BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA
Sub: HUM 313 (Principles of Accounting)
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.

1. (a) What are the different types of financial statements?
   
   (b) On May 1, 2012 Mr. "X" started a consultancy agency. The following transactions took place in the month of May:

   May 1:  Invested Tk. 4,50,000 cash as capital in the business.
   May 3:  Hired a personal secretary at a monthly salary of Tk. 8,000
   May 5:  Purchased office equipment for Tk. 30,000 on account.
   May 9:  Paid advertising expense Tk. 6,000 cash.
   May 11: Purchased supplies for Tk. 2,000 cash.
   May 13: Earned Tk. 60,000 for service rendered, 40% of which is received in cash from the customer and the balance is billed to customer on account.
   May 15: Received Tk. 10,000 from a customer in advance for consultancy service to be performed in next month.
   May 22: Paid Tk. 8,000 cash to accounts payable.
   May 29: The owner withdrew Tk. 5,000 from business.
   May 30: Paid the salary of the personal secretary.

   Required:
   Show the effects of transaction on the accounting equation.

2. (a) What are the advantages of journal in the recording processes?
   (b) What is a trial balance and what are its purpose?
   (c) The "Sun Limited" is a travel agency. During June 2011 the following events took place:

   | June 1:  | Invested Tk. 500,000 cash and equipment of Tk. 50,000 in the business. |
   | June 2:  | Paid rent for the next month Tk. 8,000. |
   | June 7:  | Purchased Tk. 90,000 of furniture from Otobi on account. |
   | June 12: | Completed a service and billed to the client Tk. 50,000 for service rendered. |
   | June 14: | Withdrawal of Tk. 14,000 for official use. |
   | June 17: | Paid advertising expenses Tk. 20,000 |

Contd ........... P/2
June 21: Received cash for Tk. 25,000 from transaction occurred in June 12.
June 25: Paid 50% of total due to Otobi.
June 28: Interest expense is paid Tk. 4,000 in cash.
June 30: Received utility bill Tk. 4,500 during the month.

Required:
(i) Show journal entries.
(ii) Prepare the ledger of "Cash Account".

3. (a) Why do we need adjusting entries? (3 1/2)
(b) "Y Company"

Trial Balance
May 31, 2013

<table>
<thead>
<tr>
<th>Accounts Name</th>
<th>Debit (Tk.)</th>
<th>Credit (Tk.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>5,700</td>
<td></td>
</tr>
<tr>
<td>Accounts receivable</td>
<td>6,000</td>
<td></td>
</tr>
<tr>
<td>Supplies</td>
<td>1,900</td>
<td></td>
</tr>
<tr>
<td>Prepaid insurance</td>
<td>3,600</td>
<td></td>
</tr>
<tr>
<td>Office furniture</td>
<td>10,200</td>
<td></td>
</tr>
<tr>
<td>Accounts payable</td>
<td></td>
<td>4,500</td>
</tr>
<tr>
<td>Unearned service revenue</td>
<td>2,000</td>
<td></td>
</tr>
<tr>
<td>Capital</td>
<td></td>
<td>17,700</td>
</tr>
<tr>
<td>Service Revenue</td>
<td></td>
<td>7,500</td>
</tr>
<tr>
<td>Salaries expense</td>
<td>3,400</td>
<td></td>
</tr>
<tr>
<td>Rent expense</td>
<td>900</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>31,700</td>
<td>31,700</td>
</tr>
</tbody>
</table>

Other Data:
Tk. 900 of supplies have been used during the month.
Travel expense incurred but not paid on May 31, 2013, Tk. 250.
The insurance policy is for 2 years.
Tk. 400 of the balances in the unearned service revenue account remains unearned at the end of the month.
Invoices representing Tk. 1,200 of service performed during the month have not been recorded as of May 31.

Requirements:
(i) Prepare adjusting entries for the month of May.
(ii) Prepare an adjusted trial balance at May 31, 2013.
HUM 313

4. (a)

