heat transfer in natural convection
• Parallel and counter flow heat exchanger.
• Emissivity apparatus.
• Stefan Boltzman Apparatus
• Critical Heat flux apparatus
• Study of heat pipe and its demonstration
• Film and Drop wise condensation apparatus

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T	Engineering Practical Book Vol-II: Basic Mechanics and Science of Materials By Farrukh Hafeez , Mohd Arif

COURSE OBJECTIVES:

To provide knowledge about application of conduction, convection and radiation heat transfer concepts to different practical applications Course Outcomes: After undergoing this course, students shall be able to: 1. Design and fabricate the experimental setups related to heat transfer phenomena. 2. Measure and analyse different heat transfer parameters. 3. Apply finite difference methods to solve simple heat transfer problems.

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEM
BTME505-18	Higher secondary Education	Introduction Heat Tranfer	1 &2

COURSE OUTCOMES:

S.NO	DESCRIPTION	Bloom's Taxonomy	Bloom's Level (B.L)
1	Apply finite difference methods to solve simple heat transfer problems	Apply	3
2	Plot the temperature profile in free and forced convection	Apply	3
3	Measure and analyse different heat transfer parameters	Analyze	4
4	Measure the performance of a heat exchanger	Analyze	5
5	Measure the thermal conductivity of metal rod, insulating material and liquids	Analyze	5
6	Design and fabricate the experimental setups related to heat transfer phenomena	Evaluate	6

CO MAPPING WITH PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	2		2	2		3					2	2			3
CO2	2						2		2	2	2	2		2	
CO3	2	3		2	2		2	2	2	3		2	2		3
CO4			3		3	3	2		2		2	2			3
CO5				3	2		2		2	2	2	2	2		3
CO6	2		2							2		2		2	2

MANUFACTURING PROCESSES LAB

PROGRAMME: ENGINEERING	**DEGREE: BTECH (MECHANICAL ENGINEERING)**
COURSE: MANUFACTURING PROCESSES LAB	**SEMESTER: 5th CREDITS: 1**
COURSE CODE: BTME506-18 **REGULATION: 2018**	**COURSE TYPE: CORE PRACTICAL**
COURSE AREA/DOMAIN: Strength of Materials	**CONTACT HOURS: 2(P) hours/Week.**
CORRESPONDING THEORY COURSE CODE : BTME503-18	**THEORY COURSE NAME MANUFACTURING PROCESSES**

SYLLABUS:

CASTING
• To determine clay content, moisture content, hardness of a moulding sand sample.
• To determine shatter index of a moulding sand sample
• To test tensile, compressive, transverse strength of moulding sand in green condition
• To determine permeability and grain fineness number of a moulding sand sample
WELDING
• To make lap joint, butt joint and T- joints with oxy- acetylene gas welding and manual arc welding processes
• To study MIG, TIG and Spot-welding equipment and make weld joints by these processes
MACHINING AND FORMING
• To study constructional features of following machines through drawings/ sketches: a. Grinding machines (Surface, Cylindrical) b. Hydraulic Press c. Draw Bench d. Drawing and Extrusion Dies e. Rolling Mill
• To grind single point and multipoint cutting tools
• To prepare job on Lathe involving specified tolerances; cutting of V- threads and square threads.
• To prepare job on shaper involving plane surface,
• Use of milling machines for generation of plane surfaces, spur gears and helical gears; use of end mill cutters.
• To determine cutting forces with dynamometer for turning, drilling and milling operations

TEXT/REFERENCE BOOKS:

S. No.	BOOK TITLE/AUTHORS/PUBLICATION
1	M.S. Matharu, Sukhpal Singh, H.N. Gupta, Manufacturing Practices Laboratory Manual For Engineering Courses, Abhishek Publications

COURSE OUTCOMES:

S.NO	DESCRIPTION	Bloom's Level (B.L)
1	**Identify** various process parameters and their effect on processes	1
2	**Conduct** various tests and to determine major characteristics of moulding sand.	3
3	**Perform** thread cutting operation as per the diagrams and compare with standard thread gauges.	3
4	**Prepare** various jobs using TIG/MIG welding.	6
5	**Create** various job using different machining process i.e. Lathe Machine, Milling Machine.	6
6	**Calculate** the material removal rate of different manufacturing process.	4

PROGRAME SPECIFIC OUTCOMES:

S.NO	DESCRIPTION
PSO1	Graduates of Mechanical Engineering will be engineering professionals and innovators in core engineering, service industries or pursue higher studies
PSO2	Graduates of Mechanical Engineering will be team players who are equipped to provide sustainable solutions for complex interdisciplinary problems using modern tools.
PSO3	Graduates of Mechanical Engineering will be able to engage in professional activities ethically and thereby enhance the knowledge and contribution towards the society through lifelong learning.

CO MAPPING WITH PO-PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	3	-	-	-	-	-	2	2	-	-	-	1	1	1
CO2	2	2	-	-	-	-	-	2	2	-	-	-	1	-	-
CO3	1	1	-	-	-	-	-	1	1	-	-	-	1	-	-
CO4	2	2	2	2	1	-	-	2	2	-	-	-	1	-	-
CO5	2	2	2	2	2	-	-	2	2	-	-	-	1	2	-
CO6	1	2	-	1	-	-	-	2	2	-	-	-	1	-	1

NUMERICAL METHOD LAB

PROGRAMME: ENGINEERING	**DEGREE: BTECH (MECHANICAL ENGINEERING)**
COURSE: NUMERICAL METHOD LAB	**SEMESTER: 5th CREDITS: 1.5**
COURSE CODE: BTME507-18 **REGULATION: 2018**	**COURSE TYPE: CORE PRACTICAL**
COURSE AREA/DOMAIN: MATHEMATICS	**CONTACT HOURS: 3(P) hours/Week.**
CORRESPONDING THEORY COURSE CODE : NA	**THEORY COURSE NAME : NA**

SYLLABUS:

1.Make a program of bisection method for solving algebraic/transcendental equations and implement it on some problems.
2. Develop a program of Newton-Raphson's method for solving algebraic/transcendental equations and implement it on some problems.
3. Develop and implement a program of Method of False Position for solving algebraic/transcendental equations.
4. Develop and implement a program of Gauss-elimination method for solving a system of linear equations.
5.Develop and implement a program of trapezoidal rule to approximate a definite integral.
6. Develop and implement a program of Simpson's rule to approximate a definite integral.
7.Develop and implement a program of Euler's method for solving initial value problems of ordinary differential equations.
8.Develop and implement a program of fourth order Runge-Kutta method for solving initial value problems of ordinary differential equations.
9.Develop and implement a program of two-step Adams-Bashforth method for solving initial value problems of ordinary differential equations.
10 Develop and implement a program of two-step Adams-Moulton method for solving initial value problems of ordinary differential equations

TEXT/REFERENCE BOOKS: NA

S. No.	BOOK TITLE/AUTHORS/PUBLICATION
1	

COURSE OUTCOMES:

S.NO	DESCRIPTION	Bloom's Level (B.L)
1	Understand different implementation modes of numerical methods.	2
2	Use the numerical methods with the understanding of limitations of these methods for solving problems.	2
3	Solve problems more accurately and efficiently in low computational time.	3
4	Handle the problems conveniently which are difficult to deal with manually.	3
5	Solve Partial Differential Equations, its formation and solutions for multi-variable differential equations originated from real world problems	3
6	Develop and implement their own computer programs.	6

PROGRAME SPECIFIC OUTCOMES:

S.NO	DESCRIPTION
PSO1	Graduates of Mechanical Engineering will be engineering professionals and innovators in core engineering, service industries or pursue higher studies
PSO2	Graduates of Mechanical Engineering will be team players who are equipped to provide sustainable solutions for complex interdisciplinary problems using modern tools.
PSO3	Graduates of Mechanical Engineering will be able to engage in professional activities ethically and thereby enhance the knowledge and contribution towards the society through lifelong learning.

