8. Unit Wise Question Bank

UNIT–I

S.No		Questions	BT	CO	
Part – A (Short Answer Questions)					
1		Why the metals in their pure form un suitable for industrial use?	L1	CO1	
2		Define (a) Toughness (b) Hardness and (c) Creep.	L2	CO1	
3		List the main advantages of forged components.	L1	CO1	
4		What are fits, tolerance and allowance?	L1	CO1	
5		A reciprocating steam engine connecting rod is subjected to a maximum load of 65kN. Find the diameter of the connecting rod at its thinnest part if the permissible tensile stress is 35 N/mm^2.	L3	CO1	
6		Derive an expression for the impact stress induced due to a falling load.	L2	CO1	
7		Write short note on maximum shear stress theory.	L1	CO1	
8		State assumptions made in deriving a bending formulary.	L1	CO1	
9		What types of stresses are induced in shafts?	L1	CO1	
10		What do you mean by factor of safety?	L1	CO1	
Part – B (Long Answer Questions)					
11	a)	Write short note on maximum shear stress theory verses maximum strain energy theory.	L2	CO1	
	b)	An unknown weight falls through 10mm on a collar rigidly attached to the lower end of a vertical bar 3m long and $600mm^2$ in section. If the maximum instantaneous extension is known to be 2mm, what are the corresponding stress and the value of un known weight? Take $E=200kN/mm^2$.	L3	CO1	
12	a)	Explain briefly the various theories of failures.	L2	CO1	
	b)	A beam of uniform rectangular cross-section is fixed at one end and carries an electric motor weighing 400 N at a distance of 300mm from the fixed end. The maximum bending stress in the beam is 40MPa. Find the width and depth of the beam, if depth is twice that of width.	L3	CO1	
13	a)	A cast iron pulley transmits 10 kW at 400 r.p.m. The diameter of the pulley is 1.2 meter and it has four straight arms of elliptical cross-section, in which the major axis is twice the minor axis. Determine the dimensions of the arm if the allowable bending stress is 15MPa	L3	CO1	
	b)	What do you understand hot and cold working processes?	L2	CO1	
14	a)	Explain the design considerations for the selection of Engineering Materials and their properties?	L2	CO1	
	b)	What are the manufacturing considerations in the design of Castings?	L2	CO1	
15	a)	Derive a relation for the shear stress developed in a shaft, when it is subjected to torsion.	L2	CO1	
	b)	A hydraulic press exerts a total load of 3.5 MN. This load is carried by two steel rods, supporting the upper b head of the press. If the safe stress is 85MPa and E= 210MPa find: 1. Diameter of the rods, and 2. Extension in the rod in a length of 2.5 m	L3	CO1	
16	a)	Explain the concept of stiffness in tension, bending, and torsion and combined situations?	L2	CO1	
	b)	Derive an expression for the impact stress induced due to a falling load.	L2	CO1	

