KATHMANDU UNIVERSITY
End Semester Examination [C]
June/July 2024

Marks Scored:

Level : B.E.
Year : II

Course : MEEG 202
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date 0 ? JUL 2024

SECTION "A"
[20Q. × 1 = 20 marks]

Choose and mark [X] in the most appropriate option from each set of choices

1. A Stress is defined as
   [ ] is the property of a material to resist fracture
   [ ] is the load per unit area acting on a material
   [ ] is the deformation of a material caused by applied load
   [ ] is the elasticity of a material

2. An 18-m-long steel wire of 5-mm diameter is to be used in the manufacture of a pre-stressed concrete beam. It is observed that the wire stretches 45 mm when a tensile force P is applied. Knowing that E = 200 GPa, determine (a) the magnitude of the force P, (b) the corresponding normal stress in the wire.
   [ ] 12.82 kN, 600MPa
   [ ] 9.82 kN, 500MPa
   [ ] 10.82 kN, 400MPa
   [ ] 2.82 kN, 500MPa

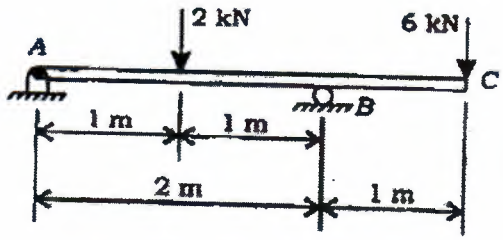
3. When a body is subjected to three mutually perpendicular stresses, of equal intensity, the ratio of direct stress to the corresponding volumetric strain is known as
   [ ] Young's Modulus
   [ ] Modulus of Rigidity
   [ ] Bulk Modulus
   [ ] Poisson's Ratio

4. If two shafts of the same length, one of which is hollow, transmit equal torque and have equal maximum stress, then they should have equal.
   [ ] Polar moment of inertia
   [ ] Polar modulus of section
   [ ] Torsional Rigidity
   [ ] Angle of twist

5. Stress Concentration Factor is defined as the ratio of
   [ ] Nominal Stress to the Maximum Stress
   [ ] Maximum Stress to the Endurance Limit
   [ ] Maximum Stress to the nominal stress
   [ ] Nominal Stress to the Endurance Limit

6. A body is subjected to a tensile stress of 1200 MPa on one plane and another tensile stress of 600 MPa on a plane at right angles to the former. It is also subjected to a shear stress of 400 MPa on the same planes. The maximum normal stress will be
   [ ] 400 MPa [ ] 500 MPa [ ] 900 MPa [ ] 1400 MPa

7. An overhanging beam ABC is supported at points A and B, as shown in the figure. Find the maximum bending moment and the point where it occurs.

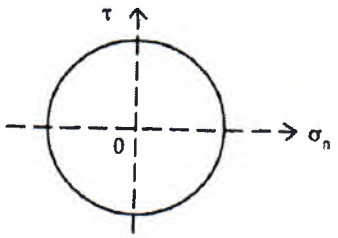


[ ] 6 kN-m at the right support
[ ] 6 kN-m at the left support
[ ] 4.5 kN-m at the right support
[ ] 4.5 kN-m at the midpoint between the supports

8. A beam of span l is fixed at one end and simply supported at other end. It carries uniformly distributed load w per unit run over the whole span. The reaction at the simply supported end is

[ ] wL/2 [ ] 3wL/8 [ ] 5wL/8 [ ] 3wL/4

9. Consider the Mohr's circle shown above
What is the state of stress represented by this circle?



[ ] $\sigma_x = \sigma_y \neq 0, \tau_{xy} = 0$ [ ] $\sigma_x + \sigma_y = 0, \tau_{xy} \neq 0$
[ ] $\sigma_x = 0, \sigma_y = \tau_{xy} \neq 0$ [ ] $\sigma_x \neq 0, \sigma_y = \tau_{xy} = 0$

10. The maximum bending moment in a simply supported beam of length L loaded by a concentrated load W at the midpoint is given by

[ ] WL/4 [ ] $WL^2/12$ [ ] $WL^2/8$ [ ] WL/12

11. For which one of the following columns, Euler buckling load is equal to $4\pi^2EI/L$

[ ] Column with both hinged ends
[ ] Column with one end fixed and other end free
[ ] Column with both ends fixed
[ ] Column with one end fixed and other hinged

12. A simply supported beam of length 'l' is subjected to a symmetrical uniformly varying load with zero intensity at the ends and intensity w (load per unit length) at the mid span. What is the maximum bending moment?