CO MAPPING WITH PO-PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2		2	2		3					2	2			
CO2	2						2		2	2	2	2		2	1
CO3	2	3		2	2		2	2	2	3		2	2		
CO4			3		3	3	2		2		2	2			
CO5				3	2		2		2	2	2	2	2		1
CO6	2		2							2		2		2	

REFRIGERATION AND AIR CONDITIONING

COURSE INFORMATION SHEET

PROGRAMME: ENGINEERING	**DEGREE: B.TECH**
COURSE: REFRIGERATION AND AIR CONDITIONING	**SEMESTER: 6 CREDITS: 4**
COURSECODE:BTME601-18 **REGULATION:2018**	**COURSE TYPE: CORE**
COURSE AREA/DOMAIN: REFRIGERATION AND AIR CONDITIONING	**CONTACT HOURS: 3(L) 1 (T) 2 (P) hours/Week.**
CORRESPONDING LAB COURSE CODE : BTME-605-18	**LAB COURSE NAME: REFRIGERATION AND AIR CONDITIONING**

SYLLABUS:

UNIT	DETAILS	HOURS
I	**Basic Concept of Refrigeration System** : Classification of refrigeration systems, Refrigeration effect, cooling capacity, heating effect, heating capacity; Units of refrigeration; Coefficient of performance and Energy Performance Ratio; Single Phase Reversed Carnot cycle and its limitations; Two Phase Reversed Carnot cycle and its limitations.	04
II	**Vapour Compression Refrigeration Systems :** . Vapour Compression Refrigeration Cycles Modifications of reversed Carnot cycle with vapour as a refrigerant, Vapour compression refrigeration cycle & system; Representation of this cycle on P-V, T-S and P-H diagrams and its analysis using T-S and P-h diagrams and Refrigeration Tables for sub cooled, saturated and superheated refrigerant, volumetric efficiency of compressor; Effect on performance of VCRS due to change in evaporator pressure, condenser pressure, sub cooling of liquid refrigerant, super heating of suction vapours; Actual vapour compression refrigeration cycle on T-sand P-h diagrams (no mathematical analysis); Numerical problems. Compound compression with single evaporator, Multi evaporators with single compressor, along with schematic representation of these systems with use of flash chamber, water intercooler, flash intercooler, with individual and multiple expansion valves arrangements. (Without numerical problems).	08
III	**Refrigerants Classification** : Refrigerants Classification and nomenclature of refrigerants; Desirable thermodynamic, chemical and physical properties of refrigerants; comparative study of commonly used refrigerants and their fields of application; Azeotropes; Zeotropes; Effect of moisture and oil miscibility; Antifreeze solution; Leak detection and charging of refrigerants; Environmental aspects of conventional refrigerants; Eco-friendly refrigerants and action plan to reduce ecological hazards	09
IV	Vapour Compression Refrigeration System Components Classifications and working of Compressors, Condensers, Expansion devices and Evaporators. Performance characteristics of the condensing unit, Performance characteristics of the compressor- capillary tube.	06

V	Vapour Absorption Refrigeration Cycle Principle of vapour absorption refrigeration; basic components of the vapour absorption refrigeration system; Desirable properties of absorption system refrigerant and absorbent; Aqua - ammonia vapour absorption refrigeration system; Lithium Bromide - water absorption system; Electrolux refrigeration system; comparison between vapour absorption and compression systems (no mathematical analysis).	**04**
VI	Psychrometry Dry Air; Moist Air; Basic laws obeyed by Dry Air and Moist Air; Psychometric properties of air: Dry bulb, wet bulb and dew point temperatures, Relative and specific humidity, degree of saturation adiabatic saturation temperature, enthalpy of air and water vapours; Psychometric chart and its use; Numerical problems. Human requirement of comforts; effective temperature and comfort charts; Industrial and comfort air conditioning.	**05**
VII	Psychometric Processes Basic psychometric processes; Adiabatic mixing of two air streams Sensible heating; Sensible cooling; cooling with dehumidification; cooling with humidification; Heating with dehumidification; Heating with humidification; By-pass factor; Contact factor; Sensible heat factor; Room sensible heat factor; Grand sensible heat factor	**05**
VIII	Air conditioning Load Calculations Sources of heat load; sensible and latent heat load; Cooling and heating load estimation; Apparatus dew point temperature; Rate and state of supply air for air conditioning of different types of premises	**04**

TEXT/REFERENCE BOOKS:

S.NO	BOOK TITLE/AUTHORS/PUBLICATION
1	C.P. Arora, Refrigeration and Conditioning, Tata McGraw Hill
2	Manohar Prasad, Refrigeration and Conditioning, Wiley Eastern Limited
3	Jordan and Priester, Refrigeration and Conditioning, Prentice Hall of India
4	W.F. Stoecker, Refrigeration and Conditioning, McGraw Hill

T/R	BOOK TITLE SUGGESTED BY FACULTY
1	Refresher On Refrigeration And Air Conditioning by Harkamal Preet Singh 1) snoitacilbuP sdroL (2019 yraunaJ

DELIVERY/INSTRUCTIONAL METHODOLOGIES/ TEACHING PEDAGOGY:
Chalk & Talk
Small Group Instruction.
Making real world connections
Presentations

E- content used:
https://youtu.be/l-zpLE6-tXU

Additional topics:

Introduction to Advance applications of Refrigeration and Air Conditioning in different fields.

COURSE OBJECTIVES:

To provide knowledge about application of conduction, convection and radiation h concepts to different practical applications

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEM
BTME 601-18	**B.Tech.**	**Introduction to Refrigeration and Air Conditioning**	**1 & 2**

COURSE OUTCOMES:

S.NO	DESCRIPTION	Bloom's Level (B.L)
CO1	Explain the properties, applications and environmental issues of different refrigerants	2
CO2	Demonstrate an ability to analysis psychrometric processes and cycles of air conditioning systems	2
CO3	Illustrate the fundamental principles and applications of refrigeration and air conditioning system	3
CO4	Calculate the energy requirements of cooling and heat equipment for air conditioning applications	4
CO5	Learn about refrigerants, their properties and evaluate the COP of VCR and VAR systems	5
CO6	Obtain cooling capacity and coefficient of performance by conducting test on refrigeration systems	6

CO MAPPING WITH PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1						3					2	2			
CO2							2		2	2	2	2		2	1
CO3	2	3		2	2		2	2	2	3		2	2		
CO4			3		3	3	2		2		2	2			
CO5				3	2		2		2	2	2	2	2		1
CO6	2		2							2		2		2	

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MECHANICAL MEASUREMENTS & METROLOGY

COURSE INFORMATION SHEET

PROGRAMME: ENGINEERING	**DEGREE: BTECH**
COURSE: MECHANICAL MEASUREMENTS & METROLOGY	**SEMESTER: 4 CREDITS: 4**
COURSECODE: BTME602-18 REGULATION:2018	**COURSE TYPE: CORE**
COURSE AREA/DOMAIN: MECHANICAL MEASUREMENTS & METROLOGY	**CONTACT HOURS: 4(L) + 0(T) + 0(P) hours/Week.**
CORRESPONDING LAB COURSE CODE : BTME606-18	**LAB COURSE NAME: MECHANICAL MEASUREMENTS &METROLOGY**

SYLLABUS:

UNIT	DETAILS	HOURS
I	**Mechanical measurement systems:** Need of mechanical measurement, basic and auxiliary functional elements of a measurement system Basic definitions: Hysteresis, Sensitivity, Linearity, Resolution, Threshold, Drift, Zero stability, loading effect and system response. Dead Time and dead zone, Measurement methods, Generalized Measurement system, Static performance characteristics, Errors and their classification.	4
II	**Sensors and transducers:** Introduction to sensors and transducers, types of sensors, review of electro-mechanical sensors and transducers - variable resistance, inductance and capacitive pickups, photo cells and piezoelectric transducers, Introduction to signal processing and conditioning.	5
III	**Linear and angular measurements:** Vernier calliper, Micrometer, Interval measurements: Slip gauges, Checking of slip gauges for surface quality, Optical flat, Limit gauges.	4
IV	**Measurement of force, torque and strain:** Load cells, cantilever beams, proving rings, differential transformers.Torsion bar dynamometer, Servo controlled dynamometer, Absorption dynamometers. Power Measurements. Mechanical strain gauges, Electrical strain gauges, strain gauge material, gauge factors, theory of strain gauges, bridge arrangement, temperature compensation.	6
V	**Displacement, velocity/speed and acceleration measurement:** Working principal of Resistive Potentiometer, Linear variable differential transducers (LVDT), Electro- Magnetic Transducers, Mechanical, Electrical and Photoelectric Tachometers, Piezoelectric Accelerometer, Seismic Accelerometer,	5
VI	**Temperature measurement:** Thermocouples, Resistance Temperature Detectors, Thermistor, Liquid in glass Thermometers, Pressure Thermometers, Pyrometer, Bimetallic strip. Calibration of temperature measuring devices.	5
VII	**Metrology:** Basics of Metrology, Line end and wavelength standards, Need for Inspection, Accuracy and Precision, Objectives, Standards of measurements.	2
VIII	**Metrologyofgearsandscrewthreads:** Sources of errors in manufacturing of gears, Measurement of tooth thickness: Gear	6

