Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B.E. Sem-III Regular / Remedial Examination December 2010

Subject code: 131902

Subject Name: Machine Design & Industrial Drafting

Date: 15 /12 /2010 **Time: 10.30 am – 01.30 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)** Differentiate between (with neat sketch): **04**
1) crushing and compressive stresses
2) torsional and transverse shear stress

(b) Define the following : **05**
1) proof resilience 2) Preferred Number 3)Factor of Safety
4)Residual stress 5) principle stress

(c) An offset link, fig. 1 has a clear swing of 10 mm. the radius of curvature of curved part is more compare to swing of link. The cross section is shown, where the thickness (t) of link is 26 mm. Find the load corresponding to a maximum fiber stress of 100 N/mm^2. **05**

Q.2 **(a)** Explain the important terminology of riveted joints and find the efficiency of the double riveted lap joints with zig-zag riveting is to be designed for 13 mm thick plates. Assume 80 MPa., 60 MPa and 120 MPa in tension, Shear and crushing respectively. Also calculate pitch of rivets. **07**

(b) 1. A circular shaft, d in diameter, is welded with annular fillet having throat thickness of t. shaft is subjected to bending moment only. Determine the moment of inertia of annular fillet weld. **03**

2. Fig.2 shows 12 mm thick plates loaded by the forces of 100 KN applied eccentrically. Determine the required lengths L_1 & L_2 of the fillet welds so that they will be equally stressed in shear. Take working stress in shear for side fillets to be equal to 80 N/mm^2 **04**

OR

(b) A bracket is to be attached to a wall with the help of six rivets. The different arrangements in which the bracket can be attached to the wall with these rivets are shown in fig. 3. The maximum allowable stress in shear is 60 N/mm^2. Determine the way in which the rivets should be arranged so that the design is economical. The bracket is required to support a load of 90 KN with an eccentricity of 200 mm. also determine the diameter of rivet for the selected arrangement. **07**

Q.3 **(a)** Define cotter, Why taper is provided in a cotter? And What is the purpose of clearance in Cotter Joints? **04**

(b) Explain with neat sketch, design procedure of coupler. **04**

(c) It is required to design a cotter joint to connect two steel rods of equal diameter. The permissible stresses for the rods, spigot end and socket end are σ_t =96 N/mm^2 , σ_c = 134 N/mm^2 & τ = 45 N/mm^2. For cotter, σ_t =80 N/mm^2 , τ = 40 N/mm^2. Each rod is subjected to an axial Tensile force of 60 KN. Calculate following dimensions: **06**
1. diameter of spigot 2. width & thickness of cotter
3. thickness of socket collar

OR

Q.3 **(a)** What is stress concentration and discuss the method to relive the stress concentration with neat sketches. **04**

(b) Suggest suitable ferrous material for the following parts stating the special property which make it more suitable for use in manufacturing. **04**

1. A shaft subjected to variable torsional and bending load 2. Valve
3. Machine tool bed 4. Keys (used for fastening) 5.Automobile cylinder block
6. Dies

(c) A 3-Ø induction motor is directly connected with a centrifugal pump **06**

Discharge of pump against a head of 10 meters = 25K lit/min
Maximum torque is 30% more then average torque.
Design shear stress = 60 N/mm^2
R.P.M. = 1000
Pump efficiency = 85%
Design the shaft of electric motor, neglecting weight of shaft & coupling.

Q.4 **(a)** What is ASME code for shaft design? **02**

(b) Determine the diameter below which the angle of twist of a shaft and not the maximum stress, is the controlling factor in design of solid shaft in torsion. The allowable shear stress is 56 MPa and the maximum allowable twist is ¼ degree per meter. Take G = 84 MPa. **06**

(c) Compare the weight, strength and rigidity of a hollow shaft of same external diameter as that of solid shafts, both the shafts are made of same material. Assume that diameter ratio for the hollow shaft is $d_i/d_o = 0.6$ **06**

OR

Q.4 **(a)** Discuss the effect of bearing pressure intensity & clearance provided between two faces of couplings in bushed pin type flexible coupling. **04**

(b) A flexible coupling as shown in fig 4, is used to transmit 15 KW power at 100 rpm. There are six pins and their pitch circle diameter is 200 mm. The length of pin in contact with the left hand flange, the gap between the two flanges and the length of bush in contact with the right hand flange are 23, 5 and 35 mm respectively. The permissible shear and bending stress in the pin are 35 N/mm^2 and 152 N/mm^2 respectively. The permissible pressure for the rubber bush is 1 N/mm^2. **06**

Calculate:
1) pin diameter by shear & bending consideration
2) O.D of the rubber bush.

