L-4/T-1/NAME Date : 14/10/2023

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2020-2021

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

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

Symbols have their usual meanings. Assume reasonable value for missing data.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) Demonstrate the docking of ships in slip docks with suitable sketches. **(15)**

   (b) Describe the process of straightening dented shell plates. **(10)**

   (c) Compare different antifouling coating based on their performance. **(10)**

2. (a) Discuss 10 major factors that affect the maintenance planning of a ship. **(20)**

   (b) Decide whether or not the engine cover plates and cylinder blocks can be repaired by welding. If not, identify the reason and also describe the appropriate repair process. **(15)**

3. (a) Classify the different types of surveys required by the International Association of Classification society. **(15)**

   (b) Describe the process of replacement of the shell plates in a welded hull. **(10)**

   (c) Explain the biocide release mechanism in self-polishing copolymer and controlled depletion polymer antifouling paints. **(10)**

4. (a) Construct a welding repair decision model for repairing deck plates in a ship. Also, illustrate this with relevant examples. **(15)**

   (b) A ship of 3000 tonnes displacement is 100 m long, has KM = 6 m, KG = 4.5 m. The draft is 5.5 m and the center of flotation is 4 m aft of amidship. Trim by stern = 450 cm, TPC = 10 tonnes and MCTC = 80 tonnes. m. By analysis, it was found that the ship would capsize during the critical period of docking. To avoid this the dockmaster decided to reduce the trim to almost zero. But during docking process, unfortunately the ship had capsized. **(20)**

   (i) Identify the reason that would cause the ship to capsize during the critical period. Do you agree with the decision made by the dockmaster?

   (ii) Also, identify the probable reason for capsizing of the ship even after reducing the trim.

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SECTION – B

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

5. (a) Briefly explain different aspects those should be observed in watertightness test for different compartments of ship. **(15)**

   (b) Compare the dismantling process of tailshaft between afloat and dry dock condition of ship. **(12)**

   (c) Describe the methods of detecting defects on ship hull. **(8)**

6. (a) What are the preliminary operations those have to be performed before a defect survey? **(5)**

   (b) Explain how you will repair the propeller in case of fractured blades, crumbled edges, and presence of cracks. **(15)**

   (c) Illustrate different methods of straightening the deformed propeller blades. **(15)**

7. (a) During service of a ship, a certain portion of a side shell plate has been found to be affected by corrosion. Apply a suitable method to measure the damage. **(10)**

   (b) A cargo vessel has been hit by a small petrol boat due to poor visibility caused by thick fog. The damage on the hull of the vessel was severe. It is carried to a dry-dock and after a through visual inspection the damages found on the hull are: **(25)**

   (i) Damage of ten external shell plates each of dimension 2.5 m × 2.5 m × 10 mm thickness with double curvature with three below waterline and the rest above.

   (ii) Damage of the midship includes shell plate of dimension 3.5 m × 2.0 m × 10 mm thickness and two in number, one keel plate of dimension 2.0 m × 2.0 m × 12 mm thickness with single curvature, and three bottom shell of dimension 2.5 m ×2.0 m × 12 mm thickness with double curvature.

   (iii) Damage of internal bulkhead of dimension 13.0 m × 12.0 m × 7 mm thickness positioned at 14.0 m aft of midship.

   (iv) Damage of four transverse internal T members of length 12.0 m each above double bottom and of dimension 85 mm × 85 mm × 7 mm thickness with double curvature.

   (v) Damage of two longitudinal internal T members below double bottom area each of 20.0 m length and having dimension 85 mm × 85 mm × 7 mm thickness with double curvature.

   (vi) Damage of bilge strake of dimension 0.5 m × 3.0 m × 7 mm thickness positioned at 14.0 m aft of midship.

   Estimate how much steel will be required and the amount of repair will be needed in terms of man-hour for removal, fairing and re-fitting of the entire above mentioned hull plates and members in place.

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NAME 415

8. (a) Explain the sputtering of tailshafts with necessary drawing. **(10)**

(b) An oil tanker named M.T. Salam is first time needed to repair after it was built in July, 2017. So, the owner of the vessel is seeking a dockyard and he is interested to repair his ship in Chattogram dry dockyard. So, he proposes the dockyard to submit him the total man-hour required for the following works: **(25)**

(i) Man-hour required for berth preparation.

(ii) Man-hour required for dock services for 10 days.

(iii) Total painting area of ship hull.

(iv) Man-hour required for removal of rudder survey.

(v) Man-hour required for propeller works

(vi) Required weight of zinc anode and man-hour to cut off and replace.

(vii) Man-hour required for opening up, cleaning, painting, closing and other works for two chain lockers.

