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KATHMANDU UNIVERSITY
End Semester Examination
August/September, 2017

AUG 31 2017

Level : B. E./B. Tech.
Year : II

Course : CIEG 208
Semester : II

Exam Roll No. :

Time: 30 min

F. M. : 10

Registration No.:

Date :

SECTION "A"

[20 Q × 0.5 = 10 marks]

Choose the most appropriate answer.

1. In the case of engineering material under unidirectional stress in the x-direction, the Poisson's ratio is equal to

a) $\frac{\varepsilon_x}{\varepsilon_y}$ b) $\frac{\sigma_x}{\sigma_y}$ c) $\frac{\varepsilon_y}{\varepsilon_x}$ d) $\frac{\sigma_y}{\sigma_x}$

2. A simply supported beam, 10 m long carries a concentrated load of 500 kN at the mid span. What is the maximum moment of the beam?

a) 1050 kN-m b) 1250 kN-m c) 2500 kN-m d) 6250 kN-m

3. The flexural rigidity for rectangular beam made up of steel with width 15 cm and depth 20 cm is _____. Take E_s = 200 GPa.

a) 20000 kNm^2 b) 11250 kNm^2 c) 11250 kN/m^2 d) 20000 kN/m^2

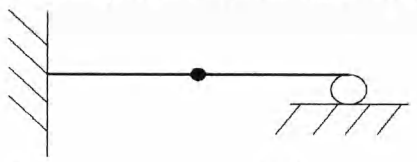
4. The maximum stress produced in a thin wall cylinder is ____ times that in a thin wall spherical shell, having same diameter, thickness and internal pressure.

a) 3 b) 2 c) $\frac{1}{2}$ d) $\frac{1}{3}$

5. Number of equilibrium equations for a two dimensional system is

a) 9 b) 6 c) 3 d) 2

6. The degree of static indeterminacy of the following structure is



a) 0 b) 1 c) 2 d) 3

7. Two prismatic beams A and B have same length. The one having larger _____ will be stronger in flexure.

a) area of cross-section
b) moment of inertia
c) first moment of area
d) section modulus

8. A small hole is scooped out from a body and is filled with a denser material. Its

a) Centroid changes in position
b) C.G moves away from the hole
c) C.G remains unaltered in position
d) C.G moves towards the hole

9. A simply supported beam carries two equal concentrated load W at distance $\frac{L}{3}$ from either support. The maximum BM is

a) $\frac{WL}{3}$ b) $\frac{WL}{4}$ c) $\frac{5WL}{8}$ d) $\frac{2WL}{5}$

10. There are _____ numbers of symmetrical axes for hollow circular cross-section.
a) 2 b) infinite c) 4 d) 8

11. A square section with side x is subjected to a shear force V, the magnitude of shear stress at the top edge of the square is
a) $\frac{1.5\,V}{x^2}$ b) $\frac{1.5\,V}{x}$ c) $\frac{V}{x^2}$ d) 0

12. For an element under a biaxial state of stress $\sigma_x = -\sigma_y$ in the x-y plane, the radius of the Mohr's circle is
a) $3\sigma_x$ b) $2\sigma_x$ c) σ_x d) $2\sigma_y$

13. When two shafts of same length, one of which is hollow, transmit equal torques and have equal maximum stress, then they should have equal
a) polar modulus c) diameter
b) polar moment of inertia d) angle of twist

14. If a member is subjected to an axial tensile load, the plane parallel to the axis of loading carries
a) maximum normal stress b) maximum bending stress
c) minimum normal stress d) maximum shear stress

15. The polar modulus Z_p of hollow circular section of inner diameter d and outer diameter D is
a) $\frac{\pi(D^4-d^4)}{32D}$ b) $\frac{\pi(D^3-d^3)}{64}$ c) $\frac{\pi(D^3-d^3)}{32}$ d) $\frac{\pi(D^4-d^4)}{16D}$

16. The strength of a column with both ends fixed is ____ times the strength when its one end is fixed and other free, other parameters remaining same.
a) 18 b) 16 c) 4 d) 2

17. For condition of no distortion of the junction in case of thin cylinder with hemispherical ends is
a) $\frac{t_s}{t_c} = \frac{1-\mu}{2-\mu}$ b) $\frac{t_c}{t_s} = \frac{\mu-1}{\mu-2}$ c) $\frac{t_s}{t_c} = \frac{\mu-1}{\mu-2}$ d) $\frac{t_c}{t_s} = \frac{1-\mu}{2-\mu}$

18. The radius of gyration of hollow circular section column with external diameter 20 cm and internal diameter 18 cm is
a) 45.25 cm b) 6.73 cm c) 5 cm d) 4.5 cm

19. The column presents convexity towards the initial centre line of the member while buckling if
a) both ends of the member are pinned b) both ends of the member are fixed
c) one end is fixed and other is free d) one end is fixed and other is pinned

20. Circular beams of uniform strength can be made by varying diameter in such a way that _____ is constant.
a) $\frac{M}{R}$ b) $\frac{E}{R}$ c) $\frac{\sigma}{y}$ d) $\frac{M}{Z}$

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SECTION "B"

Attempt *ALL* questions. Assume data if necessary.

