L-4/T-1/NAME **Date: 17/02/2018**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2016-2017

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

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 are the dynamic conditions to be investigated in the study of slamming? **(15)**

(b) Define threshold velocity. Deduce the non dimensional threshold velocity expression and hence show that it is a function of Ship's Froude No. **(10)**

(c) A ship has the following particulars: **(10)**

Length of the ship, L = 167.70 m

Threshold velocity, V_0 = 3.84 m/s

Draft at a particular station, T = 5.21 m

Speed of the ship, V_S' = 10 knots

2 m_{os} = 56.28 m^2

2 $m_{\dot{o}s}$ = 28.35 m^2/s

The sea state value is a severe 7, and the wind velocity is 41 knots. Assume significant wave height is 10.67 m. Predict the number of slams for this ship during a 30 minute operation.

2. (a) Mention the different steps for the determination of ship motion in an irregular seaway. **(20)**

(b) The rolling amplitude (double, peak to peak) of a ship in an irregular seaway were measured and shown in below: **(15)**

Double amplitude of rolling angle (deg)	Number of Occurrence	Double amplitude of rolling angle (deg)	Number of Occurrence
1	1	11	5
2	4	12	2
3	7	13	4
4	10	14	3
5	13	15	1
6	8	16	0
7	12	17	2
8	10	18	2
9	8	19	0
10	7	20	1

Find the average, significant, average of one-tenth highest, and average of one-hundredth highest rolling motions.

Contd P/2

NAME 419

3. (a) Using the ITTC formulation, plot a wave spectrum for a wind speed of 32 knots. The significant wave height $H_{1/3}$ at wind speed 32 knots is 6.1 m. **(15)**

(b) Find the significant wave height from this histogram [Question No. 3(a)] if assumption that the wave height histogram follows the Rayleigh distribution is not valid. **(20)**

4. (a) Define ship maneuverability. What are the points to be discussed in ship maneuverability, explain? **(20)**

(b)What are the satisfactory criteria of a ship from view point of standards of ship maneuverability? **(15)**

SECTION – B

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

Symbols have their usual meanings. Assume reasonable value in case of missing data.

5. (a) What is group wave? Show that a combination of two standing waves out of phase by $\frac{\pi}{2}$ produces a progressive wave. **(15)**

(b) The bow of a 150 m ship meets the successive waves every 15 sec and a wave crest takes 10 sec to cross the ship from bow to stern. If the ship is proceeding through a regular train of waves at an angle of 40° to the line of wave crests, find: **(14)**

(i) the wave length

(ii) wave speed

(iii) ship speed in knots

(c) What are the three different methods for obtaining damping by model tests? Mention advantages and disadvantages of each of the methods. **(6)**

6. (a) A ship model has the following particulars: **(25)**

$L = 19.50$ ft $B = 2.60$ ft $T = 1.144$ ft, $L_w = 19.50$ ft

Both LCG and LCB are 0.48 ft forward of amidship. Moreover, the 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

Contd P/3

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

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

(i) the value of inertial co-efficient, a

(ii) the damping co-efficient, b and

(iii) restoring force co-efficient, c

Consider the ship model is heaving in calm water.

(b) Write the expressions for undamped natural periods of roll and pitch motions. Also determine the scale factors for these natural periods between model and prototype. **(10)**

7. (a) A ship has the following particulars: **(25)**

$L = 128$ m, $B = 17$ m, $T = 6.05$ m, $C_B = C_{wp}$

Assume added mass for heaving = 90% of ship mass, and damping is negligible, then

(i) Calculate the natural period of heaving in still water

(ii) Derive the expression for heaving oscillation in still water if

$z = 0$ at $t = 0$

$\dot{z} = 1.68$ m/s at $t = 0$

(iii) Calculate the maximum force exerted on the deck of a ship by a winch that weighs 4 MT.

(b) Find the ship's speed for subcritical, critical and supercritical operations in the head sea condition considering the following data: **(10)**

$$L = 400 \text{ ft}, \quad w_\theta = 0.70, \quad \frac{L_w}{L} = 2.5$$

8. (a) A ship has the following particulars: **(25)**

$L = 137.16$ m, $B = 21.336$ m, $GM_L = 137.16$ m, $\mu = 180°$

$C_{wp} = 0.80$, $K_{yy} = 33.53$ m, $\rho = 1030$ kg/m^3

The ship has a displacement of 12700 MT which moves head sea against 6.096 m high waves that have 5.32 sec period (encountering).