The owner provides the following information:

DWT = 22000.0 tons

L_{OA} = 160.0 m

L_{PP} = 155.0 m

B(Moulded) = 15.0 m

Draft maximum = 8.0 m

Height of the boot-top = 0.5 m

Height of the topsides = 2.0 m

Height of the bulwarks = 1.5 m

Shaft diameter = 0.2 m

Tables for Question No. 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

Other adjustment factors	*Man-hour adjustment*
For fairing works:	
Remove, fair and refit	80% of renewal price
Fair in place (if practicable)	50% of renewal price

Note: For high-tensile grade AH shipbuilding steels, increase rates by 10%.

Tables for Question No. 8(b)

- Shifting of blocks after docking vessel

DWT	*Man-hours*	
	Keel block	*Side block*
< 20000	5	3
20000-100000	10	5
100000-200000	16	8
> 200000	20	12

- Dock services

Service	*Man-hours*	
	<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:	Variable	Variable
Cranage:	Variable	Variable

- 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.

DWT	*Man-hours*	
	(a)	(b)
>3000	15	165
5000	18	250
10000	20	280
15000	25	300
20000	28	350
30000	30	400
50000	35	500
80000	45	600
100000	60	800
150000	75	900
200000	90	1 000
250000	110	1 200
350000	120	1 500

- 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

Shaft dia. (mm)	*Man-hours*	
	(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

- Anodes on hull and in sea chests

Weight (kg)	*Man-hours*
3	1
5	1
10	1.5
20	2

- Anchor cables (per side)

Small vessels

Cable dia. (mm)	*Man-hours (per side)*
< 25	70
25–50	90

Large cargo vessels and oil tankers

DWT	*Man-hours (per side)*
< 20000	100
20000–50 000	130
50000–100 000	140
100000–200 000	200
200000–300 000	250
over 300000	270

- Chain lockers (per side)

Small vessels

Cable dia. (mm)	*Man-hours (per side)*
< 25	70
25–50	90

Large cargo vessels and oil tankers

DWT	*Man-hours (per side)*
< 20000	100
20000–50 000	130
50000–100 000	140
100000–200 000	200
200000–300 000	250
over 300000	270

[Necessary data: p = 0.8, Numbers of years between dry docks for zinc = 3years, for zinc anode replacements use the manufacturer supplied information: current density 20 mA/m², capacity = 781 amp-hours/kg]

L-4/T-1/NAME **Date : 03/10/2023**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2021-2022

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

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

Assume reasonable values for missing data.

Symbols have their own meanings.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) What is wave spectrum and energy spectrum? Why is the energy spectrum method used for the analysis of irregular seaways? Explain with figure how a fully developed sea is developed. **(15)**

   (b) Find the wave spectral density $S_{(\omega_w)}$ corresponding to wave frequencies ω_w mentioned in the table below based on ITTC formulation for spectral density for a significant wave height of 26.5 ft. at a wind speed of 40 knots and a characteristics wave period of 10 second (Use statistical information available on both the characteristics wave period and significant wave period). Also determine the significant wave height from this spectrum if the assumption that the wave height histogram follows Rayleigh distribution is not valid. **(20)**

Table for Question No. 1(b)

ω_w (sec^{-1})	0.3	0.6	0.9	1.20	1.50

2. (a) Describe with figures step by step sequentially, how the motion of a ship in irregular seaway is determined. **(15)**

   (b) Explain the term "response spectrum". **(10)**

   (c) For a 600 ft. ship the following data are available for rolling motion: **(10)**

   Time: 27.50 minutes,

   $m_0 = 6.522\ deg^2$; $m_2 = 3.562\ deg^2.sec^{-2}$; $m_4 = 2.276\ deg^2.sec^{-4}$

   Find the number of observations and most probable largest rolling motions.

3. (a) What is relative bow motion? Explain the importance of relative bow motion from viewpoint of ship dynamics. **(10)**

   (b) What is deck wetness and slamming? Discuss the effect of both statical swell-up and dynamic swell up of water at the bow of a ship. **(15)**

   (c) Find the frequency of deck wetness for a 121.9 m ship with an effective freeboard of 7.3 m, given the area under the relative motion spectrum: $m_{0s} = 6.78\ m^2$ and $m_{2s} = 9.30\ m^2/sec^2$ respectively. **(10)**

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4. (a) Explain the significance of ship maneuverability. Describe IMO standards for ship maneuverability. **(20)**

(b) For a ship of L = 120 m, B = 18 m, T = 4.1 m, C_B = 0.67, the hydrodynamics and rudder derivatives are as follows: **(15)**

$Y'_v = -9.65 \times 10^{-3}$; $Y'_r = 2.14 \times 10^{-3}$; $N'_v = -2.57 \times 10^{-3}$; $N'_r = -1.44 \times 10^{-3}$

$Y'_\delta = -1.0 \times 10^{-3}$; $N'_\delta = 0.5 \times 10^{-3}$.

Estimate its turning radius (r_0), drift angle (β) and yaw rate $\left(r = \frac{\partial \Psi}{\partial t}\right)$ for 16 knots at 35 deg. rudder.

