BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA
L-2/T-2 B.Sc. Engineering Examinations: January 2020 Term

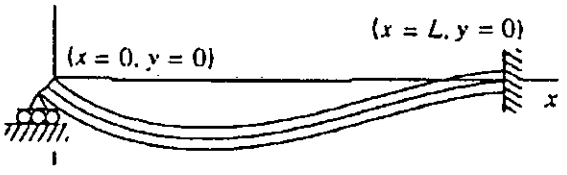
Sub: **CE 205** (Numerical Methods)

Full Marks: 120 Time: 2 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

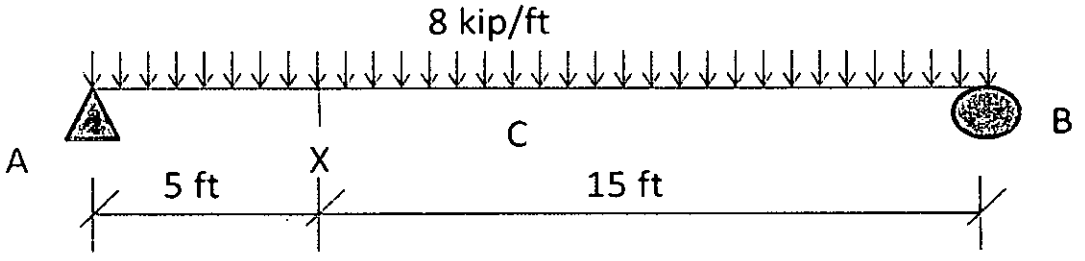
There are **FOUR** questions in this Section. Answer any **THREE.**

No.	Questions	Marks
1	The equation of the deflection curve of a beam subjected to linearly increasing load is as follows: $$y = \frac{w_0}{120EIL}\left(-x^5 + 2L^2x^3 - L^4x\right)$$ where, L = 600 cm, E = 50000 KN/cm^2, I = 30000 cm^4 and w_0 = 2.5 kN/cm. Apply bisection method to determine the point of maximum deflection (that is, the value of x where $y = y_{max}$) using any logical initial bracketing values. Perform 8 iterations. Also determine the value of the maximum deflection. The deflection curve of the beam is shown in Figure 1.  Figure 1	20
2	Use the explicit method to determine the temperature distribution at time, t = 0.2s of a long, thin rod with a length of 12 cm and the following values: k = 0.835 cm^2/sec, Δx = 2 cm and Δt = 0.1s. At t = 0, the temperature of the rod is 20°C and the boundary conditions are fixed for all times at T(0) = 100°C and T(10) = 60°C.	20
3	Determine the solution of the following simultaneous nonlinear equations using Newton-Raphson method using initial guesses of $x = y = 1.5$: $x^2 = 5 - y^2$ $y + 1 = x^2$ Perform two iterations.	20
4	(a) What are the major disadvantages of using Euler's method? How can this be overcome? (b) What type of arithmetic operations typically give rise to round-off errors? How can truncation error be minimized?	10×2 = 20

SECTION –B: CE 205

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

5. (a) Explain the two theorems of Graphical method. (10)
   (b)Find the solution for the following equation using Regula Falsi Method (10)
   $f(x) = Cosx - xe^x$
6. (a) Prove for Newton Raphson method that at each iteration absolute error is proportional to the square of the previous error and the convergence is quadratic. (10)
   (b) For the following loaded beam, estimate deflection at point X. Consider E and I values from A to C to be $30x10^6$ psi & 1200 in^4 and from C to B to be $20x10^6$ psi & 1500 in^4, respectively. (10)



7. (a) Derive the general expression for area calculation in Simpson`s rule. (10)
   (b) Estimate the value of the following integral using Gauss Quadrature. (10)

$$I = \int_0^4 \frac{dx}{1+x^2}$$

8. (a) Define Gauss quadrature. Also derive associated points and weighing coefficients for n=3 (10)
   (b) For the following data find (10)
   (i) General Polynomial equation
   (ii) Function value for X=0.28

X	0.14	0.23	0.30	0.38	0.47
F(x)	1.41	1.52	1.77	1.98	2.33

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-2 B.Sc. Engineering Examinations: January 2020 Term

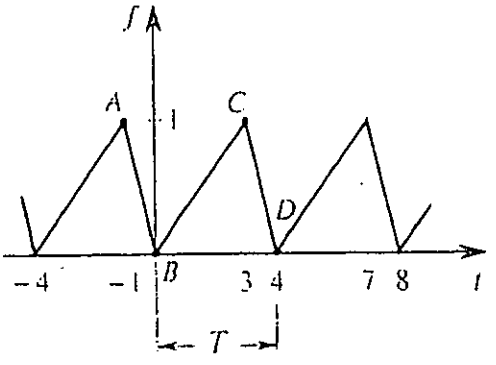
Sub: **CE 207** (Applied Mathematics for Engineers)

Full Marks: 180 Time: 2 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1(a)	If $X_1, X_2, \ldots\ldots, X_n$ are independent Poisson random variables each having mean λ, determine the maximum likelihood estimator of λ (Derive expression).	**(10)**
(b)	Bangladesh Road Transport Authority did a study a number of years ago that showed that the proportion of cars tested which failed to meet the state pollution standard was 0.37. The department would like to be able to say that the cars have improved since then. In a sample of n=100 cars more recently, the proportion not meeting the standards was 0.28. Are the cars better at meeting the standards than they used to be? Clearly state the null and alternative hypotheses. Perform the hypothesis test at level $\alpha = .01$, by computing the test statistic and explain the meaning of your conclusion in words.	**(20)**
2(a)	Determine the coefficient a_n of the Fourier Series for the function shown in Fig. 1.  Figure 1	**(12)**
(b)	Determine the response of an undamped oscillator for a forcing function shown in Fig. 2. The governing differential equation is: $mx'' + kx = F(t)$.	**(18)**

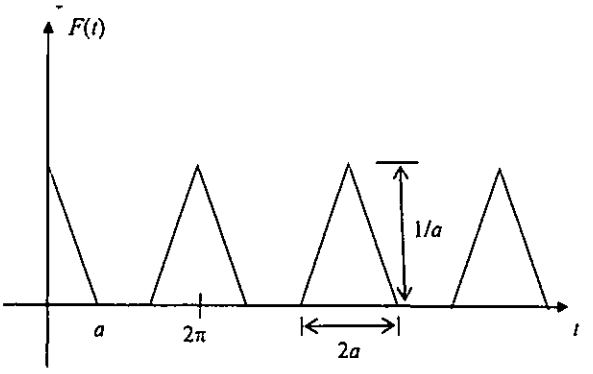
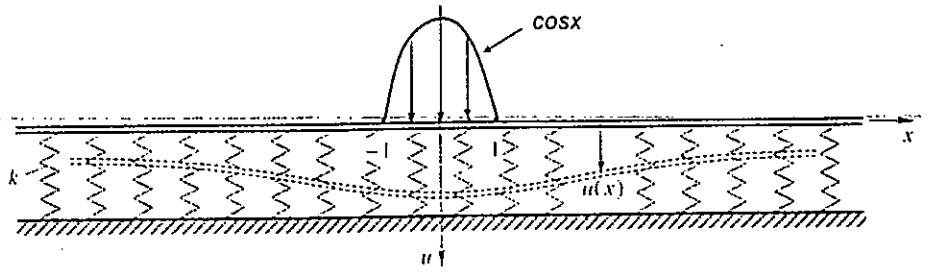