Assume the added mass of inertia to be 54% of the mass moment of inertia of the ship, and the nondimensional damping coefficient of pitching motion is

$$\frac{b\sqrt{gL}}{\Delta L^2} = 0.154$$

Again, the nondimensional amplitude of the pitching moment is

$$f_0 = \frac{M_0}{\frac{1}{2}\rho g \zeta_a L^2 B} = 0.25$$

Find:

(i) amplitude for pitching motion

(ii) phase difference between pitching and wave motions.

(b) At what heading angle against the waves, the largest rolling is expected, if a ship with a natural roll period of 15 sec is sailing with a speed of 35 knots and length of wave is 275 m. **(10)**

L-4/T-1/NAME **Date: 22/02/2018**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2016-2017

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

SECTION – A

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

1. (a) What are the causes of wear and damage of ships? **(10)**

   (b) Describe various methods of determining the magnitude of wear. **(18)**

   (c) Classify the methods of detecting defects. **(7)**

2. (a) Describe with neat sketches the procedure for docking of ships in slip docks or slip berths. **(13)**

   (b) Explain different methods of hull cleaning with merits and demerits. **(12)**

   (c) Show with neat sketches the repairing operation of different parts of underwater hull using caissons. **(10)**

3. (a) Discuss the damage distribution pattern in propeller made up of different materials. **(10)**

   (b) How propellers in the presence of cracks, crumbler edges and fractured blades are repaired? **(13)**

   (c) Explain how balancing of propeller is done. **(12)**

4. (a) Describe how sputtering of tailshafts is carried out. **(10)**

   (b) How can you check alignment of tailshafts, and of main engine and reduction gear shafts? **(12)**

   (c) What types of wear and damage may be found in crankshafts? **(13)**

SECTION – B

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

Symbols have their usual meaning. Assume reasonable values for any missing data.

5. (a) A crack is found in side shell of a ship during the inspection in drydock. Describe with necessary sketches how the crack can be repaired. **(18)**

   (b) Explain the fundamental physical process involved in straightening of shafts and shaft like components. With necessary sketches describe thermal, mechanical and thermo-mechanical straightening methods. **(17)**

Contd P/2

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6. (a) What are the principal requirements for various paints used in shipbuilding? Briefly discuss. **(12)**

(b) What are the factors affecting fouling? How will you choose an anti-fouling paint based on its performance, cost and environmental impacts? Give a comparative study among the available anti-fouling paints. **(23)**

7. (a) "Welding cast iron is much more difficult than welding steel" — why? How this problem can be solved while repairing cast iron components? **(12)**

(b) A cargo vessel has been hit by a patrol boat due to poor visibility caused by thick fog. Fortunately the crews onboard were rescued in time but the damage on the hull of the vessel was severe. It is carried to Chittagong Dockyard Ltd. and after a through visual inspection the damages found on the hull are: **(23)**

(i) Damage of the Midship includes shell plate flat vertical of dimension 3.5 m ×2 m ×10 mm and two in number

(ii) Three bottom shell plate of dimension 2.5 m × 2 m × 12 mm with double curvature.

(iii) Damage internal bulkhead of dimension 13 m × 12 m × 7 mm thickness positioned at 14 m aft of amidship.

(iv) Damage of four transverse internal T members of length 12 m each above double bottom and of dimension 85 mm × 85 mm × 7 mm thickness with double curvature.

Estimate how much steel will be required and the amount of repair will be needed in terms of man-hour.

8. (a) What are the principal forms of damage and wear found in pump and steering gear? **(12)**

(b) A passenger vessel is needed to be repaired in your dockyard. The owner provides following particulars of the vessel **(23)**

Displacement = 5000 tons
LOA = 70 m
LBP = 68 m
BM = 10 m
Draft maximum = 3.5 m
Height of boot-top = 0.4 m
Height of top-side = 1.5 m
Height of bulwark = 1 m

Estimate man-hour required for dock services assuming 7 days stay in the dock also estimate total painting area of the vessel. Assume constant for vessel shape = 0.8.