	tooth Vernier, Constant chord method, Addendum comparator method and Base tangent method, Measurement of tooth profile: Tool maker's microscope or projector, Involute tester, Measurement of pitch, Measurement of run out, Lead and Backlash checking. Measurement of concentricity, Alignment of gears.Errors in threads, screw thread gauges, measurement of element of the external and internal threads, thread calliper gauges.	
IX	**Metrology of surface finish:** Concepts and terminology, Analysis of surface traces, Specification of surface Texture characteristics, Method of measuring surface finish: Stylus system of measurement, Stylus probe instruments, Wave length, frequency and cut off, other methods for measuring surface roughness: Light Interference microscopes, Mecrin Instruments	**6**
X	**Comparators:** Functional Requirements, Classification, Mechanical Comparators, Mechanical Optical Comparators, Electrical Comparators, Pneumatic Comparators.	**4**
XI	**Miscellaneous metrology:** Precision Instrumentation based on Laser Principals, Coordinate measuring machines: Structure, Modes of Operation, Probe, Operation and applications. Optical Measuring Techniques: Tool Maker's Microscope, Profile Projector, Optical Square. Basics of Optical Interference and Interferometry, Optoelectronic measurements,	**4**

TEXT/REFERENCE BOOKS:

S.NO.	BOOK TITLE/AUTHORS/PUBLICATION
1	E.O Doebelin, Measurement System: Application and Design, McGraw Hill
2	J.P Holman, Experimental Methods for Engineers, McGraw Hill
3	D.S Kumar, Mechanical Measurement and Control, Metropolitan Book Co.
4	R.K Jain, Engineering Metrology, Khanna Publishers
5	B.C Kuo, Automatic Control systems, Prentice Hall

T/R	BOOK TITLE SUGGESTED BY FACULTY
1	Bentley, Engineering Metrology and Measurements, Pearson Education
2	Er. R K Rajput, Mechanical Measurements and Instrumentations, Kataria Publication(KATSON)

DELIVERY/INSTRUCTIONAL METHODOLOGIES/ TEACHING PEDAGOGY:
Chalk & Talk
Small Group Instruction.
Making real world connections
Presentations

E- content used:
https://www.youtube.com/watch?v=1KHEfi7aZDc&list=PLQmc-I2-FO2HCB1hEYe5WUW2RQUmfy8C2

Additional topics:
Flow measurement and types of flow measuring instruments.

COURSE OBJECTIVES:

The aim and objective of the course on Mechanical Measurements & Metrologyis to introduce the students of B. Tech. class to the formal structure of Mechanical Measurements & Metrologyso that they can use these in Engineering as per their requirement.

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION
BTME602-18	**Higher secondary Education**	**Introduction to basic terms related to measurement**

COURSE OUTCOMES:

S.NO.	DESCRIPTION	Bloom's Level (B.L)
1	Describe various industrial metrological instruments for measuring linear, angular, screw thread and gear profiles.	1
2	Apply the fundamental principles for measurement of various mechanical quantities like Force/torque etc.	3
3	Apply pressure, temperature and to flow of engineering materials.	3
4	Develop an ability of problem solving and decision making by identifying and analyzing the cause for variation and recommend suitable corrective actions for quality measurements.	2
5	Interpret characteristics of measuring instruments.	4
6	Analyze humidity, viscosity and density of mechanical quantities	4

CO MAPPING WITH PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2		2	2		2					2	2			
CO2	2					2	2		2	2	2	2		2	
CO3	2	3		2	2		2	2	2	3		2	2		2
CO4			3		3	2	2		2		2	2			2
CO5				3	2	2	2		2	2	2	2	2		
CO6	2		2							2		2		2	

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AUTOMOBILE ENGINEERING

COURSE INFORMATION SHEET

PROGRAMME: ENGINEERING	**DEGREE: B.TECH**
COURSE: AUTOMOBILE ENGINEERING	**SEMESTER: 6 CREDITS: 3**
COURSECODE:BTME603-18 **REGULATION:2018**	**COURSE TYPE: CORE**
COURSE AREA/DOMAIN: AUTOMOBILE ENGINEERING	**CONTACT HOURS: 3(L) 2 (P) hours/Week.**
CORRESPONDING LAB COURSE CODE : BTME-607-18	**LAB COURSE NAME: AUTOMOBILE ENGINEERING**

SYLLABUS:

UNIT	DETAILS	HOURS
I	**Introduction:** Basic structure, general layout and type of automotive vehicles, Frameless and unitary construction; position of power unit	04
II	**Power Unit:** Power requirements - motion resistance and power loss, tractive effort and vehicle performance curves; selection of power unit and engine performance characteristics; pollution due to vehicle emission and exhaust emission control system., turbo chargers (WGT, VGT), engine emission control by 3-way catalytic converter system, Emission norms (Euro & BS).	08
III	**Fuel Supply System:** Air cleaner and fuel pumps; Air fuel requirements and carburation; constructional details of fuel injection systems (MPFI) used in Indian make vehicles. Diesel fuel system (IDI, DI & CRDI) - cleaning, injection pump, injector and nozzles. Introduction to Gasoline Direct Injection and duel fuel supply systems	09
IV	**Lubrication and Cooling Systems**: Necessity of lubrication; Desirable properties of lubricants; various types of lubricants and oil additives; different systems of lubrication - oil filters, oil pumps and oil pressure indicator; crank case ventilation and dilution. Purpose of cooling, air and water cooling systems; radiator, thermostat, pump and fan.	08
V	**Chassis and Suspension:** Loads on the frame, considerations of strength and stiffness, engine mounting, conventional and independent suspension systems; adaptive suspension systems; shock absorbs and stablizers; wheels and tyres	04
VI	**Transmission system:** Basic requirements and components of transmission systems; constructional features of automobile clutch, gear boxes & types, differential, front and rear axles; overdrives, propeller shaft, universal joint and torque tube drive; Rear wheel vs front wheel drive, principle of automatic transmission. Types of automatic transmissions (Torque convertor AT, AMT, CVT, DCT/DSG). Traction control system	06
VII	**Steering System**: Requirement and steering geometry; castor action, camber and king pin angle, toe-in of front wheels, steering linkages and steering gears; wheel balancing & alignment; power steering (electrical and hydraulic).	05
VIII	**Braking System**: General braking requirements; Weight transfer during braking and stopping distances; Mechanical, hydraulic, vacuum power and servo brakes; Adaptive cruise control and braking system	04

IX	**Electric System**: Conventional (coil and magneto) and transistorized ignition systems; Charging, capacity ratings and battery testing; starter motor and drive arrangements: voltage and current regulation	**04**
X	**Vehicle safety systems**: Active and passive safety systems in an automobile. Air bags, collapsible steering system, seat belts, side impact rods, crumple zones etc. ABS & EBD, ESP, diver alert system	**05**
XI	**Alternative Energy Sources** : Concept and types of electric & Hybrid Vehicles . Fuel cell technology, Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles- Engine modifications required –Performance,	**06**

TEXT/REFERENCE BOOKS:

S.NO	BOOK TITLE/AUTHORS/PUBLICATION
1	W.H Crouse, Automotive mechanics, McGraw Hill
2	J. Heitner, Automotive Mechanics, East West Press
3	Kirpal Singh, Automobile Engineering Vol. I and II, Standard Publishers
4	J. Webster, Auto Mechanics, Glencoe Publishing Co.

T/R	BOOK TITLE SUGGESTED BY FACULTY
1	P.S Gill, Automobile Engineering, S.K Kataria

DELIVERY/INSTRUCTIONAL METHODOLOGIES/ TEACHING PEDAGOGY:
Chalk & Talk
Small Group Instruction.
Making real world connections
Presentations

E- content used:

Additional topics:
Introduction to Advance applications of Automobile Engineering in different fields.

