Marks scored:

KATHMANDU UNIVERSITY
End Semester Examination [C]
January, 2018

Level : B.E.
Year : II

2017 - II Sem.

Course : MEEG 202
Semester : II

Marks scored:

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Exam Roll No. :

Time: 30 mins.

F.M. : 20

Registration No.:

Date : JAN 0 5 2018

SECTION "A"
[20Q × 1 = 20 marks]

Choose the most appropriate answer and **mark [X]**.

1. A steel bar of 5 mm is heated from 15° C to 40° C and it is free to expand. The bar Will induce
   [ ] no stress [ ] shear stress [ ] tensile stress [ ] compressive stress

2. When shear force at a point is zero, then bending moment is _____ at that point.
   [ ] zero [ ] minimum [ ] maximum [ ] infinity

3. When a shaft is subjected to a twisting moment, every cross-section of the shaft will be under
   [ ] Tensile Stress [ ] Compressive Stress
   [ ] Shear Stress [ ] Bending Stress

4. Which of the following statements is/are true for a simply supported beam?
   [ ] Deflection at supports in a simply supported beam is maximum
   [ ] Deflection is maximum at a point where slope is zero
   [ ] Slope is minimum at supports in a simply supported beam
   [ ] All of the above

5. The design of a beam is based on strength criteria, if the beam is sufficiently strong to resist _____
   [ ] Shear force [ ] Deflection
   [ ] Modulus of Elasticity [ ] Non of the above

6. The shear stress acting on the neutral axis of a beam is _____
   [ ] zero [ ] minimum [ ] maximum [ ] infinity

7. If the effective length of a column is twice the actual length, then the column is _____
   [ ] fixed at both the ends
   [ ] hinged at both the end
   [ ] fixed at one end and free at other end
   [ ] fixed at one end and hinged at the other end

8. Which of the following laminas have same moment of inertia ($I_{xx} = I_{yy}$), when passed through the centroid along x-x and y-y axes?
   [ ] Circle [ ] Semi circle
   [ ] Right angle triangle [ ] Isosceles triangle

9. Thermal stress is not a function of _____
[ ] Change in temperature [ ] coefficient of linear expansion
[ ] modulus of elasticity [ ] none of the above

10. In Mohr's circle method, compressive direct stress is represented on ____
[ ] positive x-axis [ ] positive y-axis [ ] negative x-axis [ ] negative y-axis

11. Which of the following stresses can be determined using Mohr's circle method?
[ ] Torsional stress [ ] Bending stress [ ] Principal stress [ ] All of the above

12. In bending moment diagram, if no load acts between two sections, then it is represented by _____
[ ] horizontal line [ ] inclined line [ ] vertical line [ ] parabolic curve

13. A rigid body has Poisson's ratio equal to _____
[ ] 0 [ ] 1 [ ] less than one [ ] greater than one

14. A vertical column has two moments of inertia (i.e. Ixx and Iyy). The column will tend to buckle in the direction of the
[ ] axis of load [ ] perpendicular to the axis of load
[ ] maximum moment of inertia [ ] minimum moment of inertia

15. When there is a sudden increase or decrease in shear force diagram between any two points, it indicates that there is a
[ ] point load at the two points
[ ] no loading between the two points
[ ] uniformly distributed load between the two points
[ ] uniformly varying load between the two points

16. A shaft of diameter D is subjected to a twisting moment (T) and a bending moment (M). If the maximum bending stress is equal to maximum shear stress developed, then M is equal to
[ ] $T/2$ [ ] T [ ] $2T$ [ ] $4T$

17. The point of contraflexure occurs in
[ ] cantilever beams [ ] simply supported beams
[ ] overhanging beams [ ] fixed beams

18. A beam of uniform strength has
[ ] same cross-section throughout the beam
[ ] same bending stress at every section
[ ] same bending moment at every section
[ ] same shear stress at every section

19. The bending moment of a cantilever beam of length l and carrying a uniformly distributed load of w per unit length is _____ at the free end.
[ ] zero [ ] $wl/4$ [ ] $wl/2$ [ ] wl

20. The ratio between buckling load and safe load is known as
[ ] Slenderness ratio [ ] buckling factor
[ ] factor of safety [ ] none of the above

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Time : 2 hrs. 30 min.

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Semester : II
F.M. : 55

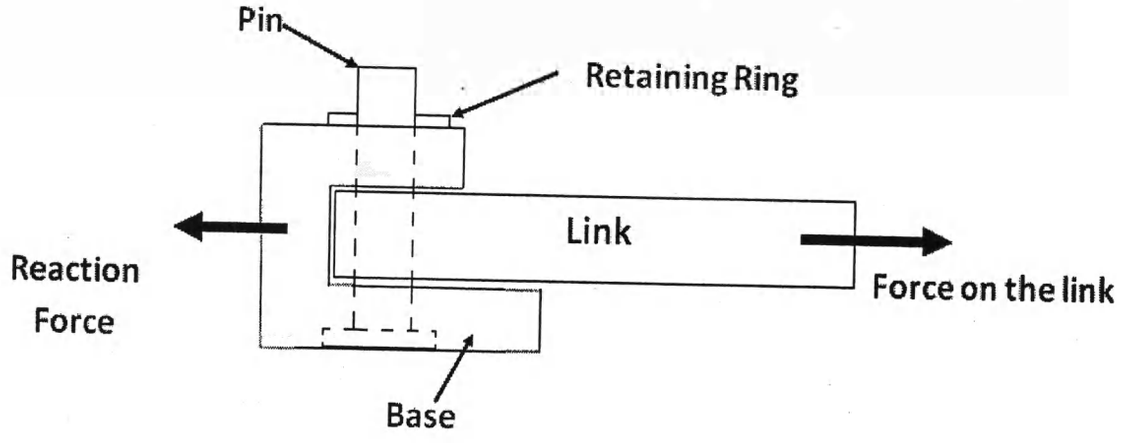
SECTION "B"

Attempt ALL question. Assume if data is missing.

