

SECTION – A

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

Symbols have their usual meaning. Reasonable value can be assumed for any missing data.

1. (a) Describe the geometric features of a marine propeller with neat sketches. (10)
 (b) A four-bladed propeller of 5.0 m diameter and 0.65 expanded blade area ratio in a single screw ship is required to produce a thrust of 550 kN. Determine the minimum depth of immersion of the shaft axis if the propeller is not to cavitate. Use the Keller criterion. (15)
 (c) Define Quasi-Propulsive Coefficient (QPC) and derive it as the product of three efficiencies. (10)
2. (a) Describe the impulse theory to explain the principle of a marine propeller. (20)
 (b) A propeller of diameter 5.0 m is to have a delivered power of 7500 kW at a speed of advance of 14.0 knots in open water. Using the $B_p-\delta$ diagram of Fig. for Q. No. 2(b), determine the rpm of the propeller for optimum efficiency as well as its pitch ratio and thrust. (15)
3. A propeller of 3.0 m diameter and constant face pitch ratio 1.0 runs at 180 rpm. The bending moments due to thrust and torque are respectively 64.70 kN-m and 58.80 kN m. The mass of each blade is 570 kg, the centroid being at a radius of 0.755 m. The centroid of the root section at $0.2R$ is 0.150 m forward of the centroid of the blade and 0.035 m towards the leading edge from it. The root section has a chord of 0.800 m, a thickness of 0.160 m and an area of 0.0900 m^2 . The position of maximum thickness is 0.270 m from the leading edge. The centroid of the section is 0.065 m from the face and 0.270 m from the leading edge. The centroid of the section is 0.065 m from the face and 0.290 m from the leading edge. The leading and trailing edges at the root section have offsets of 0.020 m and 0.010 m from the face chord. The moments of inertia of the section about axes through its centroid and parallel and perpendicular to the face chord are respectively $1.5 \times 10^{-4} \text{ m}^4$ and $3.2 \times 10^{-3} \text{ m}^4$. Determine the stresses at the leading and trailing edges, and at the face and the back. (35)
4. Write short notes on: (7×5=35)
 - (a) Controllable pitch propeller
 - (b) Ducted propeller
 - (c) Tandem propeller
 - (d) Cycloidal propeller
 - (e) Podded azimuthing propeller

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SECTION – B

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

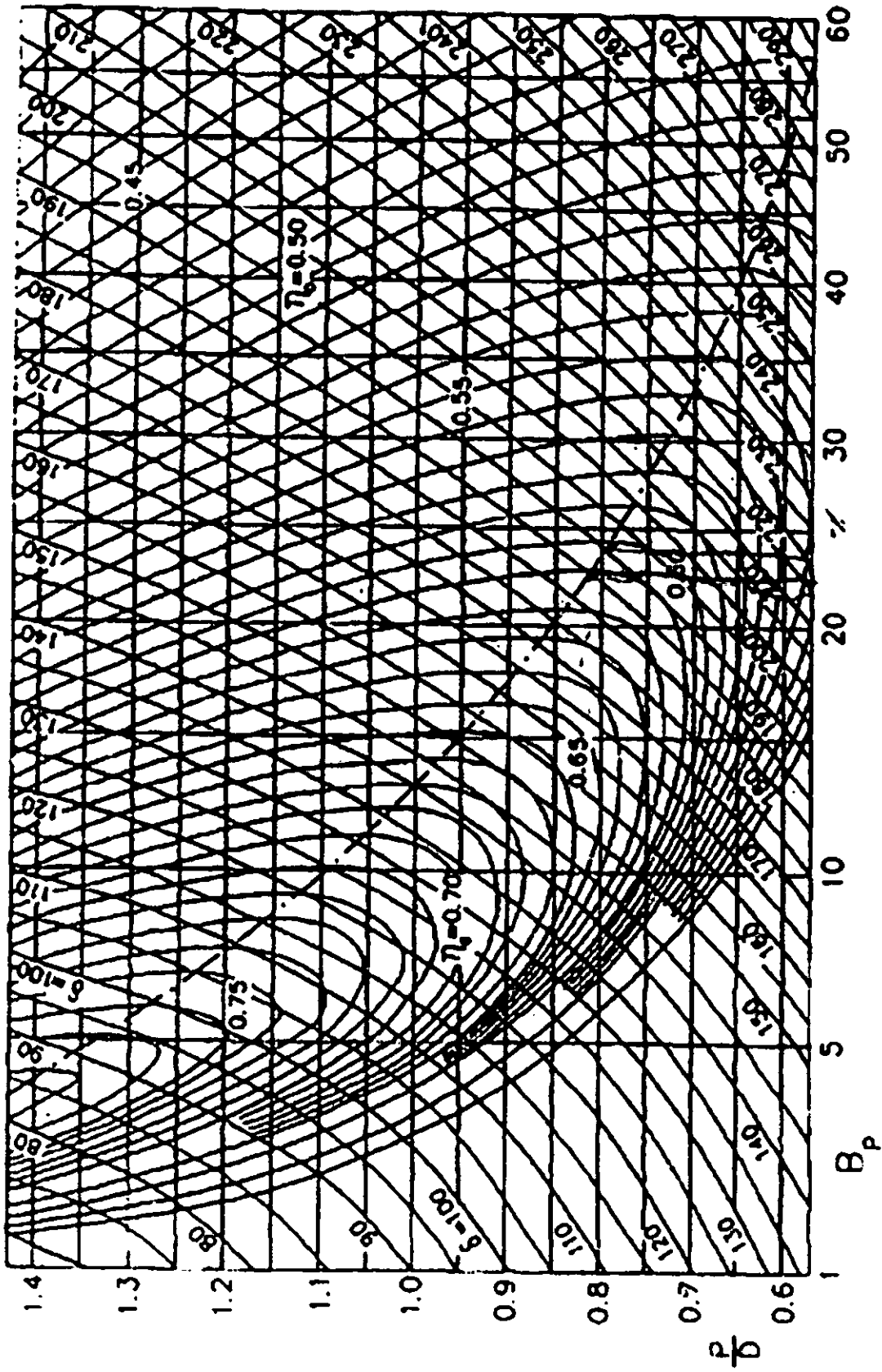
5. (a) Draw a schematic diagram for the basic components of ship resistance. (10)
- (b) Write short notes on the following: (10)
- (i) Viscous pressure resistance
 - (ii) Wave-making resistance
 - (iii) Wave pattern resistance.
- (c) Describe various features of ship wave system from Kelvin wave pattern. (15)
6. (a) Explain what you mean by primary and secondary wave systems. (10)
- (b) A supertanker operating in open water conditions is proceeding at a speed of 11 knots. Her C_B is 0.83, static even-keel draft 1.3 m with a static under keel clearance of 25 m. Her breadth moulded is 55 m with LBP of 320 m. Calculate the maximum squat for this vessel at the given speed via two different methods and her remaining under keel clearance at v_k of 11 knots. (10)
- (c) Derive an expression of wave resistance for the interference of four secondary wave system. (15)
7. (a) Describe various types of bulbous bow. What are the advantages of bulbous bow? (15)
- (b) A base ship (index 0) has the following dimensions $L_0 = 128$ m, $B_0 = 25.6$ m, $T_0 = 8.35$ m, $C_B = 0.565$. At a speed $v_0 = 17$ knots the ship has total calm water resistance $R_T = 460$ kN. The viscosity of water $\nu = 1.19 \times 10^{-6}$ m²/s and $\rho = 1025.9$ kg/m³. What is the resistance of a ship of length 250 m if the ship is geometrically and dynamically similar to the base ship and the approach of ITTC 1957 is used. The wetted surface may be estimated by $S = (3.4 \nabla^{1/3} + 0.5 \text{LWL}) \nabla^{1/3}$, and $\text{LWL} = 1.01 L$. The Reynolds number shall be based on L and the correlation co-efficient can be neglected. (20)
8. (a) What are the factors governing the ship squat? (15)
- (b) A destroyer has length, breadth and draft of 383 ft, 40.4 ft and 13.2 ft respectively. The displacement in salt water is 3100 tons and the wetted surface area is 1700 ft². At a speed of 35 knots the effective horse power is 29900. Calculate (20)
- (i) the ratio of viscous resistance to total resistance for the ship.
 - (ii) the ratio of viscous resistance to total resistance for the model.
 - (iii) the total resistance in lb of the model at the corresponding speed if the model is 20 ft long.

