

Contents: Theory

Topic and content	Hours	Marks
<p>Topic 1: Introduction to Design</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ State the need for the design ➤ List all parameters related to design ➤ Apply basic concepts in design procedure <p>1.1 Basic Design Considerations 04 Marks</p> <ul style="list-style-type: none"> • Design philosophy and Procedures • General Considerations in Design • Types of loads, concepts of stress ,strain, Stress – Strain Diagram for Ductile and Brittle Materials, Types of Stresses such as Tension, Compression, Shear, Bearing pressure Intensity, crushing, bending and torsion, Principle Stresses (Simple Numericals) • Concept of Creep, Fatigue, S-N curve, Endurance Limit. <p>1.2 Factors in Design 04 Marks</p> <ul style="list-style-type: none"> • Factor of Safety and Factors affecting its selection • Stress Concentration – Causes & Remedies • Converting actual load or torque into design load/torque using design factors <p>1.3 Properties of Engineering materials 04 Marks</p> <ul style="list-style-type: none"> • Designation of materials as per IS and introduction to International standards, advantages of standardization, use of design data book, use of standards in design and preferred numbers series. <p>1.4 Theories of Elastic Failures 04 Marks</p> <ul style="list-style-type: none"> • Principal normal stress theory, Maximum shear stress theory & maximum distortion energy theory. <p>1.5 Modern Design considerations 04 Marks</p> <ul style="list-style-type: none"> • Design for safety, Ecology, societal consideration & Concept of Product Design, System Design & Creativity in Design, Ergonomics and aesthetic considerations in design 	12	20
<p>Topic 2: Design of Joints, Levers & Offset Links</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Design a joint for a given load to be transmitted ➤ Calculate dimensions of lever/link using allowable bending and shear stress <p>2.1 Design of Cotter Joint, Knuckle Joint, Turnbuckle 06 Marks</p> <p>2.2 Design of Levers:- Hand/Foot Lever & Bell Crank Lever, 06 Marks Lever for lever safety valve, Design of Off-set links, C - Clamp, Overhang Crank.</p>	08	12

<p>Topic 3. Design of Shafts, Keys and Couplings</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Design the diameter of a shaft on the basis of equivalent twisting/bending moment and allowable shear stress ➤ Design the section of most commonly used rectangular key on the basis of torque transmitted, allowable shear stress and crushing stress ➤ Design a rigid/flexible coupling for connecting two shaft on the basis of torque and allowable shear stress ➤ Design spur gear by taking into account effective tooth load <p>3.1 Design of shaft 06 Marks</p> <ul style="list-style-type: none"> • Types of Shafts, Shaft materials, Standard Sizes, • Design of shafts (Hollow and Solid) using strength and rigidity criteria, • ASME code of design for line shafts supported between bearings with one or two pulleys in between or one overhung pulley <p>3.2 Design of key 04 Marks</p> <ul style="list-style-type: none"> • Types of keys • Design of rectangular, parallel sunk keys, • Effect of Keyways on strength of shaft. <p>3.3 Design of Couplings 06 Marks</p> <ul style="list-style-type: none"> • Flanged couplings – unprotected and protected types • Bush-pin type flexible coupling. <p>3.4 Design of spur gear 08 Marks</p> <ul style="list-style-type: none"> • Lewis equation for static beam strength of spur gear teeth • Power transmission capacity of spur gears in bending • Gear tooth failure modes – Scoring, scuffing Pitting & Teeth Breakage 	14	24
<p>Topic 4: Design of Power Screws</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Draw the different thread profiles used in power screws and state their merits and demerits ➤ Bring out the difference between self locking and overhauling ➤ Design the screw jack/toggle jack under a given loading conditions. <p>4.1 Basic concepts</p> <p>Thread Profiles used for power Screws, relative merits and demerits of each, Self locking and overhauling properties Torque required to overcome thread friction, efficiency of power screws, types of stresses induced. 06 Marks</p> <p>4.2 Design of Screw Jack, Toggle Jack (only screw and nut). 06 Marks</p>	10	12
<p>Topic 5: Design of springs</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Classify the springs on the basis of different criteria ➤ Design Helical spring based on given load conditions <p>5.1 Classification and Applications of Springs, Spring - terminology, materials specifications. Stresses in helical tension and compression springs, Wahl's correction factor, Deflection of springs, Energy stored in springs. 04 Marks</p> <p>5.2 Design of Helical tension and compression springs subjected to concentric applied loads like I.C. engine valves, weighing balance, railway buffers</p>	08	12

