BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B.Sc. Engineering Examinations 2022-2023

Sub: **WRE 203** (Engineering Geology and Geomorphology)

Full Marks: 210   Time: 3 Hours

The figures in the margin indicate full marks

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE** questions.

Assume any reasonable value where necessary.

1. (a) Briefly explain the composition of Earth with a diagram.   **(9)**

    (b) Describe the significance of engineering geology.   **(9)**

    (c) List out the importance of geology in the context of construction jobs.   **(9)**

    (d) Define the oceanic and continental Crust and tectonic plate.   **(8)**

2. (a) Distinguish between cleavage and fracture.   **(9)**

    (b) There are over 3000 types of minerals but the Dana system groups into eight basic classes. Explain the basis of this classification system. List out the eight broad classes of minerals.   **(9)**

    (c) "The composition of igneous rock can be explained by the order of mineral crystallization"- briefly explain this igneous process of igneous rock formation with a diagram.   **(9)**

    (d) "The rock cycle is an ongoing process" - do you agree? Justify your answer. **(8)**

3. (a) Explain the types of metamorphism based on the geological setting.   **(5)**

    (b) "Sedimentary rocks commonly originate from sediments laid down in horizontal strata by water or wind" - explain the stages of this rock formation; provide relevant diagrams.   **(13)**

    (c) Briefly describe different types of faults.   **(9)**

    (d) Briefly explain Flexural slip fold mechanisms.   **(8)**

4. (a) Explain how earthquakes occur.   **(9)**

    (b) Compare P-wave and S-wave.   **(9)**

    (c) What are the major tectonic Blocks and earthquake zones of Bangladesh?   **(9)**

    (d) Define the following erosional landforms (i) Gorges and Canyons (ii) Waterfalls   **(8)**

WRE 203

There are **FOUR** questions in this section. Answer any **THREE** questions.

Assume any reasonable value where necessary.

5. (a) What is geomorphology? Briefly explain the various issues that different geomorphologists address on a local scale. **(10)**

(b) What is weathering? Explain the different types of weathering with necessary sketches and examples. **(15)**

(c) Briefly describe the wind erosion and wind transport phenomenon in an arid environment. **(10)**

6. (a) What is fluvial geomorphology? Classify rivers based on their planform according to Brice (1983). **(15)**

(b) What differentiates a river from its young, mature and old stages? **(8)**

(c) For a selected reach of the Damodar River, the channel length, valley length, and air distance were found to be 17.5m, 16.66m, and 15.76m, respectively. Calculate the following parameters: **(12)**

　　　i) Total Sinuosity

　　　ii) Valley Sinuosity

　　　iii) Hydraulic Sinuosity

　　　iv) Topographic Sinuosity

Which channel pattern does the reach follow?

7. (a) What is a drainage pattern? Identify the following drainage patterns and write a brief description of it. **(10)**

Figure-(i)　　　　　　　　Figure-(ii)
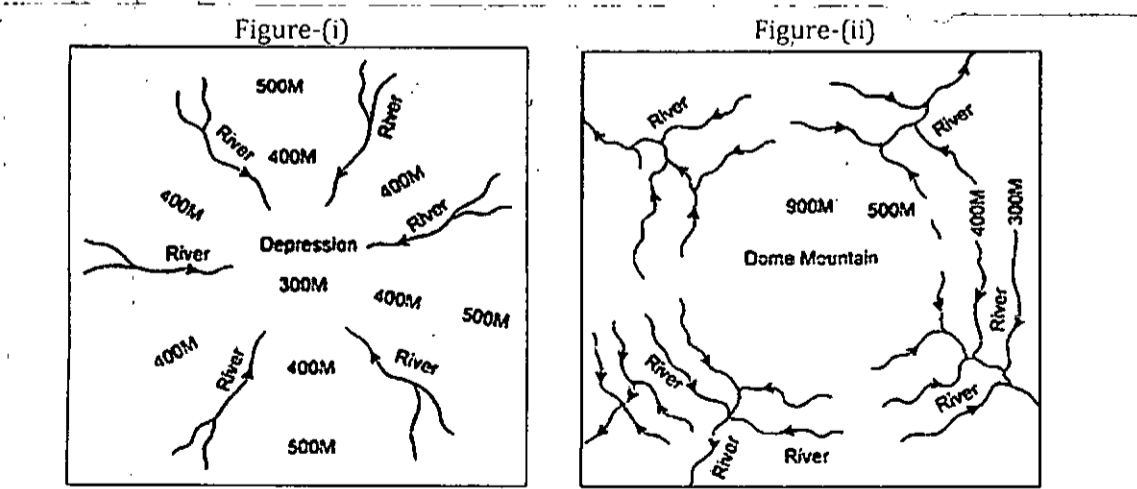
(b) Describe in detail the evolution of the river system in the Bengal basin. **(10)**