Assume $C_T = C_V + C_W$; $C_V = (1 + n_1)C_{f_0}$ and $n_1 = 19 \left(C_B \frac{B}{L} \right)^2$

For the model: $\rho = 1.94$ lb sec²/ft⁴, $\nu = 1.211 \times 10^{-5}$ ft²/sec.

For the ship: $\rho = 1.99$ lb sec²/ft⁴, $\nu = 1.282 \times 10^{-5}$ ft²/sec.

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X

Fig. for Q.N. 2(b): B_p - δ diagram

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2020-2021

Sub: **NAME 335** (Port and Harbor Engineering)

Full Marks: 210

Time: 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks

SECTION – AThere are **FOUR** questions in this section.Answer Question (1) is compulsory to answer and remaining **TWO** from the rest.

Assume reasonable value for missing data if any.

1. (a) For the construction of a rubble mound break water, construction depths are: (35)

Alternative I : construction depth, $d_s = 10.00$ mAlternative II : construction depth, $d_s = 07.00$ mAlternative III : construction depth, $d_s = 04.00$ m

The rubble mound breakwater for the design wave characteristics give in deep water as:

$$(H_{1/3})_0 = 6.00 \text{ m}$$

$$T_{1/30} = 8 \text{ sec}$$

The refraction coefficient, $K_r = 1.0$, seabed slope is 1:20 with straight line parallel bottom contours. Breakwater slope is 1:2.

For trunk section K_D given as: $K_{DNB} = 4$, $K_{DB} = 2$

$$Y_s = 2.7 \text{ t/m}^3, \gamma_w = 1.0 \text{ t/m}^3$$

Find the armor stone size of the rubble mound breakwater for all the three alternative construction depths.

2. A port is planning to accommodate a vessel considering the following factors. (35)

Length = 160.00 m

Breadth = 30.00 m

Depth = 12.00 m

Draft = 8.50 m

Cross – wind = 20 knots

Cross – current = 2 knots

Wave height = 2.50 m

calculate the width of the approach channel considering two way traffic lane for soft bed and having VTS. Also calculate the depth of the channel if the vessel draft is 12.00 m and tidal elevation is 3.00 m above the reference level.

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3. (a) Describe Multi Criteria Analysis (MCA) for the selection of a masterplan layout with a suitable example. (15)

(b) A container terminal is to be designed for the following size of the vessel (maximum). (20)

Length = 90.00 m

Breadth = 14.50 m

Depth = 6.50 m

Draft = 3.80 m

The port is to be handled 1,20,000 TEU per year. Determine the number of berths and quay length considering the following factors.

Gross production per crane = 25 moves/hr.

Number of crane per berth = 02 (TWO)

Operational hour/yr. = 5, 280

Berths occupancy = 0.56

4. (a) What is maximum instantaneous capacity and maximum annual capacity of a port? Also explain the optimum annual explain capacity of a port. (10)

(b) "For layout development of a port, the specific local condition play a dominant role and therefore no port layout is similar to another one. There are few do's and don'ts which should be kept in mind" – Explain (20)

(c) Differentiate among Wharf, Quay, Pier and Jetty. (5)

SECTION – B

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

5. (a) Describe the advantages and disadvantages of Trailing Suction Hopper Dredger (TSHD) Dredger (CSD). (20)

(b) Draw the schematic diagram of various types of anchors used for Cutter Suction dredger. (10)

(c) State five reasons for the requirement of dredging. (5)

6. (a) With schematic diagram describe the following: (20)

(i) Net underkeel clearance

(ii) Maneuvering lane

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Contd... Q. No. 6(a)

- (iii) Ship clearance lane
- (iv) Bank clearance.
- (b) What are the effects on the environment if the dredged materials are disposed at sea. (5)
- (c) Discuss the international conventions for the disposal of dredging materials. (10)
- 7. (a) Formulate a step by step guideline for the determination of cargo forecast as an element of port planning. (10)
- (b) Draw a flow chart of the master plan process for planning a port. (15)
- (c) What are the frequent obstacles in port planning? (10)
- 8. (a) Describe the advantages and disadvantages of rubber tyred gantry, rail mounted gantry and automatic stacking crane. (10)
- (b) A small terminal is to be designed for a capacity of 70,000 TEU/year of which 60,000 import (of which 15,000 via CFS) (25)
40,000 export
16,000 empties
Calculate the area for each of the types of containers and also draw a possible layout of the container terminal. Assume average dwell time for import, export, and empty containers are 10, 7 and 20 clays respectively. Consider handling by straddle carrier. Stacking height three containers (required area a per TEU is 13 m² and occupancy rate is 0.70 for all containers).

