

KATHMANDU UNIVERSITY
End Semester Examination
February/March, 2018

Marks scored:

Level : BE
Year : III

Course : MEEG 315
Semester : I

Exam. Roll No. :

Time: 30 mins.

F.M. : 20

Registration No.:

Date FEB 26 2018

SECTION "A"

[20Q × 1=20 marks]

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

1. Ball screws are found in
 screw jack airplane engine crane steering mechanism
2. A close-coiled helical spring of stiffness 30N/mm is arranged in series with another such spring of stiffness 60 N/mm. The stiffness of composite unit is
 20 N/mm 30 N/mm 45 N/mm 90 N/mm
3. If a spring is cut down into two springs, the stiffness of cut springs will be
 half same double unpredictable
4. In leaf springs, the longest leaf is known as
 Master leaf Lower leaf Upper leaf Major leaf
5. When a nut is tightened by placing a washer below it, the bolt will be subjected to
 tensile stress compressive stress shear stress bending stress
6. Transverse fillet welded joints are designed for
 tensile strength compressive strength
 bending strength torsional strength
7. When the length of the journal is equal to the diameter of the journal, then the bearing is said to be a
 short bearing long bearing medium bearing square bearing
8. For applications involving high stresses in one direction only the following type of thread would be best suited
 Acme thread Square thread Butress thread BSW thread
9. Which of the following bearing is preferred for oscillating conditions?
 Double row roller bearing Taper roller bearing
 Angular contact ball bearing Needle roller bearing
10. Deep groove ball bearings are used for
 heavy thrust load small angular displacement of shaft
 radial load at very high speed combined thrust & radial load at high speed
11. Which of the following is used in mechanical wrist watch?
 Helical compression spring Spiral spring
 Torsion spring Belleville spring
12. Rivets are generally specified by
 thickness of plates length of rivet
 diameter of rivet head nominal diameter

13. Spring index is
- ratio of coil diameter to wire diameter
 - its capability of storing energy
 - load required to produce unit deflection
 - indication of quality of spring
14. Cap screws are
- similar to small size tap bolts with variety of head shape
 - slotted for a screw driver and generally used with a nut
 - used to prevent relative motion between parts
 - provided with detachable caps
15. A tap bolt
- requires locking devices
 - has both the ends threaded
 - has a head on one end and a nut fitted to the other
 - had head at one end and other end fits into a tapped hole
16. Stress concentration factor is defined as
- ratio of highest stress near the discontinuity to yield strength
 - ratio of endurance limit to highest stress near the discontinuity
 - ratio of highest stress near the discontinuity to endurance limit
 - ratio of highest stress near discontinuity to nominal stress from elementary equation
17. Identify the correct statement. Stress concentration in static loading is
- very serious in brittle materials
 - very serious in ductile materials
 - equally serious in both ductile and brittle materials
 - seriousness would depend on other factors
18. Identify the incorrect statement.
- The spring stiffness is the load required per unit deflection of the spring
 - The spring index is the ratio of mean diameter of the coil to the diameter of the wire
 - The solid length of a spring is the product of total number of coils and diameter of the wire
 - The pitch of the coil is the axial distance between adjacent coils in the compressed state
19. Identify the incorrect statement.
- Screw used in power transmission should have high efficiency.
 - The number of rivets in shear shall be equal to number of rivets in crushing.
 - In hydrodynamic lubricated bearing, there is thick film of lubrication.
 - Square threads are not as strong as V threads and they offer more frictional resistance
20. 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

Level : BE
 Year : III
 Time : 2 hrs. 30 mins.

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

SECTION "B"

[5Q × 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) Why changes in design are preferred in the early stages rather than later stages. [2]
- (b) A bracket is attached to a column by means of five rivets as shown in figure 1. Find the diameter of the rivet for the riveted connection, if the maximum shear stress is not to exceed 90 N/mm^2 in the most heavily loaded rivet. First load is 200 mm and second load is 250 mm from CG respectively. [5]

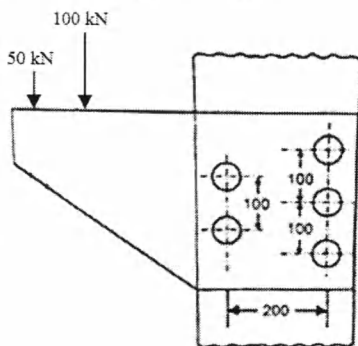


Figure 1 (Dimension in mm)