(c) Briefly explain the geomorphic characteristics of the regional rivers located in the north-western region of Bangladesh. **(15)**

WRE 203

8. (a) Briefly describe the different types of lacustrine deposits. **(5)**

    (b) Write a short note on the following glacial deposits: **(10)**

    i) Moraines

    ii) Outwash and outwash plain

    iii) Varve

    (c) A certain watershed has a catchment area of 415 km^2, basin length of 56.33 km and contains the following streams: **(20)**

Stream Order	Stream Number	Total Length (km)
1st	1016	567.05
2nd	221	242.44
3rd	55	100.02
4th	15	52.35
5th	6	32.16
6th	1	25.77

If the basin relief is 320 m, then find out the average stream length ratio, average bifurcation ratio, rho co-efficient, drainage density, form factor, circularity ratio, elongation ratio, relief ratio, ruggedness number and Melton's ruggedness number.

L-2/T-1/WRE   Date: 02/05/2024

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1   B. Sc. Engineering Examinations 2022-2023

Sub: HUM 211 (Sociology)

Full Marks: 140   Time: 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Examine how institutional means and social goals influence individual's responses, as outlined in Merton's theory of deviance. $(13\frac{1}{3})$

   (b) Define juvenile delinquency. Discuss the factors affecting 'juvenile delinquency' in society. **(10)**

2. (a) Interpret Weber's concept of the 'ideal type' to understand the social stratification systems in Bangladesh. $(13\frac{1}{3})$

   (b) Define sociological imagination. Illustrate the norms of sociological imagination. **(10)**

3. (a) What is meant by socialization? Evaluate the three distinct stages of self-development mentioned by G.H. Mead. $(13\frac{1}{3})$

   (b) Illustrate the code of ethics that social scientists must follow when conducting social research. **(10)**

4. Write short notes on any THREE of the following $(23\frac{1}{3})$

   (a) Norms
   (b) Ethnocentrism
   (c) Cultural universals
   (d) Mass media as agent of socialization

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Define industrialization and deindustrialization. Write down the important characteristics of capitalism. $(13\frac{1}{3})$

   (b) Write down the social consequences of industrial revolution. **(10)**

HUM 211/WRE

6. (a) Explain the concept of social change. Mention the main causes of social change. **(13⅓)**

   (b) Define city, megacity and smart city. Discuss the growth of cities. **(10)**

7. (a) Define natural greenhouse and man-made greenhouse. Elaborate on the potential consequences of global warming. **(12)**

   (b) Describe the types of pollution. Briefly discuss the major pollution issues in Dhaka city. **(11⅓)**

8. Write short notes on any THREE of the following – **(23⅓)**

   (a) Global warming
   (b) Malthusian Population Theory
   (c) Social impact of the Fourth Industrial Revolution
   (d) Globalization

L-2/T-1/WRE
Date: 02/05/2024
BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA
L-2/T-1   B. Sc. Engineering Examinations 2022-2023
Sub: **HUM 213** (Government)
Full Marks: 140   Time: 3 Hours
The figures in the margin indicate full marks.
USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Define state. Make a comparison between society and state. $(11\frac{1}{3})$

   (b) Discuss the meaning and significance of sovereignty as a constituent element of a state. (12)

2. (a) Write an analytical note on nationalism. $(11\frac{1}{3})$

   (b) Who is a citizen? Describe different methods of acquiring citizenship. (12)

3. (a) What is Constitution? Explain the qualities of a good constitution? $(11\frac{1}{3})$

   (b) Describe the functions of the Legislature in a state. (12)

4. (a) Classify modern government with relevant examples. $(11\frac{1}{3})$

   (b) Analyze the merits of parliamentary form of government. (12)

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Discuss the importance of language movement to the independence of Bangladesh. $(11\frac{1}{3})$

   (b) Examine the socio-economic exploitation of East Pakistan by West Pakistan during Pakistan period. (12)

6. (a) Describe the principles of Bangladesh foreign policy. $(11\frac{1}{3})$

   (b) Discuss the major political system of the USA. (12)

7. (a) Analyze the principles of Bangladesh constitution of 1972. $(11\frac{1}{3})$

   (b) What is local government? Discuss the functions of local government institutions in Bangladesh. (12)

8. (a) Describe the characteristics of socialism $(11\frac{1}{3})$

   (b) Discuss the role and functions of bureaucrats of a government. (12)

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1   B. Sc. Engineering Examinations 2022-2023

Sub : **CE 221** (Mechanics of Solids-I)

Full Marks : 210   Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

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SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

(Assume reasonable values for missing data, if any)

1. (a) The built-up wooden beam shown in Figure 1 is subjected to a vertical shear of 8 kN. Knowing that the nails are spaced longitudinally every 60 mm at A and every 25 mm at B, determine the shearing force in the nails at A and B. (Given: $I_x = 1.504 \times 10^9$ mm^4.)   **(20)**