COURSE OBJECTIVES : To understand the construction and working principle of various parts of an automobile. To have the practice for assembling and dismantling of engine parts and transmission system

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEM
BTME 603-18	**B.Tech.**	**Introduction to Automobile Engineering**	**1 & 2**

COURSE OUTCOMES :

S.NO	DESCRIPTION	Bloom's Level (B.L)
CO1	Ability to understanding vehicle safety systems and future developments in the automobile industry.	1
CO2	Identify the different parts of the automobile.	2
CO3	Ability to demonstrate the working of various parts of engine and transmission.	3
CO4	Explain the working of various parts of clutch and brakes.	4
CO5	Explain the working of various parts of steering.	4
CO6	Explain the working of various parts of suspension systems.	4

CO MAPPING WITH PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1					1		1			1		1	2	2	
CO2					1		1			1		1	1	2	2
CO3	2	2	2		1		1		2	1		1	0	1	2
CO4	2	2	2		1		1		2	1		1	2	0	2
CO5	2	2	2		1		1		2	1		1	2	1	
CO6					1		1			1		1	2	1	

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INTRODUCTION TO INDUSTRIAL MANAGEMENT

COURSE INFORMATION SHEET

PROGRAMME: ENGINEERING	**DEGREE: B.TECH**
COURSE: INTRODUCTION TO INDUSTRIAL MANAGEMENT	**SEMESTER: 6 CREDITS: 3**
COURSECODE:BTME604-18 **REGULATION:2018**	**COURSE TYPE: CORE**
COURSE AREA/DOMAIN:	**CONTACT HOURS: 3(L) 1(T) hours/Week.**
CORRESPONDING LAB COURSE CODE : NA	**LAB COURSE NAME: NA**

SYLLABUS:

UNIT	DETAILS	HOURS
I	Concept of industrial engineering, Roles of industrial engineer, Tools of management science, Introduction to quality, Excellence in manufacturing, Excellence in service, factors of excellence, relevance of total quality management.	**04**
II	Concept of production, Production system, Input output model, definition of quality, Total quality ontrol and Total Quality Management, salient features of total quality control and total quality management, benefits of total quality management	**07**
III	Introduction to product design, Effect of design on cost, Requirements of a good product design, Factors affect product design, Product life cycle, Need and concept of product planning, Concept of product development. Introduction of industrial cost, Elements of cost, Breakeven analysis.	**08**
IV	Materials management, Purchasing, Objectives of purchasing, Activities, duties and functions of purchasing department, Purchase organizations, Buying techniques, Purchasing procedure.	**08**
V	Concept of plant maintenance, Objectives and importance of plant maintenance, Duties, functions and responsibilities of plant maintenance department, Organization of maintenance, Scheduled, preventive and predictive maintenance.	**04**
VI	Inventory, Inventory control, Objectives of inventory control, ABC analysis, Just-in-time (JIT), Definition: Elements, benefits, equipment layout for JIT system, Waste elimination, workers involvement through JIT: JIT cause and effect chain, JIT implementation.	**06**
VII	Benchmarking: Meaning of benchmarking and its concept, Definition of benchmarking, Benefits of bench marking, process and types of benchmarking.	**05**
VIII	Customer: Types of customers, Customer satisfaction, Role of marketing, Data collection, Customer complaints, Redressal mechanism.	**04**

TEXT/REFERENCE BOOKS:

S.NO	BOOK TITLE/AUTHORS/PUBLICATION
1	Industrial Engineering and Management/ O. P. Khanna/ Dhanpat Rai and Sons
2	General and Industrial Management/ H Fayol/ Pitman
3	Industrial Management/ I. K. Chopde and A. M. Sheikh/ S. Chand
4	Total Quality Management/ Jeol E. Ross/ Taylor and Francis Limited.

T/R	BOOK TITLE SUGGESTED BY FACULTY
1	A Text Book of Industrial Management/ A. P. Verma and N. Mohan/ Katson

DELIVERY/INSTRUCTIONAL METHODOLOGIES/ TEACHING PEDAGOGY:

Chalk & Talk
Small Group Instruction.
Making real world connections
Presentations

E- content used:

Additional topics:

COURSE OBJECTIVES :

To help the students gain understanding of the functions and responsibilities of industrial managements.
To enable them to analyze and understand the environment of the organization.
To help the students to develop cognizance of the importance of management principles.
To provide them tools and techniques to be used in the performance of the managerial job.

COURSE PRE-REQUISITES: NA

C.CODE	COURSE NAME	DESCRIPTION	SEM

COURSE OUTCOMES :

S.NO	DESCRIPTION	Bloom's Level (B.L)
CO1	Understand the complexities associated with management in the organizations and integrate the learning in handling these complexities.	2
CO2	Demonstrate the roles, skills and functions of management.	2
CO3	Understand the concepts related to industrial management	2
CO4	Understand factual and Procedural knowledge of X & R chart and Process capability.	2
CO5	Understand the conceptual knowledge of quality, quality assurance and management	2
CO6	Learn to use sampling & the Errors in Making Inferences from Control Charts.	5

CO MAPPING WITH PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	1	1			1		1			1		1	2	2	
CO2					1		1			1		1	1	2	3
CO3	2	2	2		1		1		2	1		1	0	1	2
CO4	2	2	2		1		1		2	1		1	2	0	3
CO5	2	2	2		1		1		2	1		1	2	1	2
CO6	1				1		1			1		1	2	1	2

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NON CONVENTIONAL ENERGY RESOURCES
COURSE INFORMATION SHEET

PROGRAMME: ENGINEERING	**DEGREE: B.TECH**
COURSE: NON CONVENTIONAL ENERGY RESOURCES	**SEMESTER: 6 CREDITS: 3**
COURSECODE:BTME615-18 **REGULATION:2018**	**COURSE TYPE: CORE**
COURSE AREA/DOMAIN: NON CONVENTIONAL ENERGY	**CONTACT HOURS: 3(L) hours/Week.**
CORRESPONDING LAB COURSE CODE : NA	**LAB COURSE NAME: NA**

SYLLABUS:

UNIT	DETAILS	HOURS
I	An introduction to energy sources, Environmental Aspects of Power Generation. Heat Transfer from Solar Energy, Physical principles of conversion of solar radiation into heat utilization, Flat Plate Collectors (FPC), Thermal losses and efficiency of FPC, Practical considerations for flat plate collectors, Applications of FPC – Water heating and drying, Focusing Type Collectors: orientation and sun tracking systems, Types of concentrating collectors – cylindrical parabolic collector, compound parabolic collector, Thermal performance of focusing collectors.	**8**
II	Solar energy storage system, Application of solar energy: solar water heating, space heating and cooling,solar photovoltaic, solar cooking, solar distillation & desalination , Solar industrial process heating, Solar power generation. Solar Green Houses, Solar thermo mechanical power, solar refrigeration & air conditioning, Solar ponds.	**8**
III	Energy from Biomass: Type of biomass sources, Energy plantation, Methods for obtaining energy from biomass, Biomass conversion technologies-wet and dry processes, Biodigestion, Community/Industrial biogas plants, Factors affecting biodigestion, Design of a biogas plant, Classification, advantages and disadvantages of biogas plants, Problems related to biogas plants, Utilization of biogas. Thermal gasification of biomass, Gasifier- classification, chemistry, advantages, disadvantages and application. Alcohol fuels from biomass: overview, feedstock, methods for alcohol production, Ethanol as an alternative liquid fuel; engine performance with alcohol fuels, biodiesel from biomass.	**9**
IV	Wind Energy: Basic principles of wind energy conversion: power in the wind, maximum power, forces on the blades, lift and drag, Components of wind energy conversion systems (WEC), Classification, advantages and disadvantages of WEC systems, Types of wind machines, Performance of wind machines, Design considerations, Energy storage, Application of wind energy, Environmental aspect. Tidal Energy. Components of tidal power plants, Single and double basin arrangements, Estimation of energy and power, Advantages and limitations of tidal power. Wave energy- its advantages and disadvantages, energy and power from wave energy.	**8**

V	Chemical Energy Sources: Fuel cells: Design, principle, classification, types, advantages and disadvantages, Work output and EMF of fuel cells, Application of fuel cells, Hydrogen energy, Properties of hydrogen, Methods of hydrogen production, Storage and transportation of hydrogen, Advantages and application.	**7**

TEXT/REFERENCE BOOKS:

S.NO	BOOK TITLE/AUTHORS/PUBLICATION
1	John A Duffie & William A Beckman, 'Solar Energy Thermal processes', Wiley Interscience Publication
2	Garg & J Prakash,' Solar Energy - Fundamentals and Applications', Wiley Interscience publication. 3.Jay Cheng, 'Biomass to Renewable Energy Processes', 1st Edition, CRC press, 2009.