Figure 2

3(a)	Determine the deformation for an overburden load on a rail track on soil shown in Fig. 3.  Figure 3	(18)
(b)	Determine Fourier Transforms of the following functions: (i) $H(x-a)e^{-a(x-a)}$ (ii) $e^{-a\|x\|}\cos ax$ (iii) $x^2e^{-x^2}$	(12)
4(a)	Determine the solution of a damped oscillator due to an arbitrary force of $w(t)$ in the transformed domain. The governing differential equation is given by: $mx'' + cx' + kx = w(t)$.	(15)
(b)	Solve the following differential equation. $u'' - 9u = 50e^{-2x}$ The boundary condition is given by, $u'(0) = 0$ and $u(\infty)$ is bounded.	(15)

SECTION B: CE 207

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

5	A water tank has diameter 2 m, the hole (at bottom) has diameter 1 cm, and the initial height of the water when the hole is opened is 2.56 m. Derive a general expression for the height of water in tank at any given time. When will the tank be empty? It is given that under the influence of gravity the outflowing water has velocity, $v(t) = 0.600\sqrt{(2gh(t))}$, where, g = acceleration due to gravity, h(t) = height of water above hole at time t	**(30)**
6	Using power series method, derive the solution of the following ordinary differential equation (show details); $y'' - y' + xy = 0$	**(30)**

7(a)	Buses arrive at a specified stop at 15-minute intervals starting at 7:00 am. That is, they arrive at 7:00, 7:15, 7:30, 7:45 am etc. If passengers arrive at a stop at a time uniformly distributed between 7:00 and 7:30 am, find the probability that a passenger waits: (i) less than 5 minute; (ii) at least 12 minute.	**(15)**
(b)	A plane is missing and it is presumed that it was equally likely to have gone down in any of 3 possible regions. Let $1-\beta_i$ denote the probability that the plane will be found upon a search of the ith region when the plane is, in fact, in that region, i=1, 2, 3. (The constants β_i are called overlook probabilities because they represent the probability of overlooking the plane; they are generally attributable to the geographical and environmental conditions of the regions). What is the conditional probability that the plane is in the ith region, given that a search of region 1 is unsuccessful, i=1, 2, 3?	**(15)**
8 (a)	Piston rings are mass-produced. The target internal diameter is 45 mm but records show that the diameters are normally distributed with mean 45 mm and standard deviation 0.05 mm. An acceptable diameter is one within the range 44.95 mm to 45.05 mm. What proportion of the output is unacceptable?	**(15)**
(b)	Sample of 10 grains of metallic sand taken from a large sand heap has following lengths (mm): 2.2, 3.4, 1.6, 0.8, 2.7, 3.3, 1.6, 2.8, 2.5, and 1.9. It is known that the size of an individual particle will have an approximate lognormal distribution. Estimate the percentage of sand grains with length between 2 and 3 mm.	**(15)**

DEPARTMENT OF CIVIL ENGINEERING, BUET

NAME OF THE EXAMINATION: B. Sc. Engg. Examination			SESSION: January 2020
LEVEL: 2	TERM: 2	EXAM DATE:	TIME: 2 hours
COURSE NO: CE 213	COURSE TITLE: Mechanics of Solids-II		FULL MARKS: 180

SECTION: A

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

		Marks
1	Using moment area method calculates deflection and rotation of point A for the beam shown with loading in Figure-1.	30
2	Determine the allowable axial load for a 20-ft W 14 X 159 steel column (r = 4 in, A = 46.7 sq.in) with yield strength of 50 ksi, using AISC ASD formulas when the columns has one end pinned and other end fixed. Given that: $C_c = \sqrt{2\pi^2 E/\sigma_{yp}}$ For long columns, $(L_e/r) > C_c$: $\sigma_{allow} = \frac{12\pi^2 E}{23(L_e/r)^2}$ For intermediate columns, $L_e/r \le C_c$: $\sigma_{allow} = \frac{[1-(L_e/r)^2/2C_c^2]\sigma_{yp}}{\text{F.S.}}$ where F.S., the factor of safety, is defined as: $\text{F.S.} = \frac{5}{3} + \frac{3(L_e/r)}{8C_c} - \frac{(L_e/r)^3}{8C_c^3}$	30
3	A plate is attached to the frame of a machine by two side fillet welds as shown in Figure-2. If the allowable shearing stress of the weld is 145 MPa, what size of welds, to the nearest millimeter, should be used? Let a= 200mm, b = 150mm, c = 100mm and P = 50 kN.	30
4	Using strain energy method, calculate deflection at point D for the beam with loading shown in Figure-3. Given that: P = 50 Kips, L = 15', a =3' E = 29×10^3 ksi and I = 248 in^4.	30

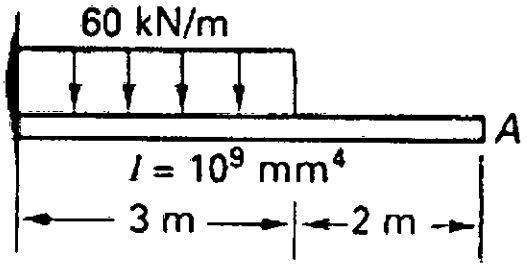


Fig-1

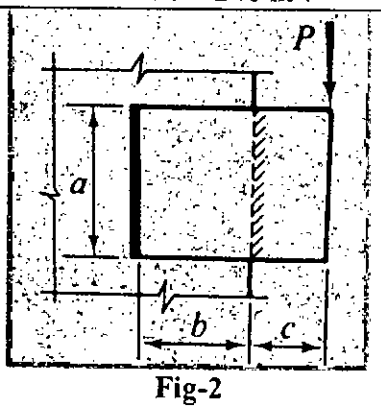


Fig-2

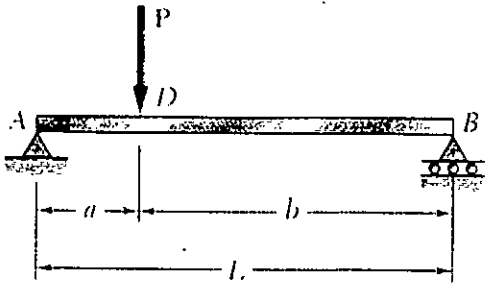


Fig-3

SECTION B: CE 213

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

5.	The column is built up by gluing the two boards together as shown on Fig. 4. If the wood has an allowable normal stress of σ_{allow} = 8 MPa, determine the maximum allowable eccentric force **P** that can be applied to the column.	30