Tom Company
Trial Balance
31st December, 2012

<table>
<thead>
<tr>
<th>Accounts Name</th>
<th>Debit</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>30,000</td>
<td></td>
</tr>
<tr>
<td>Accounts Receivable</td>
<td>20,500</td>
<td></td>
</tr>
<tr>
<td>Accounts payable</td>
<td></td>
<td>11,000</td>
</tr>
<tr>
<td>Capital</td>
<td></td>
<td>50,800</td>
</tr>
<tr>
<td>Office equipment</td>
<td>25,000</td>
<td></td>
</tr>
<tr>
<td>Service revenue</td>
<td></td>
<td>30,000</td>
</tr>
<tr>
<td>Salaries</td>
<td>12,000</td>
<td></td>
</tr>
<tr>
<td>Prepaid rent</td>
<td>4,000</td>
<td></td>
</tr>
<tr>
<td>Entertainment expense</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>Commission expense</td>
<td>3,000</td>
<td></td>
</tr>
<tr>
<td>Supplies</td>
<td>700</td>
<td></td>
</tr>
<tr>
<td>Notes payable</td>
<td></td>
<td>6,400</td>
</tr>
<tr>
<td>Drawings</td>
<td>2,000</td>
<td></td>
</tr>
<tr>
<td>Trade mark</td>
<td>20,000</td>
<td></td>
</tr>
<tr>
<td>Building</td>
<td>100,000</td>
<td></td>
</tr>
<tr>
<td>Long-term investment</td>
<td>50,000</td>
<td></td>
</tr>
<tr>
<td>Bond payable</td>
<td></td>
<td>155,000</td>
</tr>
<tr>
<td>Interest payable</td>
<td></td>
<td>15,000</td>
</tr>
<tr>
<td>Total</td>
<td>268,200</td>
<td>268,200</td>
</tr>
</tbody>
</table>

Adjustments:

- Unpaid salaries Tk. 2,000 during the period.
- Annual depreciation is Tk. 1,200 on office equipment.
- Supplies on hand at 31st December is Tk. 350.

Requirements:

(i) Prepare an income statement,
(ii) Prepare a statement of owners equity and
(iii) A classified balance sheet at 31st December, 2012

(b) Compute-

(i) Current ratio.
(ii) Quick ratio.
(iii) Debt to total asset ratio.
There are **FOUR** questions in this Section. Answer any **THREE**.

5. (a) Discuss the concept- costs, expenses, losses and assets. Give one example illustrating the relationship between them.  

(b) The data below have been taken from the cost records of Beverly Hospital. A careful study by the company's cost analyst has determined that if the number of x-rays taken is 7000, the average operating cost is Tk. 4.14 per x-ray. If the number of x-rays taken is 3000, the average operating cost is Tk. 5.65 per x-ray.

Required:

(i) Using the high-low point method, determine the variable cost per x-ray taken and the fixed cost and fixed cost in total.

(ii) Express the variable cost and fixed cost in the cost formula \( Y = mx + c \).

(iii) If the number of x-rays taken in a month is 4600, what total operating x-rays costs would you expect?

(iv) What is the major disadvantage of high-low point method?

(c) Haaki shop, Inc., is a large retailer of water sports equipment. An income statement for the company's surfboard department for the most recent quarter is presented below:

The Haaki Shop Inc.

**Income Statement - Surfboard Department for the Quarter Ended May, 31**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>Tk. 800,000</td>
</tr>
<tr>
<td>Less: Cost of goods sold</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tk. 300,000</td>
</tr>
<tr>
<td>Gross margin</td>
<td>500,000</td>
</tr>
<tr>
<td>Less: Operating expenses</td>
<td></td>
</tr>
<tr>
<td>Selling cost</td>
<td>Tk. 250,000</td>
</tr>
<tr>
<td>Administrative cost</td>
<td>160,000</td>
</tr>
<tr>
<td>Net income</td>
<td>90,000</td>
</tr>
</tbody>
</table>

The surfboard sell, on the average, for Tk. 400 each. The departments' variable costs are Tk. 50 per surfboard sold. The remaining selling expenses are fixed. The administrative costs are 25% variable and 75% fixed. The company purchases its surfboards from a supplier at a cost of Tk. 150 per surfboard.

Required: Prepare an income statement for the quarter using contribution approach.

6. (a) What is 'Break-Even point'? Why is break-even analysis important for the managers?  

(b) Crown Creative Inc. makes high quality Personal Digital Assistant (PDA). Sales and production data relating to the most recent year are given below:

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales (in unit)</td>
<td>2800</td>
</tr>
<tr>
<td>Selling price per unit (Tk.)</td>
<td>265</td>
</tr>
<tr>
<td>Contribution margin ratio</td>
<td>60%</td>
</tr>
<tr>
<td>Annual fixed costs (Tk.)</td>
<td>111,300</td>
</tr>
</tbody>
</table>

Contd .......... P/5
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Contd ... Q. No. 6(b)

Management is anxious to improve the company profit performance and has asked for several items of information.

Requirement:

(i) Compute break-even point in units and sales Taka.

