L-4/T-1/NAME Date : 23/07/2013

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2011-2012

Sub : **NAME 475** (Dredger and Dredging Technology)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

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## SECTION – A

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

1. (a) Discuss different types of grab buckets used in clamshell dredger. **(10)**

   (b) List the application areas of grab dredger. **(7)**

   (c) With a neat sketch, derive the expression for the cylinder force to move the boom of a backhoe dredger. **(10)**

   (d) Write a short note on 'dredge bucket'. **(8)**

2. (a) Briefly discuss the influence of production capacity and soil type while designing a bucket dredger. **(10)**

   (b) What is a draghead? Briefly discuss the design features with applications of various types of dragheads used in Trailing Suction Hopper Dredger (TSHD). **(15)**

   (c) Discuss the construction feature of floating pipelines for Cutter Suction Dredger (CSD). **(10)**

3. (a) What are the requirements for dumping systems of TSHD? Briefly discuss hopper discharge mechanisms of TSHD. **(20)**

   (b) Explain the components of cycle time for a clamshell dredger. **(10)**

   (c) What are benefits of incorporating a jet pump into a plain suction dredger? **(5)**

4. (a) For designing a dredging work, how would you determine the minimum width of a bend navigational channel? **(15)**

   (b) Write short notes on the followings (any three): **(20)**

   (i) Hopper barges

   (ii) Pontoon-type workboat

   (iii) Pneumatic dredger

   (iv) Dredge pump

## SECTION – B

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

5. (a) Write the major components of a cutter suction dredger (CSD). **(5)**

   (b) What are the functions of spud system in a cutter suction dredger (CSD)? **(5)**

   (c) Discuss briefly the different drives of cutter suction dredger (CSD). **(25)**

Contd ..... P/2

**NAME 475**

6. (a) What are the information that must be required for estimating the output of a cutter suction dredger (CSD)? **(15)**

   (b) Describe the four components of dredging cycle of trailing suction hopper dredger (TSHD). **(20)**

7. (a) How the types of soil influence on the dredging process of cutter suction dredger (CSD)? **(10)**

   (b) What is minimum and maximum depth of a cutter suction dredger? Discuss briefly the effect of dredging depth on the dredging process of a cutter suction dredger (CSD). **(20)**

   (c) As a naval architect, mention the basic design criteria of cutter suction dredger. **(5)**

8. (a) Describe the mechanical method of pretreatment of dredging process. **(10)**

   (b) Write the basic objectives and common features of drilling pontoon. **(15)**

   (c) Define capital and maintenance dredging. What are the basic reasons of dredging? **(10)**

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L-4/T-1/~~EEE~~ NAME

**Date : 23/07/2013**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2011-2012

Sub : **NAME 413** (Theory of Hydrofoils)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

The symbols have their usual meanings. Assume reasonable value of any missing data.

USE SEPARATE SCRIPTS FOR EACH SECTION

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## SECTION – A

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

1. (a) Define **(5)**

   (i) Bernoulli's equation and

   (ii) Euler's equation.

   (b) Discuss how Bernoulli's and Euler's equations are used for the prediction of lift produced by a hydrofoil. **(8)**

   (c) The velocity distribution around a hydrofoil section is provided below: **(22)**

| % chord (from L. E) | 5 | 10 | 30 | 50 | 80 |
|---|---|---|---|---|---|
| v/V (back) | 1.162 | 1.323 | 1.483 | 1.408 | 1.240 |
| v/V (face) | 1.214 | 1.085 | 0.869 | 0.826 | 0.808 |

   (i) Draw the pressure distribution curve.

   (ii) Calculate the section lift coefficient, and

   (iii) Predict the minimum pressure value and location along the chord.

2. (a) A circle passes through x = a = 1 m and the center of the circle is located at $x_c$ = -0.25 m, $y_c$ = 0.4m. **(20)**

   The uniform free stream velocity is U = 1.2 m/s and is inclined at an angle, $\alpha = 9°$.

   Calculate the velocity components u and v in the x and y - direction at the position x = 1.2 m, y = 1.05 m for circulation strength, $\Gamma = 0$ around the circle.

   (b) A circle passes through x = a = 1m and the center of the circle is located at $x_c = -0.3$ m, $y_c$ = 0.4 m. The uniform free stream velocity is U = 2.5 m/s and is inclined at an angle, $\alpha = 12°$.