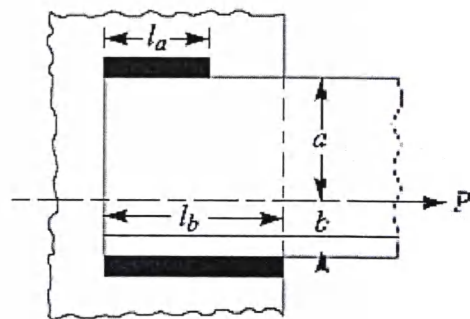


Figure 2

- (c) A double riveted, zig-zag butt joint, in which the pitch of the rivets in the outer row is twice that in the inner rows; with two cover plates. Design the boiler joint, if the boiler has internal diameter of 2m, internal pressure of 3 MPa, working stresses are: $\sigma_t = 100 \text{ MPa}$, $\sigma_c = 150 \text{ MPa}$, and $\tau = 75 \text{ MPa}$. [4]
2. (a) Explain the reason for unequal length of weld in the joint as shown in figure 2. [3]
 - (b) The bracket, as shown in figure 3, is designed to carry a dead weight of $P = 15 \text{ kN}$. What sizes of the fillet welds are required at the top and bottom of the bracket? Assume the forces act through the points A and B. The welds are produced by shielded arc welding process with a permissible strength of 150 MPa. [5]

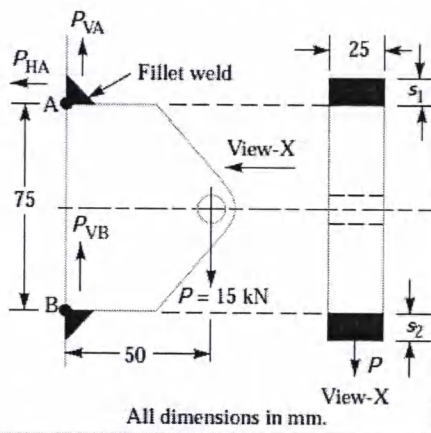


Figure 3

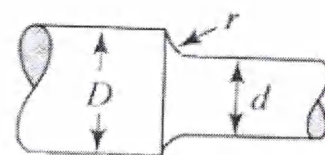


Figure 4

- (c) Find the maximum stress developed in a stepped shaft as shown in figure 4 subjected to a twisting moment of 100 Nm as shown in figure 4. $r = 6 \text{ mm}$, $d = 30 \text{ mm}$, $D = 40 \text{ mm}$. [3]

3. (a) "Single-start threads are more common in fasteners than multiple-start threads" Explain. [3]
 (b) List out differences (including advantages and disadvantages) between Nyloc and Jam nut. [3]
 (c) The screw, as shown in figure 5 is operated by a torque applied to the lower end. The nut is loaded and prevented from turning by guides. Assume friction in the ball bearing to be negligible. The screw is a triple start trapezoidal thread. The outside diameter of the screw is 48 mm and pitch is 8 mm. The coefficient of friction of the threads is 0.15. Find:
 (i) Load which can be raised by a torque of 40 N-m ;
 (ii) Whether the screw is self locking; and
 (iii) Average bearing pressure between the screw and nut thread surface. [5]

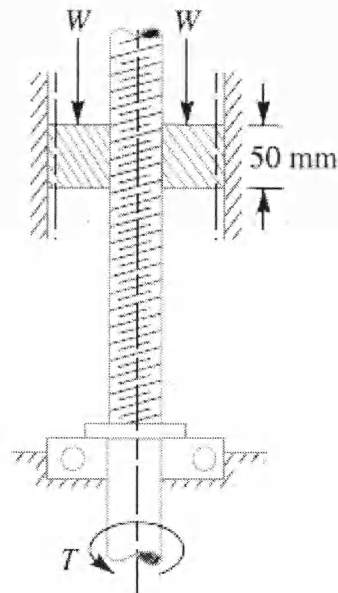


Figure 5

4. (a) A shaft in factory has to bear heavy axial as well as radial load. If there is possibility of slight eccentricity in the shaft, what type of bearing would you suggest and why? [2]
 (b) Compare between sliding contact bearing and rolling contact bearing. [3]
 (c) Select a single row deep groove ball bearing for a radial load of 4000 N and an axial load of 5000 N, operating at a speed of 1600 rpm for an average life of 5 years at 10 hours per day. Assume uniform and steady load. [6]
5. (a) What are the applications of spring with progressive spring rate compared to spring with linear spring rate? [3]
 (b) A spring is made from wire of 1.25 mm diameter and 750N/mm^2 and its yield strength. For a mean diameter of 12.5 mm and 14 active coils of the spring, determine (a) static load corresponding to yield point of the material and deflection to that (b) solid height assuming that the ends are squared and ground (c) stiffness of the spring, (d) pitch of the wire so that the solid stress will not exceed the yield point. Take $C = 0.85 \times 10^5 \text{ N/mm}^2$. [5]
 (c) Explain the reason why Leaf springs are preferred for rear suspension in automobile rather than coil springs. [3]