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Set No. 1

III B.Tech I Semester Supplementary Examinations, May/June - 2015 DESIGN OF MACHINE MEMBERS-I

(Mechanical Engineering)

Time: 3 hours

Code No: **R31035**

Max. Marks: 75

[8]

[7]

Answer any FIVE Questions All Questions carry equal marks

- 1 a) Enumerate any four most commonly used engineering materials and state at least one [7] important property and one application of each.
 - b) Define the following properties of a material :
 (i) Ductility, (ii) Toughness, (iii) Hardness, and (iv) Creep.
- 2 a) A steel shaft 35 mm in diameter and 1.2 m long held rigidly at one end has a hand wheel [7] 500 mm in diameter keyed to the other end. The modulus of rigidity of steel is 80 GPa
 - i) What load applied to tangent to the rim of the wheel produce a torsional shear of 60 MPa?
 - ii) How many degrees will the wheel turn when this load is applied?
 - b) Derive a relation for the shear stress developed in a shaft, when it is subjected to [8] torsion.
- 3 a) A double riveted double cover butt joint in plates 20 mm thick is made with 25 mm [7] diameter rivets at 100 mm pitch. The permissible stresses are : $\sigma_t = 120 \text{ MPa}; \tau = 100 \text{ MPa}; \sigma_c = 150 \text{ MPa}$

Find the efficiency of joint, taking the strength of the rivet in double shear as twice that of single shear.

- b) What do you understand by the term riveted joint? Explain the necessity of such a joint. [8]
- 4 a) Discuss on bolts of uniform strength giving examples of practical applications of such [7] bolts.
 - b) Determine the safe tensile load for bolts of M 20 and M 36. Assume that the bolts are [8] not initially stressed and take the safe tensile stress as 200 MPa.
- 5 a) Explain different types of keys with sketches.
 - b) Design a sleeve and cotter joint to resist a tensile load of 60 kN. All parts of the joint [8] are made of the same material with the following allowable stresses : $\sigma t = 60 \text{ MPa}$; $\tau = 70 \text{ MPa}$; and $\sigma c = 125 \text{ MPa}$
- 6 a) A shaft is transmitting 97.5 kW at 180 r.p.m. If the allowable shear stress in the material [7] is 60 MPa, find the suitable diameter for the shaft. The shaft is not to twist more that 1° in a length of 3 m. Take C = 80 GPa.
 - b) How the shaft is designed when it is subjected to twisting moment and axial stress? [8]

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- 7 a) Compare flange coupling and modified flange coupling with sketches.
 - b) Design of a muff coupling which is used to connect two steel shafts transmitting 40 kW [8] at 350 r.p.m. The material for the shafts and key is plain carbon steel for which allowable shear and crushing stresses may be taken as 40 MPa and 80 MPa respectively. The material for the muff is cast iron for which the allowable shear stress may be assumed as 15 MPa.

R10

8 a) Describe different end connections for compression springs. [7]

b) Design a spring for a balance to measure 0 to 1000 N over a scale of length 80 mm. The [8] spring is to be enclosed in a casing of 25 mm diameter. The approximate number of turns is 30. The modulus of rigidity is 85 kN/mm². Also calculate the maximum shear stress induced.

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Set No. 2

III B. Tech I Semester Supplementary Examinations, May/June - 2015 **DESIGN OF MACHINE MEMBERS-I**

(Mechanical Engineering)