   If the rear stagnation point has moved to x = a = 1 m, calculate the circulation strength, $\Gamma$ around the circle. **(15)**

3. Discuss Biot-Savart Law and Prove, $\delta v = \frac{\Gamma}{4\pi r^2} \sin\theta . \delta\theta \, \delta s$ **(35)**

4. (a) Discuss the four fundamental theorems of Helmholtz for vortex motion in an inviscid flow. **(10)**

Contd ..... P/2

**NAME 413**

**Contd ... Q. No. 4**

(b) Let the length of a vortex be AB and 'P' is an adjacent point located by the angular displacement $\alpha$ and $\beta$ from A and B respectively. **(25)**

If 'v' is the induced velocity at 'p' due to the vortex element AB, then prove the following relations with figure.

(i) $v = \frac{\Gamma}{4\pi h}(\cos\alpha + \cos\beta)$ for finite vortex of depth AB.

(ii) $v = \frac{\Gamma}{4\pi h}(\cos\alpha + 1)$ and also $v = \frac{\Gamma}{4\pi h}$ for semi-infinite vortex of length AB.

(iii) $v = \frac{\Gamma}{2\pi h}$ for infinite vortex of length AB.

## SECTION – B

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

5. (a) Describe thin foil theory elaborately. **(15)**

(b) A thin hydroboil has a camber line defined by the relation y = kx(x – 1) (x – 2) where x and y are the coordinates expressed in terms of unit chord and the origin is at the leading edge. If the maximum camber is 3% of the chord, calculate the lift coefficient at 4° angle of incidence. **(20)**

6. Derive the expression of lift coefficient for a general thin hydrofoil section. **(35)**

7. (a) Describe with neat sketches how you can transform a circle into a cambered hydrofoil. **(18)**

(b) Derive the expression of the lift coefficient for 2-D Zhukovsky hydrofoil. **(17)**

8. Write short notes on: **(12)**

(i) Kutta - Zhukovsky transformation

(ii) Thiskness and camber distributions of a hydrofoil **(11)**

Thickness

(iii) Spanwise loading for a finite hydrofoil. **(12)**

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21/09/13

**L-4/T-1/NAME** **Date : 21/09/2013**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2011-2012

Sub : **IPE 479** (Engineering Management)

Full Marks: 210 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

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## SECTION – A

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

1. (a) Compare product, process and fixed position layout based on their advantages and disadvantages. **(12)**

(b) From April 1 through October 31, Knox County Highway Department hires temporary employees to mow and clean the right-of-way along county roads. The County Road Commissioner has asked you to help her in determining the variable labor cost of mowing and cleaning a mile of road. The following information is available regarding current-year operations: **(15)**

| Month | Miles Mowed and Cleaned | Labor Cost |
|---|---|---|
| April | 350 | $8,000 |
| May | 300 | 7,500 |
| June | 400 | 9,000 |
| July | 250 | 5,500 |
| August | 375 | 8,500 |
| September | 200 | 5,000 |
| October | 100 | 4,800 |

Using the Least Squares Regression method, develop a cost-estimating equation for monthly labor costs. In the month of November if the miles mowed and cleaned will be 150 then calculate the labor cost for the month.

(c) Heady Company sells headbands to retailers for $5. The variable cost of goods sold per headband is $1, with a selling commission of 10 percent. Fixed manufacturing costs total $25,000 per month, while fixed selling and administrative costs total $10,000. What are the break-even sales in headbands? What are target sales in headbands to generate an income of $3,500? **(8)**

2. (a) What is work center? What are the objectives of work center scheduling? **(7)**

(b) Describe the functions of inventory? What are the basic assumptions of EOQ inventory model? **(13)**

(c) A particular raw material is available to a company at three different prices, depending on the size of the order: **(15)**

| | |
|---|---|
| Less than 100 pounds | $ 20 per pound |
| 100 pounds to 999 pounds | $ 19 per pound |
| 1000 pounds and more | $ 18 per pound |

The cost of place an order is $ 40, annual demand is 3,000 units. Holding cost is 25 percent of the material price. What is the economic order quantity?

