KATHMANDU UNIVERSITY
End Semester Examination
February/March, 2019

Marks scored:

Level : B.E.
Year : III

Course : MEEG 315
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date 17 FEB 2019

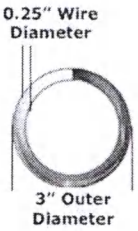
SECTION "A"
[20Q × 1=20 marks]

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

1. Hydrostatic bearing usually use ____ as lubricant
   [ ] Oil [ ] Grease [ ] Nothing [ ] Any of the above

2. A locking device extensively used in automobile industry is a
   [ ] lock nut [ ] castle nut [ ] sawn nut [ ] ring nut

3. Dimensions of a spring are shown in the figure. The D_m and C for the spring are:
   [ ] 2.5", 10 [ ] 2.75", 11 [ ] 3", 12 [ ] None of the above



4. Transverse fillet welded joints are designed for
   [ ] Tensile strength [ ] Compressive strength
   [ ] Shear strength [ ] Bending strength

5. Temperature rise in partial bearing is ____ than full bearing
   [ ] Lesser [ ] Greater [ ] Equal [ ] undeterminable

6. External diameter of 6304 series bearing is ..... to that of 6204 series bearing.
   [ ] Smaller [ ] Larger [ ] Equal [ ] Not applicable

7. A close-coiled helical spring of stiffness 30N/mm is arranged in parallel 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

8. At which stage in the design cycle would orthographic drawings be most relevant?
   [ ] Feasibility study [ ] Preliminary design [ ] Detail Design [ ] Design for production

9. A screw is said to be a self locking screw, if its efficiency is
   [ ] < 50% [ ] = 50% [ ] > 50 % [ ] none

10. Rivets are generally specified by
    [ ] Thickness of plate [ ] Length of rivet
    [ ] Diameter of head [ ] Nominal diameter

11. The lubrication in which load of bearing is carried solely by a film of fluid and there is no contact between the two bearings surface is called
    [ ] Boundary condition [ ] Full film condition
    [ ] Dry condition [ ] None of the above

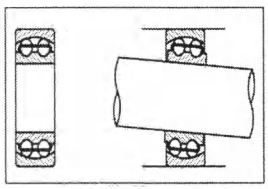
12. Which of the following is/are the cause of bearing failure?
    [ ] Sudden rise in bearing load [ ] Inappropriate bearing selection
    [ ] Improper mounting of bearing [ ] All of the above

13. Design are periodically modified to
    [ ] improve product performance
    [ ] strive for zero-based rejection and waste
    [ ] make product easier & faster to manufacture
    [ ] all of the above

14. Stress concentration is caused due to
    [ ] variation in properties of material from point to point in a member
    [ ] pitting at points or areas at which loads on a member are applied
    [ ] abrupt change of section
    [ ] all of the above

15. In a radial rolling element bearing, on increasing the size of the rolling elements would
    [ ] Increase load capacity of the radial bearing
    [ ] Decrease load bearing capacity
    [ ] Increase or decrease depending on the constraint on outer diameter of outer ring
    [ ] Increase of decrease depending on the constraint on bore diameter of inner ring

16. What is the function of the bearing shown in the figure?
    [ ] It supports and aligns the shaft.
    [ ] It increases the rotation frequency of the shaft.
    [ ] It decreases the rotation frequency of the shaft.
    [ ] It rotates the shaft at a low speed.



17. M30 x 2 for a bolt represents
    [ ] metric threads of 30mm pitch diameter and 2 number
    [ ] metric threads of 30mm pitch diameter and 2mm pitch
    [ ] metric threads of 30mm outside diameter and 2mm pitch
    [ ] metric threads of 30mm outside diameter and 2mm thread length

18. According to IBR when the thickness of the boiler shell is less than 8mm, then the diameter of the rivet hole is obtained by
    [ ] equating tearing resistance of the plate to shearing resistance of rivet
    [ ] equating tearing resistance of the plate to the crushing resistance of the rivets
    [ ] equating shearing resistance of the rivet to crushing resistance of the rivets
    [ ] none of the above

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. Identify the incorrect statement
    [ ] The longitudinal joint makes a ring from steel plate
    [ ] In boiler joint, circumferential joint is twice the longitudinal stress
    [ ] The circumferential joint is used to get the required length of boiler shell
    [ ] Circumferential joint should be stronger than the longitudinal joint in boiler

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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) 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 20 kN is applied to the bracket. 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]