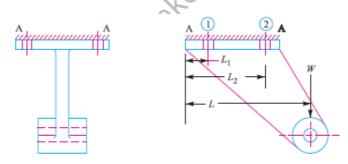
Time: 3 hours

Code No: **R31035**

Max. Marks: 75

Answer any FIVE Questions All Questions carry equal marks

- 1 a) Enumerate the various manufacturing methods of machine parts which a designer [7] should know. b) Write short notes on the following: [8]
 - (i) Interchangeability; (ii) Tolerance; (iii) Allowance; and (iv) Fits.
- 2 a) Define the terms load, stress and strain. Discuss the various types of stresses and strain. [7] b) What do you mean by factor of safety? List the important factors that influence the [8] magnitude of factor of safety.
- 3 Explain the failure modes of rivets in a butt joint with two cover plates. [15]
- 4 a) Explain the method of determining the size of the bolt when the bracket carries an [7] eccentric load parallel to the axis of the bolt.
 - b) A bracket, as shown in figure below, supports a load of 30 kN. Determine the size of [8] bolts, if the maximum allowable tensile stress in the bolt material is 60 MPa. The distances are: L1 = 80 mm, L2 = 250 mm and L = 500 mm.



- 5 a) What is a key? State its functions.
 - [7] b) Design a knuckle joint to transmit 150 kN. The design stresses may be taken as 75 MPa [8] in tension, 60 MPa in shear and 150 MPa in compression.
- 6 a) A hollow shaft has greater strength and stiffness than solid shaft of equal weight. [7] Explain.
 - b) Find the diameter of a solid steel shaft to transmit 20 kW at 200 r.p.m. The ultimate [8] shear stress for the steel may be taken as 360 MPa and a factor of safety as 8. If a hollow shaft is to be used in place of the solid shaft, find the inside and outside diameter when the ratio of inside to outside diameters is 0.5.

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[7]

[8]

[7]

- 7 a) Classify the shaft coupling. b) Design a bushed-pin type of flexible coupling to connect a pump shaft to a motor shaft
 - transmitting 32 kW at 960 r.p.m. The overall torque is 20 percent more than mean torque. The material properties are as follows :

The allowable shear and crushing stress for shaft and key material is 40 MPa and 80 MPa respectively.

The allowable shear stress for cast iron is 15 MPa.

The allowable bearing pressure for rubber bush is 0.8 N/mm^2 .

The material of the pin is same as that of shaft and key.

- 8 a) Explain the buckling of springs.
- b) Find the maximum shear stress and deflection induced in a helical spring of the [8] following specifications, if it has to absorb 1000 N-m of energy. Mean diameter of spring = 100 mm; Diameter of steel wire, used for making the spring = 20 mm; Number of coils = 30; Modulus of rigidity of steel = 85 kN/mm^2 . r's com com firstRanker.com

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Set No. 3

Max. Marks: 75

III B.Tech I Semester Supplementary Examinations, May/June - 2015 DESIGN OF MACHINE MEMBERS-I

(Mechanical Engineering)

Time: 3 hours

Code No: R31035

Answer any FIVE Questions

All Questions carry equal marks

1	a)	Write the mechanical properties of the material to be considered while designing of machine component	[7]
	b)	Define the terms stress and strain. Discuss the various types of stresses and strain	[8]
2	a) b)	What is 'stress concentration'? Write about Goodman and Soderberg's method Write short notes on: i) Endurance limit, ii) Notch sensitivity.	[7] [8]
3	a)	What do you understand by the term riveted joint? Enumerate different types of failure in riveted joints.	[7]
	b)	A plate 100 mm wide and10 mm thick is to be welded to another plate by means of double parallel fillets. The plates are subjected to a static load of 80 kN. Find the length of weld if the permissible shear stress in the weld does not exceed 55 MPa.	[8]
4	a) b)	write short note on: i) Nut locking devices ii) Bolts of uniform strength Determine the safe tensile load for bolt of M 30, assuming a safe tensile stress of 42 MPa	[7] [8]
5	a)	What is knuckle joint? Explain different types of keys with neat sketchs.	[7]
	b)	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.	[8]
6	a)	Discuss design of shaft on the basis of strength and rigidity.	[7]
	b)	A solid circular shaft is subjected to a bending moment of 3000 N-m and a torque of 10 000 N-m. The shaft is made of 45 C 8 steel having ultimate tensile stress of 700 MPa and a ultimate shear stress of 500 MPa. Assuming a factor of safety as 6, determine the diameter of the shaft.	[8]
7	a) b)	Classify the couplings and explain them. Design and make a neat dimensioned sketch of a muff coupling which is used to connect two steel shafts transmitting 40 kW at 350 r.p.m. The material for the shafts and key is plain carbon steel for which allowable shear and crushing stresses may be taken as 40 MPa and 80 MPa respectively. The material for the muff is cast iron for which the allowable shear stress may be assumed as 15 MPa.	[7] [8]
8	a)	Write the function of spring in machine. Describe the various types of springs.	[7]
	b)	Design a helical compression spring for a maximum load of 1000 N for a deflection of 25 mm using the value of spring index as 5. The maximum permissible shear stress for spring wire is 420 MPa and modulus of rigidity is 84 kN/mm^2 .	[8]