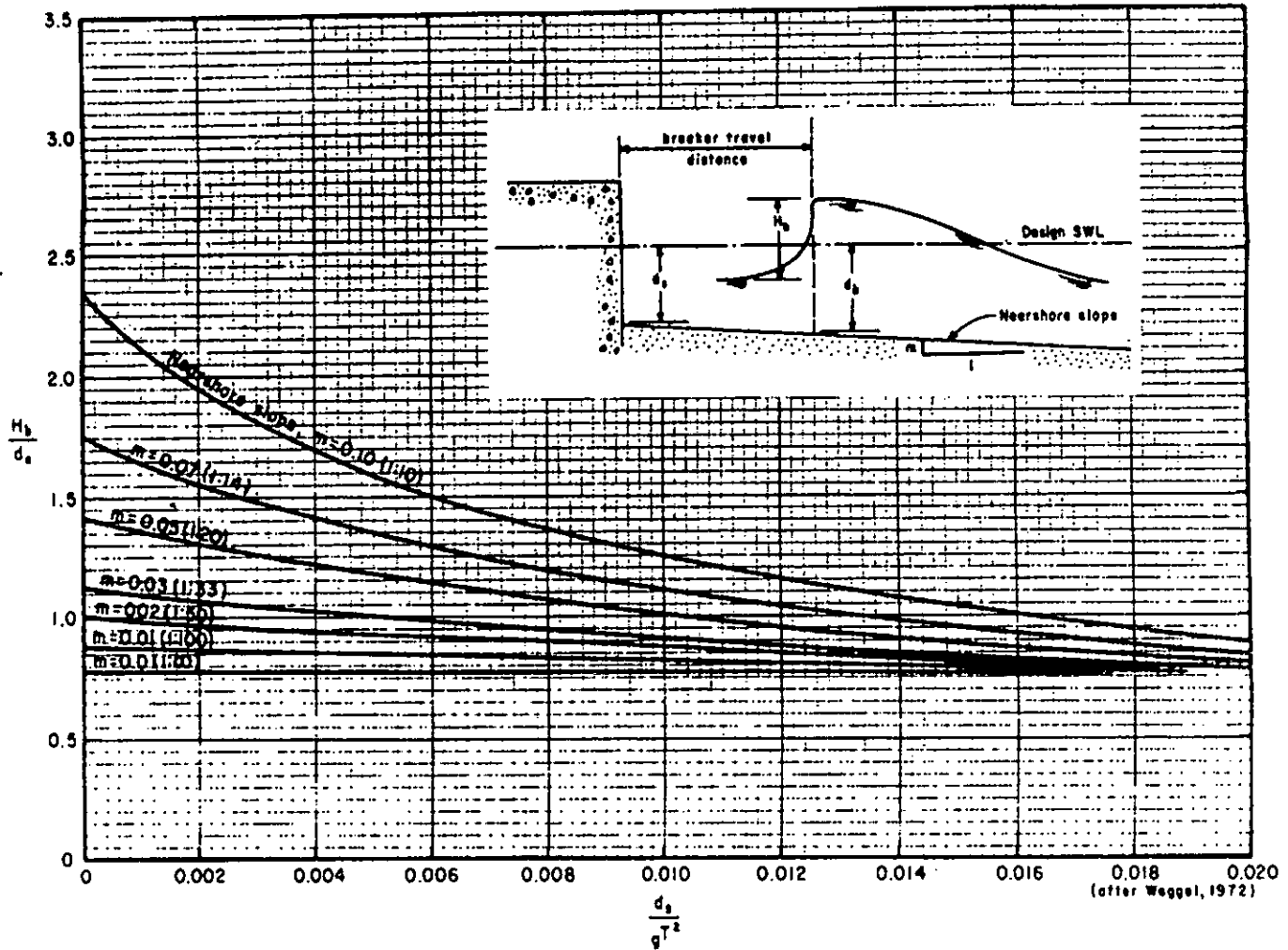


Figure: Dimensionless design breaker height versus relative depth at structure

Figure for Question No. 1

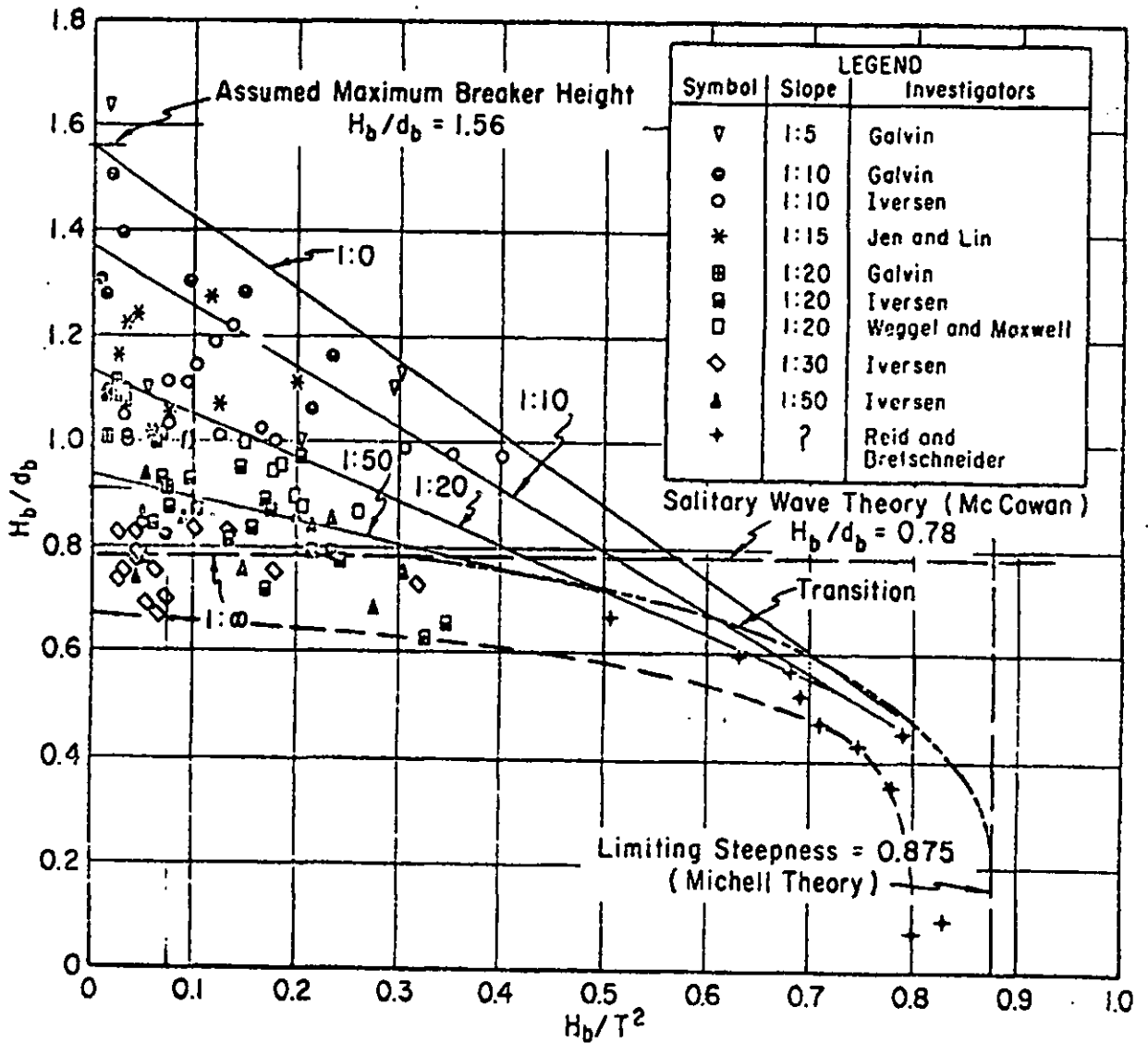


Figure Experimental Observations of d_b/H_b vs. Breaker Steepness, H_b/T^2 .