Contd ..... P/2

**IPE 479**

3. (a) The following tasks and the order in which they must be performed according to their assembly requirements are shown in the following table. These are to be combined into workstations to create an assembly line. The assembly line operates 7.5 hours per day. The output requirement is 1,000 units per day. **(25)**

| Task | Preceding task | Time (seconds) |
|---|---|---|
| A | – | 15 |
| B | A | 24 |
| C | A | 6 |
| D | B | 12 |
| E | B | 18 |
| F | C | 7 |
| G | C | 11 |
| H | D | 9 |
| I | E | 14 |
| J | F, G | 7 |
| K | H, I | 15 |
| L | J, K | 10 |

(i) Draw a precedence diagram

(ii) What is the cycle time?

(iii) Balance the line using the longest task time based on 1,000 units of forecast, stating which tasks would be done in each workstation.

(iv) For iii, what is the efficiency of the assembly line?

(b) What is conflict? Describe some conflict management strategies. **(10)**

4. (a) What is maintenance? Explain the objectives of maintenance. **(10)**

(b) Briefly describe different types of maintenance policies. **(15)**

(c) The Two Mines Company own two different mines that produce an ore which, after being crushed, is graded into three classes: high, medium and low-grade. The company has contracted to provide a smelting plant with 12 tons of high-grade, 8 tons of medium-grade and 24 tons of low-grade ore per week. The two mines have different operating characteristics as detailed below. **(10)**

| Mine | Cost per day | Productions (Tons/day) | | |
|---|---|---|---|---|
| | | High | Medium | Low |
| X | 180 | 6 | 3 | 4 |
| Y | 160 | 1 | 1 | 6 |

Company works 5 days a week. Formulate an LP Model to fulfill the contract at minimum cost.

Contd ..... P/3

**IPE 479**

## SECTION – B

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

5. (a) Describe different input sources of judgmental forecast. **(8)**

(b) Here are the actual tabulated demands for an item for a nine-month period (January through September). **(17)**

| Month | Labor Cost |
|---|---|
| January | 110 |
| February | 130 |
| March | 150 |
| April | 170 |
| May | 160 |
| June | 180 |
| July | 140 |
| August | 130 |
| September | 140 |

(i) Forecast April through September using a three period weighted average using weights of 0.5 (most recent), 0.3 and 0.2.

(ii) Use exponential smoothing to estimate April through September with a smoothing constant of 0.4.

(iii) Use MAD to decide which method produced the better forecast over the six month period.

(c) Differentiate 'Delegation' and 'Decentralization'. **(10)**

6. (a) Briefly describe four building blocks of organizational structure. **(12)**

(b) Differentiate pure, functional and matrix project. **(10)**

(c) A construction project is broken down into the following 10 activities: **(13)**

| Activity | Time (weeks) | Immediate Predecessors |
|---|---|---|
| 1 | 4 | – |
| 2 | 2 | 1 |
| 3 | 4 | 1 |
| 4 | 3 | 1 |
| 5 | 5 | 2,3 |
| 6 | 6 | 3 |
| 7 | 2 | 4 |
| 8 | 3 | 5 |
| 9 | 5 | 6,7 |
| 10 | 7 | 8,9 |

(i) Draw the network diagram.

(ii) Find the critical path and calculate the project completion time.

(iii) If activities 1 and 10 cannot be shortened, but activities 2 through 9 can be shortened to a minimum of one week each at a cost of $10,000 per week, which activities would you shorten to cut the project by four weeks?

Contd ..... P/4

**IPE 479**

7. (a) What Roles do Managers Play? Explain briefly. **(10)**

(b) Describe four basic management functions. **(12)**

(c) A wholesale grocery distribution center uses a two-step process to fill orders. Tomorrow's work will consist of filling the seven orders shown below. **(13)**

| Order | Required processing time step 1 (hrs) | Required processing time step 2 (hrs) |
|---|---|---|
| A | 1.2 | 1.4 |
| B | 0.9 | 1.3 |
| C | 2.0 | 0.8 |
| D | 1.7 | 1.5 |
| E | 1.6 | 1.8 |
| F | 2.2 | 1.75 |
| G | 1.3 | 1.4 |

(i) Determine a job sequence that will minimize the time required to fill the orders.

(ii) Determine the idle time of each step.

8. (a) What is quality? List and explain the dimensions of quality. **(8)**

(b) Briefly explain the following tools of TQM: **(12)**

(i) Pareto analysis.

(ii) Cause-effect diagram.