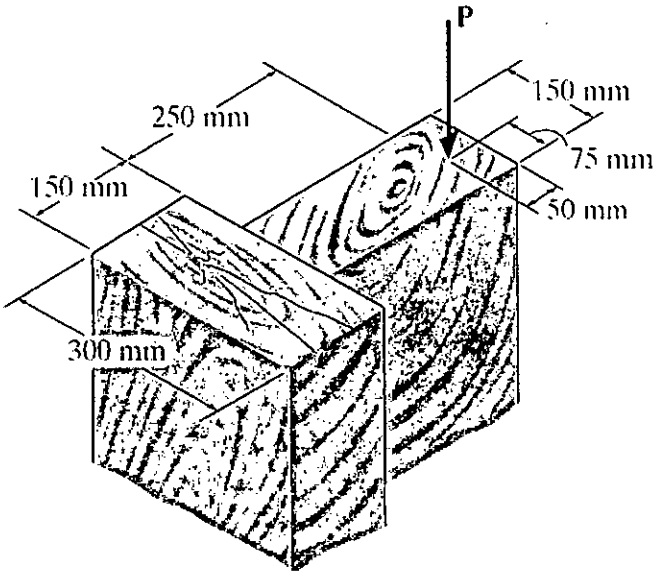


Fig. 4

No.	Questions	Marks
6	A shear wall in a reinforced concrete building is subjected to a vertical uniform load of intensity q and a horizontal force H, as shown in the first part of the Fig. 5. As a consequence of these loads, the stresses at point A on the surface of the wall have the values shown in the second part of the figure. Determine the principal stresses and show them on a sketch of a properly oriented element	30

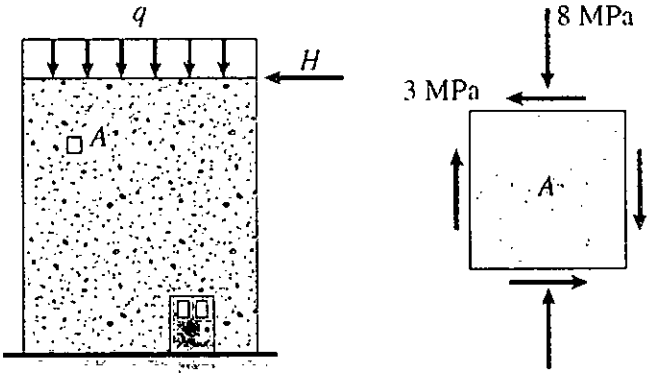


Fig. 5

7.	Compute the support reaction at A and the maximum tension in the main cable shown in Fig. 6. The hangers can be assumed to provide a simple support for the suspended beams with distributed load of 8 kips/ft.	30

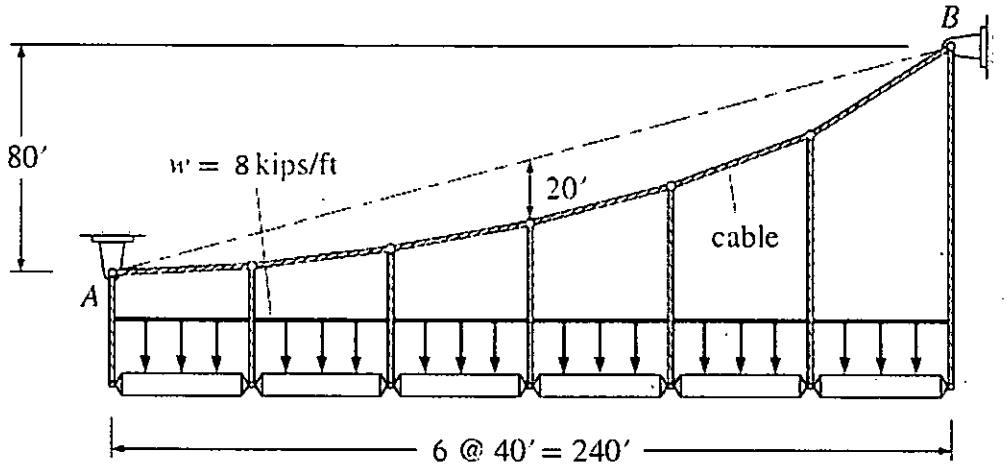


Fig. 6

8	The state of plane stress shown occurs in a machine component made of a steel with yield strength, $\sigma_y = 345$ MPa. Using the maximum-distortion-energy criterion, determine whether yield will occur for the element as shown in Fig. 7. If yield does not occur, determine the corresponding factor of safety.	30

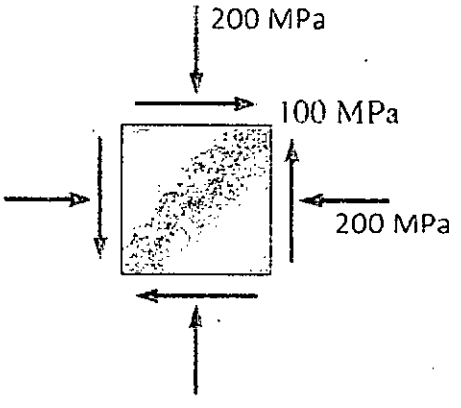


Fig. 7

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-2 B.Sc. Engineering Examinations: January 2020 Term

Sub: **CE 223** (Mechanics of Solids II)

Full Marks: 180 Time: 2 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

NO.	QUESTIONS	MARKS
1.	A flexible cable whose ends are supported at different elevation (Figure 1) subjected to a uniformly distributed load of 0.3 kip per horizontal foot. Determine, (i) horizontal component of cable tension (H), (ii) mid-span sag (t), (iii) equation of the cable having origin at left support, (iv) maximum cable tension ($T_{maximum}$), (v) cross sectional area of the cable (A), (vi) stretched length (S), elongation (ΔS) and unstretched length (S_o) of the cable. Given, allowable tensile stress in cable ($\sigma_{allowable}$) = 45 ksi and modulus of elasticity (E) = 30000 ksi.	(30)
2.(a)	Determine the proper lengths of the welds for the connection of a 76 x 51 x 11.1 mm steel angle to a steel plate as shown in the Figure 2. The connection is to develop the full strength in the angle uniformly stressed to 230 MPa. the 10 mm fillet welds, whose strength as per specification is 1020 newton per linear millimeter. Given, area of the angle = 1290 mm^2.	(15)