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Table for Q. No. ~~8(b)~~ 7(b)

Steel works renewals

Plate thickness (mm)	*Man-hours per tonne*
Up to 6	250
8	245
10	240
12.5	230
16	220
18	210
20	200

Correction for curvature	*Factor increase*
Single	1.2
Double	1.3

*Correction for location – **external***	*Factor increase*
Flat vertical side above 2 metres in height and requiring staging for access	1.1
Bottom shell, accessible areas (i.e. no removals of keel blocks)	1.12
Keel plate	1.4
Garboard plate	1.25
Bilge strake	1.25
Deck plating	1.15

*Correction for location – **internal***	*Factor increase*
Bulkhead	1.2
Longitudinal/transverse above DB areas	1.25
Longitudinal/transverse below DB areas	1.35

Table for Q. No. 8(b)

Dock services

Service	*Man-hours* <100 LOA	*Man-hours* >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.	Variable	Variable
Cranage: charges variable, dependent upon size of crane.	Variable	Variable

X

L-4/T-1/NAME **Date: 27/02/2018**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2016-2017

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**.

Assume reasonable value for missing data if any.

1. (a) With neat sketch describe the working principle of a dustpan dredger. **(12)**

   (b) Mention the advantages and disadvantages of a grab pontoon dredger. **(6)**

   (c) Name and distinguish between different types of grab buckets. **(9)**

   (d) Show the various working patterns for grab hopper dredger fitted with multiple grab cranes. **(8)**

2. (a) Write short notes on the following. **(20)**

   (i) Amphibious dredger

   (ii) Hopper barge

   (iii) Work boat

   (iv) Pneumatic dredger

   (b) With neat sketch explain the production cycle for grab hopper dredger. **(9)**

   (c) Why booster pumps are used in dredging operation? **(6)**

3. (a) Briefly discuss different types of transport of the dredged material. **(18)**

   (b) Which type of dredger/dredgers will you recommend for dredging each of the following types of soil. **(17)**

   (i) Sands and non-cohesive silts

   (ii) clay and cohesive silts.

4. (a) List the factors on which the fuel cost of a dredger depends on. **(5)**

   (b) An 18 inch Cutter Suction Dredger (CSD) has 2 Nos. engines. Each engine is 450 HP and crewed for 24 hours per day. Calculate the fuel consumption per day if the dredger working 4 hours at full power, 14 hours at 75% power and 6 hours at 10% power. Also calculate the consumption of the lubricants per day. **(15)**

   (c) Draw a schematic diagram of basic contract form for dredging works. **(10)**

   (d) Explain the advantages and disadvantages of Fixed Price Contract for dredging. **(5)**

Contd P/2

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SECTION – B

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

5. (a) Define 'production of a dredger'. With the aid of a diagram explain the productive and non-productive working time of a dredger. **(10)**

(b) Write a short note on 'mechanical breakdown factor'. **(5)**

(c) Briefly describe the procedure to estimate the production of a trailing suction hopper dredger (TSHD). **(20)**

6. (a) What are the functions of cutterhead in a cutter suction dredger (CSD)? Write down the general guidelines of cutterheads for various types of soils. **(10)**

(b) Why spud system plays an important role on the design of CSD? Briefly describe two of the most commonly used spud systems for CSD. **(20)**

(c) Write a short note on 'Christmas tree system' for CSD. **(5)**

7. (a) With the aid of a neat sketch, discuss the main features of TSHD. **(10)**

(b) List the advantages and disadvantages of a TSHD. **(10)**

(c) What are functions of hopper loading system in a TSHD? With the aid of neat sketches distinguish between various hopper loading systems. **(15)**

8. (a) What is bulking factor? Show the production cycle of a CSD. **(8)**

(b) What is the function of a draghead? Name various types of draghead with their application. **(7)**

(c) Briefly discuss the following design criteria while designing a cutter suction dredger: **(10)**

(i) type of soil, and

(ii) dredging depth

(d) Mention some important features of onshore pipelines and floating pipelines for CSD. **(10)**

L-4/T-1/NAME **Date: 27/02/2018**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2016-2017

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

SECTION – A

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

Assume reasonable value for any missing data.

1. (a) Prove that the frequency of torsional vibration of a ship is given by the expression: **(20)**

$$N = C\sqrt{\frac{B^2D^2t}{W\left(B^2+D^2\right)(B+D)L}}$$

Where,

L = length of ship

B = breadth of ship

D = depth of ship

t = thickness of plating on all sides and

C = coefficient

(b) A ship has the following particulars: **(15)**

L = 121.95 m, B = 16.46 m, D = 11.6 m, T = 6.1 m, C_B = 0.62, mean thickness (t) of deck, side, and bottom plate is 1.65 cm. Calculate the frequency of torsional vibration in the primary mode using Lockwood Taylor method. G = 850 tonnes/cm^2.