For Question No. 1

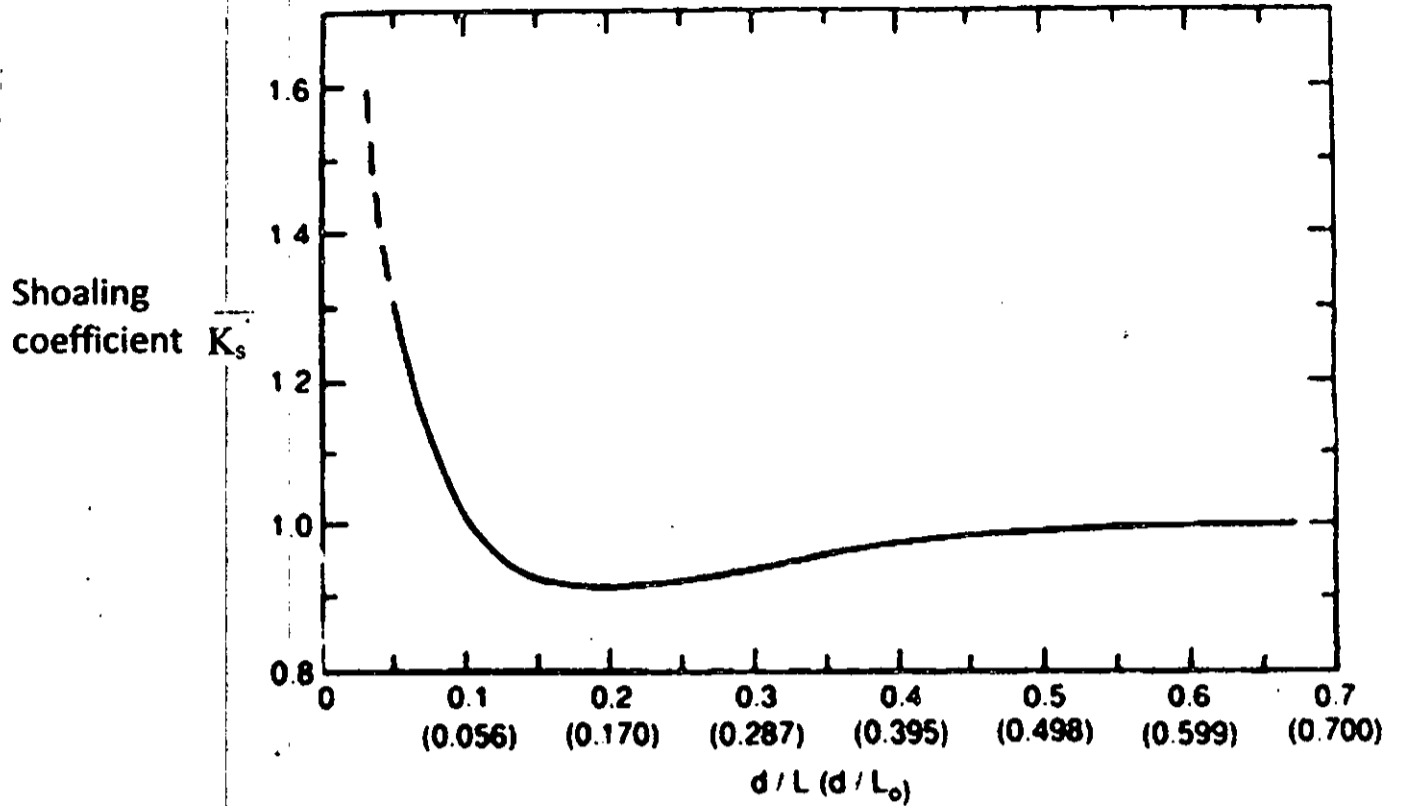


Figure Dimensionless wave height versus relative depth for two-dimensional wave transformation.

For Question No. 1

Width component	Condition	Width (m)
Basic width (W_{BM})	$1.25 D < d < 1.5 D$	1.6 B
	$d < 1.25 D$	1.7 B
Additional width (W_I)		
▪ prevailing cross-winds	15 - 33 kn	0.4 B
	33 - 48 kn	0.8 B
▪ prevailing cross-current	0.2 - 0.5 kn	0.2 B
	0.5 - 1.5 kn	0.7 B
	1.5 - 2.0 kn	1.0 B
▪ prevailing long current	1.5 - 3 kn	0.1 B
	> 3 kn	0.2 B
▪ prevailing wave height	1 - 3 m	1.0 B
	> 3 m	2.2 B
▪ aids to navigation	VTS	0
	good	0.1 B
▪ seabed characteristics	soft	0.1 B
	hard	0.2 B
▪ cargo hazard	medium	0.5 B
	high	1.0 B
▪ separation distance (W_P)	8 - 12 kn	1.6 B
	5 - 8 kn	1.2 B
▪ bank clearance (W_B)	sloping edge	0.5 B
	steep, hard embankment	1.0 B

For Question No. 2

SECTION – A

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

1. (a) Find the best welding speed to be used for single side submerged arc welding of 6 mm thick welding plates at an ambient temperature of 30° with an arc voltage of 28V and welding current 400A. The arc efficiency is 0.8 and the possible welding speeds are 10-13 mm/s. The limiting cooling rate for satisfactory performance is 6 °C/s at a temperature of 550 °C. Consider $\lambda = 0.028 \text{ J/mm s } ^\circ\text{C}$ and $\rho C_p = 0.0044 \text{ J mm}^3 \text{ } ^\circ\text{C}$. **(15)**
- (b) Define HAZ. Why it is preferable to keep the HAZ as small as possible in welding? **(10)**
- (c) What type of welding power source is suitable for a novice welder? Discuss with the help of a suitable volt-ampere diagram. **(10)**
2. (a) List some general characteristics of water jet cutting. **(10)**
- (b) With a schematic diagram describe the working principle of plasma arc cutting. **(10)**
- (c) What are the characteristics of pulsed mode power source for electric arc welding? **(10)**
- (d) Write a short note on magnetic arc blow. **(5)**
3. (a) Why CO₂ is a popular shielding gas in GMAW? What are the benefits of using Argon - CO₂ mixture as a shielding gas in GMAW? **(10)**
- (b) Why DCEP is preferred in GMAW? **(5)**
- (c) What is transition current? Explain the significance of transition current for spray metal transfer mode in GMAW. **(10)**
- (d) With a schematic diagram describe the working principle of submerged arc welding (SAW) process. What are the benefits of using multiple electrode unit for SAW? **(10)**
4. (a) Why a naval architect should consider welding distortion problem during designing a ship? **(8)**

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Contd... Q. No. 4

- (b) What are the advantages and disadvantages of resistance welding? (7)
- (c) What is form factor? Illustrate the significance of form factor in electro slag welding. (8)
- (d) Discuss the effect of following parameters on weld quality and weld metal deposition: (12)
- (i) Arc length
 - (ii) Welding speed
 - and (iii) Electrode diameter