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Set No. 4

III B.Tech I Semester Supplementary Examinations, May/June - 2015 DESIGN OF MACHINE MEMBERS-I

(Mechanical Engineering)

Time: 3 hours

Code No: **R31035**

Max. Marks: 75

Answer any FIVE Questions All Questions carry equal marks

- 1 a) Discuss the factors to be considered for the selection of materials for the design of [7] machine elements.
 - b) Discuss the stress and stain relation. Draw a neat sketch of stress-strain diagram and [8] explain various stress points.
- 2 a) What is meant by `stress concentration'? what are the factors to be considered while [7] designing machine parts to avoid fatigue failure.
 - b) Determine the diameter of a circular rod made of ductile material with fatigue strength [8] (complete stress reversal) is 265 MPa and tensile yield strength of 350 MPa. The member is subjected to a varying axial load from Wmin = 300 × 103 N to Wmax = 700 × 103 N and has a stress concentration factor = 1.8. Use factor of safety as 2.0.
- 3 a) What do you mean by welded joint? Discuss the types of welded and riveted joints. [7]
 b) A double riveted double cover butt joint in plates 20 mm thick is made with 25 mm [8] diameter rivets at 100 mm pitch. The permissible stresses are :
 σt = 120 MPa; τ = 100 MPa; σc = 150 MPa Find the efficiency of joint, taking the strength of the rivet in double shear as twice than that of single shear.
- 4 a) What do you understand by bolted joint? Discuss various types of screw fastenings [7]
 - b) Write short notes on: (i) Major diameter, (ii) Minor diameter, (iii) Pitch, (iv) Lead. [8]
- 5 a) Write about working principle of 'sleeve and cotter joint' and 'jib and cotter joint'. [7]
 - b) A shaft 80 mm diameter transmits power at maximum shear stress of 63 MPa. Find the [8] length of a 20 mm wide key required to mount a pulley on the shaft so that the stress in the key does not exceed 42 MPa.
- 6 a) What types of stresses are induced in shafts? Expalin. [7]
 - b) Find the diameter of a solid steel shaft to transmit 20 kW at 200 r.p.m. The ultimate [8] shear stress for the steel may be taken as 360 MPa and a factor of safety as 8. If a hollow shaft is to be used in place of the solid shaft, find the inside and outside diameter when the ratio of inside to outside diameters is 0.5.

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7 a) What is coupling? Write its application. Describe the flexible couplings with suitable [7] sketches.

R10

- b) Design a clamp coupling to transmit 30 kW at 100 r.p.m. The allowable shear stress for [8] the shaft and key is 40 MPa and the number of bolts connecting the two halves are six. The permissible tensile stress for the bolts is 70 MPa. The coefficient of friction between the muff and the shaft surface may be taken as 0.3.
- 8 a) Draw a neat sketch of multi leaf spring and show its essential parts. Also explain [7] nipping of leaf spring.
 - b) A helical spring is made from a wire of 6 mm diameter and has outside diameter of 75 [8] mm. If the permissible shear stress is 350 MPa and modulus of rigidity 84 kN/mm², find the axial load which the spring can carry and the deflection per active turn.

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