UNIT–II

S.No		Questions	BT	CO	
Part – A (Short Answer Questions)					
1		Explain the following method of stress concentration i) Drilled holes, ii) Using large fillet radius, iii) Added grooves.	L2	CO2	
2		Explain the modified Goodman diagram for tensional shear stresses.	L1	CO2	
3		Explain briefly about the causes of stress concentration	L1	CO2	
4		Draw the S-N curve for ferrous and nonferrous components	L2	CO2	
5		Explain about static strength design based on fracture toughness	L2	CO2	
6		What information do you obtain from Soderberg diagram?	L2	CO2	
7		Define stress concentration along with its causes. Write any one method to reduce stress concentration.	L1	CO2	
8		What are the principal causes of stress concentration?	L1	CO2	
9		Differentiate the theoretical stress concentration factor and fatigue stress concentration factor.	L2	CO2	
10		Illustrate how the stress concentration in a component can be reduced	L1	CO2	
Part – B (Long Answer Questions)					
11	a)	Explain Goodman Method for combination of stress.	L1	CO2	
	b)	A 50 mm diameter shaft is made from carbon steel having ultimate tensile strength of 630MPa.It is subjected to a torque which fluctuates between 200 N-mt-800 N-m using Soderberg method, calculate the factor of safety. Assume suitable values for any other data needed.	L3	CO2	
12	a)	Explain Soderberg Method for combination of stress.	L2	CO2	
	b)	A steel cantilever is 200 mm long. It is subjected to an axial load which varies from 150 N (compression) to 450 N (tension) and also a transverse load at its free end which varies from 80 N up to 120 N down. The cantilever is of circular cross- section. It is of diameter 2d for the first 50 mm and of diameter d for the remaining length. Determine its diameter taking a factor of safety of 2. Assume the following values: Yield stress=330 MPa, Endurance limit in reversed loading=300 MPa, correction factors=0.7 in reversed axial loading and 1.0 in reversed bending, Stress concentration factor=1.44 for bending and 1.64 for axial loading, size effect factor=0.85, Surface effect factor=0.90 ,Notch sensitivity=0.90	L3	CO2	
13	a)	Explain the Methods of reducing stress concentration with neat sketch	L2	CO2	
	b)	A hot rolled steel shaft is subjected to a torsion moment that varies from 330 N-m clockwise to 110 N-m counterclockwise and an applied bending moment at a critical section varies from 440N-m to -220 N-m. The shaft is of uniform cross section and no keyway is present at critical section. Determine the required shaft diameter. The material has an ultimate strength of 550 MN/m^2 and yield strength of 410 MN/m^2. Take the endurance limit as half of the ultimate strength, factor of safety is 2, size factor=0.85 and surface finish factor of 0.62.	L3	CO2	
14	a)	Explain the Endurance or fatigue limit with neat sketch	L2	CO2	
	b)	A machine component is subjected to a flexural stress which fluctuates between +300 MN/m^2 and -150 MN/m^2.Determine the value of minimum ultimate strength 1.Good relation 2.Soderberg take yield strength=0.55 Ultimate strength ;Endurance strength=0.5 Ultimate and factor of safety=2.	L3	CO2	
15	a)	With neat sketch completely reversed and repeated stress.	L2	CO2	
	b)	A bar of circular cross- section of 500 mm length is supported freely at its two ends. It is acted upon by a central concentrated cyclic load having a minimum value of 20 kN and a maximum value of 50kN.Determine the diameter of bar by taking a factor of safety of 1.5,size effect of 0.85, surface finish factor of 0.9. The material properties of bar is given by: ultimate strength of 650MPa, yield strength of 500MPa and endurance strength of 350MPa.	L3	CO2	
16	a)	Discuss combined steady and variable stress with neat sketch.	L1	CO2	
	b)	A bar of circular cross- section is subjected to alternating tensile forces varying from a minimum of 200 kN to a maximum of 500kN.It is be manufactured of a material with an ultimate tensile strength of 900MPa and an endurance limit of 700MPa.determine the diameter of bar using safety factors of 3.5 related ultimate tensile strength and 4 related to endurance limit and a stress concentration factor of1.65 for fatigue load. Use Goodman straight line as basis for design.	L3	CO2	