(ii) Assume that sales increases by Tk. 60,000 next year. If cost behaviour patterns remain unchanged, by how much will the company's net income increase?

(iii) Refer to the original data. Assume that next year management wants to earn a Tk. 182,850 profit. How many units will have to be sold to meet this target profit?

(iv) Refer to the original data. The sales manager is convinced that a 15% reduction in the selling price combined with a Tk. 56,100 increase in advertising expenditure would cause annual sales in units to increase by 40%. Would you recommend that the company should do as the sales manager suggests?

(v) Compute degree of operating leverage (DOL) at the present level of sales. Assume that the company like to increases in net profit by 90% next year. By what percentage would you expect sales to increase? Use DOL to answer. Verify your answer by preparing income statement.

7. (a) What is the basic difference between absorption costing and variable costing? (4½)

(b) Chuck Wagon Grills manufacturing company makes a single product - a handmade specially barbecue grill that it sells for Tk. 210. Data for last year's operations are as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity/Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Units in beginning inventory</td>
<td>0</td>
</tr>
<tr>
<td>Units produced</td>
<td>20,000</td>
</tr>
<tr>
<td>Units sold</td>
<td>19,000</td>
</tr>
<tr>
<td>Units in ending inventory</td>
<td>1000</td>
</tr>
<tr>
<td>Variable costs per unit:</td>
<td></td>
</tr>
<tr>
<td>Direct Materials</td>
<td>Tk. 50</td>
</tr>
<tr>
<td>Direct Labour</td>
<td>80</td>
</tr>
<tr>
<td>Variable manufacturing overhead</td>
<td>20</td>
</tr>
<tr>
<td>Variable selling and administrative overhead</td>
<td>10</td>
</tr>
<tr>
<td>Total variable cost per unit</td>
<td>Tk. 160</td>
</tr>
<tr>
<td>Fixed costs (Total):</td>
<td></td>
</tr>
<tr>
<td>Fixed manufacturing overhead</td>
<td>Tk. 700,000</td>
</tr>
<tr>
<td>Fixed selling and administrative overhead</td>
<td>285,000</td>
</tr>
<tr>
<td>Total fixed cost</td>
<td>Tk. 985,000</td>
</tr>
</tbody>
</table>

Contd .......... P/6
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Contd ... Q. No. 7 (b)

Required:
(i) Compute unit product cost under both absorption costing and variable costing methods;
(ii) Prepare income statements under both of the methods;
(iii) Reconcile the amount of net income under two methods and interpret the situation.

8. (a) What do you understand by cost structure? Company A's cost structure includes costs that are mostly variable, whereas company B's cost structure includes costs that are mostly fixed. In a time of increasing sales, which company will tend to realise the most rapid increase in profits? Explain.

(b) Various cost and sales data for Meriwell company for the just ended year are as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Tk.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selling expenses</td>
<td>140,000</td>
</tr>
<tr>
<td>Beginning raw materials</td>
<td>90,000</td>
</tr>
<tr>
<td>Ending raw materials</td>
<td>60,000</td>
</tr>
<tr>
<td>Plant utilities</td>
<td>36,000</td>
</tr>
<tr>
<td>Direct Labour</td>
<td>300,000</td>
</tr>
<tr>
<td>Depreciation, plant equipment</td>
<td>162,000</td>
</tr>
<tr>
<td>Purchase of raw materials</td>
<td>750,000</td>
</tr>
<tr>
<td>Sales</td>
<td>30,00,000</td>
</tr>
<tr>
<td>Insurance for factory</td>
<td>40,000</td>
</tr>
<tr>
<td>Indirect labour</td>
<td>150,000</td>
</tr>
<tr>
<td>Maintenance for plant equipment</td>
<td>87,000</td>
</tr>
<tr>
<td>Directors fees</td>
<td>130,000</td>
</tr>
<tr>
<td>Advertisement expenses</td>
<td>45,000</td>
</tr>
<tr>
<td>Sales manager's salary</td>
<td>20,000</td>
</tr>
<tr>
<td>Salary of the accountants</td>
<td>50,000</td>
</tr>
<tr>
<td>Beginning work in process</td>
<td>180,000</td>
</tr>
<tr>
<td>Ending work in process</td>
<td>100,000</td>
</tr>
<tr>
<td>Beginning finished goods</td>
<td>260,000</td>
</tr>
<tr>
<td>Ending finished goods</td>
<td>210,000</td>
</tr>
<tr>
<td>Cleaning supplies, factory</td>
<td>7000</td>
</tr>
<tr>
<td>Rent (3/5 for factory 2/5 for office)</td>
<td>120,000</td>
</tr>
<tr>
<td>Gas and water, factory</td>
<td>2,500</td>
</tr>
</tbody>
</table>

Required:
(i) Prepare a cost of goods sold statement,
(ii) Prepare an income statement.
BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

Sub: **NAME 317** (Design of Marine Vehicles)

Full Marks: 210 Time: 3 Hours

The figures in the margin indicate full marks.

