

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

1. (a) What are the dynamic effects associated with ship motion and what are the main investigations needed to assess the dynamic effects? (10)

- (b) The following values are given for a ship: (25)

$$L = 450 \text{ ft} = (\text{ship length})$$

$$L_w = 420 \text{ ft} = (\text{wave length})$$

$$\mu = 180^\circ \text{ (i.e. head sea)}$$

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

$$h_w = 20 \text{ ft} = (\text{wave height})$$

$$\text{Loaded draught, } T = 25 \text{ ft}$$

$$\text{Free board, } F = 18 \text{ ft}$$

$$\text{Ship speed } V_s = 20 \text{ Knot}$$

$$\text{Also given: Heave amplitude, } Z_a = 5 \text{ ft}$$

$$\text{Pitch amplitude, } \theta_a = 0.15 \text{ radian.}$$

$$\text{Heave phase angle, } \epsilon_z = -40^\circ$$

$$\text{and pitch phase angle, } \epsilon_\theta = 15^\circ$$

The water elevation at the bow is given by  $\zeta_b = \zeta_a \cos(\kappa_e \xi - \omega_e t)$  where  $\kappa_e$  is effective wave number.

Determine the relative vertical motion of the bow and hence find the times when forefoot will emerge and times when bow immersion will take place in the time range  $t = 0$  to  $\pi/\omega_e$  considering an interval  $\pi/4\omega_e$ .

2. By means of a suitable sketch, explain the co-ordinate system and develop the equations of motion for surge, sway and yaw of a ship with the rudder not working and hence develop the criteria for maintaining straight line stability. (35)
3. (a) Identify the eight linear hydrodynamic derivatives that arise in the study of maneuverability and discuss their relative magnitudes with sketches of relationships and justification of signs. (20)

**NAME 419/NAME**

**Contd... Q. No. 3**

(b) For a ship of  $L = 110$  m,  $B = 18$  m,  $T = 4.1$  m,  $C_B = 0.68$ , the hydrodynamic and rudder derivatives are as follows:

(15)

$$\begin{aligned} Y'_v &= -9.65 \times 10^{-3}; & Y'_r &= 2.14 \times 10^{-3}; \\ N'_v &= -2.57 \times 10^{-3}; & N'_r &= -1.44 \times 10^{-3}; \\ Y'_\delta &= -1.0 \times 10^{-3}; & N'_\delta &= 0.5 \times 10^{-3}; \end{aligned}$$

Find its turning radius and drift angle for 16 Knots at 35 degree rudder angle. Symbols have usual meanings.

4. (a) Give a description of the Dieudonne' Spiral Maneuver with suitable sketches. Show that the behavior of a ship unstable in straight-line motion is exactly analogous to the behavior of a ship which is transversely unstable.

(23)

(b) Draw a schematic diagram of ZigZag maneuver and define all the parameters associated with it.

(12)

**SECTION - B**

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

The symbols have their usual meaning. Assume reasonable value for any missing data.

5. (a) What is group velocity? Prove that the paths of water particles are circular in deep water and elliptical in shallow water.

(17)

(b) Suppose, from towing tank experiment, you have got pitch motion result for a container ship in regular wave. Select the steps for determining the motion of the same ship in irregular seaway.

(13)

(c) Explain what you mean by a 'fully developed sea'.

(5)

6. (a) The dimensions of a pontoon which has a uniform rectangular cross-section are given below:

(18)

$$L = 100 \text{ m, } B = 18 \text{ m, } T = 4 \text{ m, } KG = 5 \text{ m, } BM_T = 6.75 \text{ m, } BM_L = 208 \text{ m}$$

To determine the added masses, assuming that the sectional added mass can be estimated as  $\frac{\rho \pi B^2}{8}$ . For estimating rigid body moment of inertia, consider the transverse and longitudinal radii of gyration  $0.4 B$  and  $0.25 L$  respectively. Neglecting roll and pitch added moment of inertia, estimate the natural heave, roll and pitch period of the pontoon.

