

KATHMANDU UNIVERSITY
End Semester Examination [C]
June, 2018

Marks Scored:

Level : B. E.

Year : III

Course : MEEG 315

Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date JUN 18 2018

SECTION "A"

[20 Q. × 1 = 20 marks]

Use of Data Book is **NOT** allowed for objective. Choose the most appropriate answer and **mark [X]**.

- Looking for an acceptable solution is the purpose of
 Need analysis Preliminary design
 Feasibility study Detailed design
- The value of stress concentration factor depends upon.
 material of the part geometry of the part
 material and geometry none
- A locking device in which the bottom cylindrical portion is recessed to receive the tip of the locking set screw, is called
 castle nut jam nut ring nut sawn nut
- A screw is said to be over hauling screw, if its efficiency is
 more than 50% less than 50% equal to 50% none
- A riveted lap joint has two rivets installed. Find the diameter of the rivet for the riveted joint, if the joint fail due to shearing of rivet. Provided $P = 250 \text{ kN}$, $\tau = 60 \text{ N/mm}^2$.
 2.65 mm 1.62 mm 0.05 mm 51.50 mm
- Spherical roller bearings are normally used
 for increased radial load for increased thrust load
 when there is less radial space for reduced clearance between rollers
- Angle of helix in a close coiled spring is
 < 100 > 100 $= 100$ None
- The acme threads are usually found on
 spindles of bench vices railway carriage couplings
 feed mechanism of machine tools screw cutting lathes
- A double fillet welded joint with parallel fillet weld of length l and leg s is subjected to a tensile force P . Assuming uniform stress distribution, the shear stress in the weld is given by
 $\frac{\sqrt{2} P}{s.l}$ $\frac{P}{2 s.l}$ $\frac{P}{\sqrt{2} s.l}$ $\frac{2 P}{s.l}$
- Which type of nut was not designed to prevent slippage?
 hexagon jam castle slotted
- Transverse fillet welded joints are designed for
 tensile strength compressive strength
 shear strength torsional strength

12. Two springs with spring rate 12.6 N/mm and 10 N/mm are connected in series. If the ultimate tensile strength of steel wire is 1250 N/mm^2 , calculate the value of combined stiffness of the springs in connection.
 5.57 N/mm 0.18 N/mm 22.6 N/mm 2.6 N/mm
13. A key capable of tilting in a recess milled out in a shaft is known as
 wood-ruff key feather key flat saddle key gib head key
14. Self locking in a power screw is better achieved by
 decreasing the helix angle and decreasing the coefficient of friction.
 decreasing the helix angle and increasing the coefficient of friction.
 increasing the helix angle and increasing the coefficient of friction.
 increasing the helix angle and decreasing the coefficient of friction.
15. Split nut is a locking device in which
 one smaller nut is tightened over main nut and main nut tightened against smaller one by loosening, creating jamming
 a slot is cut partly in middle of nut and then slot reduced by tightening screw
 a hard fiber or nylon cotter is recessed in the nut and becomes threaded as the nut is screwed on the bolt causing a tight grip
 through slots are made at top and cotter-pin is passed through these and a hole is the bolt, and cotter pin splitted and bend in reverse direction at the other end
16. The purpose of circumferential lap joint in boiler shell is
 to make cylindrical ring from steel plate
 to increase the length of boiler shell by connecting one ring to another
 to make diameter and length of boiler shell
 to connect openings to shell
17. Identify the incorrect statement.
 Multiple threads are used for higher efficiency
 Buttress thread is weaker than trapezoidal thread
 Power screw can be designated with self-locking characteristics
 A screw is said to be self-locking if its efficiency is less than 50%
18. Spring index is
 its capability of storing energy
 indication of quality of spring
 ratio of coil diameter to wire diameter
 load required to produce unit deflection
19. In hydrodynamic bearings
 grease is used for lubrication
 do not require external supply of lubricant
 the oil film is maintained by supplying oil under pressure
 the oil film pressure is generated only by the rotation of the journal
20. In hydrostatic bearing
 grease is used for lubrication
 do not require external supply of lubricant
 the oil film is maintained by supplying oil under pressure
 the oil film pressure is generated only by the rotation of the journal

Level : B. E.
Year : III
Time : 2 hrs.30 mins.