Assume suitable values for missing data, if any. The symbols have their usual meanings.

USE SEPARATE SCRIPTS FOR EACH SECTION

**SECTION – A**

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

1. What are the various methods for estimation of the length for a new design of ship? Describe the methods with numerical examples. (35)

2. (a) List the components that make up the 'all-up' machinery weight.

(b) Data for a selected basic ship with Diesel machinery is as follows:

\[ P_B = 4600 \text{ kW}, \ W = 15272 \text{ tonnes}, \ V = 15.50 \text{ kt}, \ \text{machinery weight} = 663 \text{ tonnes}. \]

A new similar design has:

\[ W = 14733 \text{ tonnes}, \ V = 15.25 \text{ knot}. \]

Estimate the machinery weight for the new design by one method and validate by another method. What will be the machinery weight for the new design if steam turbine machinery is used? (25)

3. The particulars for a General Cargo basic ship and a new design are as follows:

<table>
<thead>
<tr>
<th>Item</th>
<th>Basic Ship</th>
<th>New design</th>
</tr>
</thead>
<tbody>
<tr>
<td>LBP (m)</td>
<td>133</td>
<td>137</td>
</tr>
<tr>
<td>Br. Mld (m)</td>
<td>18.36</td>
<td>19.50</td>
</tr>
<tr>
<td>Depth Mld (m)</td>
<td>11.55</td>
<td>12.20</td>
</tr>
<tr>
<td>SLWL (m)</td>
<td>8.95</td>
<td>9.52</td>
</tr>
<tr>
<td>( C_B @ \text{SLWL} )</td>
<td>0.745</td>
<td>0.753</td>
</tr>
<tr>
<td>Length of amidships Machinery space (m)</td>
<td>19.50</td>
<td>19.93</td>
</tr>
<tr>
<td>Tank top height (m)</td>
<td>1.25</td>
<td>1.42</td>
</tr>
<tr>
<td>Upper deck camber (m)</td>
<td>0.34</td>
<td>0.38</td>
</tr>
<tr>
<td>Deck sheer for’d (m)</td>
<td>2.75</td>
<td>2.76</td>
</tr>
<tr>
<td>Deck sheer aft (m)</td>
<td>1.45</td>
<td>1.38</td>
</tr>
<tr>
<td>Tank top ceiling (m)</td>
<td>0.065</td>
<td>0.065</td>
</tr>
<tr>
<td>Grain capacity (m(^3))</td>
<td>17850</td>
<td>-</td>
</tr>
</tbody>
</table>

Estimate the final Grain Capacity and Bale capacity for the new design. (35)

4. Calculate the approximate values of the following at moulded draft for a 135.5m LBP, 18.3 m Br. Mld, 8.0 m Draft Mld, 0.701 \( C_B @ \text{SLWL} \) and Draft Mld = SLWL, General Cargo Ship.

\[ C_W, \ W, \ KB, BM_T, KM_T, BM_L, KM_L, WPA, TPC \text{ and MCTC}. \] (35)

Contd ............ P/2
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SECTION - B

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

5. (a) Sketch a diagram to clearly show the theoretical speed ($V_t$), the ship speed ($V_s$) and the velocity of advance ($V_a$). On the diagram, show the Apparent slip, the Real slip and the wake speed.

(b) A vessel of 12400 tonne displacement is 120 m long, 17.5 m beam and floats at an even keel draft of 7.5 m in salt water of density 1.025 tonne/m$^3$. The propeller has a face pitch ratio of 0.75. When the propeller is turning at 100 r.p.m, the ship speed is 12 knots with a real slip ratio of 30%, calculate

- (i) block coefficient
- (ii) wake fraction
- (iii) velocity of advance
- (iv) theoretical speed
- (v) Propeller diameter
- (vi) apparent slip ratio.

6. (a) Sketch the propeller shaft, from the propeller itself to the engine room. On the sketch, label the position of the different ship powers.