Dimensions in mm
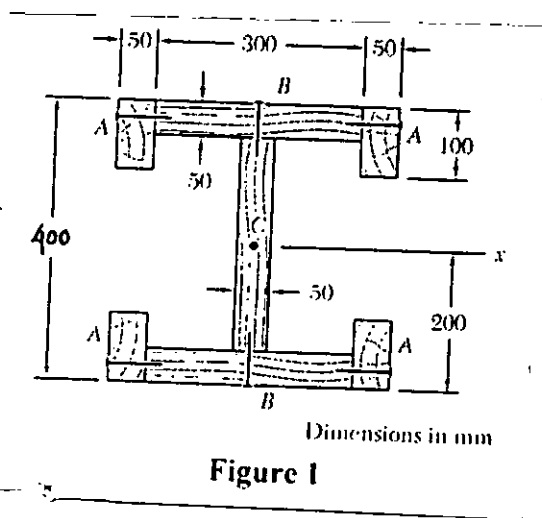
Figure 1

(b) A thin-walled beam has the cross-section shown in Figure 2. Determine the location of the shear center O of the cross-section.   **(15)**
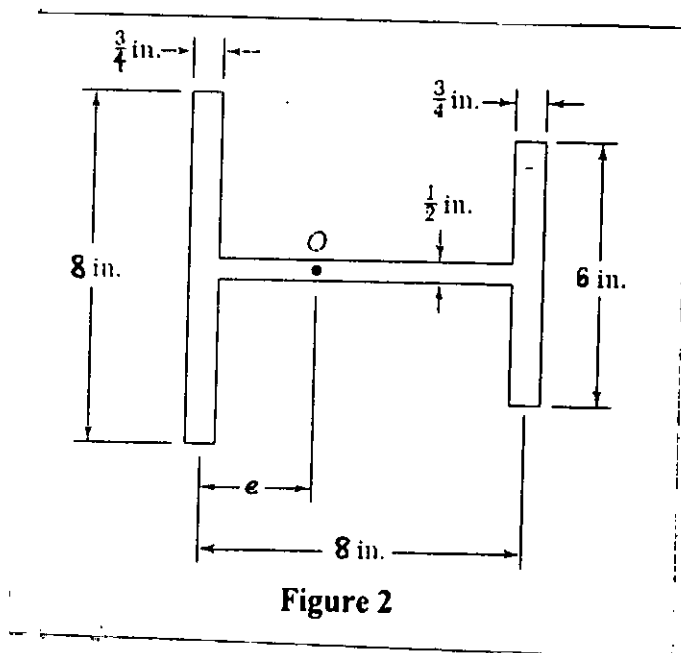
Figure 2

CE 221

2. (a) A force P of magnitude 750 N is applied to the pedal shown in Figure 3, determine (i) the diameter of the pin at C for which the average shearing stress in the pin is 40 MPa, (ii) the corresponding bearing stress in the pedal at C, (iii) the corresponding bearing stress in each support bracket at C. **(20)**
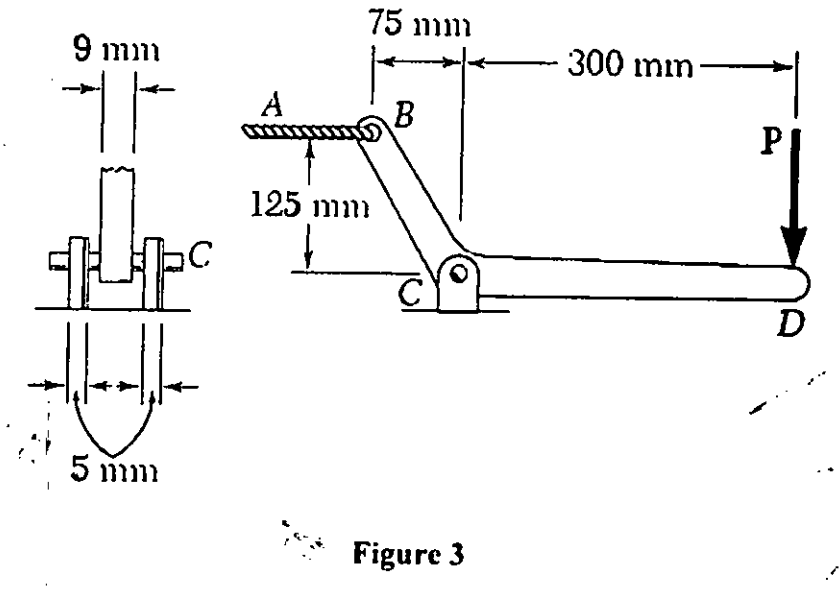
Figure 3