(c) The department has five employees with five jobs to be performed. The time (in hours) each men will take to perform each job is given in the effectiveness matrix. Develop an optimal solution to minimize the time. **(15)**

| | **Jobs** | | | | |
|---|---|---|---|---|---|
| **Employees** | **I** | **II** | **III** | **IV** | **V** |
| **A** | 6 | 12 | 3 | 11 | 15 |
| **B** | 4 | 2 | 7 | 1 | 10 |
| **C** | 8 | 11 | 10 | 7 | 11 |
| **D** | 16 | 19 | 12 | 23 | 21 |
| **E** | 9 | 5 | 7 | 6 | 10 |

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L-4/T-1/NAME Date : 28/09/2013

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2011-2012

Sub : **NAME 415** (Marine Maintenance and Repair)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

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## SECTION – A

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

Assume reasonable values for missing data, if any.

Tables are provided for Questions No. 4.

1. (a) To dock a tanker having 150 m length, 25 m breadth, and 15 m depth. Which methods of docking can be used? – Explain. **(20)**

   (b) A ship owner wants to repair the side shell plates of an oil tanker in a shipyard. Describe the appropriate procedure to carry out this repair work. **(15)**

2. (a) Formulate the amount of misalignment of tail shafts, main engine and reduction gear. **(17)**

   (b) Describe the dismantling of shafting in different stages. **(18)**

3. (a) With the neat sketch, explain the procedure of static balancing of marine propeller. **(23)**

   (b) A naval vessel has a propeller having cracks, crumbled edges and fractured blades. Is it possible to repair that propeller? If possible, how? **(12)**

4. A 300 m passenger vessel of 102027 DWT is seeking a schedule for repair works at the end of November at a dry dock. The vessel has following particulars – **(35)**

   LPP = 285 m

   B = 47.5 m

   D = 19 m

   T = 12 m

   Calculate the following:

   (i) Man-hours required for berth preparation.

   (ii) Man-hours required for dock services if the ship stays for 33 days.

   (iii) The weight of required zinc anode and required man-hours to cut off and replace zinc anode.

   (iv) Man-hours required for rudder works.

   (v) Man-hours required for propeller works.

   Consider Aluminium bronze propeller dia 4.5 m and shaft dia 325 mm. Assume number of years between dry docking = 5, zinc anode current density 20 $mA/m^2$ and capacity 781 amp hours/kg. Neglect the variable man-hours.

Contd ..... P/2

**NAME 415**

## SECTION – B

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

5. (a) Briefly describe the methods of finding the deformations of hull elements. **(15)**

   (b) Briefly discuss different procedures of testing the watertightness of hulls of sea-going vessels. **(20)**

6. (a) What are the advantages and disadvantages of electrical sputtering used for restoring the original dimensions of worn parts? Briefly discuss the various stages of sputtering process. **(20)**

   (b) Briefly describe the thermal, mechanical and thermomechanical methods of straightening shafts and shaft-like components in a ship. **(15)**

7. (a) How the cracks observed in parts of the ship hull and machinery are repaired by welding? **(15)**

   (b) Why galvanic coatings are used in ship repairing? Discuss the following galvanic coating processes mentioning their merits, demerits and applications: **(20)**

   (i) zinc galvanizing
   (ii) steel plating
   and (iii) nickel plating

8. (a) What are the defects that may be developed due to casting, forging and rolling? **(10)**

   (b) What are the principal requirements for various paints used in shipbuilding? **(15)**

   (c) Write a short note on "underwater welding and cutting". **(10)**

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**Table 1:** Shifting of blocks after docking vessel

This covers shifting of blocks at the request of the owner for access works not known at the time of quoting. This involves cutting out the soft wood capping of the block, shifting the block and reinstalling at a different location.

| | *Man-hours* | |
|---|---|---|
| *DWT* | *Keel block* | *Side block* |
| < 20 000 | 5 | 3 |
| 20 000–100 000 | 10 | 5 |
| 100 000–200 000 | 16 | 8 |
| > 200 000 | 20 | 12 |

