KATHMANDU UNIVERSITY
End Semester Examination
March/April, 2017

Marks scored:

Level : BE
Year : III

Course : MEEG 315
Semester: I

Exam. Roll No. :

Time: 30 mins.

F.M. : 20

Registration No.:

Date : MAR 2 6 2017

SECTION "A"

[20Q × 1=20 marks]

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

1. If the outside diameter of spring is 58 mm and wire diameter is 4 mm then the spring index (C) for the spring is
[ ] 14.5 [ ] 13.5 [ ] 13 [ ] 12.5

2. For a self-locking screw, the efficiency of screw must be
[ ] 60 % [ ] 50 % [ ] 40 % [ ] 25 %

3. If 'c' is the difference between diameter of bearing and diameter of journal, minimum distance between bearing and journal under complete lubrication condition is generally
[ ] c/2 [ ] c/3 [ ] c/4 [ ] c/5

4. _____ are threaded on both ends.
[ ] Through bolts [ ] Carriage bolts [ ] Tap bolts [ ] Stud bolts

5. The life of a ball bearing at a load of 10 kN is 8000 hours. Its life in hours. If the load is increased to 20 kN, keeping all other conditions same, is
[ ] 4000 [ ] 2000 [ ] 1000 [ ] 500

6. Two closely coiled springs are made from the same small diameter wire, one wound on 25 mm diameter core and other on 12.5 mm diameter core. If each spring had n coils, then the ratio of their spring constants would be
[ ] $\frac{1}{16}$ [ ] $\frac{1}{8}$ [ ] $\frac{1}{4}$ [ ] $\frac{1}{2}$

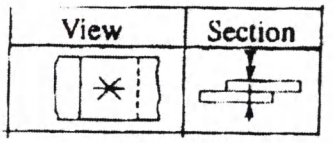
7. Rivet in a riveted joint fails by
[ ] tearing [ ] shearing [ ] bending [ ] all of above

8. Looking for an acceptable solution is the purpose of
[ ] need analysis [ ] preliminary design [ ] feasibility study [ ] detailed design

9. Which of the following stresses are associated with the tightening of a nut on a bolt?
a. tensile stress due to stretching of a bolt
b. bending stress due to bending of a bolt
c. crushing and shear stresses in threads
d. torsional shear stress due to friction
[ ] a, b, c [ ] b, c, d [ ] a, b, d [ ] a, c, d

10. Thickness of a single strap in a riveted joint is
[ ] < plate thickness
[ ] = plate thickness
[ ] > plate thickness
[ ] none

11. Identify the symbol shown in the Figure:
[ ] general rivet
[ ] bolt with place for nut
[ ] rivet countersunk
[ ] bolt head countersunk



12. Petroff's law provides fairly accurate value of _____ for concentric bearing-shaft.
[ ] coefficient of friction
[ ] power loss coefficient
[ ] clearance ratio
[ ] bearing modulus

13. The type of spring used in door hinges is
[ ] helical extension spring
[ ] multi-leaf spring
[ ] spiral spring
[ ] helical torsion spring

14. The most suitable bearing for carrying very heavy loads with slow speed is
[ ] ball bearings
[ ] roller bearings
[ ] hydrostatic bearings
[ ] hydrodynamic bearings

15. Which of the following bearings can take up large thrust loads?
[ ] deep-groove ball bearings
[ ] filing-notch ball bearing
[ ] self-aligning bearing
[ ] angular-contact bearing

16. Lubrication in journal bearing cannot
[ ] distribute the load over greater area of shaft
[ ] avoid metal to metal contact between journal and bearing
[ ] improves the wear resistance of the bearing
[ ] prevent foreign material from contaminating the bearing

17. The ideal spring material would have a
[ ] low ultimate strength, low yield point, low modulus of elasticity
[ ] high ultimate strength, low yield point, low modulus of elasticity
[ ] high ultimate strength, high yield point, low modulus of elasticity
[ ] high ultimate strength, high yield point, high modulus of elasticity