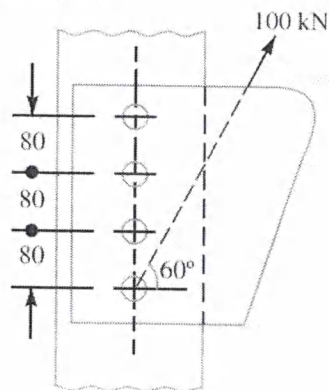
Course : MEEG 315
Semester : I
F.M. : 55

SECTION "B"

[5 Q. × 11 = 55 marks]

Use of Data Book is **ALLOWED** for this examination. Assume and/ or select suitable data if not specified. *Answer all questions.*

1. a) A bracket in the form of a plate is fitted to a column by means of four rivets of the same size, as shown in Figure 1. A load of 100 kN is applied to the bracket at an angle of 60° to the horizontal and the line of action of the load passes through the centre of the bottom rivet. If the maximum shear stress for the material of the rivet is 70 MPa, find the diameter of rivets. What will be the thickness of the plate if the crushing stress is 100 MPa? [5]



All dimensions in mm.
Figure 1

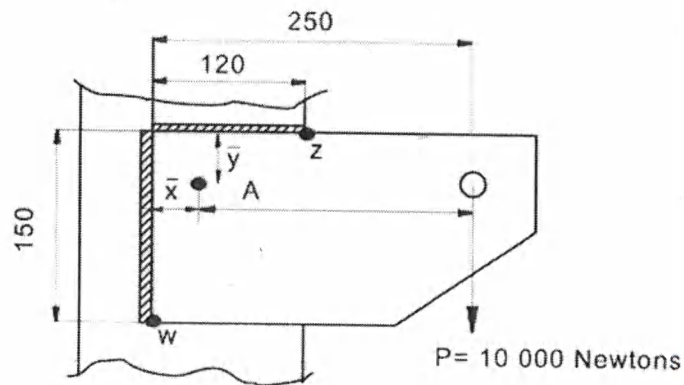


Figure 2

- b) Design a triple riveted longitudinal double strap butt joint with unequal straps for a boiler. The inside diameter of the longest course of the drum is 1.3 metres. The joint is to be designed for a steam pressure of 2.4 N/mm^2 . The working stresses to be used are: $\sigma_t = 77 \text{ MPa}$; $\tau = 62 \text{ MPa}$ and $\sigma_c = 120 \text{ MPa}$ [6]
Assume the efficiency of the joint as 81%.
2. a) Explain in brief the term stress concentration and notch sensitivity. [3]
b) Find out the weld size and throat size for the welded joint as shown in figure. The design stress is not to exceed 220 N/mm^2 . All dimensions are in mm. [4]
c) A $200 \times 150 \times 10 \text{ mm}$ angle is to be welded to a steel plate by fillet welds as shown in Figure 3. If the angle is subjected to a static load of 200 kN, find the length of weld at the top and bottom. The allowable shear stress for static loading may be taken as 75 MPa. [4]

