

COURSE TITLE : MATERIAL SCIENCE AND STRENGTH OF MATERIALS
COURSE CODE : 4053
COURSE CATEGORY : B
PERIODS/WEEK : 6
PERIODS/SEMESTER : 84
CREDITS : 6

TIME SCHEDULE

Module	Topic	Periods
1	General Properties of materials And Modern Automobile Engineering Materials	21
2	Direct Stresses	20
3	Basic Engineering Mechanics	21
4	Shear force and Bending Moment	22
TOTAL		84

GENERAL COURSE OUTCOME

Module	G.O	Student will be able to
1	1	Appreciate the general properties of materials.
	2	Understand various heat treatment Processes of materials.
	3	Classify different engineering materials used for manufacturing Auto mobile components.
	4	Identify different non metallic materials used in Auto mobile industry.
2	1	Understand the behaviour of materials under stress and strain.
	2	Explain shear and bearing stress
	3	Distinguish riveted and welded joints
	4	Calculate different strengths of rivets and plates.
3	1	Understand the concept of friction
	2	Illustrate the sliding and rolling friction.
	3	Define centre of gravity, moment of inertia and radius of gyration.
	4	Derive parallel axis and perpendicular axis theorem.
	5	Solve problems related with geometrical properties of sections.
4	1	Analyse shear force and bending moment in beams.
	2	Draw S.F and B.M diagrams.
	3	Solve problems in relation with bending and torsion of shafts.

SPECIFIC COURSE OUTCOME

MODULE I

1.1.0 Appreciate the general properties of materials

1.1.1 State the various mechanical properties

1.2.0 Understand the heat treatment of materials and its needs

1.2.1 Draw the cooling curve for pure iron

1.2.2 Explain the need for heat treatment

1.2.3 Describe the different heat-treatment processes and their applications

1.3.0 Understand the modern automobile engineering materials

1.3.1 Identify the alloy steels

1.3.2 State the need for alloying steel with other elements

1.3.3 Discuss the classification of different alloy steels with ISI specifications

1.3.4 Classify the different stainless steel

1.4.0 Comprehend the various non-metallic materials

1.4.1 Identify plastics, fiber glass, fiber reinforced plastics, composites

1.4.2 List their classification

1.4.3 State the properties

1.4.4 List the applications of plastics in automobile industry

MODULE II

2.1.0 Understand the importance of direct stress

2.1.1 Define different loads with figures

2.1.2 Describe the behavior of ductile material under tension

2.1.3 Explain the salient points of a stress- strain curve

2.1.4 Differentiate ultimate stress from working stress

2.1.5 Discuss the concept of factor of safety and need for using it

2.2.0 Understand shear and bearing stresses

2.2.1 Explain the terms shear stress and shear strain and modulus of rigidity

2.2.2 Explain the bearing stress

2.3.0 Appreciate the use of riveted joints

2.3.1 List the types of riveted joints

2.3.2 Discuss methods failure of rivet and plate

2.3.3 Calculate the different strengths of rivet and plate

2.3.4 Determine the efficiency of riveted joint, minimum pitch required

2.3.5 Discuss caulking and fullering.

2.4.0 Explain welded joints

2.4.1 List the different types of welded joints

2.4.2 Determine the efficiency of a welded joint

2.4.3 Describe the design of fillet weld

2.4.4 Compare riveted and welded joints

MODULE III

3.1.0 Understand the concept of friction

- 3.1.1 State the laws of friction
- 3.1.2 Explain the limiting friction, normal reaction
- 3.1.3 Explain coefficient of friction, angle of friction and cone of friction
- 3.1.4 Illustrate the sliding friction & rolling friction
- 3.1.5 Illustrate the equilibrium of a body on an inclined plane
- 3.1.6 Solve simple problems on the laws of friction

3.2.0 Understand the geometrical properties of sections

- 3.2.1 Define centroid, centre of gravity, moment of inertia and radius of gyration
- 3.2.2 Locate the centroid of different geometrical sections, and their combinations
- 3.2.3 Derive the expression for the moment of inertia of geometrical section
- 3.2.4 Derive parallel axis and perpendicular axis theorem
- 3.2.5 Solve simple problems

