BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1   B. Sc. Engineering Examinations 2010-2011

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

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**.
The symbols have their usual meanings.

1. (a) Provide free hand sketch of a typical hydrofoil boat and explain how does the angle of attack of a hydrofoil affects the performance of the boat. **(10)**

   (b) The velocity distribution around a hydrofoil section is provided below: **(25)**

% Chord (from L.E)	5	10	30	50	80
v/V (Back)	1.003	1.227	1.462	1.406	1.250
v/V (Face)	1.373	1.181	0.890	0.828	0.798

   (i)   Draw the pressure distribution curve

   (ii) Calculate the section lift coefficient and predict the minimum pressure value on the back surface.

2. (a) Discuss how Bernoulli's and Euler's equations are used for the prediction of lift produced by a hydrofoil. **(15)**

   (b) A hydrofoil section comprises NACA 64 meanline and NACA 0012 Basic thickness form. The relevant velocity data is provided below: **(20)**

% Chord (from L.E)	5	10	30	50	80
$\frac{v}{V}$ (for NACA 0012 thickness form)	1.188	1.204	1.176	1.117	1.024
$\frac{\Delta v_a}{V}$ (for incidence corresponding to $C_L = 1.0$ and NACA 0012 thickness)	0.680	0.477	0.242	0.150	0.065
$\frac{\Delta v}{V}$ (for NACA 64 meanline & corresponding to $C_{L_i} = 0.76$)	0.1365	0.1875	0.2595	0.2280	0.1590

   Calculate velocity distribution for 9% camber instead of 6% camber for which the $\frac{\Delta v}{V}$ values are given. The required lift coefficient, $C_L = 0.8$.

3. (a) A circle passes through $x = a = 1$ m and the center of the circle is located at $x_c = -0.2$ m and $y_c = 0.3$ m. The uniform free stream velocity is $U = 1.5$ m/s and is inclined at an angle, $\alpha = 10°$. **(20)**

   Calculate the velocity components u and v in the x and y direction at the position $x = 1.5$ m and $y = 1.2$ m for the circulation strength, $\Gamma = 0$ around the circle.

   (b) A circle passes through $x = a = 1$ m and the center of the circle is located at $x_c = -0.3$ m and $y_c = 0.4$ m. **(15)**

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Contd ... Q. No. 3(b)

The uniform free stream velocity is U = 1.5 m/s and is inclined at an angle, α = 10°.

If the rear stagnation point has moved to x = a = 1 m, calculate the circulation strength, Γ around the circle.

4. (a) Waite short notes on **(10)**

   (i) Bound vortex

   (ii) Horseshoe vortex.

   (b) Discuss Biot – Savart Law. Prove, **(25)**

$$\delta v = \frac{\Gamma}{4\pi R^2} . \sin\theta. \delta s$$

SECTION – B

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

5. (a) Write down the Kutta-Zhukovsky transformation for flow past a hydrofoil and explain its physical significance. **(15)**

   (b) Discuss the method of transformation of a circle into a cambered hydrofoil profile. **(20)**

6. (a) Explain what you mean by **(15)**

   (i) the thickness-chord ratio and

   (ii) the camber of a hydrofoil.

   (b) Describe an expression of the lift coefficient for a two-dimensional Zhukovsky hydrofoil section. **(20)**

7. (a) Derive the expressions for velocity and pressure distribution on the Zhukovsky hydrofoil. **(15)**

   (b) A thin hydrofoil 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 2% of the chord, calculate the lift coefficient at 3° incidence. **(20)**

8. (a) Discuss the relationship between spanwise loading and trailing vorticity for finite hydrofoil. **(15)**

   (b) A hydrofoil has span of 3 m and aspect ratio 6. For elliptic loading, the maximum circulation is 0.8 m²/s. If the flow velocity is 8 m/s, calculate the following: **(20)**

   (i) lift

   (ii) vortex induced drag

   (iii) lift coefficient

   (iv) vortex induced drag coefficient

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 . B. Sc. Engineering Examinations 2010-2011

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

SECTION – A

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

1. (a) Distinguish between the followings: **(15)**
    (i) Capital dredging and maintenance dredging
    (ii) Mechanical dredger and Hydraulic dredger
    (b) Classify mechanical dredgers.   **(10)**
    (c) Write a short note on 'Dustpan dredger'.   **(10)**