Contd ..... P/3

**NAME 419/NAME**

**Contd... Q. No. 6**

(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? (17)

7. (a) A ship model has the following particulars: (20)

$L = 19.50$  ft,  $B = 2.60$  ft,  $T = 1.44$  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  $\bar{A}$  at different stations are as follows:

Station No.	$B_n$ (ft)	$T_n$ (ft)	$C$	$\bar{A}$
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  $\alpha = 180^\circ$  and  $\rho = 1.94$  lb-sec<sup>2</sup>/ft<sup>4</sup>, calculate

- (i) the value of inertia co-efficient,  $a$
- (ii) the damping co-efficient  $b$ , and
- (iii) restoring force co-efficient  $c$

while the ship model is heaving in calm water.

(b) From a wave record, the following statical information is found: (15)

Wave-height intervals (m)	Average wave height (m)	Number of occurrences
0.25 - 0.75	0.50	15
0.75 - 1.25	1.00	30
1.25 - 1.75	1.50	54
1.75 - 2.25	2.00	22
2.25 - 2.75	2.50	15
2.75 - 3.25	3.00	09
3.25 - 3.75	3.50	04
3.75 - 4.25	4.00	01

Find the average height,  $\frac{1}{3}$ rd, and  $\frac{1}{10}$ th significant wave heights from the above data.

NAME 419/NAME

8. (a) For a ship speed of 20 Knots in head waves, the heave RAO's are as follows:

(25)

$\omega_e$	$\leq 0.4$	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.6	2.0
RAO	1.0	1.05	1.20	1.80	1.60	1.30	0.9	0.4	0.1	0.01

The energy spectrum of a wave is as follows:

$\omega$	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
$S_w(\omega)$	0.0	1.0	4.0	12.0	20.0	16.0	10.0	2.0	1.0	0.1

Find the heave response spectrum and the  $\frac{1}{3}$ rd significant heave height.

(b) A 500 ft long ship is proceeding through a regular train of waves at an angle of  $40^\circ$  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 in Knots.

(10)

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**SECTION – A**

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

The symbols have their usual meaning

1. (a) With the help of Bernoulli's theorem explain the nature of pressure distribution around a hydrofoil section. Discuss the effect of angle of attack of the hydrofoil section to lift force. (9)
- (b) With figure illustrate the notation for hydrofoil section geometry. (6)
- (c) Combining NACA meanline  $a = 0.8$  and NACA 65A010 Basic thickness form (data provided in table below) draw the hydrofoil section on graph paper. (20)

$x$ (% chord from L.E.)	$y$ (= $t(x)/2$ ) (% chord)	$Y_c$ (= $f(x)$ ) (% chord)	$\frac{dY_c}{dx}$
10	3.040	3.043	0.2105
30	4.742	5.863	0.0878
50	4.863	6.790	0.062
70	3.432	6.037	-0.0879
90	1.188	2.435	-0.2558

2. A hydrofoil section comprises NACA  $a = 0.8$  and NACA 66 (modified) thickness form. The relevant velocity data is provided below: (35)

% Chord (from L.E.)	5	10	30	50	80
$v/V$ [for NACA 66 (mod.) thickness form]	1.071	1.093	1.121	1.127	1.023
$\Delta v_a/V$ [for incidence corresponding to $C_L = 1.0$ & NACA 66 (mod.) thickness]	0.679	0.478	0.249	0.161	0.071
$\Delta v/V$ (for NACA $a = 0.8$ meanline & corresponding to $C_L = 1.0$ )	0.278	0.278	0.278	0.278	0.278

- (i) Calculate pressure distribution for 5% camber instead of 6.79% camber for which the  $\frac{\Delta v}{V}$  values are given. The required lift coefficient,  $C_L = 0.85$ .
- (ii) Draw the pressure distribution curve.
- (iii) Locate the position of minimum pressure and what is the value of minimum pressure?