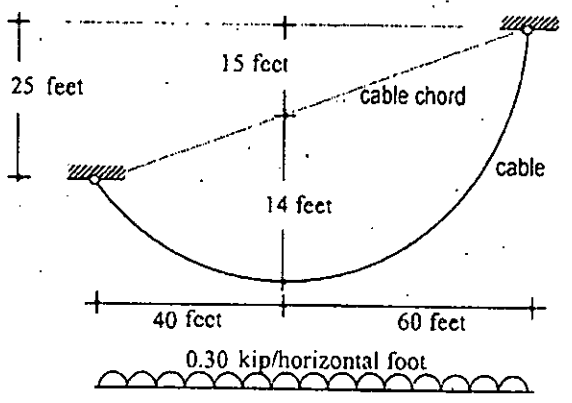


Figure 1

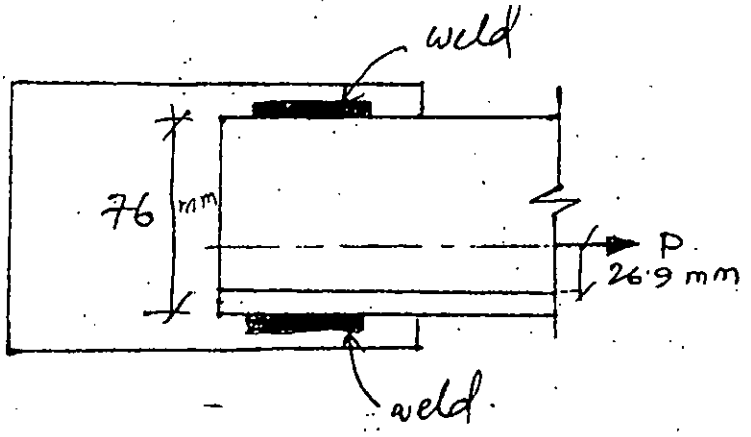
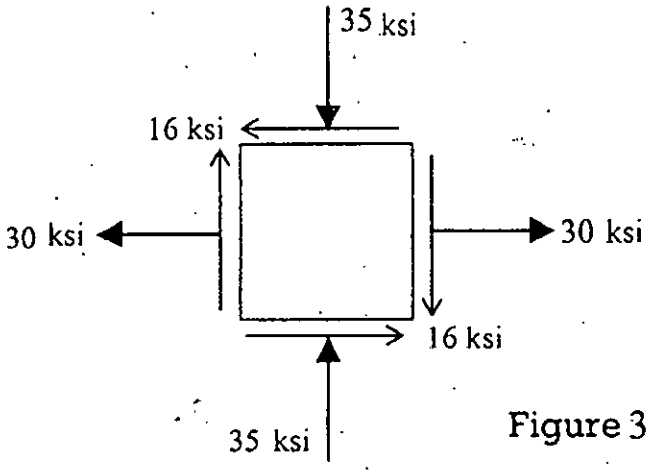
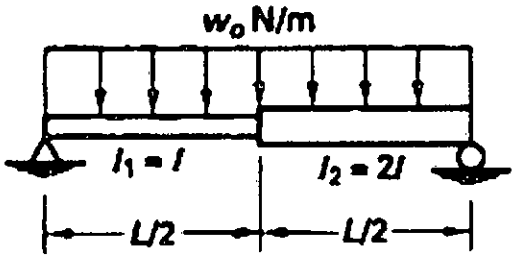


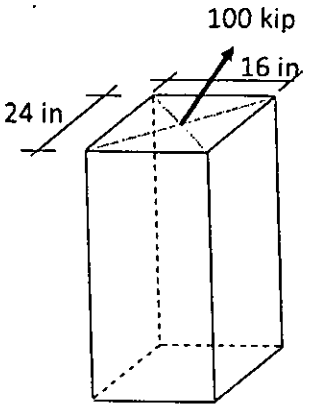
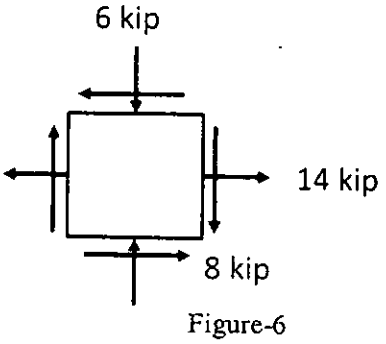
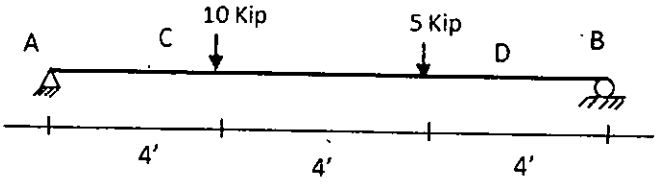
Figure 2

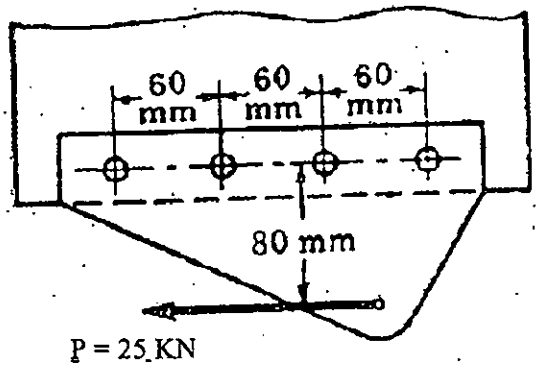
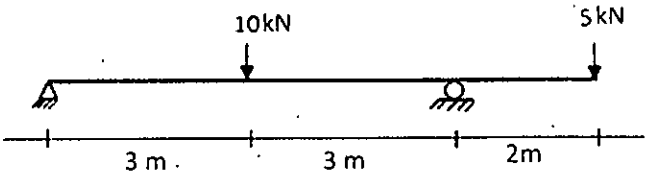
2.(b)	Define Creep and Fatigue. Write down the 7 yielding theories of failure.	(15)
3.	For the plane stress condition of an element as shown in Figure 3, (i) Determine the principle stresses and maximum shear stress (with associated normal stress) and angle of inclination of the planes over which they act. Also show their sense on properly oriented elements. (ii) Draw Mohr's circle of stress and draw principal planes, maximum shear planes (using Mohr circle) and their sense on properly oriented elements.  Figure 3	(30)

4.	A Simply Supported beam is loaded with a uniformly distributed load as shown in Figure 4. I = 10×10^6 mm^4, E = 70 GPa. Use the second order differential equation. a) Find the equation of the elastic curve b) Calculate the value of maximum deflection.  Figure 4	(30)

SECTION-B: CE 223

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

No.	Questions	Marks
5	Draw normal stress distribution diagram of the column (24×16 inch cross section) as shown in the Figure 5 at a section 2 ft below the top. Also show the neutral axis. 100 Kip force is applied diagonally with a vertical angle of 30°.  Figure-5	30
6(a)	In Figure 6, the state of stress of an element is shown. Using Von Mises theory and Tresca theory, determine whether the element yielded or not. The yield stress of the material is 20 ksi.  Figure-6	15
6(b)	Calculate the total strain energy of the beam shown in Figure 7 for normal stress. Given that, size of the beam is 4″×6″ and E= 29000ksi  Figure-7	15