2. (a) Briefly describe the chemical method of pre-treatment of rock prior to dredging operation.   **(15)**
    (b) Define the 'output' of a dredger. Describe the methodology to estimate the output of a Trailing Suction Hopper Dredger (TSHD).   **(20)**

3. (a) Discuss the role of BIWTA to carry out dredging works related to the inland waterways of Bangladesh.   **(15)**
    (b) With a neat sketch discuss the components of minimum water depth of a navigation channel.   **(20)**

4. Write short notes on the followings: **(35)**
    (i) Basic drilling cycle
    (ii) Reduction factor related to the output of a dredger
    (iii) Two-way traffic navigation channel
    and (iv) Calendar time of a dredger

SECTION – B

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

5. (a) Discuss the method of operation of a Cutter Suction Dredger (CSD).   **(15)**
    (b) What are the main requirements of the cutting tooth of a CSD? Classify the cutting tooth with soil type.   **(10)**
    (c) Mention some important guidelines for cutterheads of hard soil, non-cohesive soil and cohesive soil.   **(10)**

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6. (a) What are the main advantages and disadvantages of a Trailing Suction Hopper Dredger (TSHD)? **(10)**

(b) With neat sketches distinguish between fixed and adjustable overflow systems in a Trailing Suction Hopper Dredger. **(10)**

(c) With neat sketches discuss various types of hopper loading system in a TSHD. **(15)**

7. (a) Discuss the spud systems in a Cutter Suction Dredger. **(20)**

(b) Describe how the hoisting power, soil type and dredging depth influence the production capacity of a grab dredger. **(15)**

8. (a) Why swell compensator is used in a Trailing Suction Hopper Dredger (TSHD)? Write components of a swell compensator system. **(10)**

(b) Discuss the following design criteria of a Cutter Suction Dredger: **(15)**
   (i) production capacity
   (ii) dredging depth and
   (iii) type of soil

(c) Define 'water capacity', 'SAE capacity' and 'CECE capacity' of a backhoe dredger bucket. **(10)**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1   B. Sc. Engineering Examinations 2010-2011

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

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**.

Necessary diagrams are enclosed.

1. (a) Differentiate between Deck Wetness and Slamming. Discuss how the effects of statical swell-up of water and dynamic swell-up of water at the bow are taken into account for the determination of the effective freeboard of a ship.   **(15)**

    (b) The following information is given for a 121.95 meter long ship: **(20)**

Encountering Frequency, ω_e [sec^{-1}]	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0
Spectral density for the relative bow motion, $S_s(w_e)$ m^2-sec]	0	0.4833	4.183	10.132	11.619	5.577	1.329	0.586	0.372

Find the frequency of deck wetness for the above ship with an effective freeboard of 2.231 metre.

2. Develop the equations of motions for surge, sway and yaw of a ship when it is underway in the sea with the rudder not working and hence develop the criteria for maintaining straight line stability.   **(35)**

3. (a) With a definition diagram, describe the three phases of turn of a ship. Determine the equations of motions at each phase and hence find the expression for steady turning radius.   **(17)**

    (b) Details of two ship designs are given below: **(18)**

	Ship A	Ship B
Length on waterline, L (m)	215	252.5
Beam, B (m)	24	26.75
Draught, T (m)	7.625	8.0
Area of rudder, A_R (m^2)		50

Design B achieved a tactical diameter of 4.3 ship length at 28 knots. Assuming that tactical diameter = constant $\times$ TL^3/(BA$_R$), calculate the rudder areas necessary to give tactical diameters of 3, 3.5 and 4.0 ship length in design A at the appropriate speed.

4. (a) What are the different ways for the determination of hydrodynamic derivatives associated with equations of motions relating to maneuvering of ships? **(10)**

(b) The directional stability derivatives for a surface ship 177 m long are: **(25)**

$$Y'_v = -0.0116 \qquad N'_r = -0.00166$$

$$N'_v = -0.00264 \qquad m' = 0.00798$$

$$Y'_r = -0.00298$$

Y'_v and N'_v without a 9.29 m^2 skeg were -0.0050 and 0 respectively. Show that the ship, with skeg, is stable. What increase in skeg area is necessary to increase the stability index by 20 percent?

