

L-4/T-2/NAME

Date : 01/01/2013

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **NAME 449** (Navigation and Maritime Regulations)

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**.

[Assume suitable value in case of missing data]

1. (a) Briefly describe the components and their functions (with block diagram) of a basic pulse-modulated radar system. (18)
(b) What are the factors affecting the maximum range of a radar? (10)
(c) What are the limitations of sound signals as aid to navigation? (07)
2. (a) Give a short description of 'Buoy light systems' and 'Lighted sound buoys'. (14)
(b) What are the advantages and disadvantages of Mercator projection? (12)
(c) Write a short note on 'Fixed Lights'. (09)
3. (a) Write short notes on the following: (30)
(i) Lateral and Cardinal Buoyage system
(ii) GPS
(iii) LORAN.
(b) What is Dead Reckoning? Also write its purpose. (05)
4. (a) Find the course and distance between the following positions: (12)
A $20^{\circ} 35' N$ $32^{\circ} 15' W$
B $16^{\circ} 24' S$ $39^{\circ} 55' W$
(b) Define: (06)
(i) Vertex of a great circle
(ii) Geographical mile
(iii) Transverse Mercator
(c) Find the initial course to steer and the shortest distance between the following positions if the vessel is not to go to the south of the parallel of $45^{\circ} S$.
A $10^{\circ} 18.0' S$ $20^{\circ} 10.0' E$
B $45^{\circ} 00.0' S$ $160^{\circ} 10.0' E$

Contd P/2

NAME 449

Contd. Q. No. 4(c)

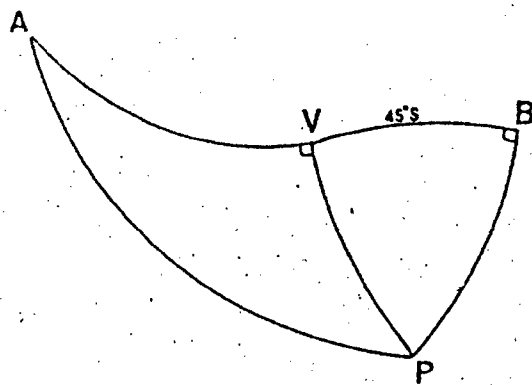


Figure for Question 4(c)

SECTION - B

There are **FOUR** questions in this Section. Answer any **THREE** including Q. No. 5.

[Question 5 is compulsory. Necessary regulation is attached]

5. (a) A double skin Crude Oil Tanker has the following particulars:

(27)

$L_{BP} = 223$ m $L_{WL} = 230$ m at 85% D

$B = 32.2$ m $D = 20.5$ m

Deadweight = 70,000 Tonnes

Lightweight = 13,700 Tonnes

Propeller diameter = 6.85 m

Draft aft in ballast condition = 7.7 m

Oil Tanker has displacements of 34,000 MT and 35,800 MT at mean drafts 6 m and 7 m respectively. In addition, tanker has 6 No. Cargo Oil Tank with centerline longitudinal bulkhead dividing each tank port and starboard side. The total length of cargo tank is 171 m, height of double bottom is 2.020 m and width of the wing tank space is 2.1 m.

Determine:

- (i) Minimum SBT capacity according to MARPOL if SBT contains salt water.
- (ii) The available volume of ballast considering rectangular cross sectional wing tank and double bottom tank. Comment about the fulfillment of MARPOL requirements in this case.
- (iii) Suppose after side damage and bottom damage, the corresponding hypothetical flows have been found 10160 m³ and 500 m³ respectively. Justify whether the limiting size and arrangement of cargo tank is OK or not.

(b) A type B ship has a freeboard length of 145 m measured on a waterline at 85% of the moulded depth of 12 m and a beam of 21 m. There is no bridge amidships and the forecastle and poop have mean covered lengths of 30 m and 15 m and heights of 2.6 m

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Contd. Q. No. 5(b)

- respectively. The displacement at a moulded draught of 85% of the moulded depth is 22700 m³ and the displacement in seawater at the summer LWL is 19,420 Tonnes with a corresponding tonnes immersion per cm of 25. Determine tropical, winter, winter North Atlantic and fresh water freeboards if summer freeboard is 2657 mm at maximum draft of 8.098 m. (8)
6. (a) Discuss the structure of IMO Bodies and mention their roles for promoting overall maritime safety. (17)
- (b) Define fatigue. Discuss the roles of naval architect for designing a fatigue-resistant ship. (18)
7. (a) Give a typical distribution of fire fighting equipment according to ISO for a ship whose engine power is 900 kW. (17)
- (b) Mention the classification of dangerous goods according to Inland Shipping Rules. (10)
- (c) Write short notes on navigational lights. (8)
8. (a) Briefly discuss the general requirements of Life Saving Appliances (LSA) for an inland passenger ship whose carrying capacity is 250 persons. (17)
- (b) Write short notes on: (18)
- (i) Ballast water management
 - (ii) Hong Kong Convention
 - (iii) UNCLOS
 - (iv) Territorial waters
-

For a. No. 5(a).

where

i - represents each compartment or group of compartments under consideration,

p_i - accounts for the probability that only the compartment or a group of compartments under consideration may be flooded, disregarding any horizontal subdivision,

$s_i = C [0.5 (GZ_{max})^{1.5} (\text{range of stability})]^{1.5}$ - accounts for the probability of survival probability after flooding the compartment or a group of compartments under consideration, including the effects of any horizontal subdivision.