1. A steel tie rod 50 mm in diameter and 2.5 m long is subjected to a pull of 100 kN. To what length the rod should be bored centrally so that the total extension will increase by 15 % under the same pull, the bore being 25 mm in diameter? Take E = 200 GPa. [5]

2. A hollow circular column of steel, of outer diameter 200 mm and thickness 5 mm, has a length of 4 m, with both ends fixed. Find the Euler's critical load if E = 200 GPa. If the yield stress is 300 MPa, determine the length below which Euler's formula cannot be applied. [5]

3. A cylindrical thin drum, 80 cm in diameter and 3 m long, has shell thickness of 1 cm. If the drum is subjected to an internal pressure of 2.5 N/mm^2, determine the change in diameter, length and volume. [5]

4. A steel shaft LMNP is made as shown in figure 1. If equal opposite torques are applied at the end of the shaft, find the maximum permissible value of d for the maximum shearing stress in LM not to exceed than that in NP. If torque applied is 10 kNm, what is the total angle of twist? Take C = 80 GPa. [6]

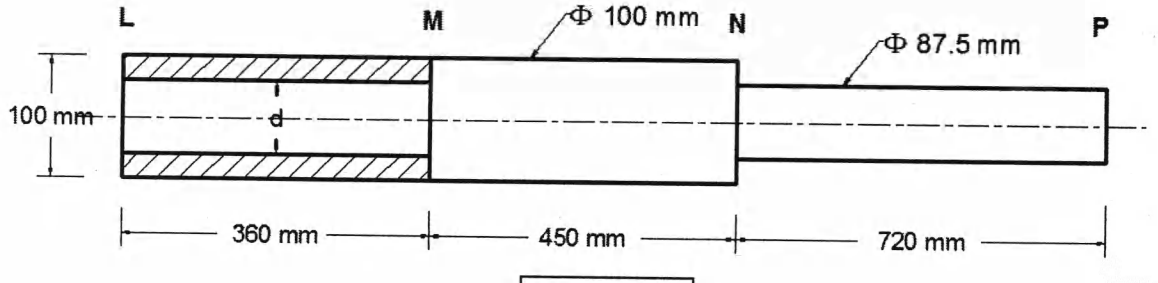


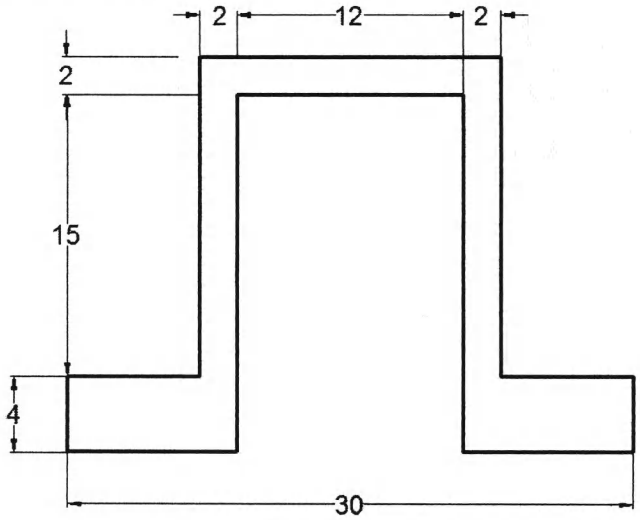
Figure 1

5. The principal tensile stresses at a point across two perpendicular planes are 120 MN/m^2 and 60 MN/m^2. Find: [5]
   i. The normal stress, tangential stress, resultant stress and its obliquity on a plane at 20° with the major principal plane.
   ii. The intensity of stress which acting alone can produce the same maximum strain. Take Poisson's ratio = $\frac{1}{4}$.

[redacted]

[redacted]

6. Figure 2 shows the cross-section of a cast iron beam. When this beam is subjected to a bending moment, the tensile stress at the bottom edge is 30 MN/m^2. Calculate: [6]
   i. The value of the bending moment.
   ii. Stress induced at the top edge.



Dimensions are in cm

Figure 2

7. Draw the AFD, SFD and BMD for the frame shown in figure 3. Indicate salient features, if any. All dimensions are in meter. [8]

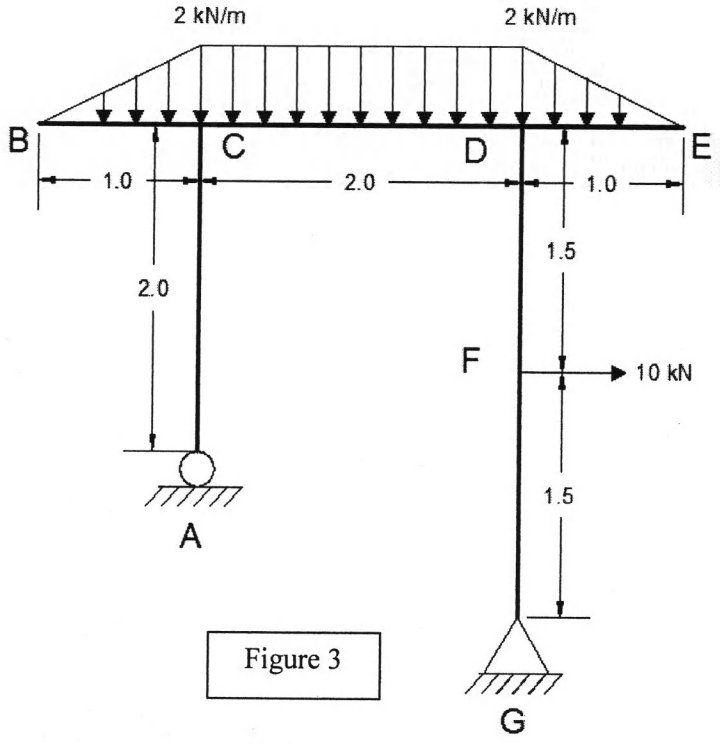


Figure 3