SECTION – B

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

5. (a) What is group velocity? Prove that the paths of water particles are circular in deep water and elliptical in shallow water. **(15)**

(b) A 5-sec wave with height 0.2 m is propagating in deep water. Find the horizontal and vertical water velocity as well as dynamic pressure at a distance x = 10 m from the crest (the crest is located at x = 0 m) at z = –1 m from the SWL and time t = 3 s. **(15)**

(c) How pitching period can be increased? Discuss briefly. **(5)**

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

L = 19.50 ft, B = 2.60 ft T = 1.144 ft, wave length = 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
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

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 inertia co-efficient, a

(ii) the damping co-efficient, b

(iii) the restoring force co-efficient, c

while the ship model is heaving in calm water.

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Contd ... Q. No. 6

(b) Show that if the linear dimension of a ship and those of its geometrically similar model are in the ratio of the scale factor X, the natural heaving period is $\sqrt{\lambda}$ times that of the model. **(10)**

(c) If a 5.12 m long model of a ship (length 128 m) has a heaving period of 1.362 sec, find the heaving period of the ship. **(5)**

7. (a) The following data is available: **(20)**

$L = 450$ ft $\quad B = 70$ ft $\quad GM_L = 450$ ft

$C_{\omega p} = 0.80$, $\quad \mu = 180°$ (head sea)

$\zeta_a = 10$ ft, $\quad \rho = 1.99$ lb-sec^2/ft^4

$\omega_c = 1.18$ rad/sec

Assume the added mass of inertia to be 54% of the mass moment of inertia of the ship and the non-dimensional damping coefficient of pitching motion is

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

Find both the amplitude of the pitching motion and the phase differences between the wave and the pitching motions, if the non-dimensional amplitude of the pitching moment is given

$$f_o = \frac{M_o}{\frac{1}{2}\rho g f_a L^2 B} = 0.25$$

(b) A ship is sailing in head sea at speed v = 15 knots. With a wavelength of x = 100 m, calculate: **(15)**

(i) Wave period

(ii) Wave encounter period

Assume deep water waves. The ship is now turns so it is sailing in following sea.

(iii) What speed must the ship obtain in order for the wave encounter period to be 0 (zero)?

(iv) What does it mean that the wave encounter period is 0?

8. (a) A ship has a rolling period of 15 sec, speed 35 knots, approaching wave length 275 m. Determine the heading of the ship relative to the waves when the largest rolling would be expected. **(15)**

(b) Explain how the rolling motion in a seaway can be drastically reduced. **(5)**

(c) Define the following terms: **(15)**

(i) Ahead seas

(ii) Overtaking seas

(iii) Critical zone

(iv) Subcritical zone

(v) Curve of extinction of rolling

L-4/T-1/NAME Date : 19/10/2023

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2021-2022

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

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

Symbols have their usual meaning.

Assume reasonable values for missing data (if any).

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) Derive Schilick's formula for estimating the natural frequency of vibration of a typical ship. What are the limitations of Schilick's formula? Discuss the advantage of Todd formula over Schilick's formula. **(25)**

   (b) The natural frequency of vertical vibration of a ship 400 ft in length having a displacement of 13,000 tones is 80 cycles per minute. The moment of inertia of the midship section is 3,50,000 in^2-ft^2. Determine the natural frequency of vertical vibration of a similar ship 410 ft in length, displacement 14,500 tones and a midship section moment of inertia of 4,50,000 in^2-ft^2. **(10)**

2. (a) The principal particulars of a tanker are as follows: **(17)**

   Length, L = 215 m

   Beam, B = 31 m

   Depth, D = 15 m

   Draft, d = 12 m

   Displacement = 45,664 ton-f

   Calculate the natural frequency of vibration using Burril's formula (I = 195 m^4, ϕ_2 = 4,34,000 and 1 MN = 100.36 ton-f).

   (b) Discuss three methods for estimating the weight curve of a ship for calculating the natural frequency of vibration. **(18)**

3. (a) How to manage out-of-balance forces or moment generated from main engines and auxiliary engines of a ship that cause excessive vibration. With schematic diagrams discuss some common detrimental issues on ship machineries that are associated with ship vibration. **(20)**

   (b) Discuss in your own words how propeller induced vibration can be managed? **(15)**

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NAME 439

4. (a) Discuss the vibration acceptance criteria for a ship according to International Standard Organization (ISO). Draw necessary diagrams and explain. **(20)**

   (b) Illustrate and explain the typical measurement locations for monitoring global ship vibration. **(15)**

SECTION – B

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

5. (a) Explain the importance of vibration in ship design? **(10)**

   (b) How can you minimize vibration of ships already built? **(17)**

   (c) A study of the response of a human body subjected to vibration/shock is important in many applications. In a standing posture, the masses of head, upper torso, hips, and legs and the elasticity/damping of neck, spinal column, abdomen, and legs influence the response characteristics. Develop a sequence of three improved approximations for modeling the human body. **(8)**

6. (a) Derive the general expression of frequency and vertical displacement of the natural vibration of a spring-mass system with viscous damping and hence explain underdamped, over-damped and critically-damped systems. **(25)**

   (b) The following data are given for a vibrating system with viscous damping: **(10)**

   W = 10 lb, k = 30 lb/in. and c = 0.121 lb/inch per second.