**NAME 413**

3. (a) A circle passes through  $x = a = 1$  m and the center of the circle is located at  $x_c = -0.25$  m and  $y_c = 0.35$  m. The uniform free stream velocity is  $U = 2$  m/s and is inclined at an angle  $\alpha = 8^\circ$ . (18)

Calculate the velocity components  $u$  and  $v$  in the  $x$  and  $y$  direction at the position  $x = 2$  m and  $y = 2$  m for circulation strength zero 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. The uniform free stream velocity is  $U = 2$  m/s and is inclined at an angle  $\alpha = 10^\circ$ . (17)

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

4. (a) Mention and discuss the four fundamental theorems of vortex motion in an inviscid flow named after HELMHOLTZ. (15)

- (b) As a special case of the Biot-Savart Law, for a linear vortex of finite length, prove the following relation with figure, (20)

$$v = \frac{\Gamma}{4\pi h} (\cos \alpha + \cos \beta)$$

If the linear vortex is of semi-infinite length, prove with figure,

$$v = \frac{\Gamma}{4\pi h} (\cos \alpha + 1) \text{ and } v = \frac{\Gamma}{4\pi h}$$

Also if the linear vortex is of infinite length, prove with figure

$$v = \frac{\Gamma}{2\pi h}$$

**SECTION - B**

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

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

5. (a) Describe the procedure for transformation of a circle into a cambered hydrofoil. Hence, discuss on the thickness-chord ratio and camber. (20)

- (b) A hydrofoil has span of 3.5 m and aspect ratio 6.0. For elliptic loading the maximum circulation is  $0.85 \text{ m}^2/\text{s}$ . Calculate lift, vortex induced drag, lift coefficient and vortex induced drag coefficient considering flow velocity of 8.6 m/s. (15)

**NAME 413**

6. (a) Describe the thin aerofoil theory and hence prove that  $U \left[ \frac{dy}{dx} - \alpha \right] = \frac{1}{2\pi} \int_0^c \frac{rdx}{x-x_1}$ . (20)

(b) Derive the expression of downwash for a finite span hydrofoil with a simple symmetric loading. (15)

7. Prove that the lift coefficient of a thin hydrofoil section can be expressed as (35)

$$C_L = 2\pi [A_0 + A_1/2].$$

8. Establish relationship between spanwise loading and trailing vorticity of a finite hydrofoil. Hence derive the expression of vortex induced drag. (35)

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BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2013-2014

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

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) Define a 'Dredger'. (10)  
What is the difference between a hydraulic dredger and a mechanical dredger?  
(b) Discuss the various extraction methods used in dredging processes. (15)  
(c) Explain the need for dredging in Bangladesh. (10)
2. (a) Explain the advantages of using spud carriage in place of fixed spud in a cutter suction dredger (CSD). (15)  
(b) Discuss the guidelines for cutterheads to be used in (i) non-cohesive soil and (ii) cohesive soil. (10)  
(c) List the functions of different winch systems used in a CSD. (10)
3. (a) What are the advantages and disadvantages of a grab hopper dredger? (10)  
(b) Discuss the hydraulic transport of dredged material with the help of pressure vs. pipeline velocity diagram. (15)  
(c) Explain the graphical method of estimating optimum overflow duration in a trailing suction hopper dredger (TSHD). (10)
4. (a) Describe the working method of a bucket dredger. (10)  
(b) Define 'performance of a dredging plant'. Briefly discuss the factors which influence the performance of a CSD. (15)  
(c) Write short notes on the followings: (10)  
(i) Floating pipelines and (ii) Hopper barges.

Contd ..... P/2



**NAME 475**

**SECTION - B**

There are **FOUR** questions in this section. Answer **Q. No. 7** and any **TWO** from the rest.

5. (a) List the advantages and disadvantages of Trailing Suction Hopper Dredger (TSHD). (10)  
(b) Draw the schematic diagram of a Trailing Suction Hopper Dredger (TSHD) showing its main features. (10)  
(c) Describe the production cycle of a Trailing Suction Hopper Dredger (TSHD). (15)
6. (a) For designing a dredging work, how would you determine the minimum width of a bend navigational channel? (15)  
(b) In Tabular form, describe various systems of hopper discharge for Trailing Suction Hopper Dredger (TSHD). (10)  
(c) Write short notes on Dustpan Dredger (DD). (10)
7. Suppose the characteristics of the site to be dredged have been identified and the possible dredger has been selected, then describe in details about the estimation of the output of the dredger. (35)
8. Write notes on: (35)  
(a) Jet pump dredger  
(b) Air lift dredger  
(c) Pneumatic dredger  
(d) Amphibian Dredger