T/R	BOOK TITLE SUGGESTED BY FACULTY
1	G D Rai, 'Non-Conventional Energy Sources', Khanna Publishers. Delhi, 2010
2	S P Sukhatme, 'Solar Energy-Principles of Thermal Collection & Storage', Tata McGraw Hill Publishing Company Ltd., New Delhi

DELIVERY/INSTRUCTIONAL METHODOLOGIES/ TEACHING PEDAGOGY:
Chalk & Talk
Small Group Instruction.
Making real world connections
Presentations

E- content used:

Additional topics:

COURSE OBJECTIVES :
Address smart energy and green infrastructure
Build models that simulate sustainable and renewable green technology systems
Understand the history, global, environmental and economical impacts of green technology
Address non renewable energy challenges

COURSE PRE-REQUISITES: NA

C.CODE	COURSE NAME	DESCRIPTION	SEM

COURSE OUTCOMES:

S.NO	DESCRIPTION	Bloom's Level (B.L)
CO1	Understand the history, global, environmental and economical impacts of green technology	2
CO2	Demonstrate the generation of electricity from various Non-Conventional sources of energy, have a working knowledge on types of fuel cells.	2
CO3	Illustrate ocean energy and explain the operational methods of their utilization.	3
CO4	Explore the concepts involved in wind energy conversion system by studying its components, types and performance.	4
CO5	Acquire the knowledge on Geothermal energy.	4
CO6	Estimate the solar energy, Utilization of it, Principles involved in solar energy collection and conversion of it to electricity generation.	5

CO MAPPING WITH PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	2		2	2		3					2	2			1
CO2	2						2		2	2	2	2		2	1
CO3	2	3		2	2		2	2	2	3		2	2		
CO4			3		3	3	2		2		2	2			
CO5				3	2		2		2	2	2	2	2		1
CO6	2		2							2		2		2	

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REFRIGERATION AND AIR-CONDITIONING LAB

PROGRAMME: ENGINEERING	**DEGREE: B.TECH**
COURSE: REFRIGERATION AND AIR-CONDITIONING LAB	**SEMESTER: 6 CREDITS: 1**
COURSECODE:BTME605-18 **REGULATION:2018**	**COURSE TYPE: CORE PRACTICAL**
COURSE AREA/DOMAIN: **REFRIGERATION AND AIR CONDITIONING SYSTEM**	**CONTACT HOURS: 2 (P) hours/Week.**
CORRESPONDING THEORY COURSE CODE : BTME- 601-18	**THEORY COURSE NAME: REFRIGERATION AND AIR-CONDITIONING**

SYLLABUS:

List of Practicals
• Demonstration of various elements of a vapour compression refrigeration system through refrigeration trainer
Performance testing of domestic refrigerator using refrigeration testrig.
• Performance testing of Electrolux refrigerator.
• Study of an Ice plant.
• Calculation/ Estimation of cooling load for a large building.
• Visit to a central air conditioning plant for the of study air-conditioning
• Visit to a cold storage for study of its working.
• Performance testing of window type room air conditioner.
• Performance testing of water cooler.

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T	

COURSE OBJECTIVES:

To introduce the students, the basic refrigeration cycles of various refrigeration systems. To impart the students with basic understanding of and air conditioning systems for different climatic seasons. To give the basic understanding of design aspects of RAC components such as evaporators, condensers, capillary tubes, expansion valve etc.

COURSE PRE-REQUISITES:

BTME605-18	**B.Tech.**	**Introduction to Refrigeration and Air Conditioning**	

COURSE OUTCOMES:

S.NO	DESCRIPTION	Bloom's Taxonomy Level
1	Conduct the performance of window type room air conditioner and system	1
2	Understand about the basics and working principle of water cooler.	2
3	Analyze the industrial set up for the working and use of vapour compression refrigeration system in cold storage	4
4	Analyze the humidity measurement and its importance in air-conditioning	4
5	Conduct and analyze the experimental data of performance of Electrolux Refrigerator	4
6	Conduct and analyze the experimental data of performance of vapour compression refrigeration system in domestic refrigerator and water cooler	4

CO MAPPING WITH PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	1	1		1	1					1		1	2	2	3
CO2	1			1	1					1		1	1	2	
CO3	2	2	2	1	1				2	1		1	0	1	3
CO4	2	2	2	1	1				2	1		1	2	0	3
CO5	2	2	2	1	1				2	1		1	2	1	3
CO6	1			1	1					1		1	2	1	2

MECHANICAL MEASUREMENTS & METROLOGY LAB

PROGRAMME: ENGINEERING	**DEGREE: B.TECH**
COURSE: MECHANICAL MEASUREMENTS & METROLOGY LAB	**SEMESTER: 6 CREDITS: 1**
COURSECODE:BTME605-18 REGULATION:2018	**COURSE TYPE: CORE PRACTICAL**
COURSE AREA/DOMAIN:	**CONTACT HOURS: 2 (P) hours/Week.**
CORRESPONDING THEORY COURSE CODE : BTME- 602-18	**THEORY COURSE NAME: MECHANICAL MEASUREMENTS & METROLOGY**

SYLLABUS:

LIST OF PRACTICAL
• Vernier Calliper/ vernier height gauge: Principle of vernier scale to measure internal and external dimensions including depth.
• Micrometerandvernier micrometer: concept,principleanduse
• Sinebarandslipgaugesandanglegauge:principleandapplications
• Surfacetexture:Roughnessofmachinedandun-machinedplaneandsphericalsurfaces.
• Profileprojector:tomeasurescrewandgear elements
• Threewiremethod: Diameter ofexternal V-threads
• Toolmakersmicroscope:tomeasurescrewandgearelements
• Deadweight gauge:calibrationofpressuregauges
• Stroboscope:measurespeedofrotatingelements
• Thermocouple:principle,applicationsandpreparation

COURSE OBJECTIVES:

The aim and objective of the Lab course on Mechanical Measurements & Metrologyis to introduce the students of B.Tech class to the formal structure of Mechanical Measurements & Metrologyso that they can use these in Engineering as per their requirement.

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION
BTME606-18	**Higher secondary Education**	**Mechanical Measurements & Metrology**

COURSE OUTCOMES:

S.NO.	DESCRIPTION	Bloom's Taxonomy	Bloom's Level(B.L)
1	Selecting suitable mechanical measuring instruments for basic and special requirement in the industries.	Remember	1
2	Identify proper measuring instrument and know requirement of calibration, errors in measurement etc	Understand	2
3	Determine error and analysing uncertainty in the measurements.	Understand	2
4	Demonstrate the use of instruments for measuring linear (internal and external), angular dimensions and surface roughness	Apply	3
5	Apply analytical and experimental methods to make measurements and to find and correct defects in measurement systems	Apply	3
6	Calibrating and analyzing the characteristics of measuring instruments.	Analyze	4

CO MAPPING WITH PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2		2	2		3					2	2			3
CO2	2						2		2	2	2	2		2	
CO3	2	3		2	2		2	2	2	3		2	2		3
CO4			3		3	3	2		2		2	2			3
CO5				3	2		2		2	2	2	2	2		3
CO6	2		2							2		2		2	2

AUTOMOBILE ENGINEERING LAB

PROGRAMME: ENGINEERING	**DEGREE: B.TECH**
COURSE: AUTOMOBILE ENGINEERING LAB	**SEMESTER: 6 CREDITS: 1**
COURSECODE:BTME607-18 REGULATION:2018	**COURSE TYPE: CORE PRACTICAL**
COURSE AREA/DOMAIN: AUTOMOBILE	**CONTACT HOURS: 2 (P) hours/Week.**
CORRESPONDING THEORY COURSE CODE : BTME- 603-18	**THEORY COURSE NAME: AUTOMOBILE ENGINEERING**

SYLLABUS:

List of Practicals
1. Valve refacing and valve seat grinding and checking for leakage of valves
2. Trouble shooting in cooling system of an automotive vehicle
3.Trouble shooting in the ignition system, setting of contact breaker points and spark plug gap
4. Demonstration of steering system and measurement of steering geometry angles and their impact on vehicle performance
5. Trouble shooting in braking system with specific reference to master cylinder, brake shoes, overhauling of system and the adjusting of the system and its testing
6. . Fault diagnosis in transmission system including clutches, gear box assembly and differential.
7 Replacing of ring and studying the method of replacing piston after repair.
8. . Dismantling and assembling of diesel and petrol engine
9. Study of cut section model of Petrol and diesel engine.