SECTION – B

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

5. (a) What is weldability? What are the influencing factors on weldability of a component? Discuss briefly. (10)
- (b) With neat Sketches show various methods of preparing the edges of corner joints. (8)
- (c) Distinguish between consumable and non-consumable electrodes. Explain E 7018 electrode code. (7)
- (d) What is welding electrode coating? List some important functions of electrode coating. (10)
6. (a) What is shot blasting? With a schematic diagram, discuss the working principle of shot blasting operation. (10)
- (b) List the equipment for oxy-acetylene welding. With a neat sketch discuss the working principle of injector type welding torch. (10)
- (c) Briefly discuss various types of flames in oxy-acetylene welding. (10)
- (d) Write a short note on flashback problem in oxy-acetylene welding. (5)
7. (a) Discuss the following welding defects. (12)
- (i) Undercutting
 - (ii) Porosity
 - (iii) Cold cracking

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Contd... Q. No. 7

(b) What is magnetic particle testing of a welded joint? Why radiograph interpretation is important for radiograph testing? (8)

(c) Mention some advantages and limitations of ultrasonic testing of a welded joint. (7)

(d) List basic steps in dye penetrant testing of a welded joint. (8)

8. (a) Explain the following welding symbols. (15)

(i)

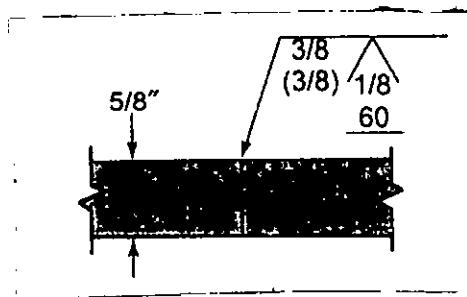


Figure for Q. No. 8(a)(i)

(ii)

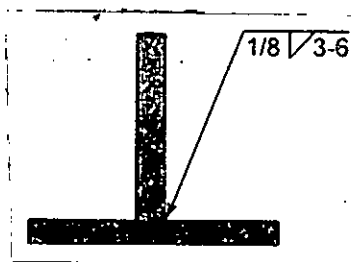


Figure for Q. No. 8(a)(ii)

(iii)

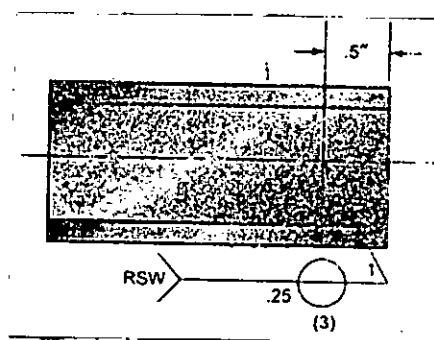


Figure for Q. No. 8(a)(iii)

(b) Distinguish between the followings: (10)

(i) Forehand and backhand welding

(ii) Back weld and backing weld.

(c) Briefly discuss the factors to consider in welding rod selection. (10)

SECTION – A

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

Assume reasonable values for any missing data.

1. (a) Schematically discuss the characteristics of shearing force and bending moment curves. (8)
(b) Derive the expression for calculating the bending moment about midship due to the addition of weight, in case of a ship structure. (10)
(c) In case of a simply supported multi-stiffener grillage, derive the expression of bending moment for longitudinal stiffener as well as transverse stiffener. (17)
2. (a) Schematically discuss the influence of shear stress on bending stress. Hence deduce the expression for total deflection in case of a box girder. (20)
(b) Determine the procedure for calculating the shear deflection of a beam, by applying strain energy method. (15)
3. (a) Describe the influence of heaving motion amongst waves on the longitudinal strength of a ship. Schematically represent the influence of heaving motion on the weight and buoyancy curves. (14)
(b) A landing craft of length 61 m may be assumed to have a rectangular cross-section of beam of 8.53 m. When empty, draughts are 0.46 m forward and 1.07 m aft and weight is made up of general structure weight assumed evenly over the last 12.2 m. A load of 101.6 tonnes can be carried evenly distributed over the first 48.8 m, but to keep the forward draught at a maximum of 0.61 m, ballast water must be added evenly to the last 12.2 m. Draw the load, shearing force and bending moment diagrams for the loaded craft when in still water of specific volume $0.975 \text{ m}^3/\text{tonnes}$. Determine the position and value of the maximum bending moment acting on the craft. (21)
4. (a) For a simply supported plate having uniformly distributed load, derive the expression for bending moment. (20)
(b) Explain hogging and sagging condition in case of a ship structure. Using Murray's method, how can you determine the still water bending moment and wave bending moment? (15)

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SECTION - B

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

5. (a) Define composite construction in case of a ship structure. Schematically represent the stress distribution in a composite beam and explain its influence on the bending moment of ship structure. (15)
- (b) Figure for Q. No. 5(b) shows the transverse section of a destroyer floating dock. The length is 315 ft. and the section is constant over the length. The weight of the structure may be assumed to be distributed uniformly throughout the length and the dock floats at a draught of 4 ft. in sea water in the light condition. The dock is now lowered at a draught of 20 ft. by means of water ballast which is added uniformly over the midship 220 ft. Draw the shearing force and bending moment diagrams of the dock in the lowered position. (20)

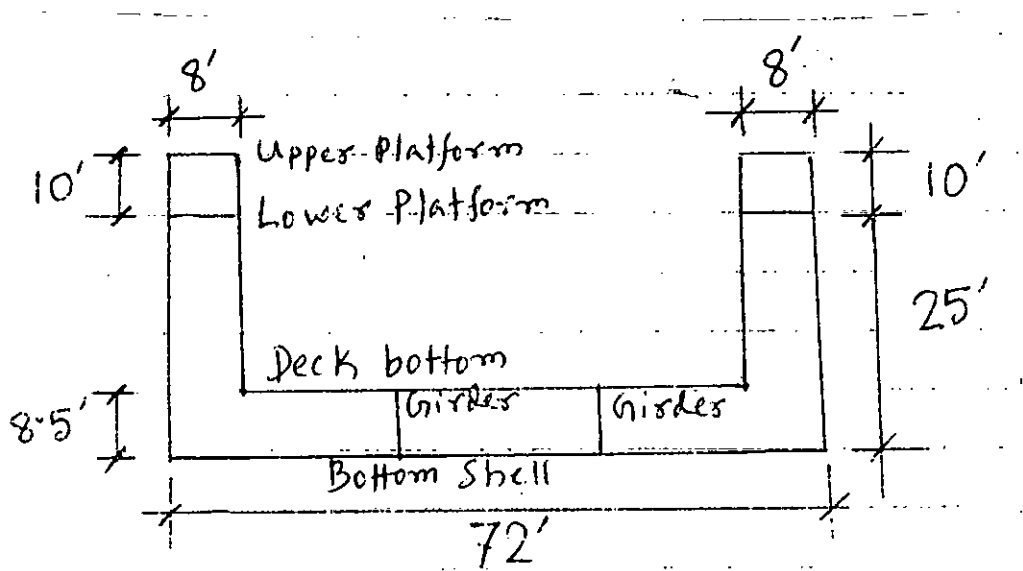


Fig. for Q. No. 5(b)

6. (a) Derive the expression for total deflection of a column if there exists an initial curvature. (15)
- (b) Explain the influence of longitudinal stiffeners on the buckling strength of plating. Hence deduce the expression for critical load. (15)
- (c) Differentiate between Euler buckling stress and experimental buckling stress. (5)
7. (a) Define stress concentration factor. Discuss the measures adopted to avoid breakdown of structure due to high stress generated. (10)
- (b) Derive the Montgomerie formula for determining the scantling of superstructure decks. (15)
- (c) What is superstructure efficiency? Discuss the significance of superstructure efficiency. Also, explain the factors that influence the superstructure efficiency. (10)

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8. (a) Differentiate between redundant and non-redundant structures.

