DEC 2 7 2018

Marks scored:

KATHMANDU UNIVERSITY
End Semester Examination [C]
December, 2018

Level : B.E.
Year : II
Course : CIEG 208
Semester: II

Exam Roll No. :
Time: 30 mins.
F. M. : 10

Registration No.:
Date :

SECTION "A"
[20 Q. × 0.5= 10 marks]

Tick (√) the most appropriate answer.

1. A beam is said to be loaded in a pure bending when
[a] Bending moment and shear force are constant but not zero
[b] Bending moment is changing linearly
[c] Bending moment and shear force both are changing linearly
[d] Bending moment is constant

2. The maximum eccentricity of compressive load acting on a short strut of diameter d without producing tension at the base section is
[a] d/2 [b] d/4 [c] d/6 [d] d/8

3. A circular shaft of length L subjected to a torque T, G rigidity modulus and J is polar moment of inertia, then the total angle of twist is given by
[a] T L/ GJ [b] T J / GL [c] T L/ G I [d] GJ / TL

4. What is the thickness of the metal required for the water main, if a water supply pipe line 50 cm diameter contains water at a pressure head of 150 m and the weight of water is 1000 kg/ $m^3$? The maximum permissible stress in the metal is 180 kg/ $cm^2$
[a] 2.4 cm [b] 2.9 cm [c] 2.1 cm [d] 3.1 cm

5. A compressive member always tends to buckle in the direction of
[a] Axis of load
[b] Minimum cross-section
[c] Least radius of gyration
[d] Perpendicular to the axis of load

6. The maximum bending moment due to a moving load on a simply supported beam occurs
[a] At the mid span
[b] At the supports
[c] Under the load
[d] Anywhere on the beam

7. Euler's formula states that the buckling load P for a column of length L, both ends hinged and whose least moment of inertia and modulus of elasticity of the material of column are I and E respectively is given by
[a] $P = \frac{\pi EI}{L^2}$ [b] $P = \frac{\pi^2 EI}{L^2}$ [c] $P = \frac{\pi L^2}{EI}$ [d] $P = \frac{\pi EI}{L}$

8. The point of contra flexure in a loaded beam in the point where
[a] The bending moment is maximum
[b] The bending moment changes sign
[c] The shear force changes sign
[d] None of the above

9. Modulus of resilience is defined by
[a] Strain energy stored in an elastic body
[b] Strain energy per unit volume of the elastic body
[c] Percentage of elongation of a ductile metal
[d] Percentage of elongation of high carbon steel

10. In a beam of I- section the maximum shear force is carried by
[a] The upper flange [b] The web [c] The lower flange [d] All of these

11. When a bar is subjected to a change of temperature and its deformation is prevented, the stress induced in the bar is
[a] Tensile stress [b] Compressive stress
[c] Shear stress [d] Thermal stress

12. When a body is subjected to the three mutually perpendicular stresses, of equal intensity, the ratio direct stress to the corresponding volumetric strain is known as
[a] Young's modulus [b] Modulus of rigidity
[c] Bulk modulus [d] Poisson's ratio

13. The torque transmitted by a solid shaft of diameter (D) is
[a] $\frac{\pi}{4} \times \tau \times D^3$ [b] $\frac{\pi}{16} \times \tau \times D^3$ [c] $\frac{\pi}{32} \times \tau \times D^3$ [d] $\frac{\pi}{64} \times \tau \times D^3$

14. Failure due to excessive deformation is controlled by
[a] Material properties [b] Design & Dimensions
[c] Both a and b [d] None

15. Time dependent yield is known as
[a] Fracture [b] Fatigue [c] Buckling [d] Creep

16. Brittle fracture is more dangerous than ductile fracture because
[a] No warning sign
[b] Crack propagates at very high speeds
[c] No need for extra stress during crack propagation
[d] All the above

17. Engineering stress-strain curve and True stress-strain curve are equal up to
[a]Proportional limit [b] Elastic limit
[c] Yield point [d] Tensile strength point

18. What is the elongation of the plate of 20 mm thickness which tapers uniformly from 100 mm to 50 mm in a length of 400 mm. if an axial force of 80 kN act on it?
Given, E = 200 GPa
[a] 0.11 mm [b] 0.55 mm [c] 0.33 mm [d] 0.44 mm

19. Identify the correct relationship that exists between the modulus of elasticity E, Modulus of rigidity G, Bulk modulus K
[a] $E = \frac{3K+G}{9KG}$ [b] $E = \frac{3KG}{3K+G}$ [c] $E = \frac{9KG}{3K+G}$ [d] $E = \frac{K}{G}$

20. What will be the change in thickness of a steel bar of 2 m length, 40 mm width and 20 mm thickness when the bar is subjected to an axial pull of 160 kN in the direction of its length? Take E = 200 GPa and Poisson's ratio = 0.3
[a] 0.006 mm [b] 0.06 mm [c] 0.6 mm [d] 0.0006 mm

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SECTION "B"

Attempt *ALL* questions. Assume the suitable data wherever necessary.