(b) Two solid cylindrical rods, AB and BC, are welded together at B and loaded as shown in Figure 4. Determine the magnitude of the force P for which the tensile stress in rod AB has the same magnitude as the compressive stress in rod BC. **(15)**
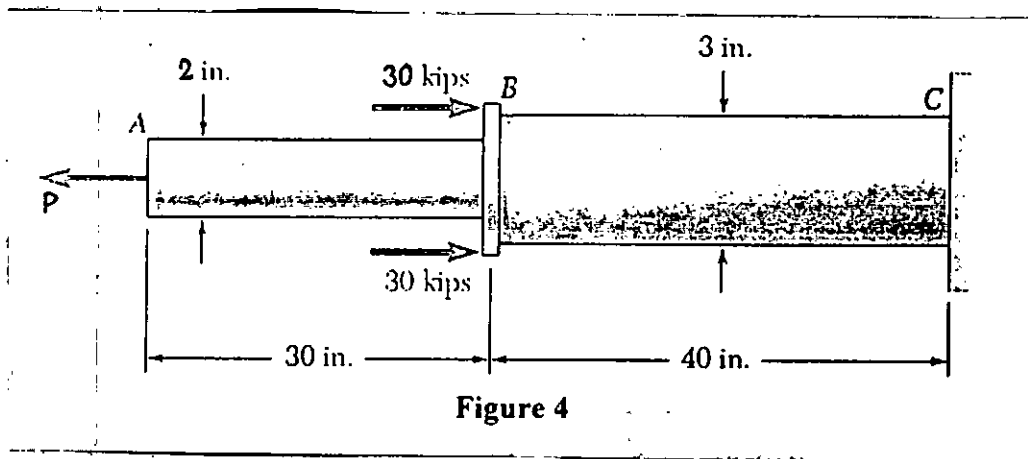
Figure 4

CE 221

3. (a) Draw the Shear Force and Bending Moment Diagram for the frame shown in Figure 5 using the method of section. Points A, B, and C are all pins. **(25)**

(b) Determine Shear Force and Bending Moment at point D and E of the frame shown in Figure 5. **(10)**

0.25 m

0.75 m

C D

0.75 m

0.75 m

E

1 m

0.75 m

B

400 N/m

60°

A
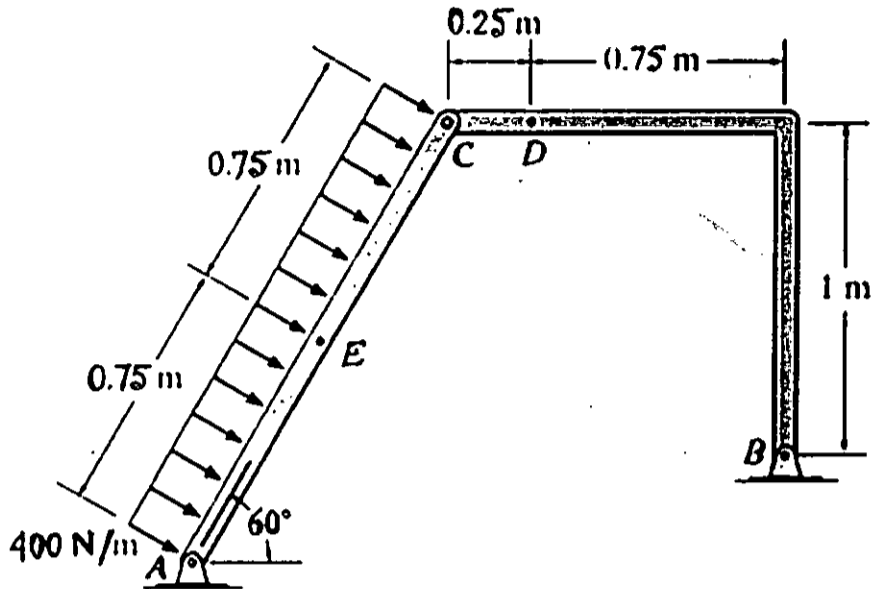
Figure 5

4. (a) The solid cylindrical shaft of variable size, as shown in mm in Figure 6, is acted upon by the torques indicated. What is the maximum torsional stress in the shaft, and between what two pulleys does it occur? **(20)**

(b) For the solid cylindrical shaft shown in mm in Figure 6, calculate the angle of rotation at point D with respect to B. **(15)**