**SECTION – A**

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

1. (a) Determine the natural frequency of the system shown in Figure for Q. No. 1(a). Assume the pulleys to be frictionless and of negligible mass. (15)
- (b) Define compound pendulum. Find the natural frequency of such a system. What is center of percussion? Discuss its use. (20)
2. (a) Derive the response of free vibration of a single degree of freedom system having viscous damping. Explain under damped, critically damped and over damped systems. (20)
- (b) A viscously damped system has a stiffness of 5000 N/m, critical damping constant of 0.2 N-s/mm, and a logarithmic decrement of 2.0. If the system is given an initial velocity of 1 m/s, determine the maximum displacement of the system. (15)
3. (a) Derive the response of a damped system under the harmonic motion of the base. What are displacement transmissibility, force transmissibility and relative motion? (20)
- (b) Find the total response of a viscously damped single degree of freedom system subjected to harmonic base excitation for the following data: (15)
 

$m = 10 \text{ kg}$ ,  $c = 20 \text{ N-s/m}$ ,  $k = 4000 \text{ N/m}$ ,  $y(t) = 0.05 \sin 5t \text{ m}$ ,  $x_0 = 0.02 \text{ m}$  and  $\dot{x}_0 = 10 \text{ m/s}$ .
4. (a) Find the natural frequencies of longitudinal vibration of the unconstrained stepped shaft of areas  $2A$  and  $A$ , and of equal lengths  $L$ , as shown in Figure for Q. No. 4(a). Use consistent mass matrix. Discuss on mode shapes. (20)
- (b) Find the frequencies of the same stepped shaft if the left end is constrained (fixed). (15)

NAME 451

SECTION - B

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

5. (a) Deduce Euler critical load of a strut whose one end is fixed and the other end is free. (20)  
(b) A horizontal strut 2.5 m long is constructed from rectangular section steel, 50 mm wide by 100 mm deep, and mounted with pinned ends. The strut carries an axial load of 120 kN together with a 15 kN concentrated lateral load along its mid position. If  $E = 210$  GPa, determine maximum deflection and maximum stress setup in the strut. (15)
6. (a) Derive the expression of maximum stress of a strut using Perry-Robertson method. Also make necessary assumptions regarding this. (20)  
(b) Explain Inglis theory of stress from view point of elliptical hole cut in a plate. (15)
7. (a) How will you explain a crack in a structure by fracture mechanics? (15)  
(b) Derive Dunkerley's approximate values of a fundamental frequency of a composite system. (20)
8. (a) Describe different modes that a crack in a solid can be stressed. (15)  
(b) Estimate the fundamental frequency of the lateral vibration of a shaft carrying three rotors as shown in Figure 8(b). (20)  
Take  $m_1 = 20$  kg,  $l_1 = 1$  m  
 $m_2 = 50$  kg,  $l_2 = 2$  m  
 $m_3 = 40$  kg,  $l_3 = 3$  m  
 $l_4 = 4$  m.
- (b) The shaft is made of steel with a solid circular cross-section of diameter 10 cm and moment of inertia is  $4.9 \times 10^{-6} \text{ m}^4$  [  $E = 207$  GPa].

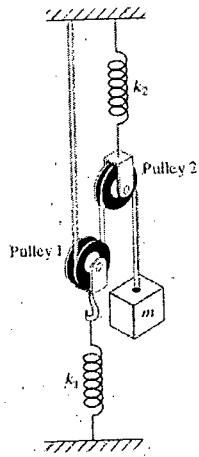


Figure for Q. No. 1(a)

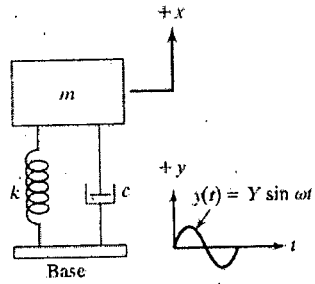


Figure for Q. No. 3(a)

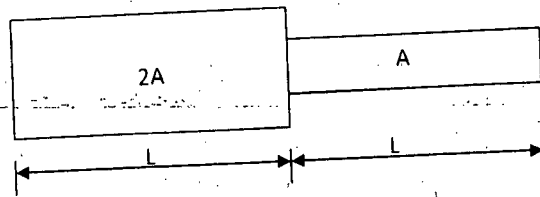


Figure for Q. No. 4(a)

