GUJARAT TECHNOLOGICAL UNIVERSITY BE - SEMESTER- IV(NEW) EXAMINATION - SUMMER 2015

Subject Code: 2142506 Subject Name: Fundamentals of Machine Design Time: 10:30am-1.00pm

Date:03/06/2015

Instructions:

Total Marks: 70

- 1. Attempt all questions.
- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.
- Q.1 (a) Define machine design. Discuss general considerations in machine design. 07
 - What is stress concentration? Discuss methods of relieving stress concentration **(b)** 07 in machine component with neat sketch.
- A mild steel shaft transmits 20 KW at 200 rpm. It carries a central load of 900 07 **O.2** (a) N and is simply supported between the bearings 2.5 metres apart. Determine the size of shaft, if the allowable shear stress is 42 MPa and the maximum compressive stress is not to exceed 56 MPa. What size of shaft will be required, if it is subjected to gradually apply fluctuating loads?
 - (b) Compare weight, strength and stiffness of a hollow shaft of the same external 07 diameter as that of solid shaft. The inside diameter of hollow shaft being 2/3 of its external diameter. Assume both the shaft have the same material and length.

OR

- (b) Enlist different types of keys. Discuss different types of sunk keys with neat 07 sketch and usual notations.
- (a) Discuss design procedure of all elements of compression coupling with neat 07 Q.3 sketch.
 - **(b)** Design a cast iron protective type flange coupling to transmit 15 KW at 900 07 rpm from an electric motor to a compressor. The service factor may be assumed as 1.35. The following permissible stresses may be used: 1) shear stress for shaft, bolt and key material = 40 MPa, (2) Crushing stress for bolt and key = 80MPa (3) Shear stress of cast iron = 8 MPa.

OR

- Q.3 **(a)** Design a muff coupling which is used to connect two steel shafts transmitting 07 40 KW at 350 rpm. The material for the shaft 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.
 - (b) Discuss step by step General procedure of design of Levers.
- **O.4** (a) Calculate the diameter of a piston rod for a cylinder of 1.5 meter diameter in 07 which the greatest difference of steam pressure on the two sides of piston may be assumed to be 0.2 N/mm^2 . The rod is made of mild steel and is secured to the piston by a tapered rod and nut and to the crosshead by a cotter. Assume modulus of elasticity as 200 KN/mm² and factor of safety as 8. The length of rod may be assumed as 3 meters.
 - (b) Discuss design procedure of connecting road and shows that I_{xx}/I_{yy} lies between 07 3 to 3.5 for standard I- section with usual proportions.

07

- Q.4 (a) A double riveted lap joint with zigzag riveting is to be designed for 13 mm thick plates. Assume $\sigma_t = 80$ MPa, $\tau = 60$ MPa and $\sigma_c = 120$ MPa. State how joint will fail and find the efficiency of the joint.
 - (b) Write step by step design procedure adopted for the design of an eccentrically 07 loaded riveted joint.
- Q.5 (a) A plate 75 mm wide and 12.5 mm thick is joined with another plate by a single transverse weld and a double parallel fillet weld as shown in fig. the maximum tensile and shear stresses are 70 MPa and 56 MPa respectively. Find the length of each parallel fillet weld, if the joint is subjected to both static and fatigue loading.



(b) Discuss design procedure of following special cases of fillet welded joints: (1) 07 circular fillet weld subjected to torsion and (2) circular fillet weld subjected to bending moment.

OR

- Q.5 (a) Write design procedure of socket and spigot cotter joint with sketch and usual 07 notations.
 - (b) Design a knuckle joint to transmit 150 KN. The design stress may be taken as 07 75 MPa in tension, 60 MPa in shear and 150 MPa in compression.