(b) For a new design, it was found that after towing a ship model that the power extrapolated to the full size ship was 3475 kW. Using basic ship information it was decided to use the following information,

- hull efficiency = 99.24%
- propeller efficiency = 68.75%
- shaft losses = 2.85%
- diesel engine efficiency = 88.73%
- weather and appendage allowances = 18.5%

Calculate:

- (i) effective power, $P_E$
- (ii) thrust power, $P_T$
- (iii) delivered power, $P_D$
- (iv) brake power, $P_B$
- (v) input power within the engine room, $P_I$
- (vi) power loss between the thrust block to the propeller tail shaft.

7. (a) A Bulk carrier has a displacement of 60144 tonne, a service speed of 14.8 knots and a shaft power of 8738 kW. What is the service speed for a similar Bulk carrier having a displacement of 62250 tonne with a shaft power of 8450 kW?

(b) A twin-screw vessel proceeds at a speed of 24 knots. She loses one of her propellers. Estimate her new forward speed.

(c) For a new vessel, the effective power is 3479 kW, delivered power is 4785 kW and the brake power is 5178 kW. Calculate Quasi-propulsive coefficient (QPC) and propulsive coefficient (PC). If the propeller revolution is 120 r.p.m, calculate the length of the ship.

Contd ............. P/3
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8. (a) For a simplex balanced rectangular rudder, the rudder depth is to be 1.694 times the rudder length. The ship is 170 m LBP with an SLWL of 9.0 m and a 'k' value of 2%.

Calculate,

(i) the rudder area
(ii) the rudder length and
(iii) the rudder depth.

Also draw the rudder profile.

(b) For a new ship $\beta$ is 585 and the rudder area $A_R$ is 35.07 m$^2$. Calculate the transverse rudder force, $F_T$, when the rudder helm is 35° and when the ship is operating at 14 knots speed. Also calculate the rudder force normal to the plane of the rudder.
SECTION – A

There are FOUR questions in this section. Answer any THREE.
Assume reasonable value of any missing data.

1. (a) Discuss truss element and differentiate it from a bar element. Discuss its use in practical field.
   (5)

   (b) Each joint of the structural system shown in Figure for Q. No. 1(b) is a pinned joint. Each member is made of steel, \( E = 210 \text{ GPa} \) and has cross sectional area of 200 mm\(^2\). Calculate the unknown nodal displacements and axial force in each member.
   (30)

2. Determine the followings for the plane stress element shown in Figure for Q. No. 2.
   (a) The Jacobian of the transformation.
       (10)
   (b) Strain-displacement matrix.
       (15)
   (c) Global load vector.
       (10)

3. (a) Discuss beam and derive the expression of the total potential energy of the same.
       (6)

   (b) Use Hermite shape functions to get the components of the first row of the element stiffness matrix of a beam element.
       (20)

   (c) For the beam shown in Figure for Q. No. 3(c), answer the followings:

       (i) how many degrees of freedom (dof) are there?

       (ii) which dofs are constrained?

       (iii) construct the global load vector.
       (9)

4. For four node isoparametric element,
   (a) derive the shape functions
       (5)

   (b) derive the expression of Jacobian matrix and strain-displacement matrix.
       (20)

   (c) explain how the element stiffness matrix can be evaluated using Gaussian quadrature.
       (5)

   (d) its use in ship structure.
       (5)

Contd ......... P/2
SECTION - B

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

5. (a) What is Finite Element Method? Why is it named so? Discuss the power and limitation of Finite Element Method over Classical Methods.
(b) When there are several FEM tools available in the market, is there any need for the Engineers to study this method? Justify your answer regarding its impact on Engineering decision in a global/societal/environmental context.

6. (a) Derive the general stress-strain relationship for a three-dimensional isotropic homogenous body. Hence obtain the expressions of stress-strain relationship for plane stress and plane strain.
(b) In a plane strain problem,
\[ \sigma_x = 20000 \text{ psi} \]
\[ \sigma_y = -10000 \text{ psi} \]
\[ E = 30 \times 10^6 \text{ psi} \]
\[ \nu = 0.3 \]
Determine the value of the stress \( \sigma_z \).

7. A tapered rod is subjected to a body force \( f = x^2 \) acting in the x direction and also a point load \( p = 2 \text{ N} \) as shown in Fig.
(i) Use the Rayleigh-Ritz method with an assumed displacement field of one degree polynomial to determine expressions for displacement \( u(x) \) and stress \( \sigma(x) \).
(ii) Solve the same problem using Finite Element method for two two-noded elements.
(iii) Compare Finite Element and Rayleigh-Ritz solutions. Give reasons for any discrepancies. What can be done to get a better result with the Finite Element Method?