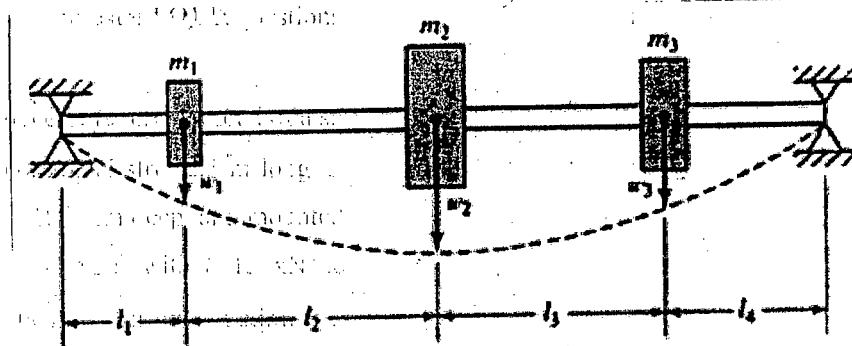


Figure for Question no. 8(b).

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

1. (a) State three properties of the standard form of the primal problem. Write down the associated dual of the following primal problem: (15)

$$\text{Maximize } Z = x_1 + 5x_2 + 3x_3$$

$$\text{Subject to } x_1 + 2x_2 + 3x_3 = 3$$

$$2x_1 - x_2 = 4$$

$$x_1, x_2, x_3 \geq 0$$

- (b) Solve the following problem by the dual simplex algorithm. (20)

$$\text{Maximize } Z = 2x_1 + 3x_2$$

$$\text{Subject to } 2x_1 + 2x_2 \leq 30$$

$$x_1 + 2x_2 \geq 10$$

$$x_1, x_2 \geq 0$$

2. (a) Derive an expression for the constrained gradient vector of  $f$  with respect to  $z$ . (15)

- (b) Solve the problem by the Jaconian Method (20)

$$\text{Maximize } Z = 2x_1 + 3x_2$$

$$\text{Subject to } x_1 + x_2 + x_3 = 5$$

$$x_1 - x_2 + x_4 = 3$$

$$x_1, x_2, x_3, x_4 \geq 0$$

3. (a) Solve the non-linear programming problem by the Lagrangean method. (20)

$$\text{Optimize } Z = x_1^2 + x_2^2 + x_3^2$$

$$\text{Subject to } x_1 + x_2 + 3x_3 = 2$$

$$5x_1 + 2x_2 + x_3 = 5$$

$$x_1, x_2, x_3 \geq 0$$

- (b) Consider the problem (15)

$$\text{Maximize } z = f(x)$$

$$\text{Subject to } g(x) \leq 0$$

Show that the Kuhn - Tucker conditions are

$$\lambda_i \geq 0$$

$$\nabla f(x) - \lambda_i \nabla g_i(x) = 0$$

$$\lambda_i g_i(x) = 0$$

$$g_i(x) \leq 0$$

**NAME 477/NAME**

4. (a) Consider the problem

(15)

$$\text{Maximize } z = f(x) : a < x \leq L$$

Show that the two successive trial points  $x_k$  and  $x_{k+1}$  approximately equal in Steepest ascent method if

$$r^k \nabla f(x_k) \approx 0$$

where the symbols have the usual significance.

(b) Solve the problem by sequential Quadratic Programming method (SQP)

(20)

$$\text{Maximize } Z = 4x_1 + 6x_2 - 2x_1^2 - 2x_1x_2 - 2x_2^2$$

$$\text{Subject to } x_1 + 2x_2 \leq 2$$

$$x_1, x_2, \geq 0$$

**SECTION - B**

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

The questions are of equal value.

5. Maximize the function by Genetic Algorithm Method  $f(x) = x^2$  where  $x$  is permitted to vary between 0 to 31.

6. What is PSO? Describe with examples. Describe the steps you would take the computational implementation of PSO in solving the following unconstrained maximization problem.

$$\text{Maximize } f(x)$$

$$\text{with } X^{(l)} \leq x \leq X^{(u)}$$

Where  $X^{(l)}$  and  $X^{(u)}$  denote the lower and upper bounds on  $X$ , respectively.