7.	A gusset plate is riveted to a larger plate by four 22-mm rivets arranged and loaded as shown in Figure 8. Determine the maximum and minimum shear stress developed in the rivets.  Figure-8	30
8.	Using moment area method, determine the maximum defection between two supports of the beam shown in Figure- 9. Consider, EI of the beam as constant.  Figure-9	30

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA
L-2/T-2 B.Sc. Engineering Examinations: January 2020 Term

Sub: **CE 267** (Structure II: Basic Mechanics of Solids)

Full Marks: 120 Time: 2 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1.	Draw axial force, shear force and bending moment diagrams for the beam shown in Fig. 1.	20
2.	The rigid beam AB rests on the two short posts shown in Fig. 2. Post AC is made of aluminum having a diameter of 2.5 inch, and post BD is made of steel having a diameter of 1 inch. Determine the displacement of points A, F and B if a vertical load of 20 kip is applied over point F. Given, modulus of elasticity of aluminum is 70 GPa and modulus of elasticity of steel is 200 GPa.	20
3.	(a) A steel bar shown in Fig. 3 is constrained to fix between two fixed supports when $T_1 = 25°C$. If the temperature is raised to $T_2 = 50°C$, determine average normal stress developed in the bar. Given that thermal expansion coefficient, $\alpha = 12 \times 10^{-6}/°C$ and modulus of elasticity of steel, E = 200 GPa. (b) Define stress, strain, and Poisson's ratio.	15 5
4.	Draw the axial force diagram of the bars shown in Fig. 4. And (i) determine the displacement at A, (ii) displacement at end D with respect to end A, (iii) axial stress in member BC and (iv) displacement of F with respect to end A. In Fig. 4, L denotes the length of each bar segment, A denotes cross sectional area, and E denotes modulus of elasticity. 1, 2, 3, 4 and 5 are the indices for the bar segments.	20

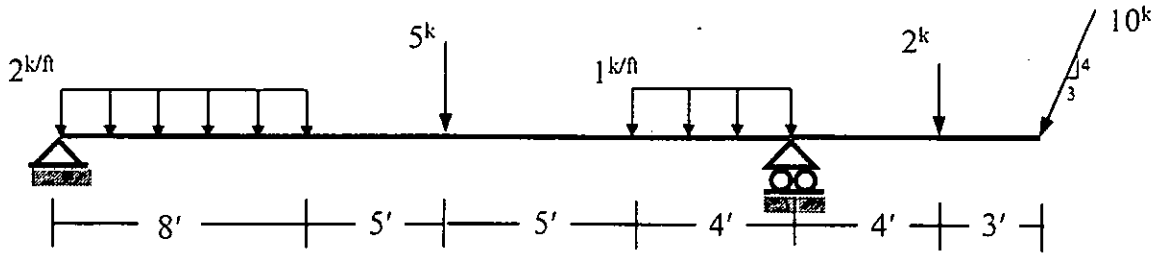


Fig. 1

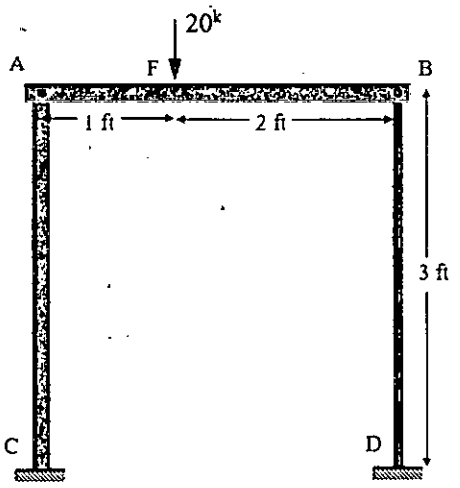


Fig. 2

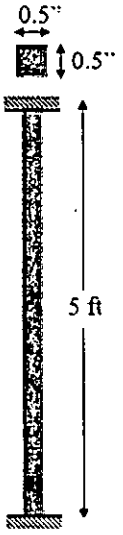
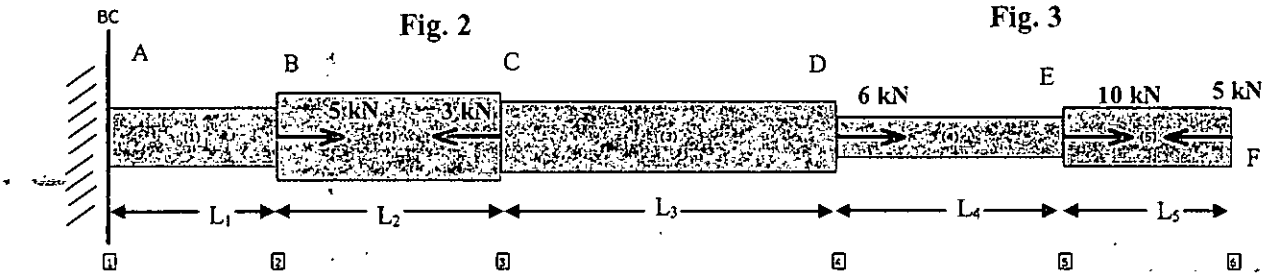


Fig. 3



Given,

$L_1 = 1.5$ m,	$A_1 = 20$ mm^2	$E_1 = 200$ GPa
$L_2 = 2$ m	$A_2 = 45$ mm^2	$E_2 = 200$ GPa
$L_3 = 3$ m	$A_3 = 30$ mm^2	$E_3 = 70$ GPa
$L_4 = 2$ m	$A_4 = 10$ mm^2	$E_4 = 70$ GPa
$L_5 = 1.5$ m	$A_5 = 20$ mm^2	$E_5 = 200$ GPa

Fig. 4

SECTION-B: CE 267

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

5(a)	A beam has a rectangular cross section and is subjected to the stress distribution shown in Fig. 5. Determine the internal moment M at the section caused by the stress distribution using the flexure formula.	10

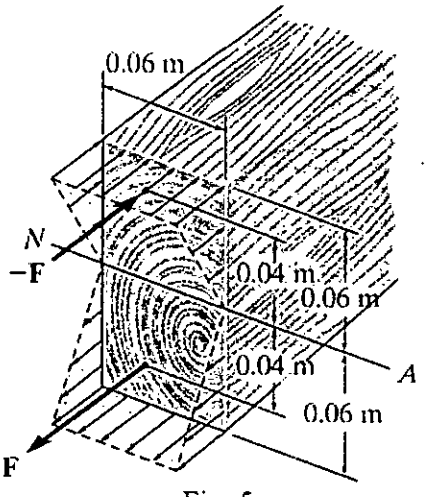


Fig. 5

(b)	The beam shown in Fig. 6 is subjected to a bending moment of M=50kN.m, determine the maximum bending stress in the beam.	10