[ ] $3wl^2/8$ [ ] $wl^2/12$ [ ] $wl^2/24$ [ ] $5wl^2/12$

13. Which of the following is true (μ= Poisson's ratio) (specifically only for Engineering Materials)

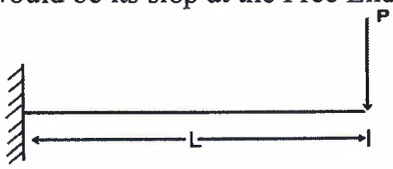
[ ] $0 < \mu < 1/2$ [ ] $1 < \mu < 0$ [ ] $1/2 < \mu < -1$ [ ] $-\infty < \mu < \infty$

14. In a cantilever beam, bending moment will be zero at

[ ] $1/4^{th}$ from free end
[ ] Centre of Beam
[ ] Fixed End
[ ] Free End

03 JUL 2024

15. A uniform cantilever beam with (EI = Constant) of length L is carrying a concentrated load P at its free end. What would be its slop at the Free End



[ ] $\theta = PL^2/EI$
[ ] $\theta = PL^2/2EI$
[ ] $\theta = 2PL^2/EI$
[ ] $\theta = 4PL^2/EI$

16. For a simply supported beam on two end supports the bending moment is maximum at
[ ] always at mid span
[ ] usually on the supports
[ ] where there is no shear force
[ ] where the deflection is maximum

17. A pin-ended column of length L, modulus of elasticity E and second moment of the cross sectional area I is loaded centrically by a compressive load P. The critical buckling load (P_{cr}) is given by:
[ ] $P_{cr} = EI/\pi^2$ [ ] $P_{cr} = \pi^2 EI/3L^2$ [ ] $P_{cr} = \pi EI/L^2$ [ ] $P_{cr} = \pi^2 EI/L^2$

18. In a long column, the length actually involved in bending is termed as
[ ] Contra flexure Length
[ ] Bending Length
[ ] Clear Span
[ ] Equivalent Length

19. According to which the theory of failure does the ductile material begin to yield, when maximum principal strain reaches the strain
[ ] Guest Theory
[ ] Rankine's Theory
[ ] St. Venant's Theory
[ ] Haigh's Theory

20. Maximum Principal Stress Theory is also known as
[ ] Rankine's Theory
[ ] St. Venant's Theory
[ ] Haigh's Theory
[ ] Guest Theory

KATHMANDU UNIVERSITY
End Semester Examination [C]
June/July 2024

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

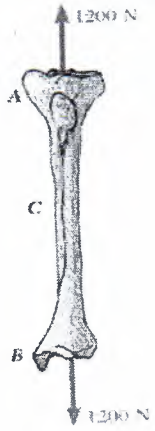
03 JUL 2024

Course : MEEG 202
Semester : II
F. M. : 55

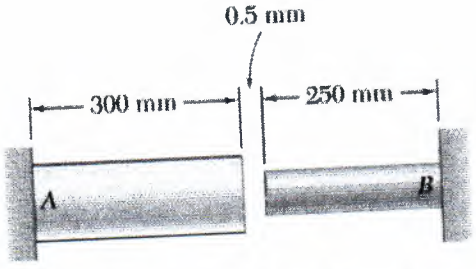
SECTION "B"
[55 marks]

Attempt *ALL* questions. Assume suitable data if necessary.