MODULE IV

4.1.0 Analyze the shear force and bending moment in beams

- 4.1.1 Discuss the various types of loads and supports
- 4.1.2 Explain the effect of S.F and B.M at different sections in beam
- 4.1.3 Describe the procedure of construction of SF and BM diagrams

4.2.0 Understand the theory of simple bending

- 4.2.1 Write the Simple Bending equation (No derivation required)
- 4.2.2 Solve simple problems

4.3.0 Comprehend the principle of Torsion of shafts

- 4.3.1 Torsion equation (No derivation required)
- 4.3.2 Solve simple problems

CONTENT DETAILS

MODULE I

Mechanical properties, tensile strength, compressive strength, ductility, hardness, impact strength, fatigue, creep resistance, malleability, toughness etc. Mechanism of grain formation, effect of rate of cooling on grain size, effect of grain size on mechanical properties, factors promoting fine grain.

Heat treatment of metals – cooling curve for pure iron – Need for heat treatment, description of different process and their applications, annealing, tempering, hardening, case hardening, normalizing and nitriding.

Alloy steels - need for alloying, alloying elements, effect of alloying on properties. Stain less steel – different types, specific properties and uses. Non-metallic materials – characteristics of plastics, fiberglass, and fiber reinforced plastics, synthetic polymers.

MODULE II

Definition and explanation of tensile, compressive and shear load, stress and strain, behavior of ductile material under tension – limit of proportionality, modulus of elasticity, elastic limit, yield point, ultimate stress, percentage elongation, percentage reduction in area. Explanation of the term working stress – relation between ultimate stress and working stress – factor of safety – need for factor of safety, commonly used values of factor of safety for members under static and dynamic load. Shearing and bearing stresses – application of shearing and bearing stresses in riveted and welded joints. Riveted joints – types, strengths of a rivet, strength of a plate, efficiency of riveted joint, empirical relations for minimum pitch of riveting, caulking and fullering. Welded joints – types, recommended working stress for a fillet weld, design of fillet weld, comparison between riveted and welded joints.

MODULE III

Friction. Introduction-Types of friction-static friction, dynamic friction, limiting friction, angle of friction, coefficient of friction, cone of friction, sliding friction, rolling friction. Laws of friction. Equilibrium of a body lying on a horizontal plane, inclined plane (no proof), force acting horizontally, at an angle. Simple problems. Geometric Properties of sections- centroids of plane figures,-method of finding centre of gravity of simple sections and combinations. Moment of inertia of plane figures, radius of gyration about a given axis. Moment of inertia of rectangle, square, triangle, circle, semi circle and combinations about horizontal centroidal axis. Parallel axis theorem and Perpendicular axis theorem. Simple problems.

MODULE IV

Different types of loads with examples. Types of supports. Effect of lateral load on a beam in equilibrium – definition of shear force and bending moment – calculation of shear force and bending moment at any section along a loaded beam, construction of shear force and bending moment diagram on cantilever and simply supported beams with point load and uniformly distributed load load. Location of points, on the beam, having maximum shear force and bending moment. Theory of simple bending- Bending equation, Torsion of shafts- torsion equation. Simple Problems.

REFERENCES

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2. E.C.Bain- Function of alloying elements in steel - Metals park publishers
3. R.K.Jain and S.C. Gupta- Production Technology-Khanna publications
4. R.K.Rajput - Strength of materials – S.Chand & Company Pvt Ltd
5. R.S.Khurmi - Strength of materials - S.Chand & Company Pvt Ltd
6. R.S.Khurmi and R.S. Sedha James - Materials science- R.S.Khurmi and R.S. Sedha James
7. James Maxwell - Plastics in the automobile industry – Woodhead publishing Ltd.
8. S.K.Hajra Choudhry and A.K.Hajra Choudhary - Materials Science and processes - India Book Distributing Company
9. P.C.Sharma- A text book of production Technology -S.Chand & Company Pvt Ltd
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