1. A metallic bar 250 mm x 100 mm x 50 mm is loaded as shown in **Figure 1.** Find the change in volume. Take E = 2x $10^5$ N/mm$^2$ and Poisson's ratio = 0.25. Also find the change that should be made in the 4 MN load in order that there should be no change in the volume of the bar. [5]

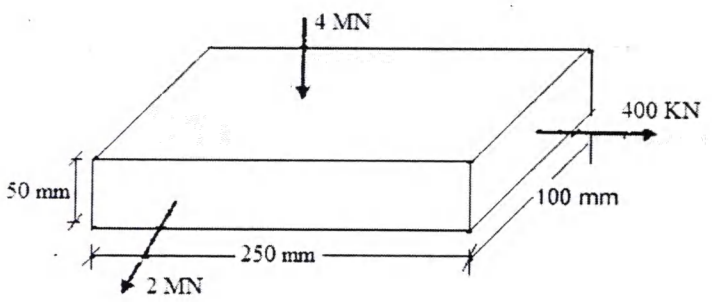


**Figure 1**

2. A timber beam 6 cm wide and 10 cm deep is to be strengthened by bolting on two steel plates each being 6 cm by 0.5 cm in section. Compare the moment of resistance for the same value of maximum bending stress if,

   [a] Plates are attached symmetrically at top and bottom

   [b] Plates are attached symmetrically at the sides.

   Take, Es = 2.1 x $10^5$ N/mm$^2$, and Et = 1.4x $10^4$ N/mm$^2$.

   [5]

3. A cast iron hollow cylindrical column 4 m long is hinged at both ends and its critical buckling load is P kg. When the same column is fixed at both the ends, its critical load rises to (P+50,000) kg. If the ratio of external diameter to internal diameter is 1.30 and E = 1.0 x $10^6$ kg/cm$^2$, determine the external diameter of the column. [5]

4. Determine the value of stresses in portion AB and BC of the steel bar as shown in **Figure 2.** The temperature of the bar is $-50^{\circ}C$ and it was rigidly fixed at supports when temperature was $+25^{\circ}C$. Take Es = 200GPa and $\propto = -12 \times 10^{6}\ /^{\circ}C$. [6]

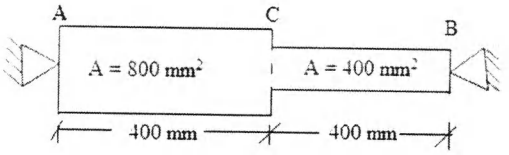


**Figure 2**

5. A hollow shaft with diameter ratio 3/5 is required to transmit 450 KW at 120 rpm with a uniform twisting moment. The shearing stress in the shaft must not exceed 60 $N/mm^2$ and the twist in a length of 2.5 m must not exceed $1^{\circ}$. Calculate the maximum external diameter of the shaft satisfying these conditions.
Take modulus of rigidity, $G = 8x\ 10^4\ N/mm^2$. [5]

6. Determine the Principal Moment of Inertia and locate the Principal Axes. For the section shown in **Figure 3.** [6]

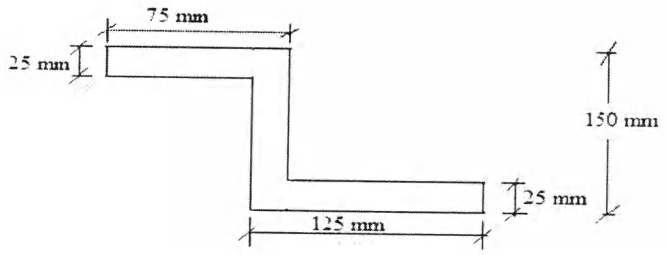


**Figure 3**

7. Draw axial force, shear force and bending moment diagrams for the given frame shown in **Figure 4.** [8]

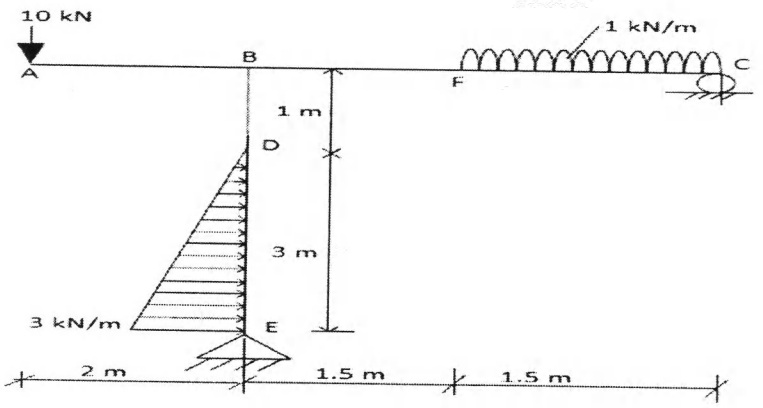


**Figure 4**