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION

COURSE OBJECTIVES :

1. Identify Construction, working, preventive maintenance, trouble shooting and diagnosis of various Automobile Systems.
2. Understand importance and features of different systems like axle, differential, brakes, steering, suspension, and balancing etc.
3. Identify Modern technology and safety measures used in Automotive Vehicles

.

COURSE PRE-REQUISITES:

BTME607-18	**B.Tech.**	**Introduction to Automobile Engineering Lab**	

COURSE OUTCOMES:

S.NO	DESCRIPTION	Bloom's Taxonomy Level
1	Identify Construction, working, preventive maintenance, trouble shooting and diagnosis of various Automobile Systems	2
2	Understand importance and features of axle and differential	2
3	Ability to distinguish modern technology and safety measures used in Automotive Vehicles	3
4	Ability to examine different features of brakes and steering	4
5	Ability to examine different features of suspension	4
6	Ability to develop balanced structure for automobile applications	6

CO MAPPING WITH PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1						3					2	2			1
CO2							2		2	2	2	2		2	1
CO3	2	3		2	2		2	2	2	3		2	2		
CO4			3		3	3	2		2		2	2			
CO5				3	2		2		2	2	2	2	2		1
CO6	2		2							2		2		2	

Prepared by

Approved By

HOD

MECHANICAL VIBRATIONS

COURSE INFORMATION SHEET

PROGRAMME: ENGINEERING	**DEGREE: B.TECH**
COURSE: MECHANICAL VIBRATIONS	**SEMESTER: 7 CREDITS: 3**
COURSECODE:BTME701-18 **REGULATION:2018**	**COURSE TYPE: CORE**
COURSE AREA/DOMAIN:STUDY OF VIBRATIONS IN MECHANICAL INSTRUMENTS AND MACHINES.	**CONTACT HOURS: 3 (L) + 1(T) hours/Week.**
CORRESPONDING LAB COURSE CODE : NA	**LAB COURSE NAME: NA**

SYLLABUS:

UNIT	DETAILS	HOURS
I	Introduction, Classification of Vibration Systems, Harmonic motion, Vector representation of harmonic motion, Natural frequency & response, Effects of vibration, superposition of simple harmonic motions, beats, Fourier analysis-analytical and numerical methods. Single Degree Freedom System, Equation of motion, Newton's method, D'Alembert's principle, Energy method etc., Free vibration, Natural frequency, Equivalent systems, Displacement, Velocity and acceleration, Response to an initial disturbance, Torsional vibrations, Damped vibrations, Vibrations of systems with viscous damping, Logarithmic decrement, Energy dissipation in viscous damping.	**10**
II	Single Degree Freedom: Forced Vibration Forced vibration, Harmonic excitation with viscous damping, steady state vibrations, forced vibrations with rotating and reciprocating unbalance, support excitation, Vibration isolation, Transmissibility, Vibration measuring instruments, Displacement, velocity and acceleration measuring instruments.	**8**
III	Two Degree Freedom systems Introduction, Principal modes, Double pendulum, Torsional system with damping, Coupled system, Principle of vibration absorber, Undamped dynamic vibration absorbers, Torsional vibration absorber, Centrifugal pendulum absorbers, Vibration isolators and Dampers.	**8**
IV	Multi-degree Freedom system: Exact Analysis, Undamped free and forced vibrations of multidegree freedom systems, influence coefficients, Reciprocal theorem, Torsional vibration of multi-degree rotor system, Vibration of gear system, Principal coordinates, Continuous systems- Longitudinal vibrations of bars, Torsional vibrations of circular shafts.	**8**
V	Multi Degree Freedom system: Numerical Analysis by Rayleigh's method, Dunkerely's, Holzer's and Stodola methods, Rayleigh-Ritz method 5 Critical speed of shafts, Whirling of uniform shaft, Shaft with one disc with and without damping, Multi-disc shafts, Secondary critical speed.	**8**

TEXT/REFERENCE BOOKS:

S.NO	BOOK TITLE/AUTHORS/PUBLICATION
1	Mechanical Vibrations – G. K. Groover, Jain Brothers, Roorkee.
2	Mechanical Vibrations-Theory & Practice, S Bhave, Pearson Education.
3	Mechanical Vibrations-N K Grover, PBS Publications.
4	Theory of Vibrations with Applications, Thomson & Dahleh, Pearson Education.

T/R	BOOK TITLE SUGGESTED BY FACULTY
R	Elements of Vibration Analysis, L Meirovitch, McGraw-Hill Education.
T	Mechanical Vibrations – V. Rama Murthy, Narosa Publications
R	Mechanical Vibrations – Tse, Morse & Hinkle

DELIVERY/INSTRUCTIONAL METHODOLOGIES/ TEACHING PEDAGOGY:
Chalk & Talk
Small Group Instruction.
Making real world connections
Presentatons

E- content used:

SWAYAM & NPTEL
Additional topics:

COURSE OBJECTIVES:

This course is designed to introduce basic concepts of mechanical vibration to the students, to understand method to measure of vibration in mechanical system with real time problems and to make understanding the applications of mechanical vibration analysis for different types of systems.

COURSE PRE-REQUISITES: NA

COURSE OUTCOMES:

S.NO	DESCRIPTION	Bloom's Level (B.L)
CO1	Understand the need and measurement of vibration in mechanical systems	2
CO2	Ability to determine vibratory responses of SDOF and MDOF systems	2
CO3	Calculate principal modes of vibration	4
CO4	Explore the suitable methods of vibration reduction and absorption	4
CO5	Formulate mathematical models of problems in vibrations using Newton's second law or energy principles	6
CO6	Create the mathematical model of a vibratory system to determine its response	6

CO MAPPING WITH PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3			2								2			2
CO2									2	2		2		2	2
CO3	3	3		2	2			2	2	3		2	2		
CO4					3				2			2			
CO5				3	2					2	2	2	2		2
CO6			2							2		2		2	

AUTOMATION IN MANUFACTURING

COURSE INFORMATION SHEET

PROGRAMME: ENGINEERING	**DEGREE: B.TECH**
COURSE: AUTOMATION IN MANUFACTURING	**SEMESTER: 7 CREDITS: 3**
COURSECODE:BTME702-18 **REGULATION:2018**	**COURSE TYPE: CORE**
COURSE AREA/DOMAIN: AUTOMATION IN MANUFACTURING	**CONTACT HOURS: 3 (L) hours/Week.**
CORRESPONDING LAB COURSE CODE	**LAB COURSE NAME:**

SYLLABUS:

UNIT	DETAILS	HOURS
I	**Introduction:** Importance of automation in the manufacturing industry. Use of mechatronics. Systems required. Rigid and Flexible automation, Computer control of Machine Tools and Machining Centers.	**6**
II	**Design of an automated system** : Building blocks of an automated system, working principle and examples, Fabrication or selection of various components of an automated system. Specifications of various elements. Use of design data books and catalogues. .	**8**
III	**Data Acquisition :** Study of various sensors required in a typical automated system for manufacturing. Construction and principle of operation of sensors, signal conditioning and data acquisition, use of microprocessor or micro controllers. Configurations. Working.	**8**
IV	**Drives** : Electrical drives – types, selection criteria, construction and operating principle.	**5**
V	**Automation Mechanisms:** Ball screws, linear motion bearings, cams, systems controlled by camshafts. Electronic cams, indexing mechanisms, tool magazines, and transfer systems.	**6**

VI	**Hydraulic and Pneumatic systems :** Hydraulic power pack, pumps, valves, designing of hydraulic circuits, configurations, compressors, valves, distribution and conditioning.	**6**
VII	**CNC technology :** NC and NC part programming, CNC-Adaptive Control, Automated Material handling. Assembly, basic elements, interpolators and programming.	**5**

TEXT/REFERENCE BOOKS:

S.NO	BOOK TITLE/AUTHORS/PUBLICATION
1	Tonshoff, H.K. and I. Inasaki, Sensors in manufacturing,Wiley-VCH, 2001
2	HMT Ltd. Mechatronics, Tata McGraw- Hill, New Delhi, 1988.