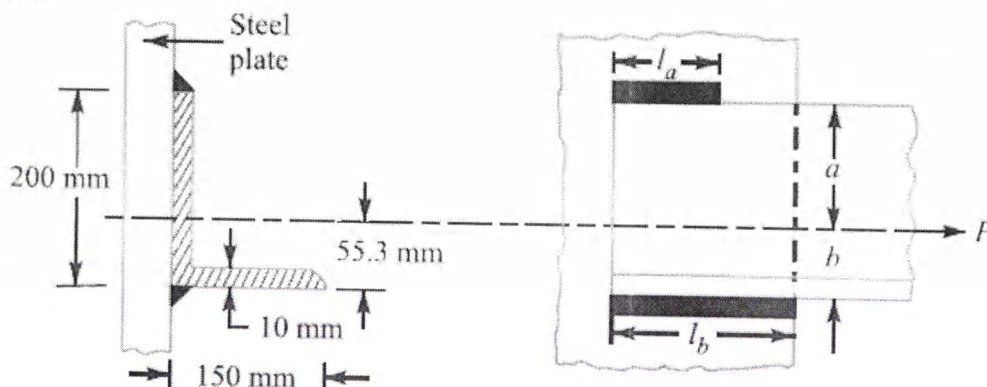


Figure 3

3. a) Make a comparison between square, acme and buttress thread in context with efficiency, bursting load and manufacturability. [3]
- b) A vertical two start square threaded screw of a 100 mm mean diameter and 20 mm pitch supports a vertical load of 18 kN. The axial thrust on the screw is taken by a collar bearing of 250 mm outside diameter and 100 mm inside diameter. Find the force required at the end of a lever which is 400 mm long in order to lift and lower the load. The coefficient of friction for the vertical screw and nut is 0.15 and that for collar bearing is 0.20. [4]
- c) An assembly consists of a tube, washer A, and a square-threaded screw. The end of the screw is threaded into the support B. The tube will be crushed if the compressive load acting on it exceeds 100 N. Determine the maximum value of the torque M that can be safely applied to the tube. The screw has lead $L = 8$ mm and mean radius = 10 mm. The coefficient of static friction between the screw and the threads in the support A is = 0.3. Neglect the friction between the washer and the tube and between the washer and the head of the screw. [4]

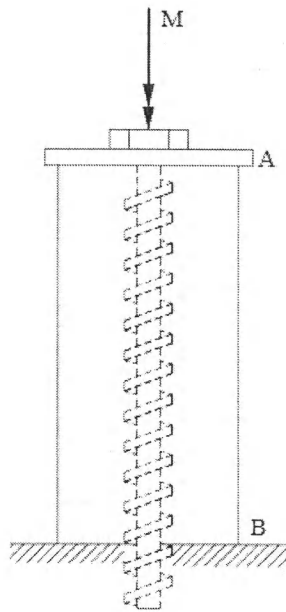


Figure 4

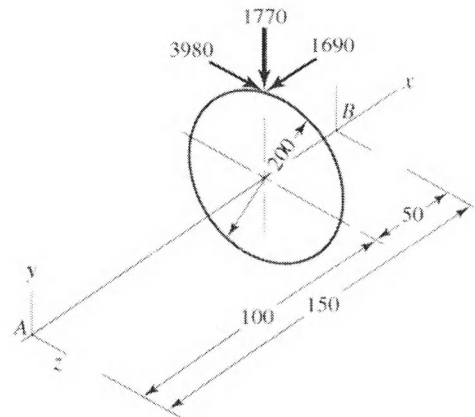


Figure 5

4. a) Explain the need of taper roller bearing compared to ball bearing. [3]
- b) What are the benefits of using leaf spring? [2]
- c) The shaft shown in figure carries a helical gear with a tangential force of 3980 N, a radial force of 1770 N, and a thrust force of 1690 N at the pitch cylinder with direction shown. The pitch diameter of the gear is 200 mm. The shaft runs at a speed of 800 rev/min, and the span (effective spread) between the direct mount bearings is 150 mm. The design life is to be 5000 hrs. Select suitable single row deep groove ball bearing. [6]
5. a) Explain the differences between compression spring and torsion spring. [2]
- b) Design the spring for an elevator at the bottom of which 8 identical springs are set in parallel to absorb the shock of the elevator in case of failure. The weight of the elevator is 20 kN and has a free fall of 1.2 m from rest. The spring is made of 20 mm dia wire and has a spring index of 5.5. Each spring has 12 active turns. Neglect the effect of counter weight. [6]
- c) A helical spring of wire diameter 6mm and spring index 6 is acted by an initial load of 800N. After compressing it further by 10mm the stress in the wire is 500MPa. Find the number of active coils. $G = 84000\text{MPa}$. [3]