7. Describe with figures the theoretical explanation and practical interpretation of special cases that arise in the application of Simplex Method.

8. Minimize  $Z = 4x_1 + x_2$

$$\text{Subject to } 3x_1 + 2x_2 = 3$$

$$4x_1 + 3x_2 \leq 6$$

$$x_1 + 2x_2 \leq 4$$

$$x_1, x_2 \geq 0$$

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

1. (a) Explain why demand forecasting is one of the most important issue for any business organization. Define different types of demand. (7+4=11)
- (b) For product B, forecast including trend for the month of July was 880 units including trend effect of 25 units. But actual demand turned out to be 845 units. Determine the forecast including trend for the month of August. The values of  $\alpha$  and  $\delta$  are .90 and .20 respectively. (9)
- (c) Sales data of different quarters for years 2012 to 2014 for are given below: (15)

Year 2012	Sales	Year 2013	Sales	Year 2014	Sales
1 <sup>st</sup> Quarter	550	1 <sup>st</sup> Quarter	1630	1 <sup>st</sup> Quarter	2320
2 <sup>nd</sup> Quarter	1220	2 <sup>nd</sup> Quarter	1860	2 <sup>nd</sup> Quarter	2450
3 <sup>rd</sup> Quarter	1260	3 <sup>rd</sup> Quarter	1820	3 <sup>rd</sup> Quarter	2550
4 <sup>th</sup> Quarter	1750	4 <sup>th</sup> Quarter	2220	4 <sup>th</sup> Quarter	2860

Forecast sales for each quarter of 2015 using least square method of linear regression.

2. (a) Differentiate fixed order and fixed time period inventory models. (5)
- (b) Determine the economic order quantity and re-order point for the following information: (20)
- Weekly demand for 7 consecutive weeks = 10400, 11500, 11900, 12300, 12800, 13300, 13800; Lead time = 14 days; Ordering cost = Tk. 500 for 5 orders; Holding cost = 1% of the purchase price per quarter; Purchase price = Tk. 50 if order size is between 0 to 1000 units; Tk. 40 if order size is between 1001 to 2000 units; Tk. 30 if order size is more than 2000 units.
- (c) Discuss factor rating system in selecting location. (10)
3. (a) Mention the objectives of job shop scheduling. (5)
- (b) A company has four manufacturing plants (MPs) and 2 distribution centers (DCs). The company wants to build a central warehouse. Products produced in MPs will be stored in the warehouse and then will be delivered to the DCs. The existing locations of the MPs and DCs and the amount that will be transferred between MPs and DCs with the warehouse are given below: (16)

**IPE 479**

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

Facility	X Co-ordinate	Y Co-ordinate	Amount (Truck Load)
MP 1	340	100	230
MP 2	450	240	340
MP 3	590	500	560
MP 4	620	300	400
DC 1	230	340	670
DC 2	500	240	460

Determine the location of the warehouse.

(c) Determine the sequence of jobs, total time required to complete all jobs in both machines, and idle time of machine 2 for the following information. (14)

Jobs	Processing Time on Machine 1 (weeks)	Processing Time on Machine 2 (weeks)
A	8	4
B	10	13
C	6	5
D	2	9
E	11	12
F	3	12
G	6	14
H	15	9
I	14	17

4. (a) A company manufactures different types of toys for kids. Which type of structure would be beneficial for this organization to handle projects and why? (12)

(b) Determine the critical path, slack times and the probability to complete the project in 70 weeks for the following information: (23)

Activities	Predecessor Activities	a (weeks)	m (weeks)	b (weeks)
A	None	5	8	10
B	A	9	11	14
C	A	10	1	14
D	B, C	6	9	12
E	D	5	7	9
F	A	34	37	40
G	E, F	5	7	10
H	E, F	3	5	7
I	G	8	10	12
J	H	6	8	10
K	I, J	6	9	12
L	K	4	6	8