UNIT–III

S.No		Questions	BT	CO	
Part – A (Short Answer Questions)					
1		Explain the various ways in which a riveted joint may fail.	L1	CO3	
2		Discuss about the bolts of uniform strength.	L2	CO3	
3		Enumerate the different types of riveted joints	L2	CO3	
4		What do you understand by the term riveted joint? Explain the necessity of such joint.	L2	CO3	
5		Explain the caulking and fullering.	L1	CO3	
6		What do you mean by efficiency of riveted joint?	L1	CO3	
7		What are the reasons of replacing the riveted joints by welded joints in modern equipment?	L2	CO3	
8		Distinguish the riveted and the bolted joints?	L2	CO3	
9		List advantages of bolted joints over welded joints.	L2	CO3	
10		Define the term throat area of the weld	L1	CO3	
Part – B (Long Answer Questions)					
11		A Steam boiler is to be designed for a working pressure of 2.5 N/mm^2 with its inside diameter of 1.6 m. Give the design calculation for the longitudinal and circumferential joints for the following working stresses for steel plates and rivet: In tension = 75 MPa : In shear = 60 MPa : in crushing = 125 MPa	L3	CO3	
12	a)	Define the terms pitch, back pitch, diagonal pitch, and margin.	L2	CO3	
	b)	Design a double riveted butt joint with two cover plates for the longitudinal seam of a boiler shell 1.5 m in diameter subjected to a steam pressure of 0.95 N/mm^2. Assume joint efficiency as 75%, allowable tensile stress in the plate 90MPa, compressive stress 140 MPa and shear stress in the rivet is 56 MPa.	L3	CO3	
13	a)	How the strength of transverse fillet weld is evaluated?	L1	CO3	
	b)	A double riveted lab joint is made between 15 mm thick plates. The rivet diameter and pitch are 25 mm and 75 mm respectively. If the ultimate stresses are 400 MPa in tension, 320 MPa in shear and 640 MPa in crushing, find the minimum force per pitch which will rupture the joint. If the above joint is subjected to a load such that the factor of safety is 4, find out the actual stresses developed in the plates and the rivets.	L3	CO3	
14	a)	How the strength of parallel fillet weld is evaluated?	L5	CO3	
	b)	Find the efficiency of the following riveted joints: 1. Single riveted lap joint of 6 mm plates with 20 mm diameter rivets having a pitch of 50 mm. 2. Double riveted lap joint of 6 mm plates with 20 mm diameter rivets having a pitch of 65 mm. Assume. Permissible tensile stress in plate = 120 MPa Permissible shearing stress rivets = 90 MPa Permissible crushing stress in rivets = 180MPa	L3	CO3	
15	a)	Advantages and disadvantages of welded joints over riveted joints.	L2	CO3	
	b)	A double riveted double cover butt joint in plates 20 mm thick is made with 25 mm diameter rivets at 100 mm pitch. The permissible stresses are tensile stress = 120 MPa; shear stress =100 MPa: Crushing stress = 150 MPa. Find the efficiency of joint , taking the strength of the rivet in double shear as twice than that of single shear.	L3	CO3	
16	a)	What do you understand by the term welded joint? How it differs from welded joint?	L2	CO3	
	b)	Two plates of 7 mm thick are connected by a triple lap joint of zig-zag pattern. Calculate the rivet diameter, rivet pitch and distance between rows of rivets for the joint. Also state the mode of failure of the joint. The safe working stresses are as follows ; tensile stress = 90 MPa ; shear stress = 60 MPa and Crushing stress = 120 MPa.	L3	CO3	

UNIT-IV

`		Questions	BT	CO	
Part – A (Short Answer Questions)					
1		Describe the purpose of gib in cotter joint? What are the applications of cotter joints?	L2	CO4	
2		Discuss the effect of keys and key ways on the strength of the shaft.	L2	CO4	
3		Write the stresses in keys?	L2	CO4	
4		Write notes on Types of keys.	L1	CO4	
5		Square key is stronger against crushing than rectangular key justify the statement.	L2	CO4	
6		Write short notes on stresses induced due to bending.	L1	CO4	
7		Distinguish between cotter joint and knuckle joint.	L2	CO4	
8		What is a key? State its function.	L1	CO4	
9		Write notes on universal coupling	L1	CO4	
10		What is the effect of keyway cut in to the shaft?	L2	CO4	
Part – B (Long Answer Questions)					
11		Design a cotter joint to support a load varying from 30 kN in compression to 30 kN in tension. The material used is carbon steel for which the following allowable stresses may be used. The load is applied statically. Tensile stress = compressive = 50 MPa: shear stress = 35 MPa and crushing stress = 90 MPa.	L3	CO4	
12	a)	Design a sleeve and cotter joint to resist a tensile load of 60 kN. All parts of the joint are made of the same material with the following allowable stresses: Tensile stress =60 MPa: shear stress = 70 MPa; and crushing stress = 125 MPa.	L3	CO4	
	b)	List out the procedure for designing a knuckle joint stating all the empirical relations involved in it with suitable diagram.	L3	CO4	
13	a)	Design the rectangular key for a shaft of 50 mm diameter. The shearing and crushing stresses for the key material are 42 MPa and 70 MPa	L3	CO4	
	b)	Explain the design procedure involved in Knuckle joint.	L2	CO4	
14	a)	A 45 mm diameter shaft is made of steel with yield strength of 400 MPa. A parallel key of size 14 mm wide and 9 mm thick made of steel with yield strength of 340 MPa is to be used. Find the required length of key, if the shaft is loaded to transmit the maximum permissible torque. Use maximum shear stress theory and assume a factor of safety of 2.	L3	CO4	
	b)	Design a knuckle joint to transmit 150 kN. The design stresses may be taken as 75 MPa in tension, 60 MPa in shear and 150 MPa in compression.	L3	CO4	
15	a)	A 15 KW, 960 r. p. m, motor has a mild steel shaft of 40 mm diameter and the extension being 75 mm. The permissible shear and crushing stress for the mild steel key are 56 MPa and 112 MPa. Design the keyway in the motor shaft extension. Check the shear strength of the key against the normal strength of the shaft.	L3	CO4	
	b)	With neat diagram explain the design procedure involved in designing a cotter joint.	L2	CO4	
16	a)	Evaluate the strength of a Sunk Key.	L4	CO4	
	b)	Explain the design procedure involved in designing a cotter joint.	L2	CO4	