18. Identify the incorrect statement related to the welded joints.
[ ] welding results in a thermal distortion of the parts
[ ] due to reinforcement there is stress concentration in joints
[ ] reinforcement in weld is provided for compensating for any flaws in the weld
[ ] compared to cast iron, welded structures have better vibration damping capacity

19. The most efficient riveted joint possible is one which would be as strong in tension, shear and bearing as the original plates to be joined. But this can never be achieved because
[ ] rivets cannot be made with the same materials
[ ] rivets are weaker in compression
[ ] there should be at least one hole in the plate reducing its strength
[ ] clearance is present between the plate and the rivet

20. Identify the incorrect statement.
[ ] 'V' thread is not used in power screws
[ ] wear is serious problem in power screws
[ ] power screw can be designated with self-locking characteristics
[ ] the efficiency of trapezoidal threads is more than that of square threads

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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) Make a comparison between the joints available and identify the efficient joint among them. The allowable stresses are 120 MPa in tension, 80 MPa in shear and 210 MPa in crushing (bearing). Assume hole diameter is equal to the rivet diameter. [5]

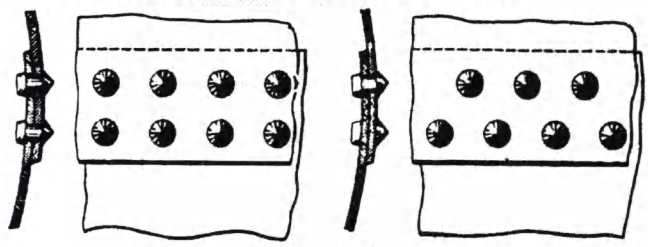


Figure 1

(b) The bracket as shown in Figure 2, is to carry a load of 45 kN. Determine the size of the rivet if the shear stress is not to exceed 40 MPa. Assume all rivets of the same size. [6]

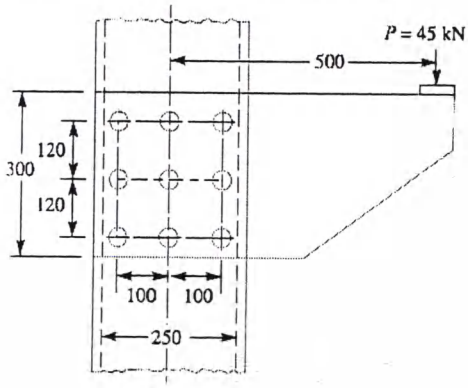
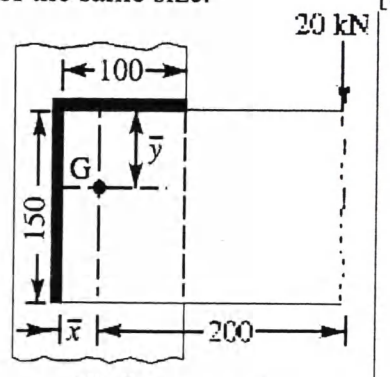


Figure 2



All dimensions in mm.

Figure 3

2. (a) Explain the term "Recognition of Need" in relation to Product Design Cycle. [3]
(b) Figure 3 shows a welded joint subjected to an eccentric load of 20 kN. Determine the uniform size of the weld on the entire length of two legs. Take permissible shear stress for the weld material as 80 MPa. [5]
(c) Compare the effect of stress concentration on the two systems shown below (Figure 4). Explain which system would fail first under application of same load. The area covered by the defect in both the system is same. [3]

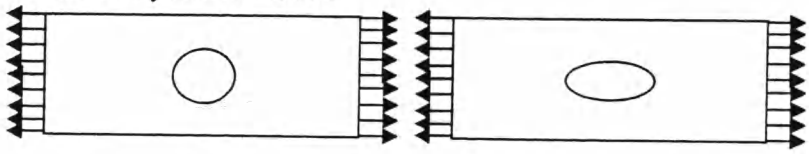


Figure 4

3. (a) A screw jack need to be designed and fabricated to lift some load in a factory. Only 'V' thread is available in its store. Would you use 'V' thread screw in the screw jack? Explain with proper reason supporting your answer. [3]