1. A mild steel rod of 20 mm diameter and 300 mm long is enclosed centrally inside a hollow copper tube of external diameter 30 mm and internal diameter 25 mm. The ends of the rod and tube are brazed together and the composite bar is subjected to an axial pull of 40 kN.
If modulus of elasticity for steel and copper is 200 GN/m^2 and 100 GN/m^2 respectively, find the stress developed in the rod and the tube. Also find the extension of the rod. [6]

2. A large pendulum is composed of a 10 kg ball suspended by an aluminum wire having a diameter of 1 mm and length of 6.30 m. The aluminum is the alloy 7075-T6 whose modulus of elasticity is 72 GPa. Compute the elongation of the wire due to the weight of the 10 kg ball. [2]

3. A force on the link in the pin joint is shown in figure is 3550 N. If the pin has diameter of 10 mm, compute the shear stress in the pin. [3]

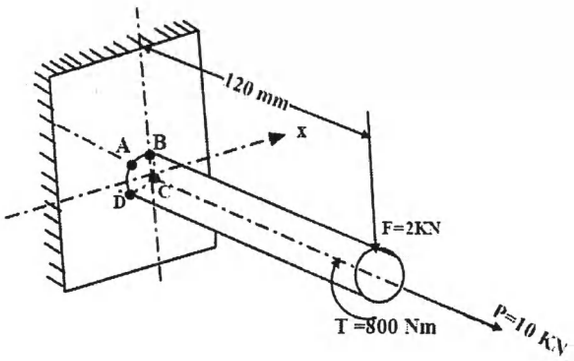


4. Explain the stress-strain curve for aluminum. [4]

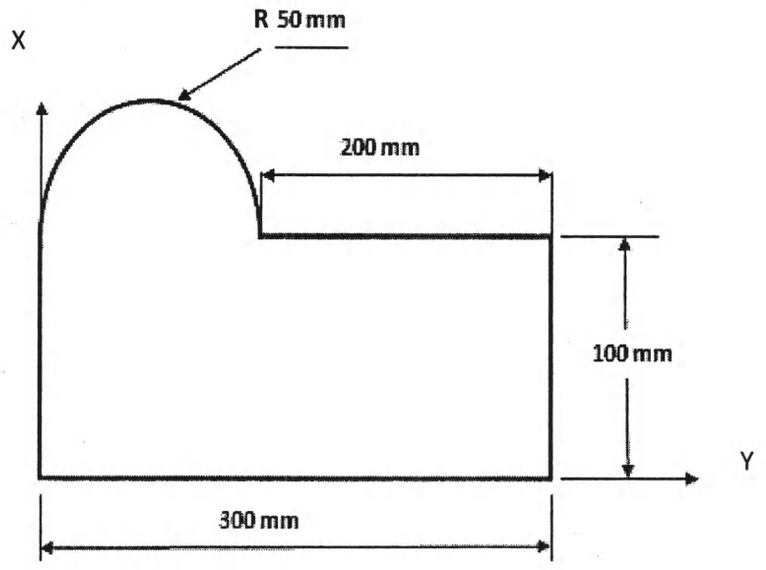
5. A steel railroad reels 10 m long are laid with a clearance of 3 mm at a temperature of 15 °C. At what temperature will the rails just touch? What stress would be induced in the rails at that temperature if there were no initial clearance? Assume $\alpha = 11.7 \times 10^6$ per °C and E = 200 GPa. [3]

6. A piece of material is subjected to perpendicular stresses of 6 MPa tensile and 4 MPa compressive. Find the normal and tangential stresses on a plane whose normal makes an angle of 30 degrees (CCW) with the axis of the second stress. Use Mohr circle Method. [6]

7. A cantilever rod is loaded as shown in the **figure**. If the tensile yield strength of the material is 300 MPa. Determine the rod diameter using (a) Maximum principal stress theory (b) Maximum shear stress theory. [6]



8. State Perpendicular axis theorem. Find Moment of inertia (I_{XX} and I_{YY}) of the uniform lamina as shown in figure. The diameter of semi circle is 100 mm. [1+6]



9. What will be the maximum deflection in the cantilever beam of length (L) carrying concentrated load (W) at a distance 'a' from the fixed end. [6]

10. A hollow shaft, having an inside diameter 60% of its outer diameter is to replace a solid shaft transmitting power at the same speed. Calculate the percentage saving in material, if the material to be used is also the same. [4]

11. Draw a complete shearing force and bending moment diagram of simply supported beam of length 'L' carrying concentrated load 'W' at mid span. [4]

12. Define slenderness ratio. Calculate the safe compressive load on a hollow cast iron column (one end rigidly fixed and other hinged) of 150 mm external diameter, 100 mm internal diameter and 10 m length. Use Euler's formula with a factor of safety 5 and $E = 95\ GN/m^2$ [1+3]