55 N·m

A

880 N·m

275 N·m

660 N·m

110 N·m

$d = 25$

C

$d = 100$

D

$d = 75$

E

$d = 75$

B

1500

1000

1000

2000
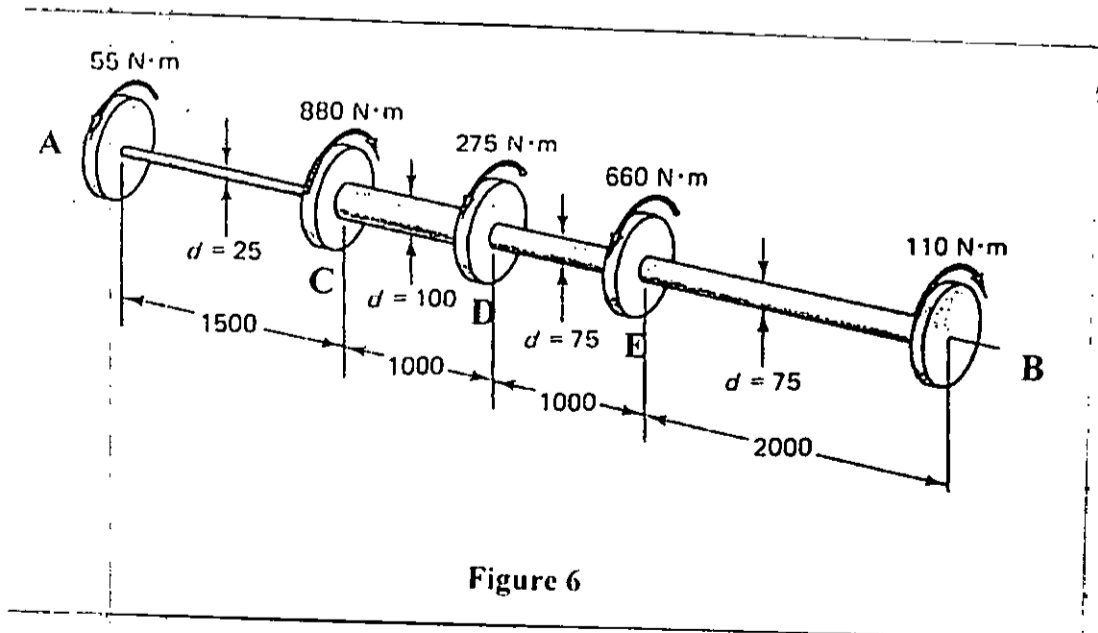
Figure 6

CE 221

<u>SECTION – B</u>

There are **FOUR** questions in this section. Answer any **THREE**.

(Symbols and notations have their usual meanings)

5. (a) The rigid bar BDE is supported by two links AB and CD as shown in Fig.7. Link AB is made of aluminum (Young's modulus = 70 GPa) and has a cross-sectional area of 500 mm^2; link CD is made of steel (Young's modulus = 200 GPa) and has a cross-sectional area of 600 mm^2. For the 30-kN force shown, determine the vertical deflections at points B,D and E.

(17½)

Fig.7
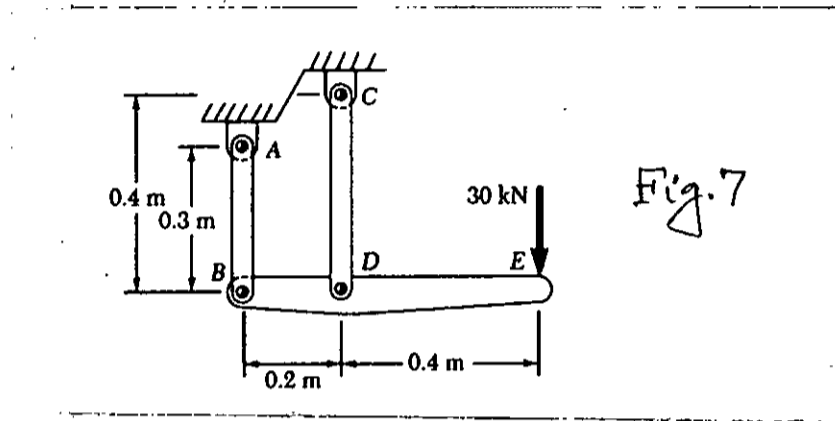
(b) Draw the shear force and bending moment diagrams of the beam shown in Fig.8. following the summation approach.

(17½)

fig. 8
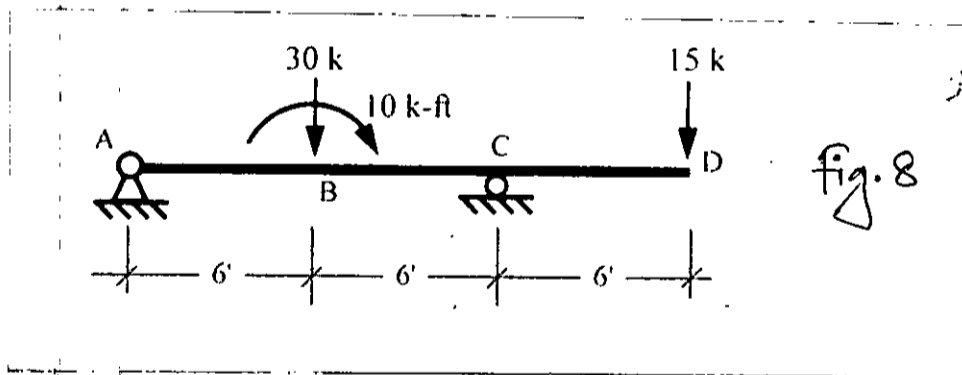
6. (a) Draw the shear force and bending moment diagrams of the beam shown in Fig. 9 following the summation approach.