**Table 2:** Dock Services

| | *Man-hours* | |
|---|---|---|
| *Service* | *<100 LOA* | *>100 LOA* |
| Fire and Safety watchman per day | 8/shift | 8/shift |
| Garbage skip per day | 2 | 4 |
| Electrical shore power connection and disconnection | 4 | 5 |
| Electrical shore power per unit | Variable | Variable |
| Temporary connection of fire main to ship's system | 5 | 6 |
| Maintaining pressure to ship's fire main per day | 3 | 3 |
| Sea circulating water connection | 3 | 4 |
| Sea circulating water per day | 4 | 4 |
| Telephone connection on board ship | 3 | 3 |
| Supply of ballast water per connection | 6 | 8 |
| Supply of fresh water per connection | 3 | 5 |
| Connection and disconnection of compressed air | 3 | 5 |
| Gas-free testing per test/visit and issue of gas-free certificate | 8 | 10 |
| Electric heating lamps per connection. | 4 | 5 |
| Ventilation fans and portable ducting each | 5 | 5 |
| Wharfage: charges to lie vessel alongside contractor's berth. Usually a fixed rate per metre of vessel's length. Cranage: charges variable, dependent upon size of crane. | Variable | Variable |

*Notes:*
Contractors often charge for temporary lights provided for their own use in order to carry out repairs. This is an arguable point as it is for their benefit and not the owners. It should be classed as an overhead and costed accordingly. Provided there are none of the ship's staff utilizing the temporary lights, then it should be a contractor's cost.

Tables for question No. 4



6

**Table 3:** Removal of rudder for survey

(a) Repacking stock gland with owner's supplied packing. Measuring clearances, *in situ*.
(b) Disconnecting rudder from palm and landing in dock bottom for survey and full calibrations. Refitting as before on completion.

| | *Man-hours* | |
|---|---|---|
| *DWT* | *(a)* | *(b)* |
| >3 000 | 15 | 165 |
| 5 000 | 18 | 250 |
| 10 000 | 20 | 280 |
| 15 000 | 25 | 300 |
| 20 000 | 28 | 350 |
| 30 000 | 30 | 400 |
| 50 000 | 35 | 500 |
| 80 000 | 45 | 600 |
| 100 000 | 60 | 800 |
| 150 000 | 75 | 900 |
| 200 000 | 90 | 1 000 |
| 250 000 | 110 | 1 200 |
| 350 000 | 120 | 1 500 |

**Table 4:** Propeller Works (fixed pitch)-1

(a) Disconnecting and removing propeller cone, removing propeller nut, setting up ship's withdrawing gear, rigging and withdrawing propeller and landing in dock bottom. On completion, rigging and refitting propeller as before and tightening to instructions of owner's representative. Excluding all removals for access, any other work on propeller and assuming no rudder works.
(b) Transporting propeller to workshops for further works and returning to dock bottom on completion.

| | *Man-hours* | |
|---|---|---|
| *Shaft dia. (mm)* | *(a)* | *(b)* |
| Up to 100 | 20 | 15 |
| 100–200 | 30 | 18 |
| 200–300 | 45 | 25 |
| 300–400 | 60 | 30 |
| 400–800 | 90 | 60 |
| 800–900 | 150 | 100 |

Tables for question No. 84

**Table 5:** Propeller Works (fixed pitch)-2

(a) Receiving bronze propeller in workshop, setting up on calibration stand, cleaning for examination, measuring and recording full set of pitch readings. Polishing propeller, setting up on static balancing machine, checking and correcting minor imbalances.
(b) Heating, fairing, building up small amounts of fractures and missing sections, grinding and polishing.

| | *Man-hours* | |
|---|---|---|
| *Dia. (mm)* | *Manganese Bronze* | *Aluminium Bronze* |
| Up to 400 | 15 | 21 |
| 400–800 | 32 | 42 |
| 800–1200 | 52 | 68 |
| 1200–1800 | 75 | 85 |
| 1800–2000 | 90 | 105 |
| 2000–2500 | 100 | 125 |
| 2500–3000 | 130 | 150 |
| 3000–4000 | 150 | 180 |
| 4000–5000 | 180 | 210 |

**Table 6:** Propeller polishing in situ (fixed pitch)

Polishing *in situ* using high-speed disc grinder, coating with oil; ship in dry dock.

| *Dia. (mm)* | *Man-hours* |
|---|---|
| Up to 400 | 6 |
| 400–800 | 11 |
| 800–1200 | 17 |
| 1200–1800 | 25 |
| 1800–2000 | 28 |
| 2000–2500 | 35 |
| 2500–3000 | 50 |
| 3000–4000 | 80 |
| 4000–5000 | 120 |

Tables for question No. 4

L-4/T-1/NAME Date : 05/10/2013

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2011-2012

Sub : **NAME 477** (Optimization Methods in Ship Design)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

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## SECTION – A

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

1. (a) Write down the properties of the standard primal problem. Consider the following Linear Programming. **(15)**

Maximize $z = 5x_1 + 2x_2 + 3x_3$

Subject to

$x_1 + 5x_2 + 2x_3 = 30$

$x_1 - 5x_2 - 6x_3 \leq 40$

The optimal solution yields the following objective equation:

$z + 0\,x_1 - 23x_2 + 7x_3 + (5 + M)x_4 + 0\,x_5 = 150$

Write the associated dual problem and determine its optimal solution from the optimal z-equation.