(5)

(b) For a stayed derrick post, derive the expression:

(10)

$$T = \frac{P \sec \phi}{1 + \frac{3E_P}{E_S} \frac{I_1}{Al^3 \cos^2 \phi}}$$

(where symbols have their usual meanings)

(c) A vessel 450 ft. long by 60 ft. beam has a constant rectangular section. The weight of the hull is 4500 tons, and may be considered to be distributed uniformly over the entire length. The machinery and fuel together weigh 3000 tons and these are distributed uniformly over a length of 100 ft. amidships. Draw the curves of shearing force and bending moment when the vessel is poised statically on a wave having sine profile and height of 15 ft. the wave crests being at perpendiculars. State the maximum values of δF and BM and positions in the length where these occur.

(20)

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2020-2021

Sub: **NAME 371** (Finite Element Method for Ship structure)

Full Marks: 210

Time: 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

Assume a reasonable value in case of missing data.

The figures in the margin indicate full marks

SECTION – AThere are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Derive the shape functions of a CST element in natural coordinates. Derive the expression of strain-displacement matrix. (10)
- (b) Which type of analysis can be performed using CST elements? What are the limitations of these elements? Comment on element quality. (10)
- (c) Determine the nodal forces for a linearly varying pressure P_x on the edge of the triangular element as shown in Figure for Q. No. 1(c). (15)

2. For the two dimensional loaded plate shown in Figure for Q. No. 2, determine the displacements of nodes 1 and 2 and the element stresses using appropriate conditions. Ignore body force. (35)

3. (a) For four node isoparametric quadrilateral element, derive the expression of Jacobian and strain-displacement matrices. (14)
- (b) For the thin plate subjected to surface traction shown in Figure for Q. No. 3(b), mesh it and prepare a typical input data file. (14)
- (c) Derive the expression of body force vector of a tetrahedral element. (7)

4. (a) Explain the characteristics of Hermite shape function. (5)
- (b) Derive the components of first row of element stiffness matrix of a beam element. (15)
- (c) A concentrated load $P = 50$ kN is applied at the center of a fixed ended beam of length 3 m, depth 200 mm and width 120 mm. Calculate the deflection and slope at the mid-point. Assume $E = 2 \times 10^5$ N/mm². Also calculate shear force and bending moment values. Comment on the results. (5)

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SECTION - B

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

5. (a) Derive the equations of equilibrium in case of a three-dimensional stress system. (7)
- (b) For three-dimensional case, develop the stress strain relation for isotropic material. (8)
- (c) Five springs, having stiffnesses $k_1 = 1 \times 10^5$ N/m, $k_2 = 2 \times 10^5$ N/m, $k_3 = 3 \times 10^5$ N/m, $k_4 = 4 \times 10^5$ N/m, and $k_5 = 5 \times 10^5$ N/m are connected as a parallel-series system and is subjected to a load $P = 1000$ N at node 4 as shown in Figure for Question. No 5(c). Determine the displacements of nodes using the principle of minimum potential energy. (20)
6. (a) For linear one-dimensional element, derive the expressions of (15)
- (i) shape functions
- (ii) strain displacement matrix
- (iii) element stiffness matrix
- (iv) traction and body force vector.
- (b) The rigid beam in Figure for Question. No 6(b) was level before the load was applied. Find the stress in each vertical member. (20)
7. (a) Consider one dimension bar as shown in Figure for Question No. 7(a). determine the nodal displacements, the forces in each element, and the reactions using piecewise polynomial by the Rayleigh-Ritz method. (25)
- (b) Explain penalty method of boundary condition in details. (10)
8. Following truss (Figure for Question No. 8) is used in a ship to lift a weight $F = 1000$ lb. Given that all truss members are made from steel (Young's modulus, $E = 30 \times 10^6$ psi) and a cross-sectional area of 1 in^2 . Find the nodal displacement, stresses in each member and hence comment on the truss structure. (35)

Cont. P/3

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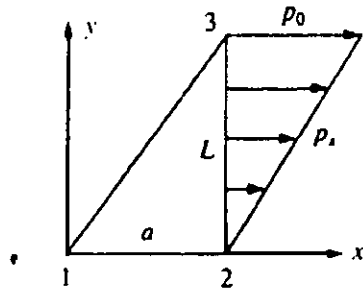


Figure for Q. No. 1(c)

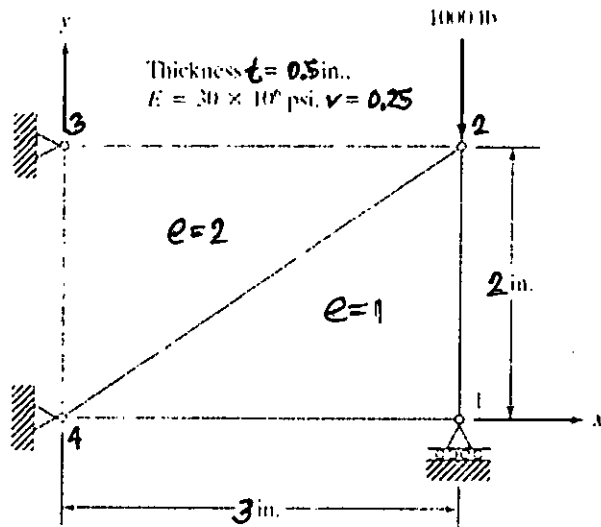


Figure for Q. No. 2

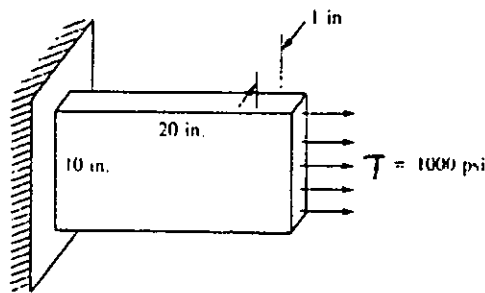


Figure for Q. No. 3(b)