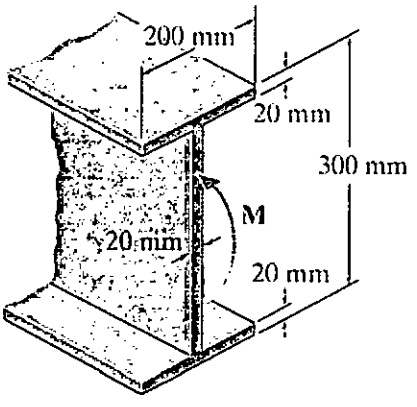


Fig. 6

6(a)	Write the flexural formula. What is kinetic assumption?	5
(b)	The beam shown in Fig.7 is made from two boards. Determine the maximum shear stress in the glue necessary to hold the boards together along the seam where they are joined.	15

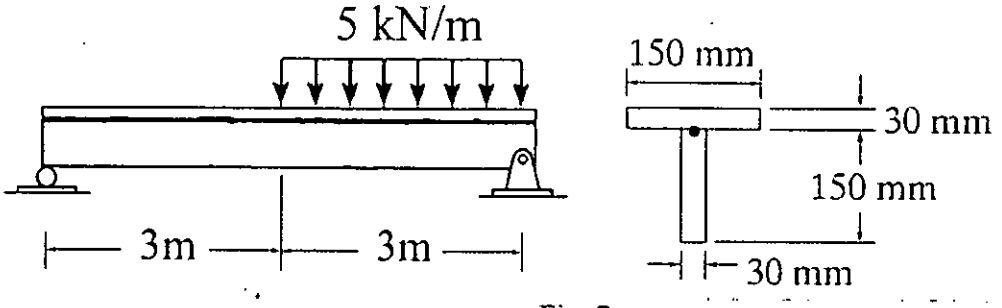


Fig. 7

7(a).	A steel wide-flange beam has the dimensions shown in Fig.8. If it is subjected to a shear of V=60kN, plot the shear-stress distribution acting over the beam's cross section.	15

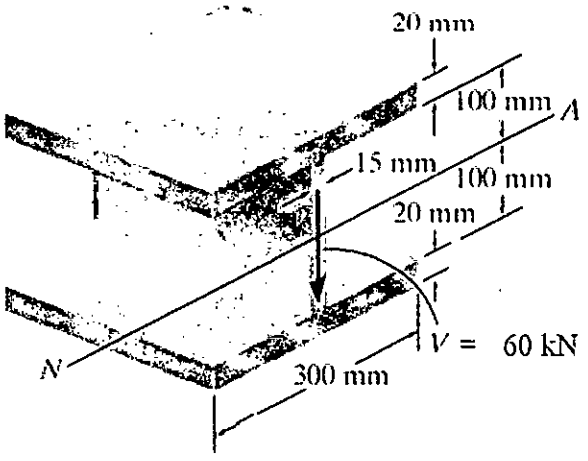


Fig.8

(b)	Write the formula of maximum shear stress over the rectangular cross section of a beam.	5
8(a)	The aluminum rod, shown in Fig. 9, has a circular cross section and is subjected to an axial load of 20kN. If a portion of the stress–strain diagram is shown in Fig.10, determine the approximate elongation of the rod when the load is applied. Consider E_{al} = 70GPa.	12

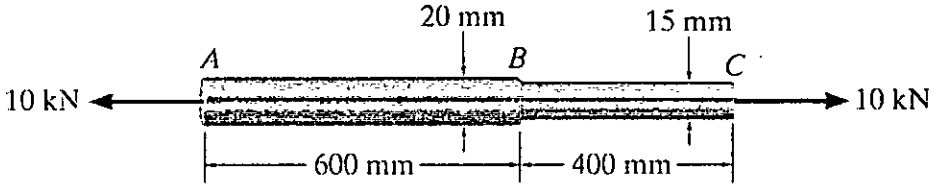


Fig.9

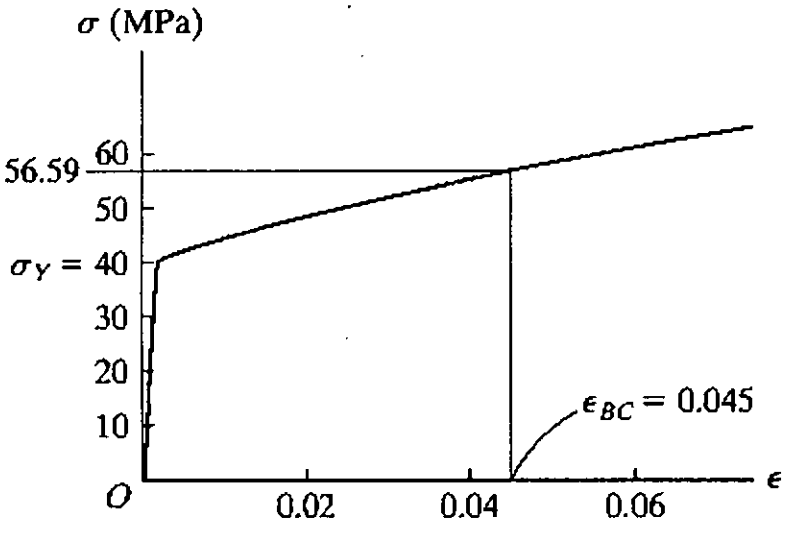


Fig.10

(b)	The casting shown in Fig.11 is made of steel having a density of 7850 kg/m^3. Determine the average compressive stress acting at points A and B.	8

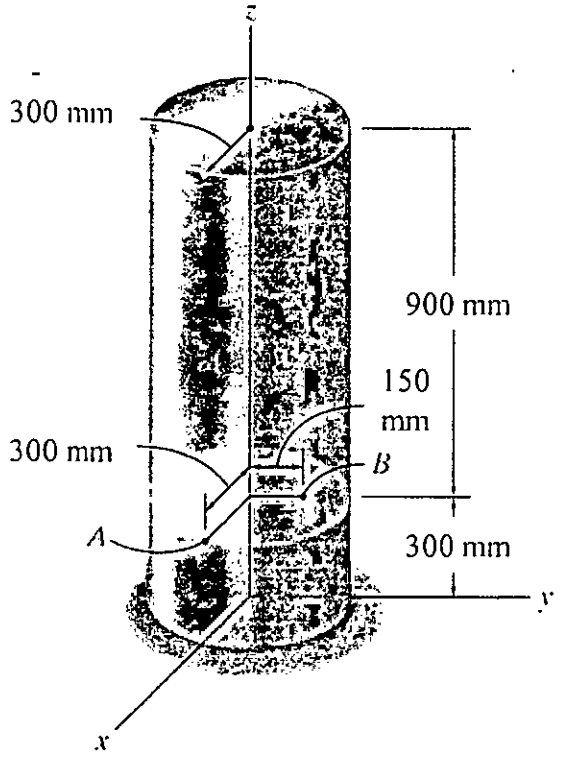


Fig.11

L-2/T-2/CE Date: 16/01/2021

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY

L-2/T-2 B.Sc. Engineering Examinations January 2020 (Online)