(b) Solve the problem by Dual Simplex method. **(20)**

Minimize $z = 3x_1 + 2x_2$

Subject to

$3x_1 + x_2 \geq 3$

$4x_1 + 3x_2 \geq 6$

$x_1 + x_2 \leq 3$

$x_1, x_2 \geq 0$

2. (a) Define ILP and write down the name of the methods used for solving ILP problem. **(10)**

(b) Solve the following ILP by Cutting Plane Algorithm. **(25)**

Maximize $z = 7x_1 + 10x_2$

Subject to

$-x_1 + 3x_2 \leq 6$

$7x_1 + x_2 \leq 35$

$x_1, x_2 \geq 0$ and integer.

Contd ..... P/2

**NAME 477**

**Contd ... Q. No. 2(b)**

Given the slacks $x_3$ and $x_4$ for the first and second constraints respectively. The optimum LP Table is as follows:

| Basic | $x_1$ | $x_2$ | $x_3$ | $x_4$ | Solution |
|---|---|---|---|---|---|
| z | 0 | 0 | $\frac{63}{22}$ | $\frac{31}{22}$ | $66\frac{1}{2}$ |
| $x_2$ | 0 | 1 | $\frac{7}{22}$ | $\frac{1}{22}$ | $3\frac{1}{2}$ |
| $x_1$ | 1 | 0 | $-\frac{1}{22}$ | $\frac{3}{22}$ | $4\frac{1}{2}$ |

3. (a) Write an expression of Taylor's series for a two-variable function in terms of gradient and Hessian matrix about the point $(x_p . y_p)$ **(5)**

(b) Derive an expression for the sensitivity co-efficient. **(10)**

(c) Determine the optimal solution for the following NLPP and check whether it maximizes or minimizes the objective function: **(20)**

Optimize $z = x_1^2 - 10x_1 + x_2^2 - 6x_2 + x_3^2 - 4x_3$

Subject to

$x_1 + x_2 + x_3 = 7$

$x_1, x_2, x_3 \geq 0$

4. (a) Derive the Kuhn-Tucker conditions for the problem below: **(10)**

Maximize $z = f(x)$

Subject to $g(x) \geq 0$

(b) Solve the following problem by Sequential Quadratic Programming (SQP) method: **(25)**

Maximize $z = 4x_1 + 6x_2 - 2x_1^2 - 2x_1x_2 - 2x_2^2$

Subject to

$x_1 + 2x_2 \leq 2$

$x_1, x_2 \geq 0$

## SECTION – B

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

5. (a) Draw the flow chart for the two-phase Simplex method. **(15)**

(b) Briefly demonstrate how a problem having infinite number of solutions can be solved. **(20)**

Contd ..... P/3

**NAME 477**

6. (a) Explain the process of Ant Colony optimization (ACO). **(10)**

   (b) Find the minimum of the function $f(x) = x^2 - 2x - 11$ in the range (0, 3) using ACO method, assuming the number of ants equal to 4. **(25)**

7. (a) Discuss the concept of stock variable, surplus variable and unrestricted variable used in LP problems. **(20)**

   Mc Burger fast food restaurant sells quarter pounder and cheese burger. A quarter pounder uses a quarter of a pound of meat, and a cheese burger uses only 0.2 lb. The restaurant starts the day with 200 lb of meat but may order more at an additional cost of 25 cents per pound to cover the delivery cost. Any surplus meat at the end of the day is donated to hot soup charity. Mc Burger's profits are 20 cents from a quarter pounder and 15 cents from a cheese burger. All in all, Mc Burger does not expect to sell more than 900 sandwitches in any one day. How many of each sandwitchs should Mc Burger make?

   (b) Describe how Genetic Algorithm differs from the traditional methods of optimization. **(15)**

8. (a) Consider the following set of two equations with five unknowns (m = 2, n = 5) **(15)**

$$x_1 + x_2 + 4x_3 + 2x_4 + 3x_5 = 8$$

$$4x_1 + 2x_2 + 2x_3 + x_4 + 6x_5 = 4$$

   Identify a feasible basic solution, an infeasible basic solution, infinity of solutions and non existing solutions.