[Diagram of a tapered rod showing the body force and point load.]
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8. (a) Derive an expression for the element body force vector for one dimensional 2-node element.

(b) Describe the properties of element stiffness matrix K. How does the dimension of K changes with degrees of freedom. Discuss (with figure) node numbering and its effect on NBW (number of bandwidth).

(c) A load \( P = 60 \times 10^3 \) N is applied as shown in the figure. Determine the displacement field, stress and support reactions in the body. Take \( E = 20 \times 10^3 \) N/mm².

\[ (a) \]

\[ (b) \]

Fig. for Q. No. 8(c)
Figure for Q. No. 1(b)

Figure for Q. No. 2

Figure for Q. No. 3(c)
BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

Date: 23/09/2013

L-3/T-1 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 – A

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

1. (a) What is harbor? What are the classifications of harbors? Give short description of each type of harbor.
   (20)

   (b) Draw a typical layout of an artificial harbor of medium size with separate openings for entering and leaving.
   (15)

2. (a) Discuss the factors upon which the selection of the type of dock and the material used for its construction depends.
   (15)

   (b) Write short notes on each of the following:
   (i) Free port or zone.
   (20)

   (ii) Dolphins.

   (iii) Fendering principle.

   (iv) Turning basin.

3. (a) Formulate a step by step guideline for the determination of cargo forecasts as an element of port planning.
   (10)

   (b) Draw a flow chart of the 'Masterplan process' for the planning of a port.
   (15)

   (c) What are the frequent obstacles in port planning?
   (10)

4. (a) Identify the factors affecting the selection of the optimum fender type for a given application.
   (10)

   (b) A container vessel has the following particulars:
   Length L = 165.00 m
   Breadth B = 26.10 m
   Depth H = 14.10 m
   Draft D = 9.50 m
   DWT = 20000 tonnes
   Block Coefficient, C_b = 0.84

   Contd .......... P/2
Distance of the point of contact to the center of the mass of the vessel, \( R = 0.3L \), \( \varphi = 70 \).
Consider softness factor for hard fenders and berth configuration factor for open berths.
Calculate berthing energy of the vessel using kinetic energy method for the easy and exposed berthing condition.

Design berthing velocity (mean value) as function of navigation conditions and size of vessel (Brolsma et al. 1977)

- a. Good berthing conditions, sheltered
- b. Difficult berthing conditions, sheltered
- c. Easy berthing conditions, exposed
- d.* Good berthing conditions, exposed
- e.* Navigation conditions difficult, exposed

SECTION – B
There are FOUR questions in this section. Answer any THREE.
Assume any reasonable value for any missing data.

5. (a) Define approach channel. What are the design parameters for the approach channel alignment? List the requirements applicable to the alignment of an approach channel and describe in brief.

(b) A channel is to be designed for a port. The port is to be handled for the following largest ship:

L: 190 m, B: 30 m, D: 17 m, T: 12 m

Contd ........... P/3
The following information are also given:

- Prevailing cross current : 1.5 Knot
- Prevailing cross winds : 30 Knot
- Prevailing wave height : 3 m
- Sea bed : soft
- Tidal elevation below which no entrance is allowed : 1 m

Determine the channel depth and width. Find also the harbor diameter if no tug is used for berthing.

6. List the major types of port terminals. An inland container terminal is to be designed for the following size of vessel (max):

- L : 80 m
- B : 13 m
- D : 6.5 m
- T : 3.6 m

The port is to be handled with 116,000 TEU per year. Determine the number of berths and quay length considering the following factors:

- Gross production/crane : 20 moves/hr
- Number of crane/berth : 2 (two)
- TEU factor : 1.5
- Operational hour/year : 5280
- Berth Occupancy : 0.5

7. (a) Define breakwater. List the major types and functions of breakwater. (10)
(b) What are the advantages and disadvantages of vertical wall breakwater? (10)
(c) A small terminal is to be designed for a capacity of 70,000 TEU/yr for which import 35,000 TEU (of which 15000 TEU via CFS), 25,000 export and 10,000 empties. Find the areas needed for the export, import, empties and CFS. Also sketch the possible layout of the terminal. (15)

8. (a) Sketch and describe the Rock Mound Breakwater Type-II. Also write down the conclusions drawn by United States Waterways Experiment Stations for the purpose of establishing guides for safe slope and size of rocks. (20)
(b) Describe in details the equation proposed by Iribarren and Hudson to determine the relationship between weight and slope for wave heights in designing rock mound breakwater. (15)
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<td>( d &lt; 1.25 , D )</td>
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<td>steep, hard embankment</td>
<td>1.0 B</td>
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SECTION – A