Cont. P. 4

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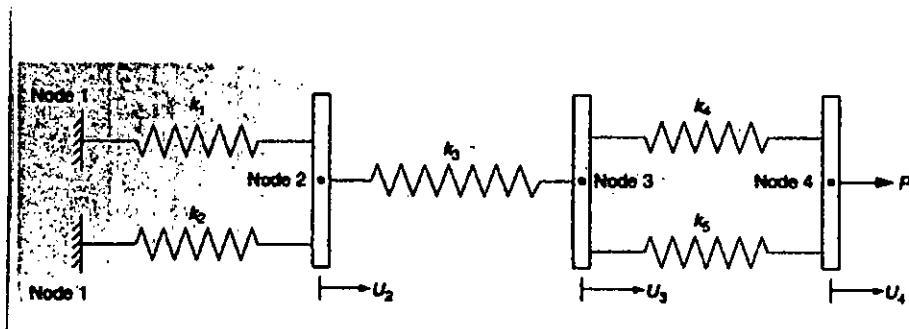


Figure for Q. No 5(c)

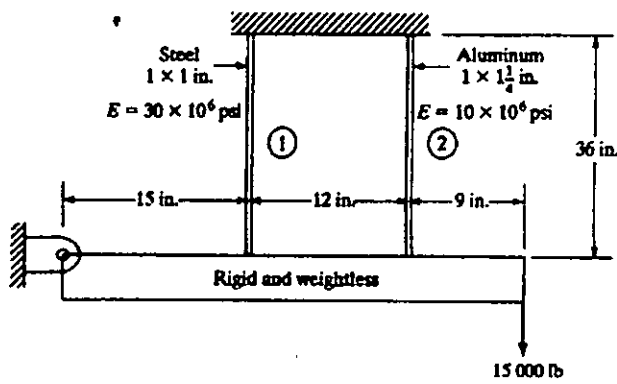


Figure for Q. No 6(b)

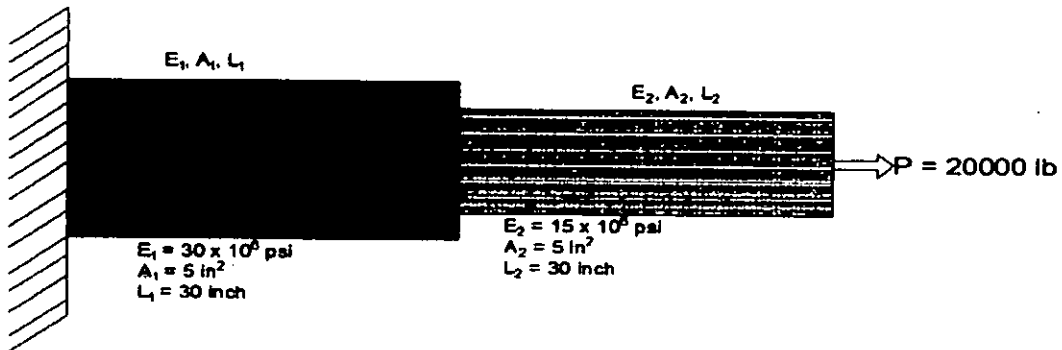


Figure for Question. No 7(a)

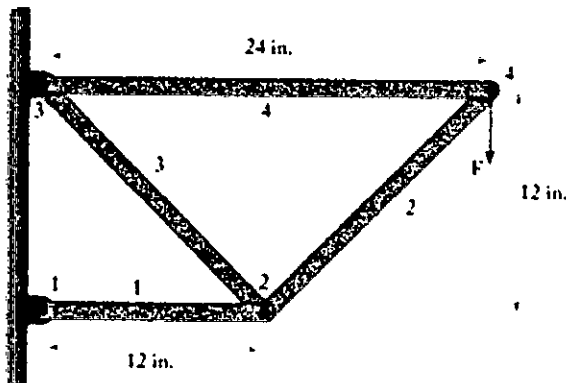


Figure for Question. No 8



SECTION – A

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

1. (a) Stamford company makes a product that sells for Tk. 15 per unit. Variable costs are Tk. 6 per unit and fixed costs are total Tk. 1,80,000 annually. (23 $\frac{1}{3}$)

Required:

- (i) What is CM ratio? Compute the product's CM ratio?
- (ii) Determine break-even point in units and in sales taka.
- (iii) The company estimates that sales will increase by Tk. 45,000 during the coming year due to increase demand. By how much should net income increase?
- (iv) Assume that the operating results for last year were as follows:

Particulars	Amount (Tk.)
Sales	Tk. 360,000
Less: Variable cost	<u>144,000</u>
Contribution margin	216,000
Less: Total fixed cost	<u>180,000</u>
Net Income	<u>36,000</u>

It is expected that sales will be increased by 15% next year. By how much should net income increase?

- (v) Refer to the original data assume that the company sold 28,000 units last year.

The sales manager is convinced that a 10% reduction in selling price combined with Tk. 70,000 increase in advertising expense, would cause annual sales in units to increase by 50%. Prepare two contribution margin income statements, one showing the results of last year operations and another showing what the results of operations would be if these changes were made. Would you recommend that the company do as the sales manager suggest?

- (vi) What is margin of safety? Compute the margin of safety in taka and percentage of sales.

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2. (a) The number of X-rays taken and X-ray costs over the last six months in Beverly Hospital are given below: (13)

Month	X-Rays Taken	X-Rays Costs (Tk.)
January	6,250	28,000
February	7,000	29,000
March	5,000	23,000
April	4,250	20,000
May	4,500	22,000
June	3,000	17,000

Required:

- (i) Using high and low point method, determine the variable and fixed cost elements for conducting X-ray.
- (ii) Express the variable and fixed costs in the form $Y = a + bX$.
- (iii) Using the cost formula, you derived above, what X-Ray costs would you expect to be incurred during a month in which 4,600 X-rays are taken.
- (iv) Using the scatter graph method determine the variable and fixed cost again.

- (b) Hardwood Company uses a job-order costing system. Overhead costs are applied to jobs based on machine-hours. At the beginning of the year, management estimated that the company would work 80,000 machine-hours and incur \$192,000 in manufacturing overhead costs for the year. (10 1/3)

Required:

- (i) Compute the company's predetermined overhead rate.
- (ii) Assume that during the year the company actually worked only 75,000 machine hours and incurred \$184,000 of manufacturing overhead costs. Compute the amount of underapplied or overapplied overhead for the year.
- (iii) How the amount of underapplied or overapplied cost will be adjusted?

3. (a) The Regal Cycle Company manufactures three types of bicycles—a dirt bike, a mountain bike, and a racing bike. Data on sales and expenses for the past quarter follow: (13 1/3)

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Contd... for Q. No. 3(a)

	Total	Dirt Bikes	Mountain Bikes	Racing Bikes
Sales	\$300,000	\$90,000	\$150,000	\$60,000
Variable manufacturing and Selling expenses	<u>120,000</u>	<u>27,000</u>	<u>60,000</u>	<u>33,000</u>
Contribution margin	180,000	63,000	90,000	27,000
Fixed Expenses:				
Advertisement traceable	30,000	10,000	14,000	6,000
Depreciation of special equipment	23,000	6,000	9,000	8,000
Salaries of product-line mangers	35,000	12,000	13,000	10,000
Allocated common fixed expenses*	<u>60,000</u>	<u>18,000</u>	<u>30,000</u>	<u>12,000</u>
Total fixed expenses	148,000	46,000	66,000	36,000
Net Operating Income (loss)	<u>32,000</u>	<u>\$17,000</u>	<u>\$24,000</u>	<u>(\$9,000)</u>

*Allocated based on sales dollars.