   Test the combinations $(x_1, x_4)$, $(x_1, x_5)$ and $(x_2, x_3)$ as zero (nonbasic) variable in the above set of equations and identify the status of their solutions.

   (b) Describe Simulated Annealing Method for solving an unconstrained optimization problem. **(20)**

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L-4/T-1/NAME Date : 05/10/2013

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2011-2012

Sub : **NAME 439** (Ship Vibration)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

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## SECTION – A

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

1. (a) Derive Schlick's formula for the natural frequency of vibration of a ship. **(20)**

   (b) A cargo ship 410 ft in length, 55 ft in breadth has a draft of 23 ft and a block coefficient of 0.69. The moment of inertia of the midship section is 330,000 $in^2.ft^2$. Calculate the frequency of vibration of the ship. **(15)**

2. (a) Derive Lockwood Taylor's formula for the torsional frequency of a ship hull. **(20)**

   (b) Discuss briefly Vedeler's formula for the effective polar moment of inertia of a box structure like that of a ship. **(15)**

3. (a) Describe briefly the conformal transformation method of Lewis for calculating the added virtual mass of a ship vibrating in water. **(25)**

   (b) Explain what you mean by 'virtual weight factor'. **(10)**

4. (a) Discuss the effect of restricted water on added virtual weight. State and explain Prohaska's formulae for added virtual weight in shallow water. **(18)**

   (b) A destroyer 364 ft long has a beam of 40.25 ft, a displacement of 3000 tons, a block coefficient of 0.575 and floats at a mean draft of 12.5 ft. If the natural frequency of vertical vibration in deep water is 100 cycles per minute, what would be the frequency in 25 ft depth? **(17)**

## SECTION – B

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

5. (a) Define longitudinal and transverse vibration. Derive the general equation of natural frequency for the transverse vibration of a beam of constant cross-section and uniformly distributed weight. **(25)**

   (b) A vibrating system has a mass 10 kg and spring constant 12 kN/m. The amplitude decreases to 20% of the initial value after six consecutive cycles. Find the damping co-efficient of the damper. **(10)**

Contd ..... P/2

**NAME 439**

6. (a) What are the major defects in Schlick formula? Describe the Lundberg method of determining the equivalent depth for ships with long superstructure. **(15)**

   (b) Derive an expression for the maximum force transmitted to the foundation by a spring mounted engine. **(20)**

7. (a) Write the Van Lammeren formula for tip clearance. Describe the effect of tip clearance on single and twin-screw ships. **(15)**

   (b) Define resonant and local vibrations of ship. What are the causes of ship hull vibration? **(20)**

8. (a) Derive a general solution of natural vibration with critical viscous damping. **(20)**

   (b) Give a note on the limit of acceptable vibration by individual as suggested by different researches. **(15)**

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Sanchaita 9/9/13

L-4/T-1/NAME Date : 06/07/2013

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2011-2012

Sub : **NAME 419** (Motion and Control)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

The symbols have their usual meaning.

Assume reasonable value in case of missing data.

USE SEPARATE SCRIPTS FOR EACH SECTION

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## SECTION – A

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

1. (a) Derive an expression for relative bow motion of a ship undergoing heaving and pitching motions in regular head waves without forward speed. **(15)**

   (b) The following values are given: **(20)**

   $L = 450$ ft = (Ship length)

   $L_W = 420$ ft = (Wave length)

   $\mu = 180°$ (i.e. head sea)

   $\xi$ = distance of bow from ship CG = 225 ft

   $h_W = 20$ ft = (Wave height)

   $T = 25$ ft = (loaded draft); $F = 20$ ft = (Freeboard)

   $V_s = 20$ knots = (Speed of ship)

   Also given: $Z_a = 5$ ft, $\theta_a = 0.15$ radian

   $\epsilon_z = -40°$ and $\epsilon_\theta = 15°$

   Determine the relative vertical motion of the bow and hence find whether the forefoot will emerge when $t = 0$ and bow imersion will take place when $t = \pi/\omega_e$.