SECTION – B

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

5. (a) Derive the expression for frequency of encounter when a vessel traveling at an angle μ from the advance of waves. From the derived expression also explain the followings: **(15)**

   (i) When the ship remains in the same position relative to the wave profile

   (ii) The ship overtakes the waves

   (iii) The waves approach the ship from the aft

(b) Derive the expression for group velocity of a wave in case of shallow water. **(10)**

(c) A 500 ft ship is proceding through a regular train of waves at an angle of 40 degree to the line of wave crests. The bow of the ship meets the successive waves every 15 sec and a wave crest takes 10 sec to pass from bow to stern. Find the speed of the ship. **(10)**

6. (a) Show that if the linear dimension of a ship and those of its geometrically similar model are in the ratio of λ (the scale factor), the natural heaving period is $\sqrt{\lambda}$ times that of the model. If a 16.8 ft long model of a ship (length 420 ft) has a heaving period of 1.362 sec, find the heaving period of the ship. **(15)**

(b) A ship has a displacement of 20,000 tons. Metacentric height 4 ft and the rolling period is 20 sec. Calculate the rolling period when a weight of 60 tons is removed from a position 40 ft directly above the C.G. It is assumed that $\overline{GM}_T$ remains unchanged and that the added mass moment of inertia for rolling is 20% of the mass moment of inertia of the ship. **(20)**

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7. A ship has the following particulars: **(35)**

        Length of the model L_m = 19.20 ft

        Maximum Beam B_m = 2.592 ft

        Draft T_m = 1.144 ft

        Longitudinal C.G. (LCG) = +0.48 ft (forward of amidship)

        Longitudinal C.B. (LCB) = +0.48 ft (forward of amidship)

        Model speed u_m = 4.788 ft/sec

        Displacement Δ_m = 2837.76 lb

Consider the wavelength is equal to ship-model length and direction of travel 180 degree. The model has also the following data:

St No.	B_n (ft)	T_n (ft)	S_n (ft^2)
0	0	1.144	0
5	2.592	1.144	2.944
10	2.592	1.144	2.944
15	2.592	1.144	2.752
20	0	1.144	0

Find the added mass for heaving in terms of model mass.

8. (a) Describe the steps for determining the ship motion in an irregular seaway. **(10)**

   (b) A ship has the following particulars: **(25)**

        L = 450 ft

        B = 70 ft

        C_{wp} = 0.80

        Δ = 12,500 tons

        ω_e = 1.18 rad/sec

        ρ = 1.199 lb-sec^2/ft^2

        Wave amplitude = 10 ft

The added mass for heaving is 80% of the actual mass of the ship. The co-efficient of damping is given in the non-dimensional form as