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

1. (a) Draw a flow diagram of different levels of hull girder response analysis. (15)
(b) Find the shear deflection of a simply supported beam with uniformly distributed load "w" per unit length by J.L. Taylor method. Assume the beam section is rectangular of breadth "b" and depth "d". (20)

2. (a) Explain why trochoidal wave is used for the buoyancy calculation of ship? Also from point of view of real ship, why the center line of the trochoidal wave is moved upward and downward from still water line in sagging and hogging condition? (15)
(b) Mathematically prove that the maximum heaving force is a function of direction of waves, ship length to wave length ratio and the shape of the waterline. (20)

3. (a) Show in a figure the general characteristics of shearing force and bending moment of a ship in both hogging and sagging condition. (10)
(b) The length of a floating dock is 96 m and the section is constant over length and shown in Figure 3(b). The weight of the dock is distributed uniformly throughout the length and the dock floats at a draught of 1.22 m in sea water light condition. The dock is now lowered to a draught 6.1 m by means of water ballast which is added uniformly over the amidship 67.00 m. Draw the shearing force and bending moment diagrams for the dock in the lowered position. (25)

4. (a) Define period of encounter. Deduce the mathematical expression of period of encounter of ships in regular sea waves. Hence show that period of encounter is reduced in head seas and is increased in following seas. (15)
(b) A barge shown in Figure 4(b) floats at a uniform draught of 1 m in sea water when empty. A heavy weight, uniformly distributed over the middle 6 m of the barge, increases the draught to 2.0 m. It may be assumed that the buoyancy curves for the barge (loaded and unloaded) and the weight distribution of the unloaded barge are constant over parallel length of the barge, decreasing linearly to zero at two ends. Find the bending moment at amidships and state hogging or sagging. (20)
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SECTION – B
There are FOUR questions in this section. Answer any THREE.

5. (a) Derive the mathematical expression of critical stress of buckling of a simply supported rectangular panel. Show that the buckling strength of plating with longitudinal stiffening is nearly four times as great as when transverse stiffening is employed.

(b) From point of view of longitudinal bending, explain how you will be benefited by using high tensile steel instead of normal mild steel in superstructure deck.

(25)

(10)

6. (a) Although all types of superstructures contain structural discontinuities, explain why midship superstructure is required greatest care to avoid stress concentration.

(b) What measures are adopted to avoid breakdown due to high stresses generated at the superstructure ends?

(c) Discuss the effects of high local stresses developed due to structural discontinuities.

(10)

(15)

(10)

7. (a) In ship structure, discuss why grillage problem is considered complicated.

(b) A simple grillage is made of two simply supported beams. The first beam which has length $l_1$ and moment of inertia $I_1$, is attached at its mid-point to a second beam of length $l_2$ and moment of inertia $I_2$. The beams carry loads per unit length $w_1$ and $w_2$ respectively. Deduce the mathematical expression of reaction at the point of intersection. Discuss the limiting values of the reaction.

(c) What are the problems associated with multi-stiffener grillage?

(20)

(10)

8. (a) Derive the mathematical expressions of shear force, bending moment and deflection of a watertight bulkhead.

(b) A derrick post 8 m long and 0.5 m external diameter is 10 mm thick. It is rigidly attached to a deck and is supported by means of a stay attached to the top of the post. This stay is inclined at 60° to the horizontal, and has a cross-sectional area of 12 sq. cm. Calculate the stress in the stay and at the bottom of the post when a horizontal load of 12 tonne is applied to the top of the post and in the vertical plane of the stay.

(20)

(15)
Figure for Question No. 3 (b)

Figure for Question No. 4 (b)
SECTION – A

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

1. (a) Define bifilar suspension. Derive the expressions for periodic time and frequency in case of a bifilar suspension.
   
   (b) A loaded railway wagon has a mass of 15 tonnes and moves along a level track at 20 km/h. It over takes and collides with an empty wagon of mass 5 tonnes, which is moving along the same track at 12 km/h. If each wagon is fitted with two buffer springs of stiffness 1000 kN/m, find the maximum deflection of each spring during impact and the speeds of the wagons immediately after impact ends. If the coefficient of restitution for the buffer springs are 0.5, how would the final speeds be affected and what amount of energy will be dissipated during impact?

2. (a) Derive an expression for the loss of kinetic energy during impact between two elastic bodies.
   