2. (a) Describe with suitable sketches various types of motion stability of a surface ship. **(12)**

   (b) Identify the important eight linear hydrodynamic derivatives that arise in the study of maneuverability and discuss their relative magnitudes with sketches of relationships and justifications of signs. **(23)**

3. (a) Two designs possess the following values of derivatives:? **(20)**

| | $Y'_v$ | $N'_v$ | $Y'_r$ | $N'_r$ | $m'$ |
|---|---|---|---|---|---|
| Design A | – 0.36 | – 0.07 | 0.06 | – 0.07 | 0.12 |
| Design B | – 0.26 | – 0.10 | 0.01 | – 0.03 | 0.10 |

   Comment on the directional stability of the two designs. Assuming both designs are 100 m long how far are the neutral points forward of the centres of gravity?

   (b) Give a description of the spiral maneuver. How does it provide an indication of ship's directional stability or instability? **(15)**

Contd ..... P/2

**NAME 419**

4. With a definition diagram, describe the three phases of turn of a ship. Determine the equations of motions at each phase. From the equations obtained at third phase, find the expressions for steady turning radius, yaw rate and drift angle and hence make comments on the nature of these parameters. **(35)**

## SECTION – B

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

5. (a) A wave tank is 150 m long, 5 m wide and 6 m deep. A wave maker in one end generates regular deep water wave with amplitude 0.20 m and wave period 2.0 sec. Determine: **(20)**

   (i) Wave frequency, wave number and wave length

   (ii) The path of fluid particle at 0.50 m below still water level

   (iii) The energy in waves per unit surface area

   (iv) The phase velocity and group velocity of waves.

   (b) What are the useful information that can be derived from a wave spectrum? What are the factors that determine the shape of such spectrum? **(15)**

6. A ship is heading at an angle of 150 degree relative to the wave direction at a speed of 20 knots. **(35)**

   (a) Plot the magnification factors for rolling against tuning factors for wave frequencies w ranging from 0 to 2.00 at an interval of 0.40. The relevant dimensions of ships are as follows:

   $L = 450$ ft  $K_{xx} = 30.8$ ft

   $GM = 5.79$ ft  $\Delta = 12{,}500$ Tons

   The added mass is 20% of the mass of the ship and the damping moment is $3200\left(\frac{d\phi}{dt}\right)$ tons-ft.

   (b) Find the amplitude of the maximum rolling motion the ship will experience if the wave height is taken to be 60 ft.

7. (a) The following information of a ship is given: **(12)**

   $L = 200$ m, $B = 30.0$ m $d = 10.0$ m, $C_B = 0.60$

   $C_w = 0.75$ $GM_T = 1.0$ m $BM_L = 200$ m

   Assume added mass is 100% of the ship, estimate the natural periods for heave, roll and pitch motions of the ship. Ignore roll and pitch added moment of inertia.

   (b) Discuss waves of infinitesimal small height and that of finite height. With neat sketches and expressions point out the differences between them. **(13)**

   (c) Explain what you mean by a 'fully developed sea' and a 'partially developed sea'. **(10)**

Contd ..... P/3

**NAME 419**

8. (a) A ship model has the following particulars: **(22)**

L = 19.50 ft B = 2.60 ft

T = 1.144 ft wavelength = 19.50 ft

Both LCG and LCB are 0.48 ft forward of amidship.

Moreover, distribution of beam, draught, added mass co-efficient C and amplitude ratio $\overline{A}$ at different stations are as follows:

| Station No | $B_n$ (ft) | $T_n$ (ft) | C | $\overline{A}$ |
|---|---|---|---|---|
| 0 | 0 | 1.144 | 0.0 | 0.0 |
| 5 | 2.592 | 1.144 | 0.98 | 0.57 |
| 10 | 2.592 | 1.144 | 0.98 | 0.57 |
| 15 | 2.592 | 1.144 | 0.84 | 0.66 |
| 20 | 0 | 1.144 | 0.0 | 0.0 |

If the model speed u = 4.79 ft/sec, displacement = 2885 lb, direction of travel $\mu = 180°$ and $\rho = 1.94$ lb-sec$^2$/ft$^4$, calculate

(i) the value of inertial coefficient, a

(ii) the damping coefficient b, and

(iii) restoring force coefficient c

While the ship model is heaving in calm water.

(b) Mention the significance of determining the motion in an irregular seaway for a ship. Suppose you have got heave motion result for a cargo ship in regular wave by towing tank experiment. Select the steps for determining the motion of the same ship in irregular seaway. **(13)**

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