2. (a) Prove that the maximum force transmitted to the foundation using elastic mountings considering damping effect is: **(20)**

$$F = P\omega^2 \frac{\sqrt{\left(1+\frac{4n^2\omega^2}{p^4}\right)}}{\sqrt{\left(1-\frac{\omega^2}{p^2}\right)^2+\frac{4n^2\omega^2}{p^4}}}$$

Where, symbols have their usual meanings. Also prove that the natural frequency of the machine on the spring must be less than 0.7 of the forcing frequency.

(b) Consider a machine having weight 2000 lb running 1800 rpm. The machine is supported by 8 helical springs each having 10 coils 4 inches in diameter, the diameter of the steel spring material being 0.5 inch. Assume the unbalanced centrifugal force at an angular speed of 1 radian per second to be 0.02 lb. Find the maximum force transmitted to the foundation when (i) there is no spring, (ii) on a spring foundation with damping. **(10)**

(c) What you understand by Transmissibility? Calculate the transmissibility of the machine for Q. No. (b). **(5)**

Contd P/2

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3. (a) Show that for a 'm' pairs of spring supporting an engine, the natural frequency of rocking motion of the engine can be expressed as: **(15)**

$$N = \frac{a}{2\pi}\sqrt{\frac{mCg}{J}}$$

Where,

a = distance of spring from the centre of the engine

C = the spring Constant

m = number of pairs of spring supporting the engine

J = Polar Moment of Inertia of the engine

(b) An Oil Tanker has the following particulars: **(20)**

L = 147.2 m, B = 20 m, D = 11.35 m, T = 8.42 m, C_B = 0.80 tonnes, $I_{NA} = 43\ m^4$, Schilick's constant = 2.7×10^6, Todd's β value = 108450, Burrill's factor, r = 0.132. Estimate the 2 NV natural hull frequency in cycles/minute using the research work of Otto Schilick, F. Todd and L. C. Burril. Also comment on the results.

4. (a) "Propeller excited vibration is probably the most troublesome type to deal with, for its inherent in the nature of the propeller and the fact that it works in a disturbed velocity field." Explain. **(15)**

(b) List the recommended configuration for stern arrangements in order to avoid excessive propeller vibration. **(10)**

(c) Write a short note on Criteria for Crew and Passenger relating to mechanical vibration. **(10)**

SECTION – B

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

5. (a) Define local and synchronous vibration. What are the causes and consequences of such vibrations? **(15)**

(b) Derive the general expressions of the frequency and the vertical displacement of the natural vibration of a spring mass system. **(20)**

6. (a) Why vibration is important in ship design? Write down a summary of check list that is to be encountered in the typical concept design process. **(15)**

(b) Discuss mathematically natural vibration with viscous damping with reference to over-damped system (n>p). Under-damped system (n<p) and critically camped system. **(20)**

Contd P/3

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7. (a) What are the major defects in the Schlick's formula? A 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 mid-ship section is 330,000 in^2-ft^2. Assuming a co-efficient of 128000 in the Schilick formula calculate the frequency of vibration. **(15)**

(b) Derive Schilick's formula for the natural period of vibration of a ship. **(20)**

8. (a) How the vibration can be minimized or can be solved for the ship already built? **(10)**

(b) What are the differences between the transverse and longitudinal vibrations? Show that the amplitude of force damped vibration is **(25)**

$$A = \frac{p}{K} \frac{1}{\sqrt{\left(1-\frac{\omega^2}{p^2}\right)^2 + \frac{4\omega^2 n^2}{p^4}}}$$

Where the symbols have their usual significance.

L-4/T-1/NAME **Date: 05/03/2018**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2016-2017

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) Briefly describe how you can develop a successful marketing strategy for a shipyard. **(15)**

   (b) Explain why value of money changes with time. Determine the discounted payback period of a project for the following information (rate of return = 8%): **(7+13=20)**

Year	Revenue (lacs)
0	–60
1	15
2	15
3	20
4	10
5	20
6	20
7	–10
8	20
9	20

2. (a) A shipyard wants to purchase a computer controlled sheet metal cutting and bending machine to replace a manual cutting machine. There is an offer under consideration for the machine. The company wants to study the financial feasibility of the offer. The associated financial data are as follows: **(20)**

   purchase and installation cost = Tk. 90 lacs; Reduction in annual maintenance cost = Tk. 2 lacs; Annual increase in profit = From year 1 to 7 - Tk. 18 lacs, From year 8 to 15 - Tk. 15 lacs, From year 16 to 20 - Tk. 12 lacs; Repair cost at 10^{th} year = Tk. 5 lacs; Salvage value = Tk. 10 lacs; Required rate of return = 10%

   Decide whether the company should accept the offer or not.