   Determine the logarithmic decrement and the ratio of any two successive amplitudes.

7. (a) What is virtual mass effect? Why it is present only in the case of accelerated motion? **(10)**

   (b) Briefly explain how added virtual weight is calculated for ships. **(25)**

8. (a) Derive the general expression of vertical displacement of forced vibration of a simple spring-mass system and hence explain the magnification factor. **(25)**

   (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 defection of the beam equal to δ_{st} = 0.025 cm. Neglect the weight of the beam and assume that the damping coefficient is 20,000 Ns/m. **(10)**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2021-2022

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

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**.

Symbols have their usual meanings.

1. Solve the truss shown in the Figure for Q. No. 1 using unit load method. **(35)**

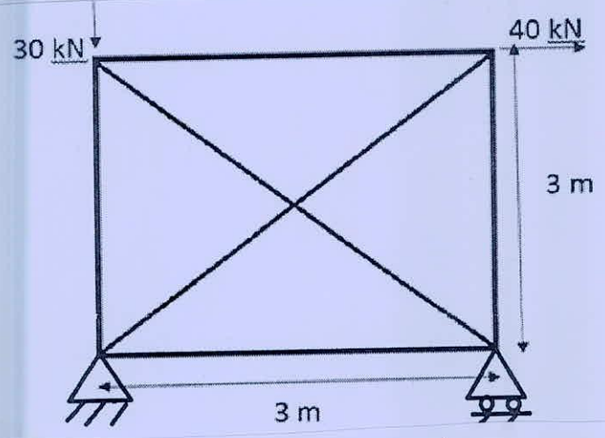

Figure for Q. No. 1

2. (a) Analyze the continuous beam shown in Figure for Q. No. 2(a) by flexibility matrix method. Flexural rigidity is constant throughout. **(25)**

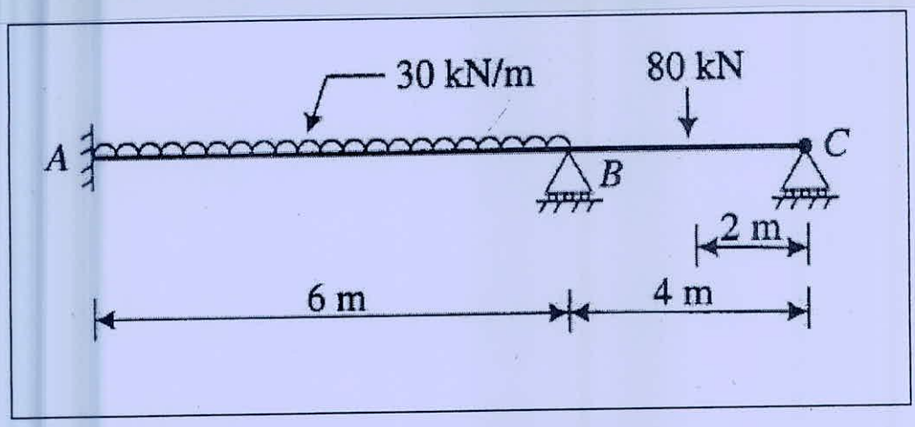

Figure for Q. No. 2(a)

(b) What is shape factor? Find the shape factor of a triangular section when the NA passes through the cg of the triangle and the NA is parallel to its base. **(10)**

Contd P/2

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3. Analyze the rigid jointed plane frame as shown in Figure for Q. No. 3 by using flexibility matrix method. **(35)**