1. A strain gage located at C on the surface of bone AB indicates that the average normal stress in the bone is 3.80 MPa when the bone is subjected to two 1200-N forces as shown. Assuming the cross section of the bone at C to be annular and knowing that its outer diameter is 25 mm, determine the inner diameter of the bone's cross section at C. [6]



2. At room temperature (20 °C) a 0.5-mm gap exists between the ends of the rods shown. At a later time when the temperature has reached 140 °C, determine (a) the normal stress in the aluminum rod, (b) the change in length of the aluminum rod. [7]

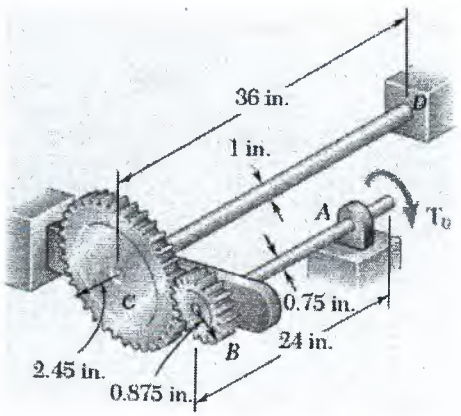


Aluminum
$A = 2000\ mm^2$
$E = 75\ GPa$
$\alpha = 23 \times 16^{-6}/°C$

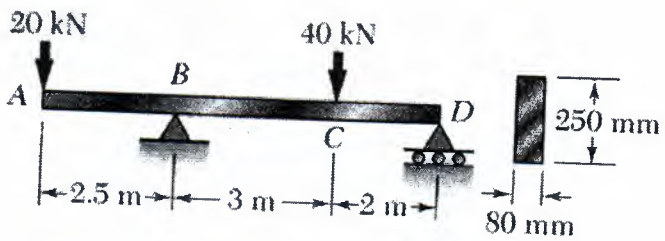
Stainless steel
$A = 800\ mm^2$
$E = 190\ GPa$
$\alpha = 17.3 \times 10^{-6}/°C$

3. List the types of Failure Theories, Explain in detail mentioning the Region of Safety for safer design using Maximum Shear Stress Theory. [7]

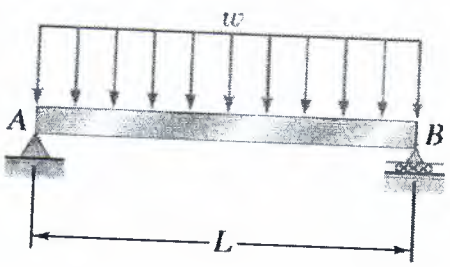
4. Two solid steel shafts are connected by the gears shown. Knowing that for each shaft $G = 11.2 \times 10^6$ psi and that the allowable shearing stress is 8 ksi, determine (a) the largest torque T_O that may be applied to end A of shaft AB, (b) the corresponding angle through which end A of shaft AB rotates. [7]



5. For the timber beam and loading shown, draw the shear and bend- moment diagrams and determine the maximum normal stress due to bending. [7]

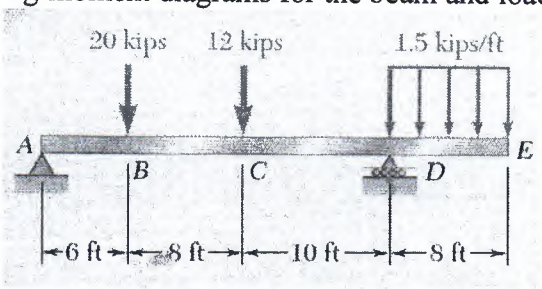


6. The simply supported prismatic beam AB carries a uniformly distributed load w per unit length as shown in the figure. Determine the equation of the elastic curve and the maximum deflection of the beam. [7]



03 JUL 2024

7. Draw the shear and bending-moment diagrams for the beam and loading shown. [7]



8. For the state of plane stress shown, determine (a) the principal planes and the principal stresses, (b) the stress components exerted on the element obtained by rotating the given element counterclockwise through 30^0.