   (b) How a business market differs from a consumer market in terms of developing marketing strategy? Explain with example. **(15)**

Contd P/2

3. (a) Briefly describe Herzberg's two factor theory of motivation. **(10)**

(b) Explain how concepts described in the equity theory of motivation can be applied in developing organizational strategies to motivate employees. **(15)**

(c) Explain the role of motivation in improving performance of the employees. **(10)**

4. (a) What are the findings of different behavioral theories of leadership? **(5)**

(b) A gasoline company wants to provide a customer with 2000 liters of 85 octane rating gasoline with vapor pressure index of 25. To do this, the supplier must mix three kinds of gasoline to form an appropriate mixture at a minimum cost. Regular unleaded gasoline costs \$0.30 per liter and has an octane rating of 80 with a vapor pressure index of 30. Premium unleaded gasoline costs \$0.33 per liter and has an octane rating of 90 with a vapor pressure index of 20. Super unleaded gasoline costs \$0.40 per liter and has an octane rating of 100 with a vapor pressure index of 10. Formulate the problem as linear programming model to minimize total cost. **(20)**

(c) Mention the characteristics of an effective performance appraisal system. **(10)**

SECTION – B

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

5. (a) The manager of the Carpet city outlet needs to be able to forecast accurately the demand for Soft Shag carpet (its biggest seller). If the manager does not order enough carpet from the carpet mill, customers will buy their carpets from one of the Carpet city's many competitors. The manager has collected the following demand for the past months **(13)**

Month	Demand for Soft Shag Carpet (1000 Yd)
1	8
2	12
3	7
4	9
5	15
6	11
7	10
8	12

(i) Compute a 3 month moving average forecast for month 4 to 9

(ii) Compute a weighted moving average forecast for month 4 to 9. Assign weights of 0.55, 0.33 and 0.12 to the month in sequence, starting with the most recent month.

Contd P/3

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Contd... Q. No. 5

(b) Annual Demand = 10,000 units **(12)**

Day per year considered in average daily demand = 365

Cost to place an order = $10

Holding cost per unit per month = 0.01% of cost per unit

Lead time = 3 days

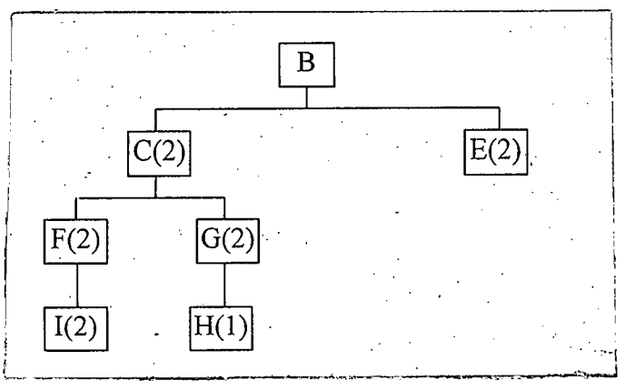
Cost per unit = $15

Determine the economic order quantity and the reorder point. Also find the Annual Ordering and Holding cost. State some significance of the obtained results.

(c) The following table contains figures on the annual usage and unit costs for a random sample of 12 items. Develop an A-B-C classification for these items. **(10)**

Item Name	Annual number of units used	Unit cost (BDT)
1	1000	4300
2	5000	720
3	1900	500
4	1000	710
5	2500	250
6	2500	192
7	400	200
8	500	100
9	200	210
10	1000	35
11	3000	10
12	9000	3

6. Brown and Brown Electronics manufactures a line of digital audiotape (DAT) players. The bill of materials, showing the number of each item required is shown below follows: **(35)**



Contd P/4

Data for B: Gross requirement is 100 units on 9th week, Lead time is 2 weeks, Lot for lot

Data for C: Lead time is 1 week, Lot for lot

Data for E: Lead time is 2 weeks, scheduled receipt is 50 on 1st week, lot size on 150 units

Data for F: Lead time is 1 weeks, scheduled receipt is 60 on 1st week, on hand inventory is 40, lot for lot

Data for G: Lead time is 1 weeks, scheduled receipt is 100 on 1st week, on hand inventory is 50, lot for lot

Data for H: Lead time is 1 weeks, scheduled receipt is 100 on 1st week, lot size is 400

Data for I: Lead time is 1 weeks, scheduled receipt is 60 on 1st week, on hand inventory is 15, lot for lot

Prepare a MRP schedule to satisfy demand.