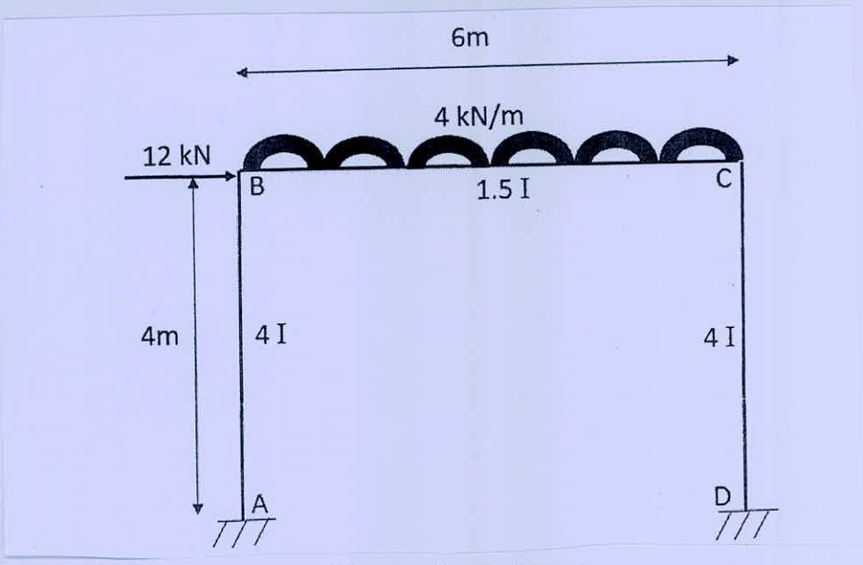

Figure for Q. No. 3

4. (a) A rectangular-section steel beam, 50 mm wide by 20 mm deep, is used as a simply supported beam over a span of 2 m with the 20 mm dimension vertical. **(20)**

(i) Determine the value of the central concentrated load which will produce initiation of yield at the outer fibers of the beam.

(ii) If the central load is then increased by 10% find the depth to which yielding will take place at the center of the beam span.

(iii) Over what length of the beam will yielding then have taken place?

(iv) What are the maximum deflections for each load case?

For steel σ_y in simple tension and compression = 225 MN/m^2 and E = 206.8 GN/m^2.

(b) A non-uniform, three-span beam is fixed at support A, simply supported on rollers at D, F, and G and carries unfactored loads as shown in Figure for Q. No. 4(b). Determine the minimum M_{pl} value required to ensure a minimum load factor equal to 1.7 for any span. **(15)**

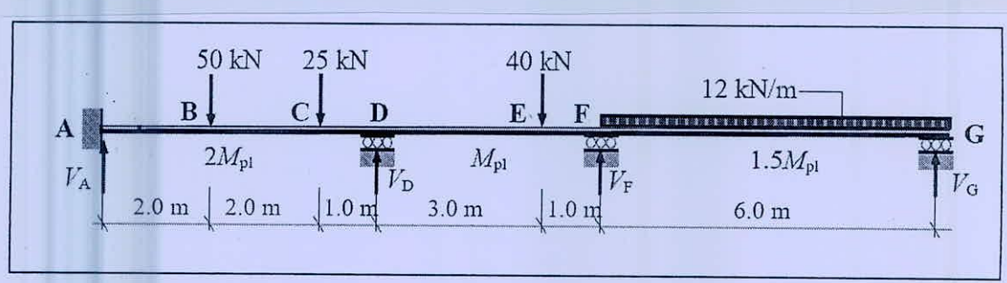

Figure for Q. No. 4(b)

NAME 451

SECTION – B

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

Assume reasonable values for any missing data.

Symbols have their usual meanings.

5. (a) Discuss the reasons for the 'Liberty Ships' fracture. **(10)**

(b) "Both approaches based on the force required to break atomic bonds and energy required to create new surfaces yield essentially equivalent results, and both predict much higher than the observed values of strength", explain in detail. **(13)**

(c) Discuss Griffith's theory of brittle fracture and Orowan's modification of it. **(12)**

6. (a) For plane stress conditions, **(7)**

(i) Formulate compatibility equation

(ii) Formulate harmonic equation.

(b) For a crack problem, state the Westergaard function and show that it fulfills all the boundary conditions. **(10)**

(c) For the mode-1 problem, formulate the expressions of crack tip stress components. **(18)**

7. (a) An 8 m long column is constructed from two 400 mm × 250 mm I-section joists jointed as shown in Fig. for Q. No. 7(a). One end of the column is arranged to be fixed and the other free and a load equal to one-third of the Euler load is applied. Find the load factor provided if the Perry-Robertson formula s used as the basis for design. **(25)**

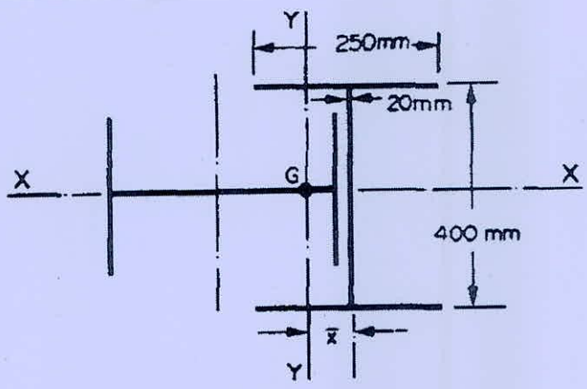

Figure for Question No. 7(a)

(b) Consider a pin-ended strut with uniformly distributed load, explain it for required information. **(10)**

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8. (a) An edge crack, detected on a large plate, is of length 3.1 mm under a constant amplitude cyclic load having σ_{max} = 310 MPa and σ_{min} = 172 MPa. If the plate is made of ferrite-pearlite steel and K_{1c} = 165 MPa $m^{1/2}$, Find (i) propagation life up to failure and (ii) propagation life if the crack length a is not allowed to exceed 25 mm. **(11)**

(b) Write short notes on **(12)**

(i) S-N Curve, (ii) Effect on an overload, (iii) Crack closure, (iv) Variable amplitude fatigue load.