(17½)

fig. 9
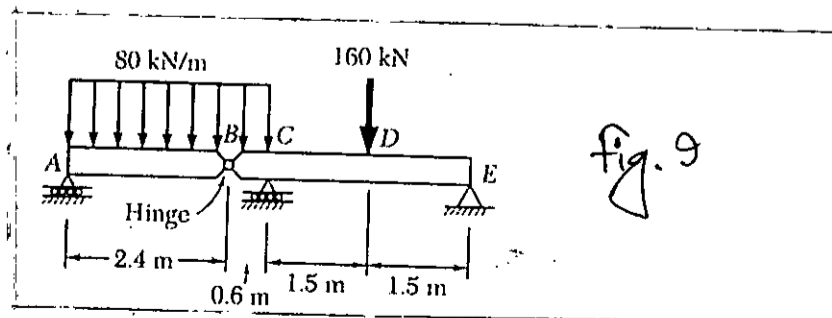
CE 221

Contd ... Q. No. 6

(b) The closely coiled helical spring shown in Fig. 10 has a wire diameter of $\frac{3}{8}$ ". Shear modulus of the spring material is 1.16×10^7 lb/in². AB, CD and EF are rigid bars. A force P = 196 lb shortens the spring causing the link AB to rigidly displaced downward touching the vertical links at C and E and resting on them (shown by dashed line). What will be the axial force in member CD?

(17½)

Fig. 10
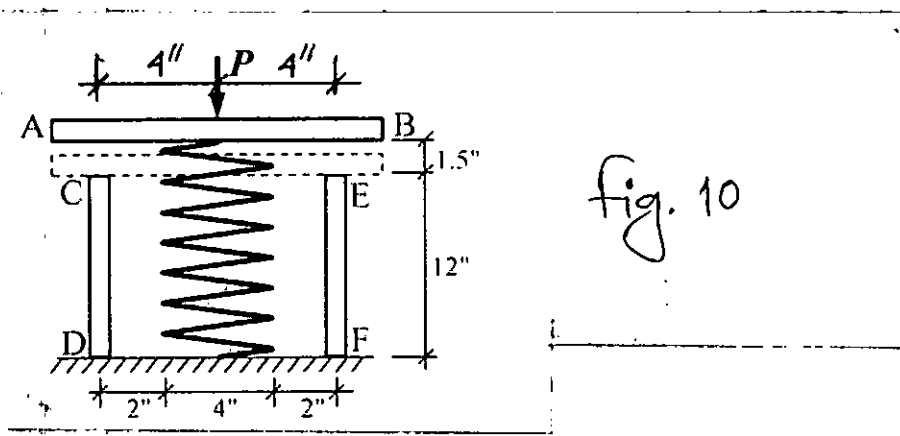
7. (a) The beam in Fig. 11(a) has the T-shaped cross section shown on the right. The bending moment diagram is also shown in Fig 11(b). Determine the values and locations of the maximum tensile and compressive bending stresses.

(17½)