T/R	BOOK TITLE SUGGESTED BY FACULTY
R	Bradley, D. A., Dawson D., Burd, N. C. and Loader A. J.,Mechatronics: Electronics in products and processes, CRC Press, Florida, USA, 2010.

DELIVERY/INSTRUCTIONAL METHODOLOGIES/ TEACHING PEDAGOGY:

Chalk & Talk
Small Group Instruction.
Making real world connections
Presentatons

E- content used:

Additional topics:

Introduction of latest techniques used in Automation used for Manufacturing system.

COURSE OBJECTIVES:

To understand the importance of automation and a thorough knowledge of its various elements such as sensors, pneumatics, hydraulics and CNC

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME B.Tech.	DESCRIPTION	SEM
BTME702-18	INTRODUCTION AUTOMATION IN MANUFACTURING		

COURSE OUTCOMES:

S.NO	DESCRIPTION	Bloom's Level (B.L)
CO1	Students should be able to identify and design the automated systems using pneumatics.	2
CO2	Students should be able to identify proper hydraulic system for designing of automated systems.	2
CO3	Students should be able to apply PLC programming and implement it on PLC kits.	3
CO4	Students should be able to devise Assembly automated systems using feeders, orienteers and escapement devices	4
CO5	Analyze various automated flow lines, Explain assembly systems and line balancing methods	4
CO6	Students should be able to design and implement electro-pneumatic/hydraulic solutions for automated systems.	6

CO MAPPING WITH PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1						3					2	2			3
CO2							2		2	2	2	2		2	3
CO3	2	3		2	2		2	2	2	3		2	2		3
CO4			3		3	3	2		2		2	2			
CO5				3	2		2		2	2	2	2	2		3
CO6	2		2							2		2		2	

FUNDAMENTALS OF MANAGEMENT FOR ENGINEERS

COURSE INFORMATION SHEET

PROGRAMME: MECHANICAL ENGINEERING	**DEGREE: BTECH**
COURSE: FUNDAMENTALS OF MANAGEMENT FOR ENGINEERS	**SEMESTER: 7 CREDITS: 4**
COURSECODE:BTME703-18 **REGULATION:2018**	**COURSE TYPE: CORE**
COURSE AREA/DOMAIN: MANAGEMENT	**CONTACT HOURS: 3(L) + 0(T) +0(P) hours/Week.**

SYLLABUS:

UNIT	DETAILS	HOURS
I	Introduction to Management: Definition, Nature and Scope, Functions of Management, Managerial Roles, Levels of Management, Managerial Skills, Challenges of Management.	**3**
II	Introduction to Operations Management, Types of Plant Layout, Introduction to Total Quality Management (TQM), Total Quality Management Models, Benefits of TQM, Basics of Six Sigma and Lean Manufacturing.	**5**
III	Introduction to Marketing, Functions of Marketing, Types of Marketing, Marketing vs. Selling, Marketing Mix, Product Life Cycle, Market Segmentation, Supply Chain Management (SCM).	**5**
IV	Introduction to Work Analysis, Definition, need and scope of work analysis, Method Study: Objectives, Step-by-step procedure, Charts and diagrams for recording data, Principles of Motion economy, Therbligs, Work Measurement: Definition, Various techniques of work measurement such as Work Sampling, Stop Watch Time Study, Analytical Estimating, Predetermined Motion Time System, Need for operator rating, Methods of rating, Allowances and their types, Standard time	**8**
V	Introduction to Productivity: Definition, Reasons for low productivity, methods to improve productivity, Value Engineering: Definition, Types of values, concept, phases and applications of value	**4**
VI	Introduction to Personnel Management, aims and objectives of personnel management, Principles of a good personnel policy, Recruitment and selection of employees, Education and training of employees, Safety engineering.	**4**

TEXT/REFERENCE BOOKS:

S.NO	BOOK TITLE/AUTHORS/PUBLICATION
1	Industrial Engineering and Management/ O. P. Khanna/ Dhanpat Rai and Sons
2	Management Essentials/ Andrew Dubrin/ Cengage Learning
3	Fundamentals of Management/ Stephen P. Robbins/ Pearson Education
4	General and Industrial Management/ H Fayol/ Pitman

T/R	BOOK TITLE SUGGESTED BY FACULTY
1	Industrial Management/ I. K. Chopde and A. M. Sheikh/ S. Chand
2	A Text Book of Industrial Management/ A. P. Verma and N. Mohan/ Katson

DELIVERY/INSTRUCTIONAL METHODOLOGIES/ TEACHING PEDAGOGY:

Chalk & Talk
Small Group Instruction.
Making real world connections
Presentations

E- content used:

https://archive.nptel.ac.in/courses/110/105/110105146/

https://archive.nptel.ac.in/courses/112/107/112107238/

Additional topics:

- Six Sigma, Group Technology and other layouts, JIT and lean operations.

COURSE OBJECTIVES: The course enables the student;

1. To understand the Management Concepts, applications of Concepts in Practical aspects of business and development of Managerial Skills for Engineers.
2. To help the students gain understanding of the functions and responsibilities of industrial managements.
3. To enable them to analyze and understand the environment of the organization.
4. To help the students to develop cognizance of the importance of management principles.
5. To provide them tools and techniques to be used in the performance of the managerial job.

.**COURSE PRE-REQUISITES:**

COURSE OUTCOMES:

S.NO	DESCRIPTION	Bloom's Level (B.L)
CO1	**Understand** the significance of Management in their Profession.	2
CO2	**Explain** various Management Functions like Planning, Organizing, Staffing, Leading, and **relate** them with engineering management in an organization.	1,3
CO3	**Understand** the complexities associated with management in the organizations and **integrate** the learning in handling these complexities.	2,4
CO4	**Develop** cognizance of the importance of management principles.	6
CO5	**Understand** concept of personnel management ; appraise the welfare of employees and safety engineering.	2
CO6	**Demonstrate** the roles, skills and functions of management.	3

PROGRAME SPECIFIC OUTCOMES:

S.NO	DESCRIPTION
PSO1	Graduates of Mechanical Engineering will be engineering professionals and innovators in core engineering, service industries or pursue higher studies
PSO2	Graduates of Mechanical Engineering will be team players who are equipped to provide sustainable solutions for complex interdisciplinary problems using modern tools.
PSO3	Graduates of Mechanical Engineering will be able to engage in professional activities ethically and thereby enhance the knowledge and contribution towards the society through lifelong learning.

CO –PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	2	2	1	1	2
CO2	-	-	-	-	-	-	-	-	-	-	2			1	-
CO3	-	-	-	-	-	-	-	-	-	-	3				-
CO4	-	-	-	-	-	-	-	-	-	-	2		1		-
CO5	-	-	-	-	-	2	-	1	-	-	2	2			1
CO6	-	-	-	-	-	-	-	1	-	-	3			1	-

PRODUCT DESIGN AND DEVELOPMENT

COURSE INFORMATION SHEET

PROGRAMME: MECHANICAL ENGINEERING	**DEGREE: BTECH**
COURSE: PRODUCT DESIGN AND DEVELOPMENT	**SEMESTER: 7 CREDITS: 3**
COURSECODE:BTME614-18 **REGULATION:2018**	**COURSE TYPE: CORE**
COURSE AREA/DOMAIN: PRODUCT CYCLE	**CONTACT HOURS: 3(L) + 0(T) +0(P) hours/Week.**

SYLLABUS:

UNIT	DETAILS	HOURS
I	**Introduction to Product Design:** Design by Evolution and Innovation, Essential factors of product design, Production consumption cycle, Flow and value addition in Production consumption cycle, The Morphology of Design, Primary design phases and flowcharting, Role of Allowances, process capability and tolerances in detailed design and assembly	**4**
II	**Product Design and Industry:** Product Strategies, Time to Market, Analysis of the Product, Standardization, Simplification and specialization, Basic design considerations, Role of Aesthetics in product design, Functional design practice	**5**
III	**Design for Production:** Producibility requirements in the design of machine components, Forging design, Pressed component design, Casting design for economical molding, eliminating defects and features to aid handling, Design for machining ease, the role of process Engineer, Ease of location and Clamping, Some additional aspects of production design, Design of powder metallurgical parts	**7**
IV	**Economic Factors Influencing Design:** Product value, Design for safety, reliability and Environmental considerations, Manufacturing operations in relation to design, Economic analysis, profit and competitiveness, break even analysis,	**6**
V	**Modern Approaches to product Design:** Concurrent Design, Quality Function Deployment (QFD) **Rapid Prototyping:** Principle of Rapid Prototyping, Rapid Prototyping Technologies (RPT), RPT in Industrial Design.	**6**
VI	**Introduction to Product Design:** Design by Evolution and Innovation, Essential factors of product design, Production consumption cycle, Flow and value addition in Production consumption cycle, The Morphology of Design, Primary design phases and flowcharting, Role of Allowances, process capability and tolerances in detailed design and assembly	**6**

TEXT/REFERENCE BOOKS:

S.NO	BOOK TITLE/AUTHORS/PUBLICATION
1	Product Design and Development by Kail T Ulrich and Steven D Eppinger
2	Product Design and Development by AK Chitale and Gupta

T/R	BOOK TITLE SUGGESTED BY FACULTY
1	Design of Systems and Devices by Middendorf Marcel Dekker
2	

DELIVERY/INSTRUCTIONAL METHODOLOGIES/ TEACHING PEDAGOGY:

Chalk & Talk
Small Group Instruction.
Making real world connections
Presentations

E- content used:

Swayam/ NPTEL

Additional topics:

COURSE OBJECTIVES:

The student will be able to:

1. Understand desirable design aspects considering various production processes and also understand the economic factors of design.
2. Employ engineering, scientific, and mathematical principles to execute a design from concept to finished product
3. Apply the modern approaches to product design considering concurrent design, quality function deployment and various rapid prototyping methods.
4. Apply innovative process techniques in synthesizing information, problem-solving and critical thinking.

COURSE PRE-REQUISITES: NA

COURSE OUTCOMES:

S.NO	DESCRIPTION	Bloom's Level (B.L)
CO1	Understand desirable design aspects considering various production processes and also understand the economic factors of design	2
CO2	Ability to coordinate multiple, interdisciplinary tasks in order to achieve a common objective.	2
CO3	Identify, formulate and solve engineering problems.	2
CO4	Apply the modern approaches to product design considering concurrent design, quality function deployment and various rapid prototyping methods	3
CO5	Apply innovative process techniques in synthesizing information, problem-solving and critical thinking	3
CO6	Employ engineering, scientific, and mathematical principles to execute a design from concept to finished product	6

PROGRAME SPECIFIC OUTCOMES:

S.NO	DESCRIPTION
PSO1	Graduates of Mechanical Engineering will be engineering professionals and innovators in core engineering, service industries or pursue higher studies
PSO2	Graduates of Mechanical Engineering will be team players who are equipped to provide sustainable solutions for complex interdisciplinary problems using modern tools.
PSO3	Graduates of Mechanical Engineering will be able to engage in professional activities ethically and thereby enhance the knowledge and contribution towards the society through lifelong learning.

CO –PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2		2	2		3					2	2			2
CO2	2						2		2	2	2	2		2	2
CO3	2	3		2	2		2	2	2	3		2	2		2
CO4			3		3	3	2		2		2	2			
CO5				3	2		2		2	2	2	2	2		2
CO6	2		2							2		2		2	

PRODUCT DESIGN AND DEVELOPMENT

COURSE INFORMATION SHEET

PROGRAMME: MECHANICAL ENGINEERING	**DEGREE: BTECH**
COURSE: COMPUTER AIDED DESIGN	**SEMESTER: 7 CREDITS: 3**
COURSECODE:BTME613-18 **REGULATION:2018**	**COURSE TYPE: CORE**
COURSE AREA/DOMAIN: DESIGN	**CONTACT HOURS: 3(L) + 0(T) +0(P) hours/Week.**

SYLLABUS:

UNIT	DETAILS	HOURS
I	Introduction: Historical Development, Geometric Modeling, Explicit and Implicit Equations, Intrinsic Equations, Parametric Equations, Coordinate Systems.	**3**
II	Curve Design: Fundamental of Curve Design, Parametric Space of a Curve, Blending Functions, Reparametrization, Space Curves, Straight lines, Spline Curves, Bezier Curves, B-Spline Curve, Rational Polynomials, NURBS.	**5**
III	Surface Design: Fundamental of Surface Design, Parametric Space of a Surface, Reparametrization of a Surface patch, Sixteen Point form, Four Curve Form, Plane surface, Cylindrical and Ruled Surfaces, Surface of Revolution, Bezier Surface, B-Spline Surface.	**6**
IV	Solid Design: Fundamental of Solid Design, Parametric Space of a Solids, Continuity and Composite Solids, Surfaces and Curves in a Solid.	**5**
V	Solid Modeling: Topology and Geometry, Set Theory, Boolean Operators, Set-membership Classification, Euler operators, Graph Based Models, Boolean Models, Instances and Parameterized Shapes, Cell Decomposition and Spatial Occupancy Enumeration, Sweep Representation, Constructive Solid Geometry, Boundary Representation.	**6**
VI	Transformations: Translation, Rotation, Scaling, Symmetry and Reflection, Homogeneous Transformations, Orthographic Projections, Axonometric Projections, Oblique Projections, Perspective Transformation.	**5**
VII	Assembly Design: Assembly-Modeling, Analytical Properties, Relational Properties and Intersections, Data Transfer Formats.	**4**

TEXT/REFERENCE BOOKS:

S.NO	BOOK TITLE/AUTHORS/PUBLICATION
1	Zeid, I., CAD/CAM, McGraw Hill (2008).
2	Rogers, D. F. and Adams, J. A., Mathematical Elements for Computer Graphics, McGraw Hill (1989).
3	Rogers, D. F., Procedural Elements for Computer Graphics, McGraw Hill (2008).
4	Rooney, J. and Steadman, P., Principles of Computer Aided Design, prentice Hall (1988).

T/R	BOOK TITLE SUGGESTED BY FACULTY
1	Radhakrishnan, P. and Kothandaraman, C. P., Computer Graphics & Design, Dhanpat Rai Publication (2005).
2	Mallineuse, G., Computational Concepts and Methods, Kogan Page Ltd. (1986).

DELIVERY/INSTRUCTIONAL METHODOLOGIES/ TEACHING PEDAGOGY:

Chalk & Talk
Small Group Instruction.
Making real world connections
Presentations

E- content used:

Swayam/ NPTEL

Additional topics: NA

COURSE OBJECTIVES:

The students will be able to:

1. Understand the different wireframe primitives using parametric representations.
2. Create surface primitives using parametric modeling.
3. Create the different solid primitives using the different representation schemes.
4. Apply geometric transformations on the created wireframe, surface and solid models.

COURSE PRE-REQUISITES: Concept of Engineering drawing and Auto-CAD.

COURSE OUTCOMES:

S.NO	DESCRIPTION	Bloom's Level (B.L)
CO1	Create the different wireframe primitives using parametric representations	6
CO2	Create surface primitives using parametric modeling	6
CO3	Create the different solid primitives using the different representation schemes	6
CO4	Apply geometric transformations on the created wireframe, surface and solid models	3
CO5	Understand and implement the coding.	2
CO6	Understand the concept of group technology, transformation of points and lines in computer aided software.	2

PROGRAME SPECIFIC OUTCOMES:

S.NO	DESCRIPTION
PSO1	Graduates of Mechanical Engineering will be engineering professionals and innovators in core engineering, service industries or pursue higher studies
PSO2	Graduates of Mechanical Engineering will be team players who are equipped to provide sustainable solutions for complex interdisciplinary problems using modern tools.
PSO3	Graduates of Mechanical Engineering will be able to engage in professional activities ethically and thereby enhance the knowledge and contribution towards the society through lifelong learning.

CO –PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			2	2		3					2	2			2
CO2							2		2	2	2	2		2	2
CO3	2	3		2	2		2	2	2	3		2	2		2
CO4	3		3		3	3	2		2		2	2			
CO5	2			3	2		2		2	2	2	2	2		2
CO6			2							2		2		2	

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