**IPE 479**

**SECTION-B**

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

5. (a) Define managerial and organizational performance. Discuss the management process. (4+12=16)  
(b) Explain the challenges of modern management. (12)  
(c) Differentiate efficiency and effectiveness with examples. (7)
6. (a) Mention the contribution and limitations of scientific management theory. (8)  
(b) Describe Henry Fayol's 14 principles of management. (17)  
(c) What is bureaucratic management system? Why bureaucratic system failed in the twentieth century? (10)
7. (a) Explain the significance of the span of management in organizational design. (7)  
(b) Describe the equity theory of motivation. (16)  
(c) Briefly discuss the two factor theory of motivation. (12)
8. (a) Define departmentalization. Why coordination is important in managing an organization? (4+6=10)  
(b) A company is considering replacing an old machine. They are considering purchasing a new CNC machine. The related financial data is given below: (25)  
Purchase Cost= 35 lacs, Installation cost = 4 lacs, Increase in profit = 5 lacs in year 1; 7 lacs from year 2 to 8; 9 lacs from year 9 to 15; 6 lacs from year 16 to 20. Annual Maintenance cost = 0.75 lac. Repair cost at 10<sup>th</sup> year = 5 lacs. Salvage value = 8 lacs. Required rate of return =10%.  
Decide whether the company should purchase the new machine:



**SECTION-A**

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

1. (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) How butt welding is carried out considering the length of the seam? (10)
- (c) What are the major difficulties observed while performing cast iron welding in case of machinery parts and installations of a ship? (5)
2. (a) Why galvanic coatings are used in slip repairing? Discuss the following galvanic coating processes mentioning their advantages, disadvantages and applications: (20)
  - i) Chromium plating
  - ii) Zinc galvanizing
  - iii) Steel plating
  - iv) Tin plating
- (b) Briefly describe the thermal, mechanical and thermo mechanical methods of straightening shafts and shaft-like components in a ship. (15)
3. (a) Describe the principal forms of wear and damage found in various pumps of a ship. How can we repair these? (15)
- (b) How the assessment of amount of repair work is done by inspection? (12)
- (c) Write short notes on – (8)
  - i) Wet sand blasting
  - ii) Electrolytic cleaning
4. (a) A naval vessel has a propeller having cracks, crumbled edges and fractured blades. Is it possible to repair that propeller? If possible, how? (12)
- (b) Why balancing of propellers are required? What types of balancing are done in propeller and why? (8)
- (c) If a propeller has  $L/D = 2.5$  and peripheral velocity is  $14 \text{ ms}^{-1}$ , which method of balancing is used? Describe the method schematically. (15)

NAME 415

SECTION-B

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

5. (a) Describe the methods of determining the magnitude of wear in ship's machine parts. (17)
- (b) Describe the ways of physical and technological inspection to find the defects in various parts of ship-hull and machineries. What are the defects that may arise from casting, forging and rolling? (18)
6. (a) Describe how the following repair works are done: (15)
- i) repair of shell plating in the presence of cracks.
  - ii) Straightening of dented plates.
  - iii) replacement and straightening of double-bottom framing and of boiler foundations.
- (b) Describe how the machining of shafts and repairing threads on tail shafts are carried out. Describe also how tail shafts are protected from corrosion. (20)
7. A ship owner is seeking for a schedule repair works in mid of April at a dry dock having the following particulars of a ship: (35)
- LOA = 110 m
  - LPP = 105 m
  - DWT = 4645 tonne
  - Draft = 4.90 m
  - Wetted surface area = 12,592 m<sup>2</sup>
- Calculate:
- i) Man-hours required for berth preparation.
  - ii) Man-hour required for dock services if the ship stays for 15 days.
  - iii) The weight of required zinc anode and required man-hours to cut off and replace zinc anode. Current density of material is 20 mA/m<sup>2</sup>. Design life is 3 years and capacity of materials is 781 amp-hours/kg.
  - iv) Man-hours required for fender works of 300 mm dia.
  - v) Man-hours required for fractured propeller work having diameter 3.90 m of Aluminum Bronze and shaft dia 140 mm.
8. (a) Describe (with necessary figures) the dismantling work of the shafting of an engine. (27)
- (b) How are the repair works of stem and adjoining shell plates containing cracks and deformations are carried out? (8)