(c) Discuss the major factors influencing environment-assisted fracture. **(12)**

L-4/T-1/NAME Date : 19/10/2023

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2021-2022

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

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

Symbols have their usual meaning.

Assume reasonable value for any missing data.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) Define the following terms: **(10)**

   Capital dredging, maintenance dredging, dike, beach nourishment, anti-eutrophication.

   (b) List the advantages and disadvantages of the following dredger: **(20)**

   (i) TSHD (ii) Dipper dredger (iii) Bucket dredger

   (c) Mention the factors in selection of dredging equipment. **(5)**

2. (a) 'A backhoe dredger is a mechanical excavation which has evolved from the common land-based hydraulic backhoe excavation' – Do you agree with this statement? Justify your answer mentioning what specific advantages can be gained for this type of dredger compared to other mechanical type dredger. **(10)**

   (b) With reference to the measurement of production for the TSHD, elaborately explain the following methods with their pros and cons: **(25)**

   (i) in-situ measurement

   (ii) measurement in the pipeline

   (iii) measurement in means of conveyance

3. (a) Briefly discuss how geotechnical investigation and bathymetric survey are done in dredging project. **(20)**

   (b) List potential short term and long term impacts of dredging. **(10)**

   (c) Mention function of draghead and swell compensator for TSHD. **(5)**

4. (a) A heavy duty slurry pump is used as dredge pump of a dredger for the following duty: **(25)**

   70 MT/hr of sand, specific gravity of solids = 2.65

   average particle size d_{50} = 0.211 mm

   concentration of solids C_w = 30% by weight

   static discharge head = 19.81 m

   suction head = 0.91 m (positive)

   Length of pipeline = 100 m

   Value and fitting = 5 × 90° long radius bend,

Contd P/2

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Contd ... Q. No. 4(a)

Calculate:

(i) the quantity of slurry

(ii) the slurry mixture velocity

(iii) the limiting settling velocity

(Take $F_L = 1.04$, pipe dia 150 mm)

(iv) Total dynamic head on the pump

(Take for each valve and fittings head loss 3.4 m and f = 0.016)

(v) Pump power

(b) Briefly describe various methods of hopper discharge for TSHD. **(10)**

SECTION – B

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

5. (a) What do you mean by CSD500? Mention the advantages and disadvantages of a CSD. **(10)**

(b) Describe the function of the following components used in CSD. **(15)**

(i) Anchor handling boom

(ii) onboard service crane

(iii) Ladder swinging winches

(iv) Ladder pump

(v) Cutter head

(c) A Cutter Suction Dredger (CSD) can dredge yearly 5 Mm^3 rock with a unconfined compressive strength of 5 MPa. The tensile strength is 1 MPa. The following data is available. **(10)**

The dredger has to work 168 hrs. a week

Yearly overhead 4 weeks. Christmas leave 1 week

General delay 10%. Dredging delay 20%

Estimated spillage 25%. Time losses due to stepping, spud changes 15%

SPE = 5 MJ/m^3

Find the required mean cutter power.

6. (a) A pipeline is designed to transport 140 metric ton of sand per hour. The specific gravity of the sand particles is 2.65. The concentration by weight is 30%. Determine the density of the mixture if the carrier fluid is water and also determine the resultant flow rate. **(10)**

(b) What is critical velocity? Mention why it is important for slurry pump transportation. **(10)**

(c) "In the design of a centrifugal dredge pump, it is necessary to consider more factors than those customarily considered in the design of a centrifugal water pump" – do you agree with the statement? Support your answer by elaborating the associated factors in this regard. Using the diagram, illustrate the power, head and efficiency curves of centrifugal pump handling slurry and water at constant speed. **(15)**

Contd P/3

NAME 475

7. (a) Briefly describe the following types of advancement mechanism of CSD with advantages and disadvantages: **(20)**

   (i) Rotor Spud System

   (ii) Walking Spud System

   (iii) Spud Carriage System

   (iv) Christmas Tree System

   (b) Using a Tabular form, show the classification of Mechanical, Hydraulic and Pneumatic Dredgers considering individual type, method of extraction, method of transportation and method of disposal. **(15)**

8. (a) Mention the salient features, advantages and disadvantages of each of the following dredger type. **(25)**

   (i) Dustpan dredger

   (ii) Jet Pump dredger

   (iii) Air Lift dredger

   (iv) Pneumatic dredger

   (b) Which type of dredger is suitable for the dredging of confined areas: such as alongside quays, in dock entrances, around jetties? Justify your answer by mentioning the salient feature of this particular type dredger. **(10)**

L-4/T-1/NAME **Date: 30/10/2023**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2021-2022

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**.

Question No. 4 is compulsory.

