

SKILLS AND INNOVATION LAB

Week	Topic Practicle lab
1st	Understand and identify research topics related to Mechanical Engineering through brain storming sessions.
2nd	Propose a novel idea/modified technique/new interpretation after identifying the existing research work.
3rd	Devise specific identified issue/problem in the form of research objectives.
4th	Work in a group and communicate effectively the research topic though presentation and/or brain storming.
5th	Understand the research analysis of issues/problems on topics related to Mechanical Engineering.
6th	Understand the techniques and tools used for research analysis.
7th	Understand literature related to a research topic.
8th	Communicate effectively the research topic though presentation and/or brain storming.
9th	Internal Vivo-Vice

STEAM GENERATION & POWER, SGP LAB

Week	Theory		Practical	
	Lecture Day	Topic (Including Assignment/Test)	Practical Day	Topic
Unit - I : Fuel and Combustion				
1 st	1	Characteristics of solid, liquid and gaseous fuels	1	Introduction
	2	Laws of combustion and reactions		
	3	Gravimetric and volumetric analysis,		
	4	Air-fuel ratio, Exhaust gas analysis		
2 nd	5	Orsat apparatus. Calorific values of fuel,	2	To estimate the composition of flue gases by Orsat apparatus
	6	Bomb calorimeter, Numericals		
	7	Formation of steam at constant pressure		
3 rd	8	Variation in steam properties during phase change	3	To find the calorific value of fuel using bomb calorimeter
	9	Enthalpy - entropy (Mollier) diagram		
	10	Steam tables and their uses,		
	11	Carnot and Rankine vapour cycles, Rankine cycle with reheat and regeneration,		
	12	Numericals.		
Unit - II : Steam Generators				
5 th	13	Classification of steam boilers,	5	To study the construction and working of low pressure boiler
	14	Essentials of a good boiler, Construction and operational details of Cochran,		
	15	Babcock Wilcox, Locomotive		
	16	Lancashire, Benson, Lamont, Loeffler		
6 th	17	Velox boilers, Boiler mountings and accessories.	6	To study the construction and working of high pressure boiler
	18	Natural (Chimney) draught		
	19	Maximum discharge through a chimney		
	20	Artificial draught,		
7 th		1st Minor Test		
8 th	21	Evaporative capacity and efficiency of boilers	7	To study the working and performance of impulse and reaction steam turbine.
	22	Energy balance in a boiler		
	23	Numericals.		
	24	Assignment 1		
Unit - III : Boiler Draught And Performance				
9 th	25	Steam flow through a nozzle	8	To study the construction and working of steam engine
	26	Critical pressure ratio (maximum discharge condition) and its physical significance		
	27	Flow through actual nozzles, Supersaturated expansion of steam,		
	28	Numericals.		
10 th	29	Working principle of impulse and reaction steam turbines	9	Internal Vivo-Vice-1.
	30	Vector diagrams of velocities, Optimum operating conditions of turbines,		
	31	Compounding of impulse turbines, Losses in steam turbines, Governing of steam turbines		
	32	Performance analysis of steam turbines		
Unit - IV : Steam Engine And Condenser				
11 th	33	Construction and working of steam engines	10	To study the construction and working of surface and jet condenser
	34	Indicator diagrams		
	35	Performance of steam engines, Governing of steam engines,		
	36	Problem and solutions		
12 th	37	Elements of a condensing plant	11	To study the working of cooling tower
	38	Types of condensers		
	39	Comparison of jet and surface condensers		
	40	Condenser and vacuum efficiency		
13 th	41	Cooling towers,	12	Internal Vivo-Vice-2
	42	Problem and solutions		
	43	Problem and solutions		
	44	Assignment - I I		
14 th		2nd Minor Test		
15 th	45	Numericals	13	
	46	Presenta tion		
	47	Problems and Solutions		