Sub: **WRE-211** (Fluid Mechanics)

Full Marks: 180 Time: 2 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

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

1. (a) A very small quantity of liquid having a surface tension σ forms a circular spot of diameter **D** between two glass plates separated by a small distance **h**. Obtain the expression for **force** required to pull the plates apart. **(15)**

(b) Capillary rise of water in two vertical clean glass tubes indicate a difference in height, **h**. Diameter of tube-1 = half of the diameter of tube-2. Difference in height between two menisci, h = 15* diameter of tube-1 (mm). Given that the diameter of tube-1 = 1 + 0.001*R (mm), where R is the last three digits of your student number. Estimate the **surface tension** of water. Assume logical values for standard temperature and pressure for solving the problem. **(15)**

2. (a) Show that for circular pipes, friction factor, $f = 8\tau_w / (\rho V^2)$. Here, τ_w = shear stress at wall, ρ = density of fluid, **V** = average cross-sectional velocity. **(15)**

(b) Determine the exponential expression for **head loss** when water flows in 12-inch cast iron clean pipe. Use the Darcy-Weisbach formula and assume that velocity ranges from (1 + 0.001*R) m/s to (1.5 + 0.001*R) m/s, where R is last three digits of your student number. Vary the value of friction factor from 0.019 to 0.021 for different flow conditions. **(15)**

3. (a) Derive the expression for **variations of pressure** with location in fluid at rest using wedge shaped elementary area. Consider downward going vertical axis as the positive direction. **(15)**

(b) One end of a U tube manometer is connected to a vessel and the other end is open to atmosphere. For empty vessel condition, the manometer reading is shown in Figure 1. Find the

manometer reading when the vessel is completely filled with water. In the given figure, assume the value of H = 2 + 0.005*R (where R is last three digits of your student number). **(15)**

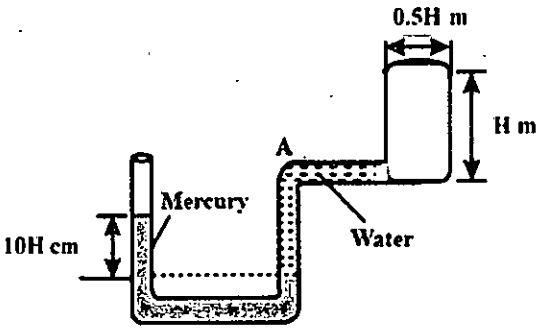


Figure 1 for Question 3(b)

4. (a) Figure 2 shows gate AB which is hinged at B and rests against a smooth wall at A. Determine the **depth of water h** which will just cause the gate to open. The gate is 2m wide and weighs (6000 + R*30) N when submerged, where R is the last three digits of your student number. **(12)**

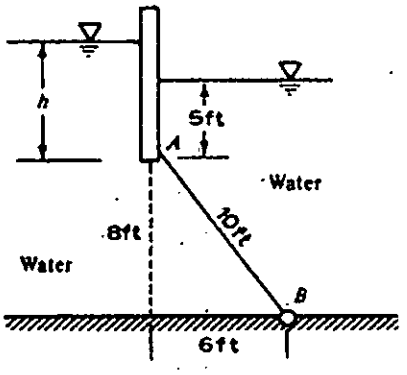


Figure 2 for Question 4(a)

(b) Find the **flow rate** of water through the system (from A tank to B tank) shown in Figure 3. Total head difference between points A and B is (5 + R*0.015) m, where R is the last three digits of your student number. Consider both major and minor losses. Apply both of the following methods: **(18)**

i. Equivalent velocity method
ii. Equivalent length method

Data given:

Pipe 1	Length, L1= 300m	Diameter, D1= 600mm	Friction factor, f= 0.0265
Pipe 2	Length, L2= 240m	Diameter, D2= 1m	Friction factor, f= 0.0168

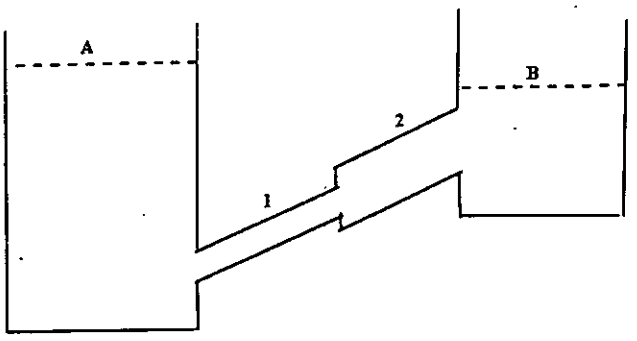


Figure 3 for Question 4(b)

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**. Assume any Reasonable values if missing. Clearly state any assumptions if you considered during solving problems.

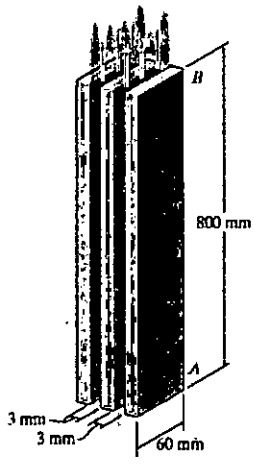
5. (a) According to different approaches adopted in solving the real-world fluid mechanics problems, as per your basic knowledge in this subject matter, which approach best suits for solving civil/water resources engineering problems, and why? How can you identify the basic operational differences between two widely used Turbomachines? **(7+5 = 12)**

(b) The velocity of a flow field is defined by $u = -\frac{y}{4}$ (m/s) and $v = \frac{x}{9}$ (m/s), where x and y are in meters. Determine the magnitude of the velocity and acceleration of a particle that passes through point (3 m, 2 m). Predict whether the pathway of the streamline is: i) Circular, ii) Parabolic, or ii) Elliptical? **(18)**

6. (a) A researcher proposed that a Newtonian fluid follows an equation for calculating the dynamic or absolute viscosity: $\mu = 0.0129 + (197 - X) * 0.0001$ (N-s/m^2), where, X is the last three digits of your Student Number. If the fluid has a specific gravity of 0.91 and flows through a 25 mm diameter pipe with a velocity of 2.5 m/s, identify, whether the flow is: i) Laminar, ii) Transitional, or iii) Turbulent? **(8)**

(b) How the Path lines and Streak Lines can be correlated? **(8)**

(c) A nuclear reactor cooling system consisting of three plates spaced at 3 mm apart and 800 mm long as shown in **Figure 4**. During an initial test, water enters at the bottom of the reactor (plates) and flows upwards at $\mathbf{0.8 + (197 - X) * 0.001}$ m/s. Determine the pressure difference in the water between A and B. Take the average water temperature to be (70 + 0.115*X)°C. Assume the value of X is the last three digits of your student number. **(14)**



