

KATHMANDU UNIVERSITY
End Semester Examination
January/February 2024

Marks Scored:

Level : B.Arch.

Year : II

Exam Roll No. :

Time: 30 mins.

Course : CIEG 241

Semester : II

F. M. : 10

Registration No.:

Date :

SECTION "A"

[20Q. × 0.5 = 10 marks]

Encircle the most appropriate answer.

- The elongation of a circular tapered rod is given by
a. $\frac{4Pl}{\pi E d_1 d_2}$ b. $\frac{4Pl}{\pi E d_1 d_2}$ c. $\frac{4Pl}{E d_1 d_2}$ d. $\frac{4Pl}{\pi E d_1^2 d_2}$
- The limiting value of stress upto which stress is proportional to strain and material behaves linear and elastic is called
a. Elastic limit b. Plastic limit c. Ultimate Stress d. Limit of proportionality
- Torsional rigidity is defined as the torque required to introduce unit angle of twist in unit shaft length and is given by
a. GI b. GJ c. EI d. GL
- If the permissible bearing stress is 300 MPa, what is the bearing strength of an 8 mm plate when a 16 mm diameter rivet connect it to another 12 mm plate
a. 38.4 kN b. 42 kN c. 57.6 kN d. 63 kN
- Maximum shear stress induced in a solid circular shaft of diameter 15cm, if shaft transmits 150 kN power at 180 rpm is
a. 10 MPa b. 11 MPa c. 12 MPa d. 13 MPa
- In case of riveted joint margin is the distance between the
a. Centers of 2 consecutive rivets in a row
b. Center of rivet hole to the nearest plate edge
c. Centers of rivets in adjacent row
d. End to end distance of 2 consecutive rivets in a row
- Strain energy is the
a. energy stored in a body when strained within elastic limits
b. energy stored in a body when strained upto the breaking of a specimen
c. maximum strain energy which can be stored in a body
d. proof resilience per unit volume of a material
- A steel wire 20 m long is subjected to a tensile stress of 50 MPa. What is the total elongation of the wire? [Take $E = 200 \text{ GPa}$]
a. 5m b. 5cm c. 5mm d. 2.5mm

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SECTION "B"

Attempt ALL questions.

1.
 - a. Draw and state (only) the various regions of the stress-strain curve for a mild steel. [1]
 - b. Describe various types of failures of a riveted joint. State (only) expression for the tearing strength, shearing strength and bearing strength of rivet joint. [2]

2. A copper flat 6cm by 3cm is brazed to another 6cm by 6cm mild steel. The combination is heated through 120 degree Celsius. Length of each flat is 0.4m. Determine [1+2+2]
 - a. The stress produced in each of the bar.
 - b. Shear force which tends to rupture the brazing and
 - c. Shear stress

Take $\alpha_c = 18.5 \times 10^{-6}$ per $^{\circ}C$, $\alpha_s = 12 \times 10^{-6}$ per $^{\circ}C$, $E_c = 110$ GN/m², $E_s = 220$ GN/m²

3. A T-section beam is shown in Figure 1 is subjected to a vertical shear force of 100kN. Calculate the shear stress at the neutral axis and at the junction of the web and the flange. Moment of inertia about horizontal neutral axis is 0.0001134 m⁴. Also draw shear stress distribution for composite section. [5]

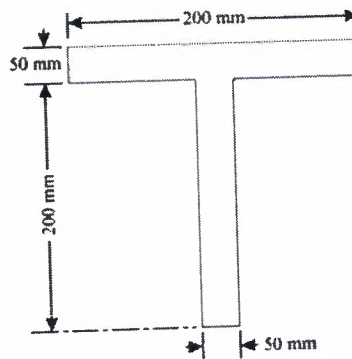


Figure 1

4. At a point in a material under stress, the intensity of the resultant stress on a certain plane is 50 MN/m² (tensile) inclined at 30 degree to the normal of that plane. The stress on a plane at right angles to this has a normal tensile component of intensity of 30MN/m² as shown in Figure 2. Calculate: [2+2+2]
 - a. The resultant stress on the second plane
 - b. The principal planes and stresses
 - c. The plane of maximum shear and its intensity

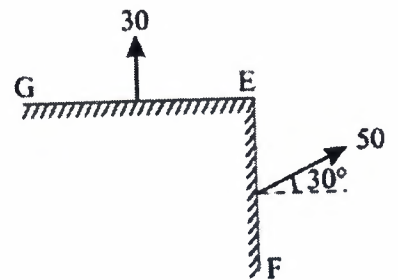


Figure 2

5. A reinforced concrete aqueduct of cross-section shown in Figure 3 carries water over a simply supported span of 7.5 m. Calculate Moment of inertia of section about the Centroidal axis and then find the maximum bending stresses developed in the section in tension and compression at the midspan and quarter span. [2+2+2]
 Assume unit weight of concrete as 25 kN/m^3 and of water as 10 kN/m^3 .

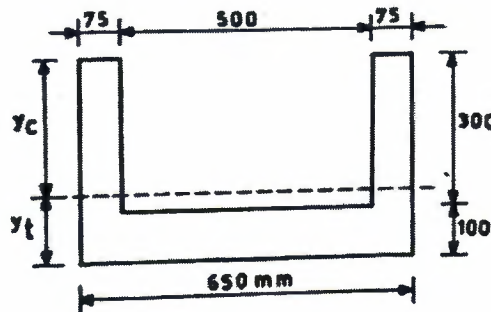


Figure 3 (Dimensions are in mm)

6. A single riveted double cover butt is used to connect 2 plates 15 mm thick. The rivets are 26mm in diameter and are provided at a pitch of 10cm. The allowable stresses in tension, shear and crushing are 130, 75 and 150 MPa respectively. Calculate: Safe Load per pitch length of the joint and efficiency of the joint. [2.5+2.5]

OR

A beam 6m long simply supported at its ends is carrying a point load of 50kN at its center. The moment of inertia of the beam is given as $78 \times 10^6 \text{ mm}^4$. If Young's Modulus of beam is $2.1 \times 10^5 \text{ MPa}$, Calculate deflection at the midspan and slope at supports in degree. Use of direct formula is desirable. [2.5+2.5]

7. The external and internal diameter of a hollow shaft are 160mm and 120mm respectively. If the shaft is subjected to a torque of 20kNm, calculate [2+2+2]
- Shear stress at outer surface of the shaft
 - Shear stress at inner surface
 - Rate of twist in degree per meter of the shaft. Apply $G=7.5 \times 10^4 \text{ MPa}$
8. State assumptions of Euler Formula and find Euler's buckling load (critical load) for a column with both end support pinned. [4]

OR

State assumptions of Simple Bending and derive the flexural equation of a beam with σ stress, y distance above neutral axis, E modulus of elasticity and ρ is the radius of curvature of the beam. [4]