

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-IV(New) • EXAMINATION – WINTER 2016

Subject Code:2141907

Date:23/11/2016

Subject Name:Machine Design & Industrial Drafting

Time:02:30 PM to 05:00 PM

Total Marks: 70

Instructions:

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

MARKS

Q.1 Short Questions

14

- 1 What is Machine design? Why the study of machine design is necessary?
- 2 Differentiate among shaft, spindle and axle.
- 3 Write any two applications of knuckle joint.
- 4 Why nut is manufactured from phosphor bronze in case of power screws?
- 5 Define lead and state the relation between lead and pitch in case of threaded screws.
- 6 What is the function of cotter in cotter joint? Where it is used?
- 7 What is the difference between rigid coupling and flexible coupling?
- 8 Differentiate between crushing stress and bearing stress.
- 9 “As the value of tolerances increases i.e. more precise tolerances, the cost of manufacturing the product is increases”, Justify the statement.
- 10 Draw the neat sketch of any two types of geometric tolerances and explain the meaning of each.
- 11 List the types of riveted joints.
- 12 What is the criterion of design of fulcrum pin in levers?
- 13 State the Rankine’s formula in the design of columns.
- 14 Differentiate between strut and column.

Q.2 (a) What are the reasons for using factor of safety? Why its values are different for different applications? 03

(b) What is stress concentration? Explain any two methods of reducing of it with neat sketches. 04

(c) The load on a bolt consists of an axial pull of 10 kN together with a transverse shear force of 5 kN. Find the diameter of bolt required according to (i) maximum principal stress theory, (ii) maximum principal shear stress theory, (iii) maximum distortion energy theory. 07
Take permissible tensile stress at elastic limit as 100 MPa and poisson’s ratio as 0.3.

OR

(c) Design a right angled bell crank lever to raise a load of 6 kN at short arm. The lengths of short and long arms of a lever 07

are 90 mm and 540 mm respectively. The lever and the pins are made of steel. The permissible stresses of steel are 80 N/mm² in tension, 40 N/mm² in shear and 10 N/mm² in bearing. Assume the cross section of the lever as rectangular with depth as three times the thickness.

- Q.3** (a) Classify the couplings. **03**
(b) Compare the strength of square key and rectangular key, if the diameter of the shaft is 80 mm and length of key is 50 mm. **04**
(c) Design a shaft supported by two bearings placed 1 m apart. A 600 mm diameter pulley is mounted at a distance of 300 mm to the right of left hand bearing and this drives a pulley directly below it with the help of belt having maximum tension of 2.25 kN. Another pulley 400 mm diameter is placed 200 mm to the left of right hand bearing and is driven with the help of electric motor and belt, which is placed horizontally to the right. The angle of contact for both the pulleys is 180° and $\mu = 0.24$. The allowing working stress of 63 MPa in tension and 42 MPa in shear for the material of shaft. Assume that the torque on one pulley is equal to that on the other pulley. **07**

OR

- Q.3** (a) Define: basic size, tolerance and deviation. **03**
(b) Explain with neat sketches hole basis and shaft basis system of fits. **04**
(c) Design a cast iron protective type flange coupling to transmit 15 kW at 900 r.p.m. from an electric motor to a compressor. The service factor may be assumed as 1.35. The shaft, bolt and key are made from steel having yield point stress and crushing stress of 160 N/mm². The ultimate tensile strength of cast iron is 32 N/mm². Assume the shear stress is half of the normal stress and factor of safety of 2. **07**

- Q.4** (a) Explain with neat sketches failures in knuckle pin. **03**
(b) Find the tolerances, maximum interference and type of fit for the data as Hole $\phi 50^{+0.25}_{-0.10}$ and Shaft $\phi 50^{+0.20}_{-0.20}$. **04**
(c) Calculate the dimensions of the socket end of a cotter joint used to connect two rods, made of plain carbon steel 40C8 having yield point strength 380 N/mm². The diameter of each rod is 50 mm and the cotter is made from a steel plate of 15 mm thickness. Assume (i) the yield strength in compression is twice of the tensile yield strength, (ii) the yield strength in shear is 50 % of the tensile yield strength, (iii) the factor of safety is 6. **07**

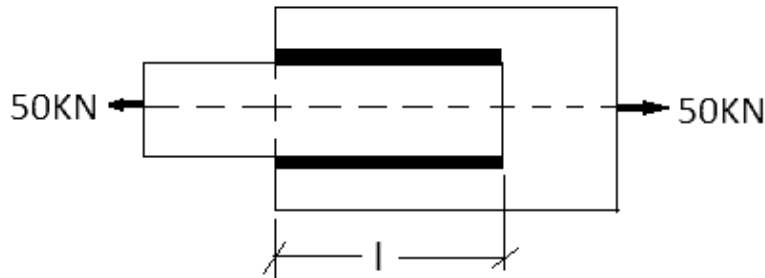
OR

- Q.4** (a) State the assumptions presume for the derivation of Euler's formula. **03**
(b) An I-section 400 mm x 200 mm x 10 mm and 3 meter long is used as a strut with both ends pinned. Find Euler's crippling load. Assume Young's modulus of elasticity for the material of the section as 200 kN/mm². **04**

- (c) Find the suitable size of 300 mm long push rod of a petrol engine carrying a maximum load of 1400 N. It is hollow in section having the outer diameter 1.25 times the inner diameter. Spherical seated bearings are used for the push rod. The modulus of elasticity for the material of the push rod is 210 kN/mm^2 . Assume factor of safety of 2.5. 07
- Q.5** (a) Explain different form of threads used in power screws. 03
- (b) Explain the phenomenon of self locking and overhauling of power screws. 04
- (c) 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 rpm. Assuming uniform wear condition at the collar and allowable thread bearing pressure of 5.8 N/mm^2 , find: (i) the torque required to rotate the screw; (ii) the stress in the screw; and (iii) the number of threads of nut in engagement with screw. 07

OR

- Q.5** (a) What are the advantages and disadvantages of threaded joints? 03
- (b) A steel plate 100 mm wide and 10 mm thick is welded to another steel plate by means of double parallel fillet welds as shown in figure given below. The plates are subjected to a static tensile force of 50 kN. Determine the required length of the welds if the permissible shear stress in the weld is 94 N/mm^2 . 04



- (c) A bracket is attached to a steel channel by means of nine identical rivets as shown in figure given below. Determine the diameter of rivets, if the permissible shear stress is 60 N/mm^2 . 07