$$b\sqrt{\frac{gL}{\Delta}} = 1.70$$

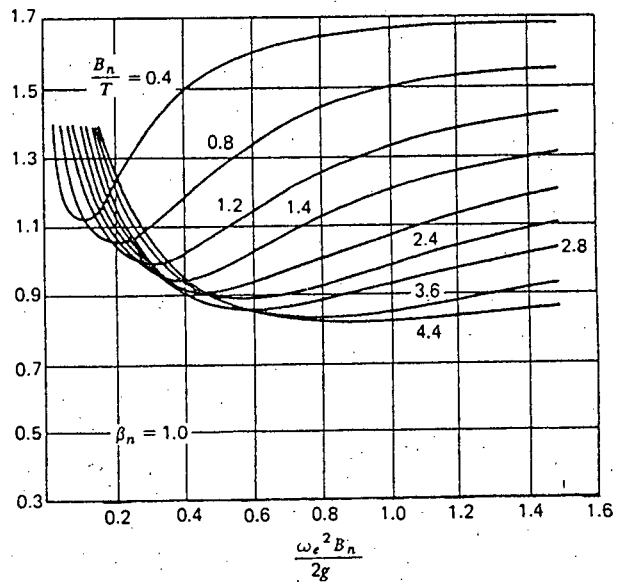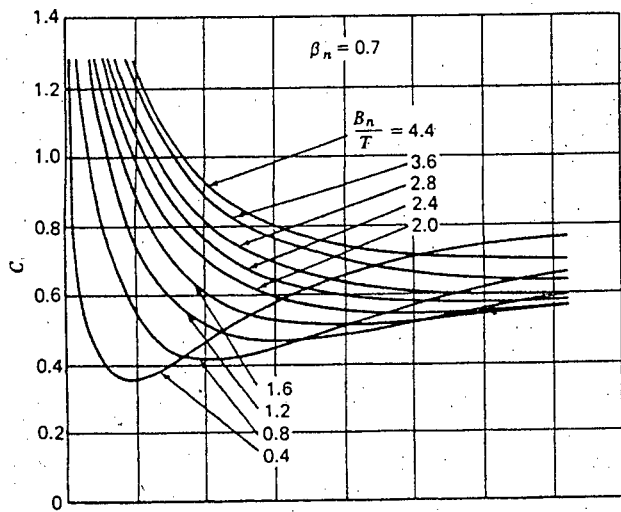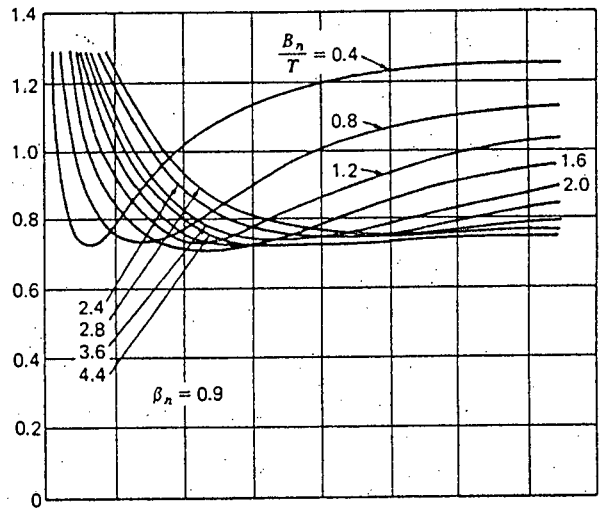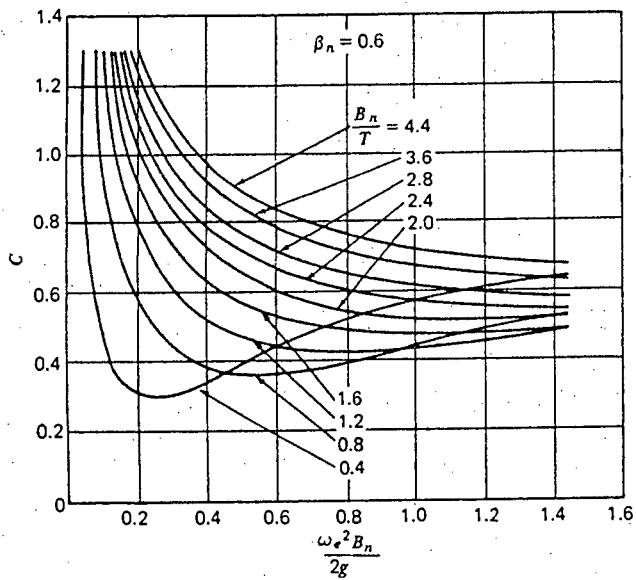The amplitude of exciting force for heaving motion is given non-dimensionally as

