Total No. of Questions – [08] Total No. of Printed Pages-04

G.R. No.	

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T.Y. B.TECH. (MECHANICAL ENGINEERING) (SEMESTER-I)

COURSE NAME: Design of Machine Elements-1

COURSE CODE: MEUA31171

(PATTERN 2017)

Time: [**2 Hours**] [Max. Marks: **50**]

(*) Instructions to candidates:

1) **Answer Q.1, Q.2, Q.3, Q.4, Q.5 OR Q.6, Q.7 OR Q.8**
2) **Figures to the right indicate full marks.**
3) **Use of scientific calculator is allowed**
4) **Use suitable data where ever required**

Q.1) a) What is series of preferred numbers? In an Industry, it is required to standardize 11 shafts from 100mm to 1000mm diameter. Specify the series to which they belong and calculate the diameters for the shaft. [6]

OR

b) Derive an expression for bending stress in the cotter of a cotter Joint. [6]

Q.2) a) An overhang hollow shaft carries a 900 mm diameter pulley whose centre is 250 mm from the centre of the nearest bearing. The weight of the pulley is 600N and the angle of lap is 180°.The pulley is driven by a motor vertically below it. If permissible tension in the belt is 2650 N and if the coefficient of a friction between the belt and pulley surface is 0.3. Estimate diameter of shaft when internal diameter is 0.6 of the external. Assume permissible tensile and shear stresses in the shaft are 84Mpa and 63 MPa respectively.Combined shock and fatigue factor for bending and torsion is 1.5. [6]

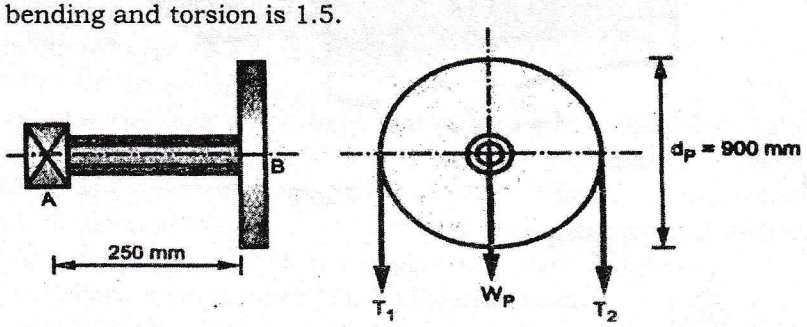

Fig-1

OR

b) A rigid coupling is used to transmit 20 kw power at 720 rpm there are four bolts and the pitch circle diameter of the bolts is 125 mm. the bolts are made of steel 45C8 (S_{yt} =380N/mm^2) and the factor of safety is 3 and (S_{sy} = 0.577 S_{yt}). Determine the diameter of bolts. Assume that the bolts are finger tight in reamed and ground holes. [6]

Q.3) a) A double threaded power screws, with ISO metric trapezoidal threads is used to raise a load of 300Kn. The nominal diameter is 100 mm and the pitch is 12 mm. the coefficient of a friction at the screw threads is 0.15. Neglecting collar friction. Calculate Torque required raising and lowering the load and efficiency of the screw. [6]

OR

b) Explain with neat sketch recirculating ball screw. [6]

Q.4) a) Write the equations for strength of transverse fillet weld joint and parallel fillet weld joint with neat sketch [4]

OR

b) A steel plate is fixed to a channel by using five identical bolts as shown in fig.2 the bolts are made of plain carbon steel. Take permissible shear stress for the bolt material as 65Mpa. Find the size of bolt. [4]