and governor springs.	06 Marks		
5.3 Leaf springs - construction and applications	02 Marks		
Topic 6: Design of Threaded and Welded Joints			
Specific Objectives:			
<ul style="list-style-type: none"> ➤ State the applications of fasteners ➤ Design threaded/welded joints under different load conditions 		08	12
6.1 Stresses in Screwed fasteners, bolts of Uniform Strength, Design of Bolted Joints subjected to eccentric loading.			
			06 Marks
6.2 Design of parallel and transverse fillet welds, axially loaded symmetrical section, Merits and demerits of screwed and welded joint			
			06 Marks
Topic 7: Antifriction Bearings			
Specific Objectives:			
<ul style="list-style-type: none"> ➤ Classify the bearings ➤ Select rolling bearings, for specific applications, using manufacturers catalogue. 		04	08
Classification of Bearings – Sliding contact & rolling contact.			
Terminology of Ball bearings – life load relationship, basic static load rating and basic dynamic load rating, limiting speed. Selection of ball bearings using manufacturer's catalogue.			
Total		64	100

Skills to be developed in Practicals

Intellectual Skills:

1. Understand the basic philosophy and fundamentals of Machine Design.
2. Apply and use the basic knowledge of earlier subjects like mechanical Engineering materials, strength of materials and theory of machines.
3. Analyze and evaluate the loads, forces, stresses involved in components and subassemblies and decide the dimensions.
4. Understand the modes of failures of m/c components and decide the design criteria and equations.
5. Understand the concept of standardization and selecting standard components.
6. Understand the methods of computer aided design practices.
7. Use of different design data books and IS codes.

Motor Skills:

1. Draw the components assembly as per the designed dimensions.
2. Modify drawings and design as per requirement.
3. Use the different design software.

List of Practicals:

1. Analyse the various modes of failure of machine components under different load patterns
2. Understand different codes used for design of machine elements.
3. Select the material for given applications using design data book.
4. Design and draw mechanical joints for given load.
5. Design and draw mechanical levers for given load.
6. Design project - 1
Design and prepare the drawing on drawing sheet of transmission system by observing transmission of power through shaft, keys, coupling, pulley and belt drive etc.
7. Design project - 2

Design and prepare the CAD drawing of transmission system by observing transmission of power through Power screw.

8. Design of springs.
9. Design of fasteners.

Learning Resources:

1. Books:

Sr. No.	Title	Author	Edition	Publisher
1	Machine Design	RS Khurmi and Gupta	14th	S. Chand
2	Machine Design	VB Bhandari	3rd	Tata McGraw Hill
3	Machine Design	U C Jindal	2 reprint	Pearson Education India
4	Mechanical Engg. Design	Richard G Budynas,J. Keith Nisbett	9th	Tata McGraw Hill
5	Theory and problems of Machine Design	Hall,Holowenko, Laughlin	Reprint 2005	McGraw Hill
6	Design Data Book	PSG	8th	PSG College of Technology Coimbatore
7	Fundamentals of Machine Components Design	Robert C.Juvinall Kurt M Marshek	3rd	Wiley India Edition

2. IS Codes:

- 1) IS 4218: 1967 ISO Metric Threads
- 2) IS 2693: 1964 Cast Iron Flexible Couplings
- 3) IS 2292: 1963 Taper keys & Keyways
- 4) IS 2293: 1963 Gib Head Keys & Keyways
- 5) IS 2389: 1963 Bolts, Screws, Nuts & Lock Nuts
- 6) IS 4694: 1968 Square threads
- 7) IS 808: 1967 Structural Steel
- 8) SKF Catalogue for Bearings