$$f_0 = \frac{F_0}{\rho g \zeta_a LB} = 0.17$$

Find the heaving amplitude of the ship.
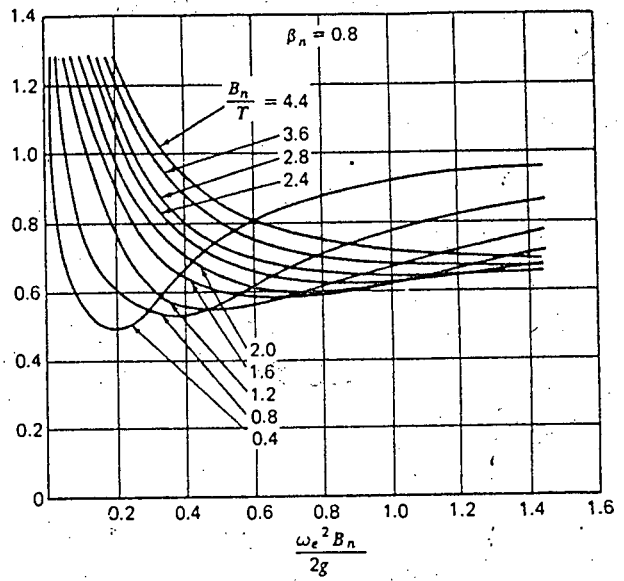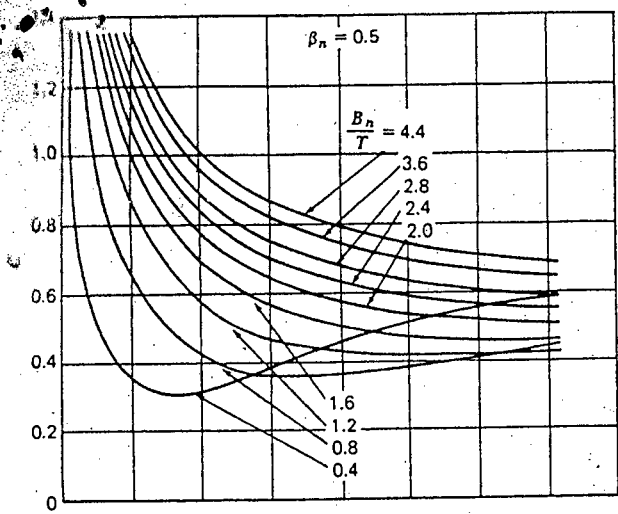
For Q. No. 7

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1   B. Sc. Engineering Examinations 2010-2011

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

Full Marks: 210   Time : 3 Hours

The figures in the margin indicate full marks.

Assume reasonable data if necessary.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) What do you mean by 'shear deflection'? Discuss the effect of shear deflection on hull frequency. **(10)**

    (b) Derive the following expression and explain its physical significance. **(25)**

    $$N_c = \frac{N_m}{\sqrt{(1+r_s)}}$$

    where the symbols have their usual significance.

2. (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) Explain what you mean by 'hydrodynamic inertia coefficient'. Compare the hydrodynamic inertia coefficients for a circular cylinder, an elliptic cylinder and a sphere. **(17)**

3. (a) A circular disc of mass moment of inertia I_p is attached to the lower end of an elastic vertical shaft. If the mass of the shaft is small, and the shaft has torsional stiffness K, derive the differential equation of motion for the free torsional vibration of the disc. What is its natural frequency? **(20)**

    (b) A shaft 10 mm in diameter and 2.0 m long connects a generator to the main engine. If the mass moment of inertia of the generator rotor is 0.55 Nmms², determine the natural frequency in torsion $\left[G = 8 \times 10^6 \, N/cm^2\right]$. **(15)**

4. (a) Derive an expression for the natural frequency of rocking motion of a marine engine. **(20)**

    (b) Derive the equation which relates maximum amplitude to maximum acceleration for different frequencies of vibration. Discuss the physical significance of this equation with particular reference to limits of acceptable vibration on passenger ships. **(15)**

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SECTION – B

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

5. (a) Write short notes on   **(20)**

    (i)   Natural vibration

    (ii) Forced vibration

    (iii) Modes of vibration and

    (iv) Importance of studying ship vibration.

    (b) Discuss the case in which a periodic disturbing force acts on a weight suspended on a spring.   **(15)**

6. (a) Discuss the purpose of vibration generator. Explain its principle of operation with figures.   **(20)**

    (b) Discuss Schlick formula and its defects. How can these defects be minimized?   **(15)**

7. (a) Explain the effects of propeller on ship hull vibration.   **(15)**

    (b) Determine the magnification factor of forced vibration produced by an oscillator, fixed at the middle of the beam at a speed of 600 rpm. The weight concentrated at the middle of the beam is $W = 5000\ N$ and produces a statical deflection of the beam equal to $\delta_{st} = 0.025$ cm. Neglect the weight of the beam and assume that the damping is equivalent to a force acting at the middle of the beam proportional to the velocity and equal to 500 N at a velocity of 2.5 cm/sec.   **(20)**

8. (a) Explain why the natural frequency of a machine on springs must be less than 0.7 of the forcing frequency.   **(20)**

    (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 coefficient of the damper.   **(15)**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1   B. Sc. Engineering Examinations 2010-2011

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

Full Marks: 210   Time : 3 Hours

The figures in the margin indicate full marks.