Fig. 11
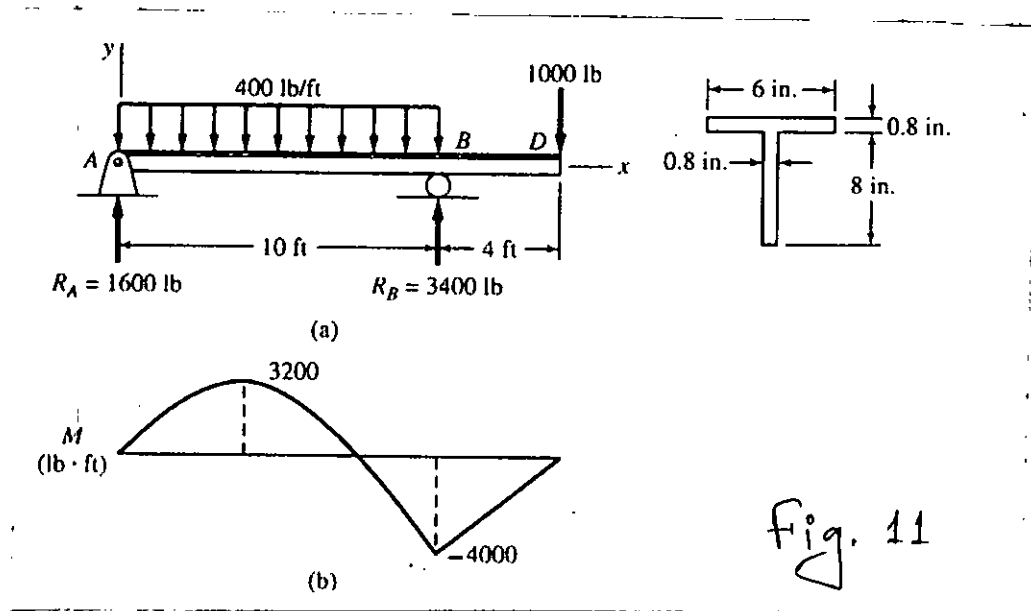
(b) Structural aluminum tubing of 2.5 × 4-in. as shown in Fig. 12 was fabricated by extrusion. As a result of defective fabrication, walls AB and AC are 0.120-in. thick, and walls BD and CD are 0.200-in. thick. Determine the shearing stress in each of the four walls when it is subjected to a torque of 24 kip-in.
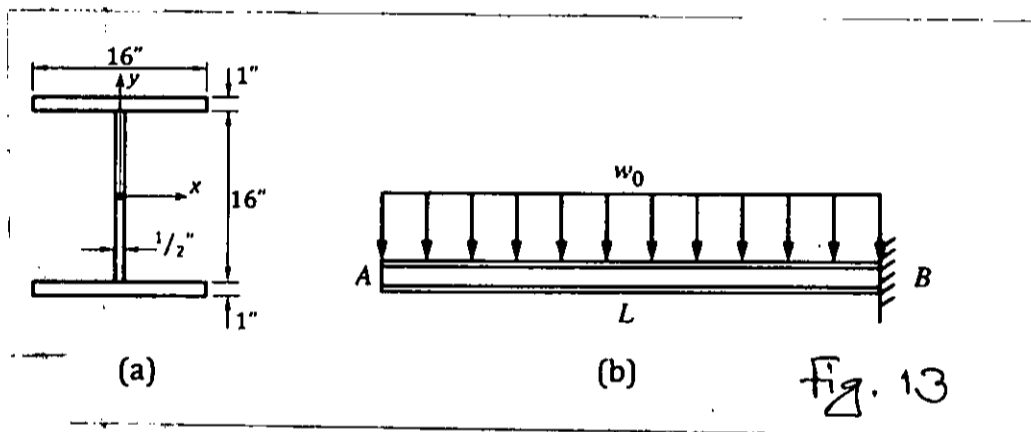
(17½)

CE 221
Contd ... Q. No. 7



4 in.

A B

0.120 in.

2.5 in.

0.200 in.

C D

Fig. 12
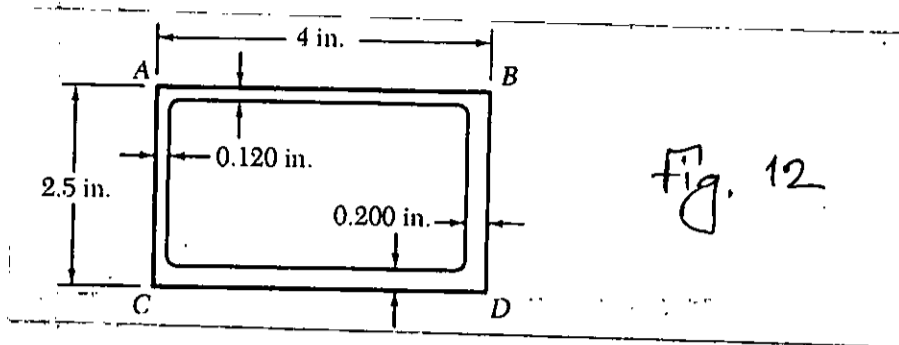
8. (a) A wide flange section as shown in Fig 13(a) is used as a cantilever beam of length L = 20 ft as shown in Fig 13(b). Neglecting the self-weight of the beam, determine the largest uniformly distributed load w_0 (kip/ft) that can be carried if the bending stress is not to exceed 36 ksi. (17½)

16"

y

1"

x

16"

½"

1"

(a)

w_0

A B

L

(b)

Fig. 13

(b) A metal plate ABCD of size 250mm × 300mm and thickness 5mm as shown in Fig. 14 is held fixed at the base AB while a horizontal shear force V is applied at the top of the plate. The load causes the plate to deform in a parallelogram shape ABC'D' such that CC' = DD' = 1.5mm. If the shear modulus of the metal is 80,000 MPa, what is the magnitude of V? (17½)
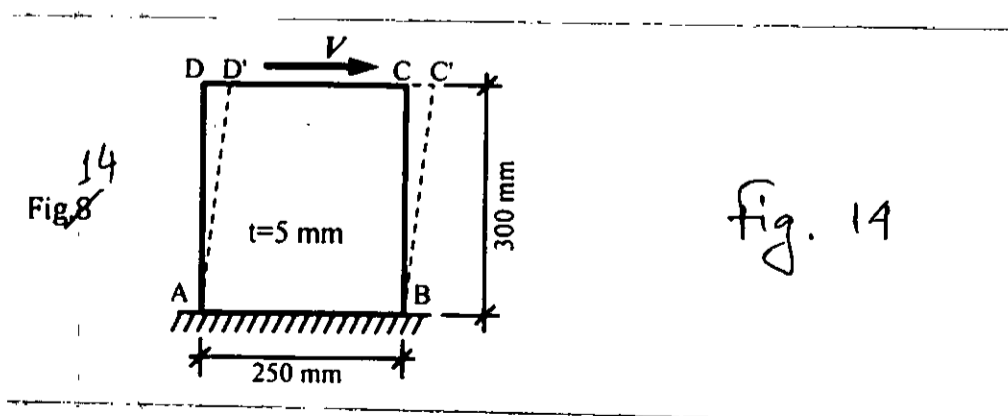
Fig. 14