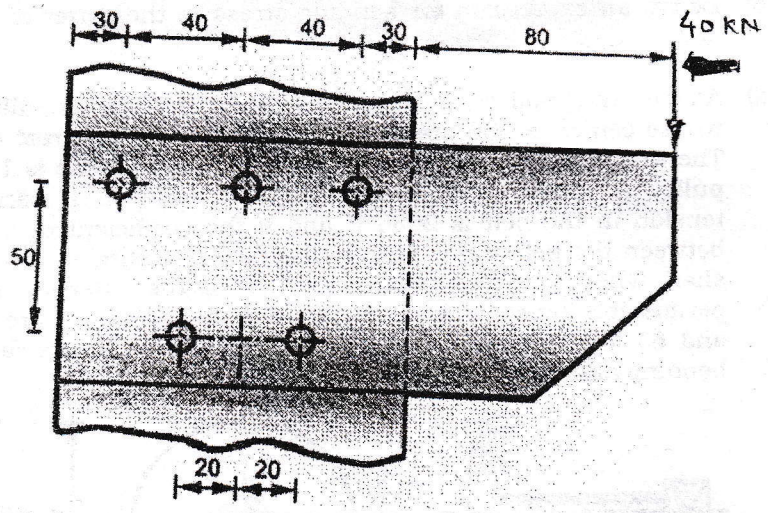

Fig-2

Q.5) a) A heavy duty spring is composed of two concentric helical compression springs having following specifications: [6]

Description	Outer spring	Inner spring
Outer diameter of coil	240mm	150mm
Number of active coils	7	10
Diameter of wire	40mm	25mm
Free height of spring	(h+20)mm	(h) mm
Modulus of rigidity	8×10^4 N/mm^2	8×10^4 N/mm^2

For a load of 100 Kn , find;
i) deflection of each spring;
ii)load carried by each spring;
iii) Combined spring stiffness.

b) Explain different types of stresses induced in helical spring. [4]

c) Define the terms 1] Solid length 2] Free length 3] Spring index and 4] Spring stiffness. [4]

OR

Q.6) a) The following data refers to a helical compression spring: [6]
Maximum axial load=8 Kn
Spring rate=72 Kn/m
Mean coil diameter =125 mm,
S_{ut}=550 N/mm^2,
G=80 x 10^3N/mm^2,
permissible shear stress for spring wire=0.5 x S_{ut}
available standard spring wire
diameters:18,19,20,21,22,23,24,25,26,27,28 and 30mm.
Determine i) wire diameter, ii) number of active coils.

b) Explain the types of ends for helical compression springs. [4]

c) Describe concentric helical spring with neat sketch. [4]

Q.7) a) A work cycle of a mechanical element is subjected to complete Reversed bending stress as follows: [6]
i) 300MPa for 30% of time.
ii) 275 MPa for 25% of time.
iii) 400 MPa for 10% of time.
iv) 325 MPa for 25% of time.
v) No load for remaining time.
The material has a ultimate tensile strength 1200 MPa. Take surface finish factor as 0.8, size factor 0.85, reliability factor 0.897. The operating temperature is 400^0 C and the temp factor is 0.5. Assume fatigue stress factor at the most stressed section as 0.7. Determine the life of component.

b) Write short on endurance limit modifying factors. [4]

c) Derive miner's equation. State its applicability. [4]

OR

Q.8) a) A cantilever beam of circular cross section is fixed at one end and subjected to completely reversed force of 10 KN at a free end. The distance between fixed and free end is 100mm. The beam is made up of steel with ultimate tensile strength of 540 N/ mm^2 and tensile yield strength of 320 N/ mm^2. The construction of cantilever is such a way that there is no stress concentration. The size factor, surface finish factor, and reliability factor are 0.85, 0.8, and 0.868 respectively. The operating temperature is 50°C for which the temperature factor is 1.01. If the diameter of beam is 35mm, determine the life of beam. [6]

b) A plate made of plain carbon steel 30C8(S_{ut}=450 N/mm^2) in hot rolled condition as shown fig.3 the thickness of plate is 35mm. the theoretical stress concentration factor is 2.51 and notch sensitivity is 0.8.the surface finish factor and size factor are 0.67 and 0.85 respectively. for reliability of 90% the reliability factor is 0.897. if the factor of safety is 1.5, determine the maximum completely reversed axial force the plate can take for infinite life. [4]

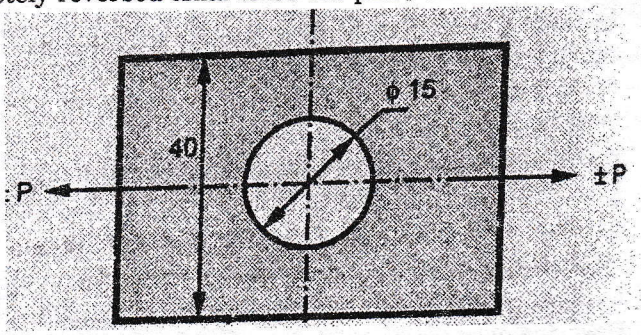

Fig-3

c) Explain modified Goodman diagram with neat sketch. [4]

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