MECHANICS OF SOLID - II

Week	Theory		Practical	
	Lecture Day	Topic (Including Assignment/Test)	Practical Day	Topic
Unit-I : Thin Pressure Vessels , Thick Cylinders & Spheres				
1 st	1	Introduction to subject and basic terms like Cylinders and Spheres, Stress, Strain, Force and Pressure etc. What is Longitudinal Stress & Strain and Hoop stress & strain		NA
	2	Concept of Internal Pressure in Thin Cylindrical and Spherical vessels		
	3	Problems and solutions		
	4	Hoop and Longitudinal Stresses and strains in Thin Cylindrical Vessels under internal pressure		
	5	Problems and solutions		
2 nd	6	Hoop and Longitudinal Stresses and strains in Thin Spherical Vessels under internal pressure		NA.
	7	Problem and solutions		
	8	Wire Wound thin Cylinders		
	9	Problem and solutions		
	10	Derivtion of Lamé's Equations		
3 rd	11	Radial and hoop stresses and strains in thick and compound cylinders under internal pressure		NA.
	12	Problems and solutions		
	13	Problems and solutions		
	14	Radial and hoop stresses and strains in thick spherical shells subjected to internal fluid pressure		
	15	Problems and solutions		
4 th	16	Problems and solutions		NA
	17	Wire wound Thick Cylinders		
	18	Problems and solutions		
	19	Hub Shrunk on Solid Shaft		
	20	Problem and solutions		
Unit-II : Rotating Rims & Discs , Beam Columns				
5 th	21	Stresses in uniform rotating rings and discs		NA
	22	Concept of Rotating Discs of uniform stength		
	23	Problem and solutions		
	24	Stresses in rotating rims neglecting the effect of spokes		
	25	Problems and solutions		
6 th	26	Stresses in rotating cylinders , Hollow cylinders & solids cylinders		NA
	27	Problems and solutions		
	28	Beam columns subjected to Single concentrated load , Number of concentrated loads		
	29	Problems and solutions		
	30	Beam columns subjected to Continuous lateral load		

7 th		1st Minor Test		
8 th	31	Problems and solutions		NA
	32	Concept of End couple		
	33	Couple at both ends triangular loads		
	34	Problem and solutions		
	35	Assignment 1		
Unit-III : Strain Energy & Impact Loading , Springs				
9 th	36	Definition and expression for strain energy stored in a body when load is applied Gradually, Suddenly and with impact		NA
	37	Problems and solutions		
	38	Strain energy of beams in bending , Beam Deflections		
	39	Strain energy of shafts in twisting		
	40	Problems and solutions		
10 th	41	Energy methods in determining spring deflection, Castiglano's & Maxwell Theorems		NA
	42	Problems and solutions		
	43	Stresses in open coiled helical spring subjected to axial loads and twisting couples		
	44	Leaf springs, Flat springs , Concentric Springs		
	45	Problems and solutions		
Unit- :IV Slope & Deflection, Theories of Elastic Failure				
11 th	46	Concept of Slope and Deflection		NA
	47	Relationship between bending moment, slope and deflection		
	48	Calculation for Slope and Deflection using integration method.		
	49	Problems and solutions		
	50	Macaulay's and area moment methods of Cantilevers and simply supported beams with or without overhang.		
12 th	51	Problems and solutions		NA
	52	Macaulay's and area moment methods of fixed beams under concentrated loads and uniformly distributed loads		
	53	Problems and solutions		
	54	Macaulay's and area moment methods of fixed beams under combination of Concentrated loads & Uniformly distributed loads		
	55	Problems and Solutions		
13 th	56	Varying Loads and application of moments, propped beams, sinking of prop		NA
	57	Problems and solutions		
	58	Continuous Beams		
	59	Problems and solutions		
	60	Derivation and Graphical Representations of Elastic Failure		
14 th	2nd Minor Test			
15 th	61	Application to problems of 2-dimensional stress system with Combined Direct loading and Bending		NA
	62	Problems and solutions		
	63	Application to problems of 2-dimensional stress system with Combined torsional and Direct loading.		
	64	Problems and solutions		
	65	Assignment-II		