7. (a) There are following seven jobs and they must pass through Machine 1 and Machine 2. Operating time for both the machines is shown below for each of the job. **(11)**

Job	Operations Time for machine 1 (Hour)	Operations Time for machine 2 (Hour)
A	9	6
B	8	5
C	7	7
D	6	3
E	1	2
F	2	6
G	4	7

(i) Schedule (job sequence and show the arrangement in diagram for machine 1 and 2) the seven jobs through two machines in sequence to minimize the flow time using Johnson's rule.

(ii) Find the job completion time.

(iii) Find the slack time or idle time for machine 1 and 2, separately.

(b) Briefly describe the different types of Facility layout with their relative advantages. **(20)**

(c) Discuss the One Bin and Two Bin System with their relative advantages. **(4)**

8. (a) Briefly describe Fiedler's contingency model of leadership. **(12)**

(b) Define different leadership style according to path goal theory. **(10)**

(c) Briefly explain different types of errors that occur in appraising performance. **(13)**

L-4/T-1/NAME **Date: 11/03/2018**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2016-2017

Sub: **NAME 451** (Advanced Ship Structure)

Full Marks: 210 Time: 3 Hours

The figures in the margin indicate full marks.

The symbols have their usual meanings. Incase of missing data, assume reasonable value.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) A rigid block of mass 'M' is mounted on four elastic supports as shown in Figure for Q. No. 1(a). A mass 'm' drops from a height '*l*' and adheres to the rigid block without rebounding. If the spring constant of each elastic support is 'k', find the natural frequency of vibration of the system **(15)**

   (i) without the mass 'm' and

   (ii) with the mass 'm'.

   Also find the resulting motion of the system in case (ii).

   (b) Discuss the free vibration of an undamped torsional system. **(5)**

   (c) Derive the expression of natural frequency of compound pendulum in terms of centre of percussion. **(15)**

2. (a) Derive the response of a damped system under rotating unbalance. **(15)**

   (b) In the study of vibrations of valves used in hydraulic control systems, the value and its elastic stem are modeled as a damped spring-mass system, as shown in Figure (i) for Q. No. 2(b). In addition to the spring force and damping force, there is a fluid pressure force on the value that changes with the amount of opening or closing of the valve. Find the steady-state response of the valve where the pressure in the chamber varies as indicated in Figure (ii) for Q. No. 2(b). Assume k = 2500 N/m, C = 10 N-s/m and m = 0.25 kg. **(20)**

3. (a) For free vibration of undamped two-degree of freedom system, derive natural frequency and mode shape. **(20)**

   (b) A machine of mass m = 500 kg is mounted on a simply supported steel beam of length l = 2 m having a rectangular cross section (depth = 0.1 m, width = 1.2 m) and Young's modulus E = 2.06×10^{11} N/m^2. To reduce the vertical deflection of the beam, a spring of stiffness k is attached at mid-span as shown in figure for Q. No. 3(b). Determine the value of k needed to reduce the deflection of the beam by 75 percent of its original value. **(15)**

4. (a) Derive the expression for consistent mass matrix of a truss element. **(15)**

   (b) Find the natural frequencies of the simply supported beam as shown in Figure for Q. No. 4(b) using one finite element. **(20)**

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SECTION – B

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

5. (a) Derive Perry-Robertson formula for strut and explain necessary assumptions. **(15)**

(b) A slender column is built-in one end and an eccentric load of 600 kN is applied at the other (free) end. The column is made from a steel tube of 150 mm outer dia and 125 mm inner dia and it is 3 m long. Deduce the equation for the deflection of the free end of the beam and calculate the maximum permissible eccentricity of load if the maximum stress is not to exceed 225 kN/m^2. E = 200 GN/m^2. **(20)**

6. (a) If a crack is found in a component that gives $k_I > k_{IC}$. Recommend some options that can be applied to avoid such a situation. **(10)**

(b) Briefly discuss the major factors influencing environmental-assisted fracture. **(10)**

(c) An edge crack, detected on a large plate, is of length 3.1 mm under a constant amplitude cyclic load having $\sigma_{max} = 310$ MPa and $\sigma_{min} = 172$ MPa. If the plate is made of ferrite–pearlite steel whose k_{IC} = 165 MPa$\sqrt{m}$, material constant in Paris Law: C = 6.8 × 10^{-12} and m = 3.0, determine **(15)**

(i) propagation life up to failure

(ii) propagation life if the crack length 'a' is not allowed to exceed 25 mm.