(c) Determine the maximum and the minimum normal stress for a 75 mm diameter rod, supported at one end as a cantilever which is subjected to an axial compressive load of 15 KN and a torsional moment of 1KN-m. **04**

Q.5 **(a)** What is fit and explain types of fits with neat sketch also state application of each. **04**

(b) What do you understand by self locking screw? Explain the condition for self locking. **02**

(c) The screw shown in fig.5 is operated by a torsional moment applied at the lower end. The nut is loaded and prevented from turning by guides. The outside diameter of the screws is 50 mm, pitch of 8 mm and the thread is acme triple start. The coefficient of friction of the threads is 0.15. Assume the friction in ball bearing as negligible. If the torsional moment M_t is 45 Nm. **08**

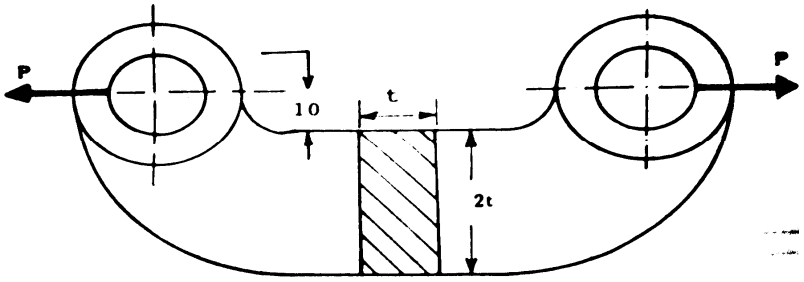
1) Determine the load which could be raised
2) Would the screw be overhauling?
3) Determine the average bearing pressure between the screw and nut thread surfaces.

OR

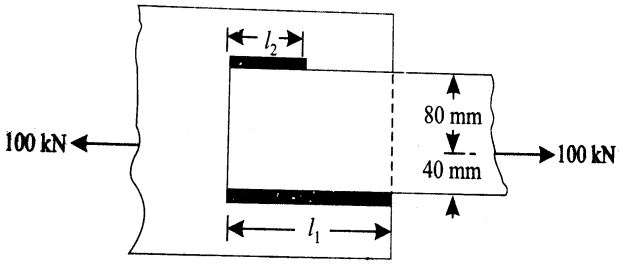
Q.5 **(a)** Explain any four editing commands of AUTOCAD. **04**

(b) Why the levers are generally made tapers? **02**

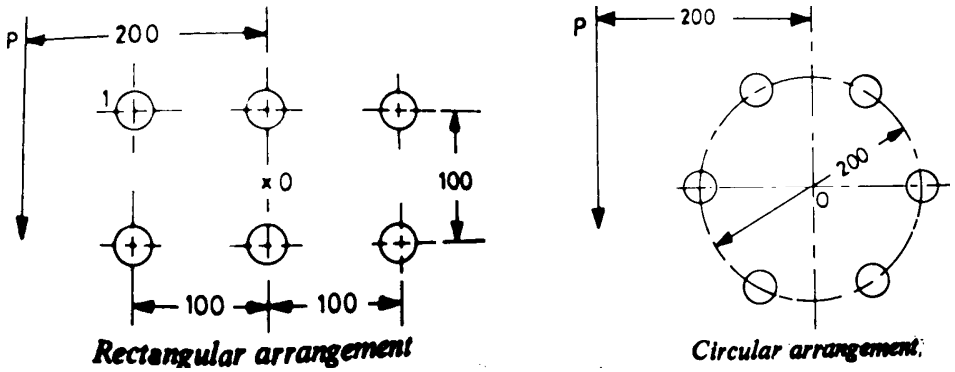
(c) A lever loaded safety valve is 70 mm in diameter and is to be designed for a boiler to blow off at a pressure of 1N/mm^2. design a suitable mild steel lever of rectangular cross section using the following permissible stresses: **08**
Tensile stress- 70 N/mm^2, Shear stress- 50 N/mm^2,
Bearing pressure - 25 N/mm^2
The pin is made of mild steel. The distance from the fulcrum to the weight of the lever is 880 mm and the distance between the fulcrum and pin connecting the valve spindle links to the lever is 80 mm.



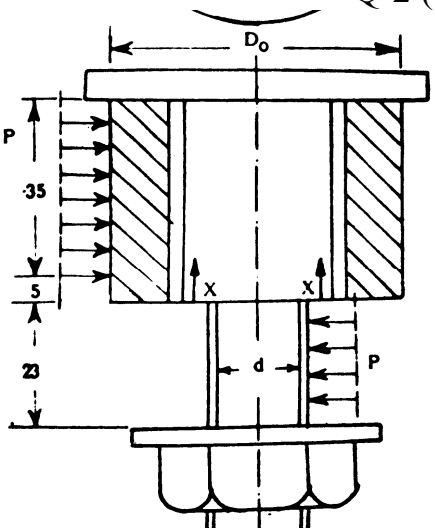
Q-1 (c) Fig-1



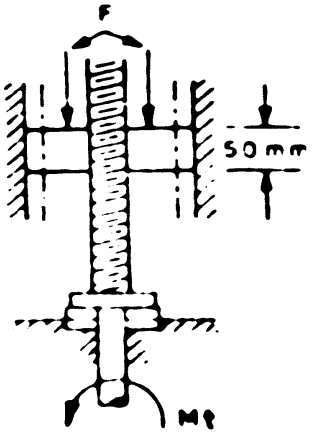
Q-2 (b_2) Fig-2



Q-2 (b) (OR) Fig-3



Q-4 (b) (OR)Fig-4



Q-5 (c)Fig-5

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