UNIT–V

S.No		Questions	BT	CO	
Part – A (Short Answer Questions)					
1		Write short notes on flexible couplings.	L1	CO5	
2		What are flexible couplings and what are their applications?	L2	CO5	
3		What is the effect of keyway cut into the shaft?	L1	CO5	
4		Write short notes on muff coupling	L2	CO5	
5		With suitable example state when flexible coupling is preferred over the rigid coupling.	L2	CO5	
6		What is the importance of muff couplings?	L1	CO5	
7		Write a short note on universal coupling?	L1	CO5	
8		Discuss the effect of keys and key ways on the strength of the shaft.	L2	CO5	
9		What is a coupling? Classify shaft couplings?	L2	CO5	
10		What are the requirements of a good Coupling?	L2	CO5	
Part – B (Long Answer Questions)					
11	a)	Explain briefly a design of shafts subjected to combined bending and torsion.	L2	CO5	
	b)	A shaft supported at the ends in ball bearing carries a straight tooth spur gear at its mid span and is to transmit 7.5kW at 300 r.p.m. The pitch circle diameter of the gear is 150 mm. The distance between the center line of bearings and gear are 100 mm each. If the shaft is made of steel and the allowable shear stress is 45 MPa, determine the diameter of the shaft. Show in sketch how the gear will be mounted on the shaft; also indicate the ends were the bearings will be mounted? The pressure angle of the gear may be taken as 20^0.	L3	CO5	
12	a)	How does the working of a clamp coupling differ from that of muff coupling?	L2	CO5	
	b)	Design a shaft to transmit power from an electric motor to a lathe head stock through a pulley by means of a belt drive. The pulley weighs 200N and is located at 300mm from the centre of the bearing. The diameter of the pulley is 200mm and the maximum power transmitted is 1KW at 120rpm. The angle of lap of the belt is 180°and coefficient of friction between the belt and the pulley is 0.3. The shock and fatigue factors for bending and twisting are 1.5 and 2.0 respectively. The allowable shear stress in the shaft may be taken as 35MPa.	L3	CO5	
13		Design a cast iron protective type flange coupling to connect two shafts in order to transmit 7.5kW at 720rpm. The following permissible stresses may be used:	L3	CO5	
		Permissible shear stress for shaft, bolt and key material = 33MPa Permissible crushing stress for shaft, bolt and key material = 60MPa Permissible shear stress for the cast iron = 15MPa.			
14	a)	Explain the design procedure for flexible coupling	L2	CO5	
	b)	Design a Cast Iron flange coupling for a steel shaft transmitting 15 KW at 200 rpm and having an allowable shear stress of 40 MPa. The working stress in the bolts should not exceed 30 MPa. Assume that the same material is used for shaft and key and that the crushing stress is twice the value of its shear stress. The maximum torque is 25 % greater than the full load torque. The shear stress for a Cast Iron is 14 MPa.	L3	CO5	
15	a)	Explain about the design of Bushed pin flexible coupling with a neat sketch	L2	CO5	
	b)	Design a Cast Iron flange coupling for a mild steel shaft transmitting 90 KW at 250 rpm. The allowable shear stress in the shaft is 40 MPa and the angle of twist is not to exceed 10 in a length of 20 diameters. The allowable shear stress in the coupling bolts is 30 MPa.	L3	CO5	
16	a)	Explain the design procedure for Muff Coupling.	L2	CO5	
	b)	Design a Cast Iron flange coupling for a mild steel shaft transmitting 100 KW at 300 rpm. The allowable shear stress in the shaft is 40 MPa and the angle of twist is not to exceed 10 in a length of 20 diameters. The allowable shear stress in the coupling bolts is 30 MPa.	L3	CO5	

Blooms Taxonomy Level (BT)(L1 – Remembering; L2 – Understanding; L3 – Applying; L4 – Analyzing; L5 – Evaluating; L6 – Creating)