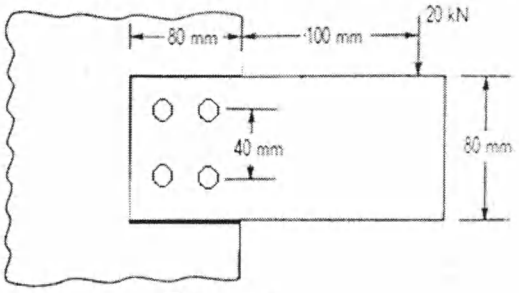

Figure 1

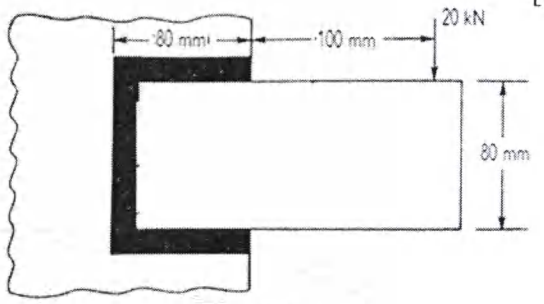

Figure 2

(b) A bracket carrying a load of 20 kN is to be welded as shown in figure 2. Calculate the size of the weld if the working shear stress is not to exceed 70 N/mm^2. What will be the change in load bearing capacity of the welded joint if the joint is welded in all four sides? [5]

(c) Considering above questions, explain which joint you would prefer for the provided conditions. [1]

2. (a) A triple riveted butt joint with double straps of unequal width is to be designed for a boiler shell. The pitch of the rivets in the outer row is double the pitch in the inner row and zigzag riveting is proposed. How many rivets are there per pitch and how many rivets are single and double shear? [2]

(b) Design the longitudinal joint for a boiler with shell plate thickness of 23 mm. The joint is triple-riveted, double cover plate butt joint with straps of unequal width. The rivets and plates are made of mild steel having ultimate strength in tension, crushing and shear as 60 N/mm^2, 100 N/mm^2 and 45 N/mm^2 respectively. Consider efficiency of the joint as 80%. [5]

(c) An angle of size 200 mm x 150 mm x 20 mm is welded to a flat plate with long side of the angle along the length of the plate, as shown in figure 3 with Axial load of 15 kN. The allowable shear stress for static loading may be taken as 70 MPa. Design the joint. [4]

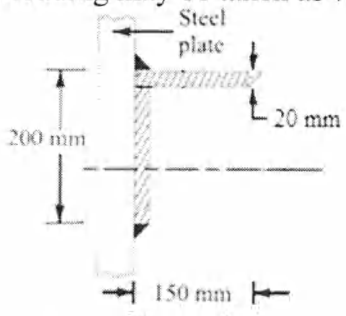

Figure 3

3. (a) Compare the working of acme and buttress thread forms including advantages and disadvantages of each. [3]

(b) Explain Lock nut, Shake proof washer, Locking with a plate & Penn, ring and grooved nut [4]

(c) A power screw has a double start square thread with a pitch diameter of 30 mm and a pitch of 3 mm. The coefficient of friction between the threads is 0.14 and collar is 0.08. If the screw has a power input of 3 kW at 60 rpm and a collar diameter of 40 mm, determine the maximum axial load against which the screw may be safely driven, and the mechanical efficiency of the screw. [4]

4. (a) Explain the need of spherical bearing and needle bearing. [3]
(b) Why taper bearing is preferred to cylindrical roller bearing? [2]
(c) A transmission shaft is supported by two deep grove ball bearings at two ends. The centre distance between the bearings is 160 mm. A load of 300 N acts vertically downwards at 60 mm distance from the left hand bearing whereas a load of 550 N acts horizontally at right hand bearing. Shaft speed is 3000 rpm and expected life of bearing is 7000 hours. It is intended to use same bearing at both ends of the shaft. Select suitable single row deep groove ball bearings. [6]

5. (a) Explain the working of Belleville disc as spring and as a locking device. [3]
(b) A concentric spring for an aircraft engine valve is to exert a maximum force of 5000 N under an axial deflection of 40 mm. Both the springs have same free length, same solid length and are subjected to equal maximum shear stress of 850 MPa. If the spring index for both the springs is 6, find (a) the load shared by each spring, (b) the main dimensions of both the springs, and (c) the number of active coils in each spring. Assume G = 80 kN/mm^2 and diametral clearance to be equal to the difference between the wire diameters. [5]
(c) Shown in figure 4 is a composite spring. Find the maximum shear stress developed in both springs when they are compressed to 10 mm. Both springs has outer diameter of 50 mm and wire diameter of 5 mm. [3]

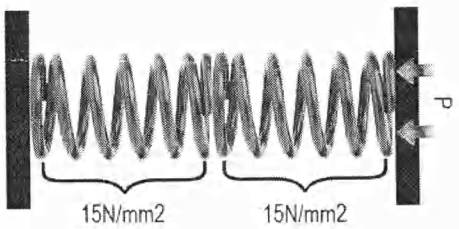

Figure 4