   (b) A mechanism, as shown in Fig. for Q. No. 2(b), has the following dimensions:
       
       OA = 200 mm; AB = 1.5 m; BC = 600 mm; CD = 500 mm; BE = 400 mm
       
       Locate all the instantaneous centres. If crank OA rotates uniformly at 180 r.p.m. clockwise, find
       
       (i) the velocity of B, C and D
       
       (ii) the angular velocity of the links AB, BC and CD

3. (a) Describe the relative velocity method to find the velocity of a point on a link whose direction is known and the velocity of some other point on the same link in magnitude and direction is given.
   
   (b) Define mechanical advantage. Distinguish between actual and ideal mechanical advantage.
   
   (c) The dimensions of the mechanism, as shown in the Fig. for Q. No. 3(c), are as follows:
       
       AB = 0.45 m; BD = 1.5 m; BC = CE = 0.9 m
       
       The crank AB turns uniformly at 180 r.p.m. in the clockwise direction and the blocks at D and E are working in frictionless guides.
       
       Draw the velocity diagram for the mechanism and find the velocities of the sliders D and E in their guides. Also determine the turning moment at A, if a force of 500 N acts on D in the direction of arrow X and a force of 800 N acts on E in the direction of arrow Y.

Contd ........... P/2
4. (a) Define Coriolis Component of Acceleration. Also show its directions. 
(b) Find out the acceleration of the slider D and the angular acceleration of link CD for the engine mechanism, as shown in Fig. for Q. No. 4(b). The crank OA rotates uniformly at 180 r.p.m. in clockwise direction. The various lengths are – 
\[ OA = 150 \text{ mm}; \ AB = 450 \text{ mm}; \ PB = 240 \text{ mm}; \ BC = 210 \text{ mm} \text{ and } CD = 600 \text{ mm} \]

SECTION – B
There are FOUR questions in this section. Answer any THREE.

5. (a) A whitworth quick return motion mechanism, as shown in Fig. 5(a) has the following particulars: 
Length of the stroke = 150 mm; Dividing crank length = 40 mm. Ratio of the time of cutting stroke to return stroke is 2. Find the lengths of CD and PD. Also determine the angles \( \alpha \) and \( \beta \).
(b) Assemble the links of a single slider crank chain to form such a mechanism that is used to convert reciprocating motion into rotary motion.
(c) Calculate the degrees of freedom of the following 6 bar mechanism having no higher pair.

6. (a) Consider a body of weight \( W \) is lying on a rough inclined plane. The angle of inclination of the plane is greater than the friction angle. If a force \( P \) is being applied parallel to the plane; then derive an expression for \( P_{\text{min}} \) and inclination efficiency of the plane.
(b) Derive an expression for the maximum efficiency of a self-locking screw. A square threaded screw of 12 mm pitch and of mean diameter 50 mm requires 100 N force to be applied at the end of the lever to raise a load of 10 N. Co-efficient of friction of the plane is 0.21. Determine (i) length of the lever (ii) mechanical advantage obtained and (iii) state whether it is a self-locking screw or not.

7. (a) Show that for maximum power transmission by belt, \( \frac{1}{3} \) rd of the maximum tension is absorbed as centrifugal tension. Hence determine the velocity of the belt for maximum power.
(b) The power transmitted between two shafts 3.5 m apart by a cross belt drive round the two pulleys 600 mm and 300 mm in diameters is 6 KW. The speed of the larger pulley (driver) is 220 r.p.m. The permissible load on the belt is 25 N/mm width of the belt which is 5 mm thick. The co-efficient of friction between the smaller pulley surface and the belt is 0.35. Determine:
(i) Necessary length of the belt
(ii) Width of the belt
(iii) Necessary initial tension in the belt
(iv) Maximum power in the tight side and in the slack side
(v) Velocity ratio considering there is a slip of 1.5% at each drive and thickness.

Contd .......... P/3
8. (a) Draw a schematic diagram and illustrate the terms used in gears. (13)

(b) Identify the advantage of gear drive over belt drive. (5)

(c) Two mating gears have 20 and 40 involute teeth of module 10 mm and 20° pressure angle. The addendum on each wheel is to be made of such a length that the line of contact on each side of the pitch point has half the maximum possible length. Determine the addendum height for each gear wheel, length of the path of contact, arc of contact and contact ratio. (17)
Fig. for Q. No. 2(b)

Fig. for Q. No. 3(c)
All dimensions in mm.

Fig. for Q. No. 4(b)

Fig. for Q. No. 5(a)

Fig. for Q. No. 5(c)