7. (a) If we use a specimen with a large lateral dimension to find k_{IC}, the accuracy of the experimental results is high. But in experiments to determine the SIF, specimens with large lateral dimensions are not usually employed. Why not? **(8)**

(b) A crack of 3 mm length is emanated from the surface of a 50 mm diameter hole in a large plate as shown in Figure for Q. No. 7(b). Compute the maximum stress that would not allow the crack to grow. Treat as single-edge-crack under tensile stress. K_{IC} = 55 MPa$\sqrt{m}$, σ_{ys} = 300 MPa, E = 207 GPa. **(10)**

(c) Show that Westergaard function for a centre crack in an infinite plate subjected to a bi-axial stress field satisfies the boundary conditions and justify why the solution of a biaxially loaded plate is employed for both uniaxially and biaxially loaded problems. **(17)**

8. (a) A horizontal strut 2.5 m long is constructed from rectangular section steel, 50 mm wide, 100 mm deep and mounted with pinned ends. The strut carries an axial load of 120 kN together with a uniformly distributed lateral load of 5 kN/m along its complete length. If E = 200 GN/m^2 determine the maximum stress set up in the strut. Check the result using the approximate Perry method with $M_{max} = M_0\left[\frac{P_e}{P_e - P}\right]$. **(15)**

(b) Derive the expressions of magnification factors of main mass and the vibration neutralizer. Hence discuss the followings: **(20)**

(i) when the frequency of main mass and the vibration neutralizer are equal to the frequency of the exciting force.

(ii) when the frequency of the main mass is equal to the frequency of the exciting force but not equal to that of the vibration neutralizer.

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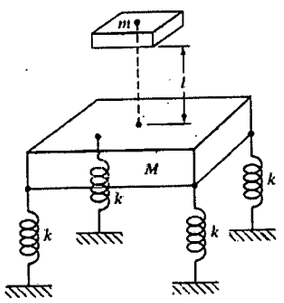
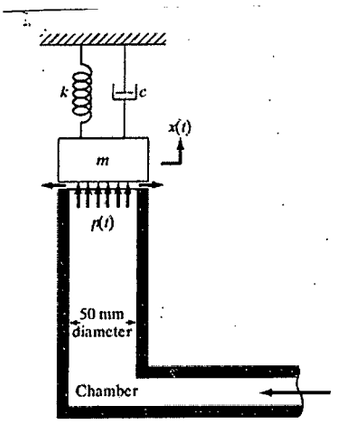
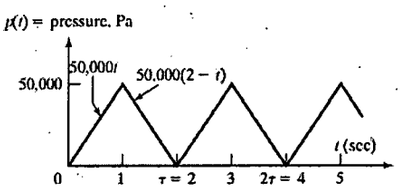


Figure for Q. No. 1(a)



(i)



(ii)

Figure for Q. No. 2(b)

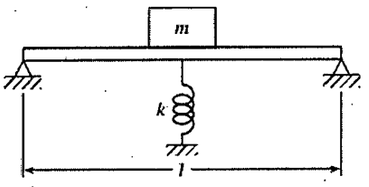


Figure for Q. No. 3(b)

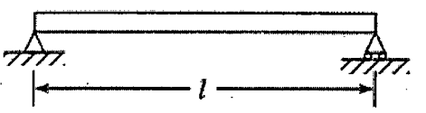


Figure for Q. No. 4(b)

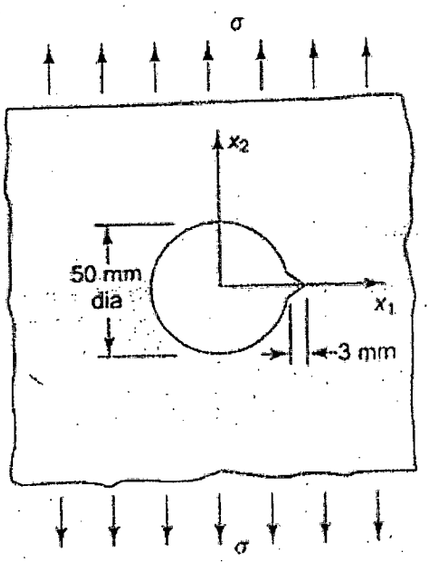


Figure For Q. No. 7(b)

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2016-2017

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

SECTION – A

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

1. (a) What is integer programming and why is it important? Discuss the strategy of integer programming algorithms. **(15)**

   (b) Use branch and bound technique to solve the following integer programming problem: **(20)**

   Maximize $Z = 7x_1 + 9x_2$

   Subject to $-x_1 + 3x_2 \le 6$

   $7x_1 + x_2K \le 35$

   $x_1 \ge 0,\ x_2 \le 7$

   x_1, x_2 are integers

2. (a) A project consists of activities A, B, C, D, E, F, G, H, I, J, K, and L that satisfy the following conditions: **(15)**

   (i) A, B and C are the first activities of the project and can start simultaneously.