Management is concerned about the continued losses shown by the racing bikes and wants a recommendation as to whether the line should be discontinued. The special equipment used to produce racing bikes has no resale value and does not wear out.

Required:

Should production and sale of the racing bikes be discontinued? Show computations to support your answer and explain.

(b) Han Products manufactures 30,000 units of part S-6 each year for use on its production line. At this level of activity, the cost per unit for part S-6 is as follows:

(10)

Particulars	Amount (Tk.)
Direct Material	3.60
Direct Labor	10.00
Variable manufacturing overhead	2.40
Fixed manufacturing overhead	9.00
Total cost per unit	\$25.00

An outside supplier has offered to sell 30,000 units of part S-6 each year to Han Products for \$21 per part. If Han Products accepts this offer, the facilities now being used to manufacture part S-6 could be rented to another company at an annual rental of \$80,000. However, Han products have determined that two-thirds of the fixed manufacturing overhead being applied to part S-6 would continue even if part S-6 were purchased from the outside supplier.

Required:

Prepare computations showing how much profits will increase or decrease if the outside supplier's offer is accepted and comment whether the offer should be accepted or not.

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4. As a manager of the Heliberton Company, you are going to evaluate following two Projects: named as Project S and Project L. Both projects will require initial cost of Tk. 3,000. The cash flows of the projects during their 4-year life time have been presented below:

(23 1/3)

Year	Project S	Project L
1	Tk. 1,500	Tk. 400
2	1,200	900
3	800	1,300
4	300	1,500

Assume the required rate of return is 10%.

Which project you will accept, if the decision is based on (showing computation):

- (i) Pay-Back Period
- (ii) Net Present Value
- (iii) Internal Rate of Return
- (iv) Profitability Index.

SECTION – B

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

5. (a) What are the components of financial statements? What types of information do the components provide?

(3 1/3)

- (b) Pine Valley Golf Course was opened on May 1 by Mr. Baker. The following selected events and transactions occurred during May 2022.

(20)

- May-1: Invested \$20,000 cash in the business.
- May-2: Purchased Golf Land for \$15,000 cash.
- May-5: Advertised the opening of the driving range and miniature golf course, paying advertising expenses of \$700.
- May-10: Paid cash \$600 for a one-year insurance policy.
- May-12: Purchased golf discs and other equipment for \$1,050 from GFL Company payable in 30 days.
- May-15: Received \$340 in cash for golf fees earned.
- May-18: Sold 100 coupon books for \$10 each. Each book contains 4 coupons that enable the holder to play one round of disc golf.
- May-20: Withdrew \$800 cash for personal use.
- May-22: Paid salaries of \$250.
- May-24: Paid GFL Company in full.
- May-30: Received \$200 cash for fees earned.

Required: Journalize the above transactions for May 2022.

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6. (a) Selected financial statements data for Fusion Corporation are presented below: (12)

	2021 (Tk.)	2020 (Tk.)
Net Sales (all in credit)	7,00,000	6,50,000
Cost of Goods Sold	4,20,000	4,00,000
Interest Expense	35,000	30,500
Net Income	45,000	30,000
Account Receivable	45,000	48,000
Inventory	1,33,000	1,15,500
Total Assets	6,40,000	6,00,000
Current Liabilities	75,000	80,000
Non-Current Liabilities	80,000	85,000
Total Shareholders' Equity	4,85,000	4,35,000
Weighted average common shares outstanding	34,000	31,000
Market price of each share	Tk.4.00	Tk.5.00

Additional information: For 2019, Total Assets was Tk. 5,33,000; Current Liability was Tk. 70,000 and Non-Current Liability was Tk. 50,000

Required: Compute the following ratios for 2021 & 2022 and comment about the performance of the entity.

- (i) Current Ratio
- (ii) Profit Margin
- (iii) Return on Total Asset
- (iv) Earnings per share
- (v) Price-earnings ratio
- (vi) Debt to Asset ratio

(b) The comparative Income Statement of Honda Corporation are shown below (11 1/3)

Particulars	2021	2020
Net Sales	\$ 600,000	\$ 500,000
Cost of Goods Sold	<u>483,000</u>	<u>420,000</u>
Gross Profit	117,000	80,000
Operating Expenses	57,200	44,000
Net Income	<u>59,800</u>	<u>36,000</u>

- (i) Prepare a horizontal analysis of the income statement data for Honda Corporation using 2020 as a base and comment about the performance.
- (ii) Prepare a vertical analysis of the income statement data for Honda Corporation in columnar form for both years and comment about the performance.

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7. The trial balance of Ayan Company Ltd. on September 30, 2020 is given below:

(3 1/3)

Ayan Company Ltd. Trial Balance September 30, 2020		
Account Title	Debit (Tk.)	Credit (Tk.)
Cash	12,800	
Supplies	2,500	
Prepaid Insurance	3,000	
Office Equipment	5,000	
Note Payable		5,000
Account Payable		2,500
Unearned Revenue		1,200
Capital		10,000
Drawings	500	
Service Revenue		10,000
Salary Expense	4,000	
Utility Expense	900	
Total	<u>28,700</u>	<u>28,700</u>

Analysis reveals the following additional data:

- (i) Supplies on hand on January 31, Tk. 1,200.
- (ii) Insurance policy is for two years.
- (iii) Depreciation Tk. 200 for each month.
- (iv) Unearned revenue is still unearned Tk. 800.
- (v) Interest accrued at January Tk. 200.
- (vi) Service provided but not received Tk. 1,200.

Required:

- (i) Prepare adjusting entries for September 30, 2020.
- (ii) Prepare adjusted trial balance as on September 30, 2020.

4. (a) What types of comparisons can be done through financial statements analysis?

(3 1/3)

(b) The following is the trial balance of Roles Royce Company as on December 31st, 2021.

(20)

Roles Royce Company Trial Balance December 31 st 2021		
Account Title	Debit (Tk.)	Credit (Tk.)
Sales Revenue		50,000
Merchandise Inventory (01.01.21)	6,000	
Purchase	24,000	
Purchase Return		1,000
Sales discounts	2,500	
Accounts Receivable	20,000	
Accounts Payable		14,000
Capital		40,000
Drawings	10,000	
Salaries	8,000	
Supplies	3,000	
Delivery Van	20,000	
Cash	9,300	
Prepaid Insurance	2,200	
Total	<u>1,05,000</u>	<u>1,05,000</u>

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Contd... for Q. No. 4(b)

Other Information:

- Supplies used Tk. 1,200.
- Depreciation on delivery van is Tk. 2,000.
- Merchandise Inventory (31.12.21) was Tk. 5,500.
- Tk. 2,500 of accounts receivable was uncollectible.
- Salaries were accrued Tk. 4,000.
- Insurance expense was Tk. 2,000.

Required:

- (i) Prepare a classified Income Statement and Owners Equity Statement.
- (ii) Prepare a classified Balance Sheet as on 31st December 2021.