Assume reasonable data if necessary.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) Define monotonic and unimodal function with examples. State the optimality criteria for determining whether a given solution is optimal. **(13)**

    (b) Find the optimal points and saddle points of the following function: **(11)**

    $$f(x) = 5x^6 - 36x^5 + \frac{165}{2}x^4 - 60x^3 + 36$$

    (c) Find the global maximum optimal points of the function below: **(11)**

    $$f(x) = -x^3 + 3x^2 + 9x + 10 \qquad -2 \le x \le 4$$

2. (a) Derive the necessary and sufficient conditions for the following non linear programming problem (NLPP): **(17)**

    Maximize $\quad Z = f(X)$

    Subject to $\quad g(X) \le b$

    $\qquad\qquad X \ge 0, \qquad X = (x_1, x_2, x_3 \ldots x_n)$

    (b) Use the method of lagrangian multipliers to solve the non linear programming problem (NLPP). Does the solution maximize or minimize the objective function? **(18)**

    $$Z = 2x_1^2 + x_2^2 + 3x_3^2 + 10x_1 + 8x_2 + 6x_3 - 100$$

    Subject to

    $$x_1 + x_2 + x_3 = 20$$

    $$x_1, x_2, x_3 \ge 0$$

3. Solve the following function using Steepest accent method (up to six iteration) **(35)**

    Maximize $\quad f(x, y) = 4x + 6y - 2x^2 - 2xy - 2y^2$

    Starting point $(x, y) = (1, 1)$

4. Write short notes on the following (any two): **(2×17½)**

    (i)   SQP (Sequential Quadratic Programming)

    (ii) SUM\T (Sequential Unconstraint Minimization Technique)

    (iii) Simulate Annealing method.

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<u>SECTION – B</u>

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

Assume reasonable value of any missing data. Symbols have their usual meaning.

5. What is M-method of optimization? Solve the following problem using M-method: **(35)**

   Minimize $\quad Z = 4x_1 + x_2$

   Subject to $\quad 3x_1 + x_2 = 3$

   $\qquad\qquad 4x_1 + 3x_2 \geq 6$

   $\qquad\qquad x_1 + 2x_2 \leq 4$

   $\qquad\qquad x_1, x_2 \geq 0$

6. (a) What are the steps of Integer Programming Algorithm? **(10)**

   (b) Solve the following problem using Branch-and-Bound (B & B) Algorithm: **(25)**

   Maximize $\quad Z = 5x_1 + 4x_2$

   Subject to $\quad x_1 + x_2 \leq 5$

   $\qquad\qquad 10x_1 + 6x_2 \leq 45$

   $\qquad\qquad x_1, x_2 \geq 0$ and integer.

7. Solve the following problem using Cutting-Plane Algorithm: **(35)**

   Maximize $\quad Z = 7x_1 + 10x_2$

   Subject to $\quad -x_1 + 3x_2 \leq 6$

   $\qquad\qquad 7x_1 + x_2 \leq 35$

   $\qquad\qquad x_1, x_2 \geq 0$ and integer.

8. Using Simplex Algorithm, solve the following problem: **(35)**

   Maximize $\quad Z = 5x_1 + 4x_2$

   Subject to $\quad 6x_1 + 4x_2 \leq 24$

   $\qquad\qquad x_1 + 2x_2 \leq 6$

   $\qquad\qquad -x_1 + x_2 \leq 1$

   $\qquad\qquad x_2 \leq 2$

   $\qquad\qquad x_1, x_2 \geq 0$

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1   B. Sc. Engineering Examinations 2010-2011

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

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) Compare different types of production systems based on their characteristics and advantages. **(12)**

    (b) Describe different types of priority rules used for scheduling a specific number of jobs on one machine. **(8)**

    (c) Schedule the following five jobs through two machines in sequence to minimize the flow time using Johnson's rule. **(15)**

Job	Operations time	
	Machine 1	Machine 2
A	6	3
B	0	4
C	5	2
D	8	6
E	2	1

2. (a) The following matrix contains the costs (in dollars) associated with assigning jobs A, B, C, D and E to machine 1, 2, 3, 4 and 5. Assign jobs to machines to minimize costs. **(15)**

Machines	1	2	3	4	5
Jobs					
A	6	11	12	3	10
B	5	12	10	7	9
C	7	14	13	8	12
D	4	15	16	7	9
E	5	13	17	11	12

    (b) Write down the elements of a good forecast. **(8)**

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(c) Historical demand for a product is: **(12)**

Period	Actual demand
January	12
February	11
March	15
April	12
May	16
June	15

(i) Using a weighted moving average with weights of 0.6, 0.3 and 0.1, find the July forecast.

