

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-III (Old) EXAMINATION – WINTER 2019****Subject Code: 131902****Date: 28/11/2019****Subject Name: Machine Design & Industrial Drafting****Time: 02:30 PM TO 05:30 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Explain hole-based and shaft based limit system with neat sketch. **07**  
(b) Define (1) Crushing stress (2) Preferred Number (3) Factor of Safety **07**  
(4) Residual stress (5) transverse stress (6) Static Load (7) Shock load
- Q.2** (a) Explain different failures of riveted joint with neat sketches. **07**  
(b) A double riveted lap joint is made between 18 mm thick plates. The rivet diameter and pitch are 24 mm and 72 mm respectively. If the ultimate stresses are 415 MPa in tension, 330 MPa in shear and 675 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. **07**
- OR**
- (b) A double riveted single cover butt joint in plates 22 mm thick is made with 25 mm diameter rivets at 85 mm pitch. The permissible stresses are:  $\sigma_t = 100$  MPa;  $\tau = 85$  MPa;  $\sigma_c = 120$  MPa. Find the efficiency of joint. **07**
- Q.3** (a) Design a socket and spigot cotter joint to support a load varying from 35 kN in compression to 35 kN in tension. The material used is carbon steel for which the allowable are:  $\sigma_t = \sigma_c = 55$  MPa;  $\tau = 40$  MPa and crushing stress = 100 MPa. The load is applied statically. **07**  
(b) Design a knuckle joint to connect two steel rods under a tensile load of 35 kN. The allowable stresses are 60 MPa in tension 55 MPa, in shear and 85 MPa in crushing **07**
- OR**
- Q.3** (a) Find the diameter of a solid shaft to transmit 30 kW at 230 rpm. The shear stress is 50 MPa. If a hollow shaft is to be used in place of solid shaft, find the inside and outside diameter when the ratio of inside to outside diameter is 6:8 **07**  
(b) Write practical applications of shaft and axle. **07**
- Q.4** (a) Explain with sketch design procedure of bell crank lever **07**  
(b) A lever safety valve is 75 mm in diameter. It is required to blow off at 1.3 N/mm<sup>2</sup>. Design the mild steel lever of rectangular cross-section if the permissible stresses are 70 MPa in tension, 52.5 MPa in shear and 24.5 MPa in bearing. The pin is made of the same material as that of the lever. The distance from the fulcrum to the dead weight of the lever is 800 mm and the distance between the fulcrum pin and the valve spindle link pin is 80 mm. **07**
- OR**
- Q.4** (a) Explain the design procedure of sunk key **07**  
(b) What is coupler? Explain step by step design procedure for coupler **07**
- Q.5** (a) Derive an equation for torque required to lower the load of square threaded power screw **07**  
(b) Design a rigid type cast iron flange coupling for a steel shaft transmitting 15 KW at 200 rpm and having an allowable shear stress of 40 N/mm<sup>2</sup>. The maximum **07**

torque is 25% greater than full load torque. The working stress in bolt should not exceed  $30 \text{ KN/mm}^2$ . Assume that same material is used for shaft and key and that crushing stress is twice value of its shear stress. The shear stress for cast iron is  $14 \text{ KN/mm}^2$ .

**OR**

- Q.5 (a)** A power screw having double start square threads of 25 mm nominal diameter and 5 mm pitch is acted upon by an axial load of 10 KN. The outer and inner diameters of screw collar are 50 mm and 20 mm respectively. The coefficient of thread friction and collar friction may be assumed as 0.2 and 0.15 respectively. The screw rotates at 12 R.P.M. Assuming uniform wear condition at the collar and allowable thread bearing pressure of  $5.8 \text{ N/mm}^2$ , Find: 1. the torque required to rotate the screw; 2. the stress in the screw; and 3. the number of threads of nut in engagement with screw. **07**
- (b)** Explain any four editing commands of AUTOCAD **07**

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