1. (a) Derive an expression for the constraint gradient vector for $f(y,z)$ with respect to z. Also explain the expression for sensitivity Co-efficient. **(20)**

   (b) Solve the following non-linear programming using the Lagrangian multipliers: **(15)**

   Optimize $z = 4x_1^2 + 2x_2^2 + x_3^2 - 4x_1x_2$

   Subject to

   $$x_1 + x_2 + x_3 = 15$$
   $$2x_1 - x_2 + 2x_3 = 20$$
   $$x_1, x_2, x_3 \geq 0$$

2. (a) A company is evaluating five projects to be executed on the basis of yearly expenditures, returns and available funds. Illustrate which optimization principle is best suited for the case? Also describe the algorithm with necessary figures. **(15)**

   (b) Formulate and solve the problem by Jacobian method **(20)**

   Minimize $z = f(x) = x_1^2 + x_2^2 + x_3^2$

   Subject to

   $$g_1(x) = x_1 + x_2 + 3x_3 - 2 = 0$$
   $$g_2(x) = 5x_1 + 2x_2 + x_3 - 5 = 0$$

   Also explain the sufficiency condition for this case.

3. (a) Consider the following LP: **(15)**

   Maximize $z = x_1 + 4x_2 + 7x_3 + 5x_4$

   Subject to

   $$2x_1 + x_2 + 2x_3 + 4x_4 = 10$$
   $$3x_1 - x_2 - 2x_3 + 6x_4 = 5$$
   $$x_1, x_2, x_3, x_4 \geq 0$$

   Generate the simplex tableau in matrix form associated with the basis B = (P_1, P_2).

   (b) Solve the following (non-linear programming problem) using the Kuhn-Tucker conditions: **(20)**

   Maximize $z = 2x_1^2 - 7x_2^2 + 12x_1x_2$

   Subject to $2x_1 + 5x_2 \leq 98$

   $$x_1\ x_2 \geq 0$$

Contd P/2

NAME 477

4. (a) How sequential quadratic programming is used to determine the optimal solution for constrained optimal solution for constrained optimization problem? Construct the Kuhn-Tucker condition for sequential quadratic programming. **(20)**

(b) What are the modern methods of optimization? How does Genetic-Algorithm (GA) differ from the traditional methods of optimization? Describe all the GA processes by considering a ship design problem. **(15)**

SECTION – B

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

5. (a) What do you mean by optimization? Discus the various types of optimization problem. **(10)**

(b) The Burroughs Garment Company manufactures men's shirts and women's blouses for Walmark Discount Stores. Walmark will accept all the production supplied by Burroughs. The production process includes cutting, sewing, and packaging. Burroughs employs packaging department. The factory works on 8-hr shift, 5 days a week. The following table gives the time requirements and profits per unit for the two garments. **(25)**

	Minutes per unit			
Garment	Cutting	Sewing	Packaging	Unit profit ($)
Shirts	20	70	12	8
Blouses	60	60	4	12

Determine the optimal weekly production schedule for Burroughs.

6. (a) State three properties of standard primal optimization problem. **(10)**

(b) Consider the following LP **(25)**

Maximize $z = 2x_1 + 3x_2$

Subject to

$$x_1 + 3x_2 \leq 6$$
$$3x_1 + 2x_2 \leq 6$$
$$x_1, x_2 \geq 0$$

(i) Express the problem in standard form

(ii) Determine all the basic solutions of the problem and classify them as feasible and infeasible.

Contd P/3

NAME 477

7. (a) State the optimality and feasibility conditions of the Simplex method. **(10)**

(b) Solve the following problem by the M-method **(25)**

Minimize $z = 4x_1 + x_2$

Subject to

$$3x_1 + x_2 = 3$$
$$4x_1 + 3x_2 \geq 6$$
$$x_1 + 2x_2 \leq 4$$
$$x_1, x_2 \geq 0$$

8. (a) Explain how you will construct the dual problem from standard primal. **(10)**

(b) Consider the following LP **(25)**

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

Subject to

$$x_1 + 5x_2 + 2x_3 = 30$$
$$x_1 - 5x_2 - 6x_3 \leq 40$$
$$x_1, x_2, x_3 \geq 0$$

The optimal solution yields the following objective equation:

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

Where artificial x_4 and slack x_5 are the starting basic variables. Write the associated dual problem and determine its optimal solution from the optimal z-equation.

L-4/T-1/NAME Date : 08/10/2023

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2021-2022

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

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

Assume reasonable values for missing data, if any.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

Assume reasonable values for missing data, if any.

1. (a) A company that operates 10 hours a day manufactures three products on three processes. Table for Question 1(a) summarizes the data. **(20)**

Table for Question 1(a)

	Minutes per unit			
Product	*Process 1*	*Process 2*	*Process 3*	Unit price
1	10	6	8	$4.50
2	5	8	10	$5.00
3	6	9	12	$4.00

Required:

Using the Simplex method, determine the optimal product mix to maximize the profit.