(ii) Using exponential smoothing with $\alpha = 0.2$ and a June forecast= 13, find the July forecast.

3. (a) What do you understand by Quantity discount inventory model?   **(8)**

(b) Items purchased from a vendor cost $20 each, and the forecast for next year's demand is 1000 units. If it costs $5 every time an order is placed for more units and a storage cost is $4 per unit per year, what quantity should be ordered each time? Calculate the expected time between orders and the total annual inventory cost.   **(12)**

(c) The following tasks must be performed on an assembly line in the sequence and times specified: **(15)**

Task	Task time (seconds)	Task that must precede
A	50	-
B	40	-
C	20	A
D	45	C
E	20	C
F	25	D
G	10	E
H	35	B,F,G

(i) Draw the precedence diagram.

(ii) What is the theoretical minimum numbr of stations required to meet a forecasted demand of 400 units per 8-hour day?

(iii) Use the longest task time rule and balance the line in the minimum number of stations to produce 400 units per day.

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4. (a) Puck and Pawn Company manufactures hockey sticks and chess sets. Each hockey stick yields a profit of $2 and chess set $4. A hockey stick requires four hours of processing at machining center A and two hours processing on machining center B. A chess set requires six hours at machine center A, six hour at machining center B and one hour machining center C. Machining center A has maximum capacity of 120 hours per month, machining center B has 72 hours and machining center C has 10 hours. If the company wishes to maximize profit, how many hockey sticks and chess sets should be produced per month? **(15)**

(b) Define different phases of a project life cycle. **(8)**

(c) A project has been defined to contain the following list of activities, along with their required times for completion. **(12)**

Activity	Time (days)	Immediate Predecessors
A	4	-
B	3	A
C	2	A
D	5	B
E	1	B, C
F	3	C
G	4	E, F
H	4	D, E
I	6	G, H

(i) Draw the network diagram.

(ii) Show the early start and early finish times for each activity.

(iii) Show the critical path and calculate the project completion time.

SECTION – B

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

5. (a) Define management and manager. What are the different categories of manager? Discuss different skills that manager must have and the roles they can fill. **(20)**

(b) Describe Fayol's 14 principles of management. **(15)**

6. (a) What is motivation? How does reinforcement theory explain motivation? How behavior can be modified according to this theory? **(15)**

(b) What basic assumptions underlie the Fielder model? What is the LPC scale? What are the basic elements in the work situation that determine which leadership style will be effective? In what situation is a high LPC or low LPC leader effective? **(20)**

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7. (a) Describe the stages of team development.   **(10)**

    (b) Distinguish power and authority. List and explain five sources of power.   **(10)**

    (c) What are the advantages and disadvantages of functional and product organization?   **(10)**

    (d) Why it is important to choose an appropriate span of management for organization?   **(5)**

8. (a) Heritage Corporation sells only one product with a selling price of $200 and a variable cost of $80 per unit. The company's monthly fixed expense is $60,000. The corporation would like to achieve a profit of $30,000 per month. Determine the units to be sold and sales dollars necessary to achieve the target profit?   **(10)**

    (b) The Skyler Company has provided the following information for last year   **(15)**

Raw materials inventory, January 1	$20,000
Work in process inventory, January 1	40,000
Finished goods inventory, January 1	70,000
Direct labor incurred	110,000
Raw material purchased	80,000
Finished goods inventory, December 31	30,000
Raw materials inventory, December 31	10,000
Rent expense, factory	50,000
Indirect labor expense	20,000
Depreciation expense, factory	10,000
Utilities expense, factory	10,000
Work in process inventory, December 31	60,000

Using these data prepare a cost of goods manufactured schedule.

(c) Briefly describe different types of maintenance policies.   **(10)**