Material Science and Material Science lab

Week	Theory		Practical	
	Lecture Day	Topic (Including Assignment/Test)	Practical Day	Topic
Unit-I : Crystallography & Imperfection in metal crystals				
1 st	1	Crystallography: Review of crystal structure, space lattice	1	To study crystal structures of a given specimen.
	2	Crystal planes and crystal directions, co-ordination number		
	3	Number of atoms per unit cell, atomic packing factor		
	4	Numerical related to crystallography Imperfection in metal crystals		
2 nd	5	Crystal imperfections and their classifications	2	To study crystal imperfections in a given specimen
	6	Point defects, line defects		
	7	Edge & screw dislocations, surface defects		
	8	Volume defects & effects of imperfections on metal properties		
Unit-II : Solid solutions and phase diagram & Heat Treatment				
3 th	9	Solid solutions and phase diagram: Introduction to single and multiphase solid solutions and types of solid solutions	3	To study microstructures of metals/ alloys .
	10	Importance and objectives of phase diagram		
	11	Systems, phase and structural constituents		
	12	Cooling curves, unary & binary phase diagrams		
4 th	13	Gibbs's phase rule, Lever rule	4	To prepare solidification curve for a given specimen
	14	Eutectic and eutectoid systems, peritectic and peritectoid systems		
	15	Iron carbon equilibrium diagram and TTT diagram.		
	16	Heat Treatment: Principles, purpose		
5 th	17	Classification of heat treatment processes	5	To study heat treatment processes (hardening and tempering) of steel specimen .
	18	Annealing, normalizing, stress relieving		
	19	Hardening, tempering, carburizing		
	20	Nitriding, cyaniding, flame and induction hardening		
6 th	21	Allotropic transformation of iron and steel.	6	To study microstructure of heat-treated steel
	22	Properties of austenite, ferrite, pearlite, martensite		
	23	Problems and Solutions		
	24	Assignment-I		
7 th	1st Minor Test			
Unit- :III Deformation of Metal & Failures of metals				
8 th	25	Deformation of Metal: Elastic and plastic deformation	7	To study the properties of various types of plastics
	26	Mechanism of plastic deformation		
	27	Twinning, conventional and true stress strain curves for polycrystalline materials		
	28	Yield point phenomena, strain ageing		
9 th	29	Work hardening, Bauschinger effect	8	Internal Vivo-Vice-1
	30	Season cracking. Recovery, re-crystallization and grain growth		
	31	Failures of metals: Failure analysis		
	32	Fracture, process of fracture		
10 th	33	Types of fracture, fatigue, characteristics of fatigue,	9	To study the mechanism of chemical corrosion and its protection
	34	Fatigue limit, mechanism of fatigue		
	35	Factors affecting fatigue		

	36	Problems and Solutions		
		Unit- :IV Creep & Corrosion & Plastic, Composite and Ceramics		
11 th		Creep & Corrosion: Definition and concept	10	To study the creep behavior of a given specimen
		Creep curve, mechanism of creep		
		Impact of time and temperature on creep, creep fracture		
		Creep testing and prevention against creep		
12 th		Corrosion: Mechanism and effect of corrosion	11	To study thermo-setting of plastics.
		Prevention of corrosion		
		Plastic, Composite and Ceramics: Polymers		
		Formation of polymers, polymer structure and crystallinity		
13 th		Polymers to plastics types, reinforced particles-strengthened and dispersion strengthened composites	12	Internal Vivo-Vice-2
		Ceramic materials: Types of ceramics, properties of ceramic, ceramic forming techniques		
		Mechanical behavior of ceramic		
		Assignment-II		
14 th	2nd Minor Test			