(b) A company makes bicycles. It produces 450 bicycles a month. It buys the tires for bicycles from a supplier at a cost of $20 per tire. The company's inventory carrying cost is estimated to be 15% of cost and the ordering is $50 per order. Compute the economic order quantity (EOQ). Also, calculate the cycle length in days. **(10+5=15)**

2. (a) The production scheduler for XYZ Machine Shop has six jobs ready to be processed that can each be assigned to any of six different workstations. Due to the characteristics of each job and the different equipment and skills at the workstations, the time to complete a job depends on the station it is assigned to. Table for Question 2(a) shows the data on the jobs and the time it would take to do each job at each workstation. **(20)**

Table for Question 2(a)

	Job Completion Time at Workstation (hours)					
Job	**1**	**2**	**3**	**4**	**5**	**6**
A	3.2	3.5	2.9	3	4	3.6
B	2.7	2.9	2.3	3	3.1	3.7
C	3.8	4	4.3	4.5	4.1	3.6
D	2.8	2.1	2.9	2.5	3	2.2
E	6.1	6.5	6.7	7	6	6.2
F	1.5	1.3	1.9	2.9	4	3.6

Required:

Using the Hungarian method, assign each job to a machine to minimize total processing time.

Contd P/2

IPE 479/NAME

Contd ... Q. No.2

(b) Using numerical examples, present the following capital budgeting decision tools. **(3×5=15)**

(i) Discounted payback period (DPP)

(ii) Net present value (NPV)

(iii) Internal rate of return (IRR)

3. Milo Company manufactures beach umbrellas. The company is preparing detailed budgets for the third quarter and has assembled the following information to assist in the budget preparation: **(18+17=35)**

(i) The Marketing Department has estimated sales as follows for the remainder of the year (in units):

July	30,000	October	20,000
August	70,000	November	10,000
September	50,000	December	10,000

The selling price of the beach umbrellas is $12 per unit.

(ii) All sales are on account. Based on past experience, sales are collected in the following pattern:

30% in the month of sale

65% in the month following sale

5% uncollectible

Sale for June totaled $300,000.

(iii) The company maintains finished goods inventories equal to 15% of the following month's sales. This requirement will be met at the end of June.

(iv) Each beach umbrella requires 4 feet of Gilden, a material that is sometimes hard to acquire. Therefore, the company requires that the ending inventory of Gilden be equal to 50% of the following month's production needs. The inventory of Gilden on hand at the beginning and end of the quarter will be:

30% in the month of sale

65% in the month following sale

5% uncollectible

(v) Gilden costs $0.80 per foot. One-half of a month's purchases of Gilden is paid for in the month of purchase; the remainder is paid for in the following month. The accounts payable on July 1 for purchases of Gilden during June will be $76,000.

Required:

(a) Prepare a sales budget, by month and in total, for the third quarter. (Show your budget in both units and dollars.) Also prepare a schedule of expected cash collections, by month and in total, for the third quarter.

(b) Prepare a direct materials budget for Gilden, by month and in total, for the third quarter. Also prepare a schedule of expected cash disbursements for Gilden, by month and in total, for the third quarter.

Contd P/3

IPE 479/NAME

4. (a) Suppose, we have the following demand data for a product for previous twelve quarters. **(20)**

Table for Question 4(a)

Quarter	Sales	Quarter	Sales
1	600	7	2,600
2	1,550	8	2,900
3	1,500	9	3,800
4	1,500	10	4,500
5	2,400	11	4,000
6	3,100	12	4,900

Showing all the calculations, develop the regression equation for predicting demand for the product. Also, plot the data in a graph and draw the best fitted line.

(b) Using numerical examples, explain three key performance indicators (KPIs) to measure forecast accuracy. **(3×5=15)**

SECTION – B

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

Make appropriate assumptions for any missing data.

5. (a) What do you understand by management? Explain different functions of management. **(10)**

(b) Write down the purposes of organizing. **(10)**

(c) Mention different types of departmentalization. Differentiate product departmentalization from process departmentalization. **(15)**

6. (a) Define leadership and explain how it is similar to and different from management. **(10)**

(b) Briefly discuss the seven traits associated with leadership. **(10)**

(c) Explain the rewards and challenges of being a manager. **(15)**

7. (a) What do you mean by motivation? Write down the important characteristics of Halsey's wage plan. **(4+6=10)**

(b) Briefly explain Maslow's hierarchy of needs theory with an appropriate diagram. **(10)**

(c) Discuss Fayol's 14 principles of management. **(15)**

8. (a) Define quality. What are the dimensions of product quality? **(10)**

(b) Briefly describe the main distinguishing characteristics of TQM. **(10)**

(c) Differentiate effectiveness and efficiency in Management. Describe three essential management skills and how the importance of these skills changes with different managerial levels. **(5+10=15)**