(b) A single square-thread power screw has an input power of 3 kW at a speed of 1 rev/s. The screw has a major diameter of 36 mm and a pitch of 6 mm. The frictional coefficients are 0.14 for the threads and 0.09 for the collar, with a collar friction radius of 45 mm. a) Find the axial resisting load F and the combined efficiency of the screw and collar. b) Indicate whether the screw is self-locking or not. Nut and power screw are made of C60 and assume shear yield strength is half of tensile yield strength. (Do not consider buckling) [5]

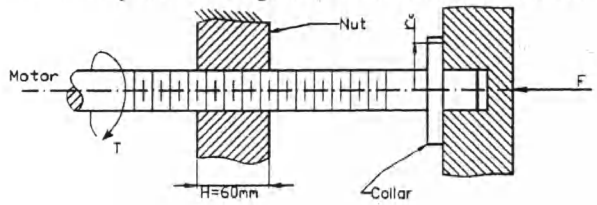


Figure 5

(c) Explain wire locking of threaded fasteners along with Figure. [3]

4. (a) Bearings are needed to be selected for drum pulley of a conveyor system in a factory to transport a corrosive powder. Explain which type of bearing you would select for the system along with its SKF number and seal type. [3]

(b) Figure shows a 45 mm diameter shaft supported by two 6300-series bearings. Two gears with equal and opposite torque are keyed to the shaft as shown. The load on each gear consists of a radial and a tangential component. The radial component of each gear is 0.466 times the tangential component on that gear. The gear loads are 90 degrees out of phase from gear 1 to gear 2. For the given data, select a suitable bearing (from Figure 6) for bearing 1. [6]

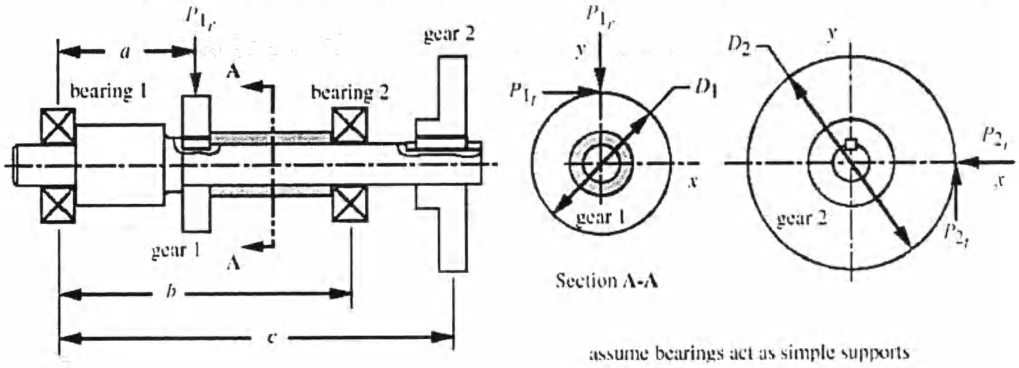


Figure 6

a	b	c	P_{1t}	D_1	D_2	L	F_a
100 mm	200 mm	300 mm	10 kN	150 mm	300 mm	80 millions of rev	4 kN

F_a: Axial load on bearing

(c) "Additive in lubrication oil improves the performance of base oil". Explain with example. [2]

5. (a) Explain the term spring index and its significance. [2]

(b) Design a compression helical spring to carry a load of 500 N with a deflection of 25 mm. The spring index may be taken as 8. Assume the following values for the spring material:
Permissible shear stress = 350 MPa Modulus of rigidity = 84 kN/mm^2 [5]

(c) Prepare a table comparing sliding contact and rolling contact bearing based on following parameters: [4]

i. load
ii. speed
iii. damping of vibration
iv. starting friction
v. type of lubricant
vi. noise
vii. space requirement
viii. quantity of lubricant