FLUID MECHANICS AND FLUID MECHANICS LAB

Week	Theory		Practical	
	Lecture Day	Topic (Including Assignment/Test)	Practical Day	Topic
Unit-I : Fluid Properties, Fluid Statics & Kinematics				
1 st	1	Basics about subject like force, pressure etc. and their units and What is Fluid Mechanics Introduction and relation with other subjects	1	To verify the Bernoulli's Theorem.
	2	Concept of fluid and flow, Viscosity, ideal and real fluids, continuum concept		
	3	Properties of fluid, Newtonian and non-Newtonian fluids,		
	4	Pascal's Law & Monometers		
	5	Problem and solutions		
2 nd	6	Hydrostatic equation, hydrostatic forces on plane & curved surfaces	2	To determine the meta centric height of a floating body.
	7	Buoyancy and flotation		
	8	Stability of floating and submerged bodies		
	9	Problem and solutions		
	10	Problem and solutions		
3 rd	11	Eulerian and lagrangian description of fluid flow	3	To determine the minor losses due to pipe fitting in pipes.
	12	Types of flows , Flow rate and continuity equation		
	13	Differential equation in cylindrical coordinates.		
	14	Differential equation in polar coordinates.		
	15	Problem and solutions		
4 th	16	Rotation and vorticity	4	To determine the major losses due to friction in pipe flow.
	17	circulation, Stream function		
	18	potential function		
	19	flow net and Problem and solutions		
	20	Problem and solutions		
Unit-II : Fluid Dynamics, Potential Flow				
5 th	21	Concept of system and control volume	5	To determine the coefficient of discharge of venturimeter.
	22	Euler's equation		
	23	Bernoulli's equation, venturimeter , Orifices,		
	24	Orifice meter, Mouthpieces		
	25	Problem and solutions		
6 th	26	Kinetic and Momentum Correction Factors	6	To determine the coefficient of discharge of notch (V and Rectangular types).
	27	Impulse Momentum relationship and its applications		
	28	Uniform and Vortex flow ,		
	29	Flow past a Rankin half body		
	30	Problem and solutions		
7 th		1st Minor Test		
8 th	31	Source, sink, source-sink pair and doublet	7	To determine the coefficient of discharge of an orifice meter.
	32	Flow past a cylinder with and without circulation		
	33	Problem and solutions		
	34	Problem and solutions		
	35	Assignment 1		

Unit-III : Viscous Flow, Flow Through Pipes				
9 th	36	Flow regimes and Reynold's number	8	To Find critical Reynolds number for a pipe flow.
	37	Relationship between shear stress and pressure gradient		
	38	Uni-directional flow between Stationary and moving parallel plates,		
	39	Hagen Poiseuilli law		
	40	Problem and solutions		
10 th	41	Major and Minor Losses in pipes	9	Internal Vivo-Vice-1
	42	Hydraulic Gradient and Total Energy Lines, Series connection of pipes,		
	43	Equivalent Pipe, Parallel connection of Pipes		
	44	Branched pipes, Power transmission through pipes		
	45	Problem and solutions		
Unit- :IV Boundary Layer Theory & Turbulent Flow				
11 th	46	Boundary layer concept	10	To determine the coefficient of discharge, contraction & velocity of an orifice
	47	Displacement, momentum and energy thickness		
	48	Von-Karman momentum integral equation,		
	49	Problem and solutions		
	50	Problem and solutions		
12 th	51	Laminar and turbulent boundary layer flows	11	To determine the density and viscosity of any three fluids.
	52	Drag on a flat plate		
	53	Boundary layer separation and control		
	54	Presentation		
	55	Problem and solutions		
13 th	56	Shear stress in turbulent flow	12	To determine the minor losses due to sudden enlargement, sudden contraction and bends.
	57	Prandtl mixing length hypothesis		
	58	Hydraulically smooth and rough pipes		
	59	Velocity distribution in pipes pipes		
	60	Problem and solutions		
14 th	2nd Minor Test			
15 th	61	Friction coefficients for smooth and rough pipes	13	Internal Vivo-Vice-2
	62	Problems and Solutions		
	63	Problem and solutions		
	64	Presentation		
	65	Assingment-II		