D D' V C C'

t=5 mm

300 mm

A B

250 mm

Fig. 14

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B.Sc. Engineering Examinations 2022-2023

Sub: **MATH 231** (**Differential Equations**)

Full Marks: 210   Time: 3 Hours

The figures in the margin indicate full marks

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are FOUR questions in this section Answer any THREE questions.

Symbols have their usual meaning.

1. (a) Form a differential equation by eliminating arbitrary constants a and b from the equation $xy = ae^x + be^{-x}$ **(11)**

   (b) Solve $\dfrac{dy}{dx} = e^{x+y} + x^2 e^{x^3+y}$ **(12)**

   (c) Solve $\dfrac{dy}{dx} + \dfrac{y}{2x} = \dfrac{x}{y^3}$ at $y(1) = 2$ **(12)**

2. (a) Write the algorithm to convert a non-exact differential equation to the exact form and to solve the equation. Find the solution of $y(xy+1)dx + x(1-xy)dy = 0$ **(18)**

   (b) A body weighting 8 lb falls form the rest toward the earth form a great height. The air resistance (in pounds) numerically equals $2v$, where v is the velocity (ft/s). Find the velocity and distance fallen at any time t (in seconds). **(17)**

3. (a) Find the solution of the higher-order differential equation $\dfrac{d^2 y}{dx^2} + 2y = x^2 \sin 2x$. **(17)**

   (b) Reduce the following differential equation into Cauchy-Euler form and then solve: **(18)**

   $$(1+x)^4 \frac{d^3 y}{dx^3} + 2(1+x)^3 \frac{d^2 y}{dx^2} - (1+x)^2 \frac{dy}{dx} + (1+x)y = \frac{1}{1+x}.$$

4. Apply the Frobenious method to solve the following differential equation in series near $x = 0$: **(35)**

   $$x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (x^2 - 4)y = 0$$

MATH 231 (WRE)

SECTION – B

There are <u>FOUR</u> questions in this section Answer any <u>THREE</u> questions.
Symbols have their usual meaning.

5.   (a) Define the order, degree, linearity and non-linearity of a partial differential equation.   **(8)**

(b) Form a partial differential equation of all spheres of radius α, having centre in the x-y Plane.   **(10)**

(c) Describe the Lagrange auxiliary equation of solving the linear partial differential equation of order one.   **(5)**

(d) Find the integral surface of $x^2 p + y^2 q = -z^2$, which passes through the hyperbola $xy = x + y, \; z = 1$.   **(12)**

6.   (a) Explain the complete, particular and general solution of a partial differential equation.   **(5)**

(b) Using Charpit's method, find a complete and singular integral of $q = (z + px)^2$.   **(10)**

(c) Find the general solution of the following higher-order partial differential equations: **(10+10)**

(i) $(D_x^2 - D_x D_y + D_y - 1)z = 3\cos(x + 2y) + 2e^y$.

(ii) $(D_x + D_y - 1)(D_x + 2D_y - 3)z = 2x + 3y$.

7.   (a) Solve the following higher-order partial differential equation: **(10)**

$(x^2 D_x^2 - 2xy D_x D_y - 3y^2 D_y^2 + D_x - 3D_y)z = x^2 y \, \sin(\ln x^2)$

(b) Define and write an expression for the Bessel function of first kind $(J_n(x))$ and second kind $(J_{-n}(x))$ of order n.   **(5)**

(c) Evaluate $\int_0^{\frac{\pi}{2}} \sqrt{(\pi x)} J_{\frac{1}{2}}(2x)\, dx$.   **(10)**

(d) Prove that: $2J_n'(x) = J_{n-1} - J_{n+1}$.   **(10)**

8.   (a) Define the Legendre equation of order n.   **(5)**

(b) Show that the Legendre polynomial can be expressed as,   **(10)**

$P_n(x) = \frac{1}{\pi} \int_0^\pi \left[x \pm \sqrt{x^2 - 1} \; \cos\phi \right]^n \, d\phi$, where n is a positive integer.

(c) Use the generating function of Legendre polynomial to prove that,

$nP_n(x) = xP_n'(x) - P_{n-1}'(x)$ **(10)**

(d) Express the function $f(x) = \begin{cases} 0, & if \; -1 < x < 0 \\ 1, & if \quad 0 < x < 1 \end{cases}$ in the form of Legendre's series.   **(10)**