   (ii) A and B precede D.

   (iii) B precedes E, F and H.

   (iv) F and C precede G.

   (v) E and H precede I an J.

   (vi) D and J precede K.

   (vii) K precedes L.

   (viii) I, G and L are terminal activities of the project.

   Draw the network diagram.

   (b) In the following network diagram (Fig. for Q. No. 2(b)), all the durations are in days. Find the critical path of the project. **(20)**

Contd P/2

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

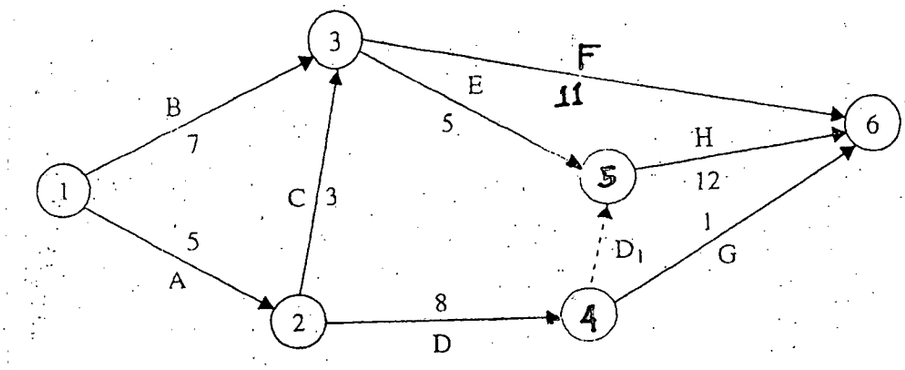

Fig. for Q. No. 2 (b)

3. (a) Discuss the fundamentals of Program Evaluation and Review Technique (PERT) with necessary diagrams. **(15)**

(b) Consider the following project: **(20)**

Activity	t_o	t_m	t_p
1–2	20	30	46
1–3	9	12	21
2–3	3	5	7

Activity	t_o	t_m	t_p
2–4	2	3	4
3–5	1	2	3
4–5	12	18	24

(i) Draw the network diagram and find the total project duration.

(ii) Find the critical path

4. (a) What is artificial neural network? Discuss with respect to (i) characteristics (ii) elements and (iii) applications. **(17½)**

(b) Discuss the fundamentals of Genetic Algorithm. Elaborate with necessary diagrams and/or flowcharts. **(17½)**

SECTION – B

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

Assume suitable values, if required.

5. Describe the various OR technique for solving real life problems. How do you decide which technique you would use in solving your problem associated with shipyard business? What are the drawbacks of Queuing and Simulation Model? **(35)**

Contd P/3

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6. What are the examples of optimization system observed is Nature? **(35)**

ABC Marine Coating Ltd. produce paints for ships which can produce two types of marine coating (or paints) one for exterior and one for interior with use of only two kinds of raw materials M_1 and M_2. A market survey indicates that the daily demand for interior paint cannot exceed that for exterior paint by more than 1 ton. Also, the maximum daily demand for interior paint is 2 tons.

Formulate the problem and determine the optimum product mix of paints that maximizes the daily total profit. The following table provides the basic data of the problems.

	Tons of raw material per ton of		Maximum daily availability (tons)
	Exterior paint	Interior paint	
Raw materials M_1	6	4	24
Raw materials M_2	1	2	3
Profit per ton ($1000)	5	4	

7. Describe the various steps in formulating an LP problem. **(35)**

Minimize $z = 5x_1 - 4x_2 + 6x_3 - 8x_4$

Subject to $x_1 + 2x_2 + 2x_3 + 4x_4 \leq 40$

$2x_1 - x_2 + x_3 + 2x_4 \leq 8$

$4x_1 - 2x_2 + x_3 - x_4 \leq 10$

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

8. (a) Describe the simplex method for solving the general LP problem **(35)**

Discuss how the simplex based sensitivity analysis is used to provide important economic interpretations about the optimum solution.