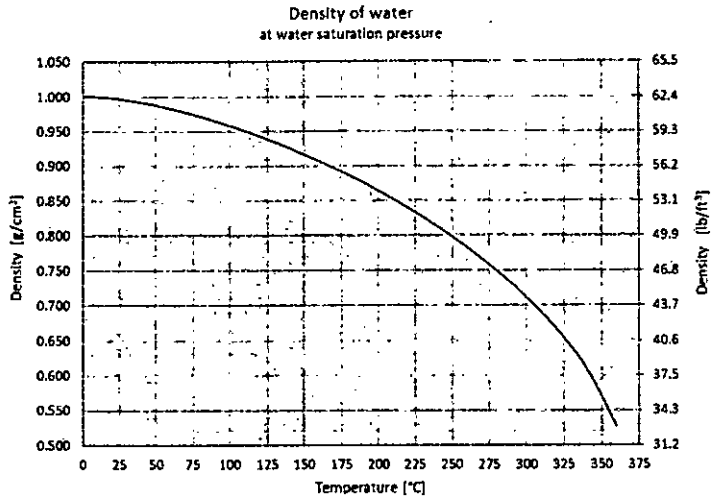


Figure 4 For Problem No. 6 **(b)**.

7. **(a)** Water flows through the pipe C at 4 m/s. Determine the horizontal and vertical components of force exerted by elbow D necessary to hold the pipe assembly in equilibrium (Figure 5). Neglect the size and weight of the pipe and the water within it. The pipe has a diameter of 60 mm at C, and at A and B the diameters are 20 mm. Consider the pipping system is in the vertical plane. **(20)**

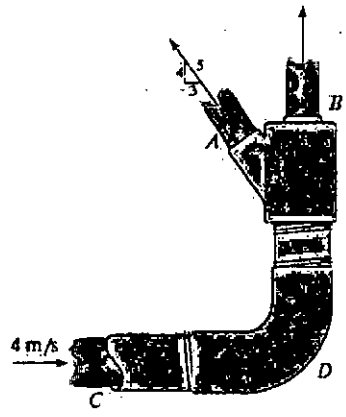


Figure 5 For Problem No. 7 **(a)**

(b) According to Bernoulli's Principal, the gage pressure of a fluid is zero at locations where the HGL intersects the fluid. The pressure in a flow section that lies above the HGL is negative, and the pressure in a section that lies below the HGL is positive. Show your supportive mathematical and/or analytical explanations from the Bernoulli's Equation to establish these statements using a hypothetical piping network system. **(10)**

8. **(a)** Water is drawn into the pump, such that the pressure at the inlet A is -35 kPa and the pressure at B is 120 kPa (Figure 6). The pipe has a constant diameter of 100 mm. The discharge at B is 0.08 m^3/s, and h = (2 + 0.01*X) m, where X is the last three digits of your student number. (i) Determine the power output of the pump. (ii) Draw the EGL and HGL for the pipe ACB using a datum at A considering no friction loss. (iii) Show in your sketch the qualitative changes in the EGL and the HGL considering all losses in the system. **(20)**

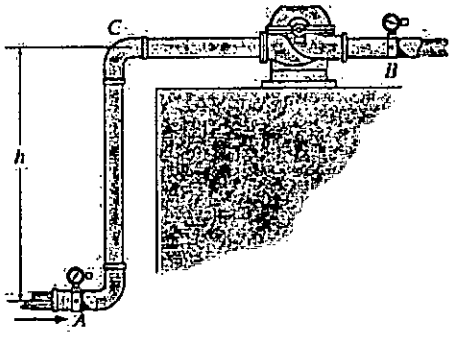


Figure 6 For Problem No. **8 (a).**

(b) A wind turbine has an efficiency of $Y\%$ and a rotor diameter of 60 m. Given that the wind speed is 15 m/s wind. If the density of the air is ρ_a = 1.25 kg/m^3, determine the thrust on the blade shaft, and the power withdrawn by the blades. The efficiency of the turbine can be calculated from the equation $Y = [0.50 + (197 - X) * 0.0003] * 100$, where X is the last three digits of your Student Number. **(10)**

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L-2/T-2/CE Date: 19/01/2021

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-2 B.Sc. Engineering Examination, January 2020

Sub: **HUM 217** (Engineering Economics)

Full Marks: 120 Time 2 Hours

The Figures in the margin indicate full marks

USE SEPARATE SCRIPTS FOR EACH SECTION

There are 03 page(s) in this question paper.

SECTION – A

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

All the symbols have their usual meanings

Assume reasonable values for missing data.

1. Evaluate Ernst Engel's Law with reference to the present state of agriculture in Bangladesh. Given the demand function of a commodity X (20)

$Q_{dx} = 1380 - 16P_x + 0.006M + 2.5\ P_y - 6P_z$

Where, price of X, P_x = tk. 28, price of Y, P_y = tk. 50, price of Z, P_z = tk. 15 and income, M = tk. 55000. Find the cross-price elasticities and income elasticity of X. State the implications of the results you have obtained.

2. What are the implications of 'change in quantity demanded' and 'change in demand'? From the following demand and supply functions (20)

$Q_D = 1560 - 65P_z$

$Q_S = 780 + 32P_z$

Find the equilibrium price and quantity of the commodity Z. If the Government provides a subsidy of tk. 3.50 per unit, what will be the new equilibrium price and quantity?

3. What do you understand by Marginal Rate of Substitution (MRS)? Illustrate the terms and conditions of optimal consumption point of a consumer with the help of indifference curve analysis. (20)

4. What are the main challenges that every economic system has to face? Briefly explain the approaches that different economic systems adopt to overcome these challenges. (20)

SECTION – B

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

All the symbols have their usual meanings

5. (a) What do you understand by MRTS? Explain any three characteristics of an isoquant. (10)

(b) Complete the following table and plot the total product (TP), average product (AP) and marginal product (MP) of labour. Show the different stages of production in the graph. (10)

Number of workers	Total product (TP)	Average Product (AP)	Marginal Product (MP)
1	8		
2	24		
3	54		
4	82		
5	95		
6	100		
7	100		
8	96		

6. (a) From the following revenue and cost functions calculate the profit maximizing level of output and maximum profit. (10)

$$R = 111Q - 2Q^2$$

$$C = \frac{1}{3}Q^3 - 8Q^2 + 122Q + 50$$

(b) Graphically explain the short-run equilibrium of a firm under perfect competition. (10)

7. (a) How would you derive the long run average cost (LAC) curve of a firm from its short run average cost curves? Explain graphically. (10)

(b) Complete the following table and sketch the graph explaining the relations among the various short run average cost corves. (10)

Quantity of output	Total fixed cost	Total variable cost	Total cost	Average fixed cost	Average variable cost	Average Total cost	Marginal cost
1	70	30					
2	70	40					
3	70	45					
4	70	55					
5	70	75					
6	70	120					

8. (a) What do you understand by localization of industries? What are the causes of localization of industries? (10)

(b) Explain the advantages of localization of industries. (10)