Total No. of Questions – [4] Total No. of Printed Pages 2

G.R. No.	

U359-151(T1)

OCTOBER 2019/ IN-SEM (T1)

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

COURSE NAME: Design of Machine Elements -I

COURSE CODE: MEUA31171

(PATTERN 2017)

Time: [**1 1/2 Hour**] [Max. Marks: **30**]

(*) Instructions to candidates:

1) **Answer Q.1 OR Q.2 and Q.3 OR Q.4.**
2) **Figures to the right indicate full marks.**
3) **Use of scientific calculator is allowed**
4) **Use suitable data wherever required**

Q.1)a) A right angled bell crank lever is to designed to raise a load of 5 kN at the short arm end as shown in **Fig 1.** The lengths of short and long arms are 100mm and 450mm respectively. The lever and the pins are made of steel 30C8(S_{yt}=400N/mm^2) and the factor of safety is 5. The permissible bearing pressure on the pin is 10 N/mm^2. The lever has rectangular cross section and the ratio of width to thickness is 3:1. The length to diameter ratio of fulcrum is 1.25:1. Design a bell crank lever. [6]

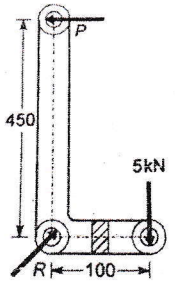

Fig 1

b) Explain 1) Standards and Codes 2) Aesthetic and Ergonomics [6]

c) Two rods are connected by means of cotter joint. The inside diameter of the socket and outside diameter of the socket collar are 50mm and 100mm resp. The rods are subjected to a tensile load of 50 kN, The cotter is made of steel 30C8(S_{yt}=400 N/mm^2)and the factor of safety is 4. The width of cotter is five times the thickness. Calculate width and thickness of cotter based on shear failure and bending failure. [4]

OR

Q.2)a) Explain the Procedure of machine design with example. [6]

b) Two rods made up of plane carbon steel 40C8 (S_{yt}=380 N/mm^2) are to be connected by means of cotter joint. The diameter of each rod is 50mm and the cotter is made of steel plate of 15 mm thickness. Calculate the dimensions of socket end. Assume compression yield strength is twice of tensile strength and yield strength in shear is 50% of the tensile strength. Take factor of safety= 6. [6]

c) The frame of the hydraulic press consisting of two identical steel plates as shown in **Fig 2.** The maximum force P acting on the frame is 20 kN. The plates are made of steel 45C8 with tensile yield strength of 380 N/mm^2 and the factor of safety is 2.5. Determine the plate thickness. [4]

Q.3)a) A layout of a transmission shaft carrying two pulleys B and C supported on Bearing A and D as shown in **Fig-3.** Power is supplied to the shaft by means of a vertical belt on pulley B, which is then transmitted to pulley C carrying a horizontal belt. The maximum Tension in the belt on pulley B is 2.5KN. The angle of wrap on both pulleys is 180^0 and the coefficient of friction is 0.24. The shaft is made of plane carbon steel 30C8 (S_{yt}=400 N/mm^2) and the factor of safety is 3. Determine the shaft diameter on strength basis. [6]

b) The standard cross-section for a flat key, which is fitted on a 50 mm diameter shaft, is 16×10 mm. The key is transmitting 500 N-m Torque from the shaft to the hub. The key is made of commercial steel ($S_{yt} = S_{yc} = 230N/mm^2$). Determine the length of key, if factor of safety is 3. [4]

c) Define coupling and what are the requirement of good coupling. [4]

OR

Q.4) a) A Rigid flange coupling is required to transmit 20 kW power at 720 rpm. The shaft and bolts are made of plane carbon steel 30C8 (S_{yt}=400N/mm^2) and the factor of safety is 4. Assume S_{yc}=1.5S_{yt} and S_{sy}=0.5S_{yt}. Number of bolts are 3. Find diameter of shaft, dimensions of flange and diameter of bolt. [6]

b) A circular shaft of length 'L' is subjected to a torque 'T'. If the permissible angle of twist for shaft is 'θ' in degrees and G is modulus of rigidity, prove that the diameter of shaft is given by $d = \left[\frac{584TL}{G}\right]^{1/4}$ [4]

c) Prove that compressive stress induced in square key due to transmitted torque is twice the shear stress. [4]

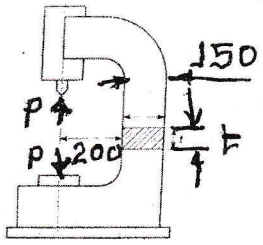

Fig-2

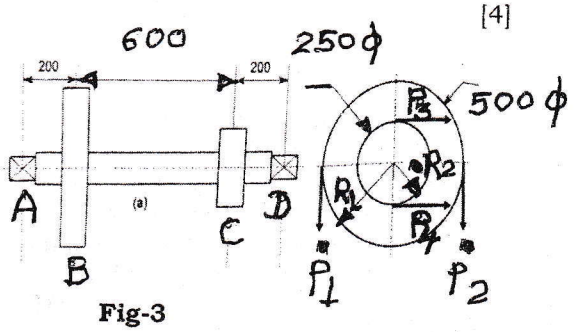

Fig-3