$C = 1$ if $\theta_e \leq 25^\circ$

$C = 0$ if $\theta_e > 30^\circ$

$C = [(30 - \theta_e) / 5]^{1.5}$ otherwise

GZ_{max} - maximum positive righting lever (m) within the stability range, but not greater than 0.1 m

θ_e - final equilibrium angle of heel ($^\circ$)

The stability range is taken maximally up to the angle of heel of 20° .

The attained subdivision index must be higher than the required one. If that is not the case, some interventions have to be made in the design, either by additional subdivisions, increased freeboard, rearrangement or heightening of hatch coamings or by using some other means.

Appendix A2: MARPOL rules of major importance in the design procedure

Minimum dimensions for the double side and double bottom are established in Chapter II, Regulation 13F. The minimum width (w) of the double side is defined in the following way:

$w = 0.5 + DW / 20000$ (m), or (A2.1)

$w = 2.0$ (m), whichever is the lesser. The minimum value is 1.0 m

where DW (t) is deadweight.

Minimum height (h) of the double bottom is determined in the following way:

$h = B / 15$ (m), or (A2.2)

$h = 2.0$ (m), whichever is the lesser. The minimum value is 1.0 m where B (m) is the moulded breadth of the ship.

Maximum dimensions of cargo tanks are defined in Chapter III. It will be briefly presented with in the following text.

Maximum length of a cargo tank is 10 m or any of the following values, whichever value is greater:

a) for tankers with no longitudinal bulkhead inside the cargo tanks

$(0.5 b_i / B + 0.1) L$ but not to exceed $0.2 L$ (A2.3)

b) for tankers with a centreline longitudinal bulkhead inside the cargo tanks

$(0.25 b_i / B + 0.15) L$ (A2.4)

c) for tankers with two or more longitudinal bulkheads inside the cargo tanks

(i) for wing cargo tanks: $0.2 L$ (A2.5)

(ii) for centre cargo tanks:

(1) if b_i / B is equal to or greater than one fifth: $0.2 L$ (A2.6)

(2) if b_i / B is less than one fifth:

- with no centreline bulkhead: $(0.5 b_i / B + 0.1) L$ (A2.7)

- with a centreline bulkhead: $(0.25 b_i / B + 0.15) L$ (A2.8)

where b_i is the minimum distance from the ship's side to the outer longitudinal bulkhead of the tank in question measured inboard at right angles to the centreline at the level corresponding to the assigned summer freeboard.

The length of a ship L (m) is defined as 96% of the total length on the waterline at 85% of the moulded depth, or as a distance from the stem to the axis of rudder stock on that waterline, whichever value is greater.

Maximum cargo tank capacity is defined in the way that a hypothetical oil outflow in the case of side damage of the ship O_s or the bottom damage of the ship O_b should not exceed $30,000 \text{ m}^3$ or $400 (DW)^{0.3}$, whichever value is greater, but subject to a maximum of $40,000 \text{ m}^3$.

Basic calculations of a hypothetical cargo discharge in the case of ship damage are as follows:

(a) for side damages

$O_s = \Sigma W_i + \Sigma K_i C_i$ (A2.9)

(b) for bottom damages

$O_b = 1/3 (\Sigma Z_i W_i + \Sigma Z_i C_i)$ (A2.10)

where

W_i (m^3) = volume of a wing tank assumed to be breached by the damage

C_i (m^3) = volume of a centre tank assumed to be breached by the damage

$K_i = 1 - b_i / t_c$ when b_i is equal to or greater than t_c , K_i shall be taken as 0

$Z_i = 1 - h_i / v_b$ when h_i is equal to or greater than v_b , Z_i shall be taken as 0

b_i (m) = width of wing tank under consideration measured inboard from the ship's side at right angles to the centreline at the level corresponding to the assigned summer freeboard

h_i (m) = minimum depth of the double bottom under consideration

t_c, v_b are assumed damages defined in following text.

For the purpose of calculating hypothetical oil outflow following extent of damages are assumed:

(a) Side damage

(i) Longitudinal extent (l_i): $1/3 L^{0.3}$ or 14.5 m, whichever is less (A2.11)

(ii) Transverse extent (t_i): $B/5$ ili 11.5 m, whichever is less (A2.12)

(iii) Vertical extent (v_i): from the baseline upwards without limit

(b) Bottom damage From 0.3 L from the forward perpendicular Any other part of the ship

(i) Longitudinal extent (l_i): $L/10$ $L/10$ or 5 m, whichever is less (A2.13)

- (ii) Transverse extent (t_1): $B/6$ or 10 m, 5 m (A2.14)
whichever is less, but not less than 5 m
- (iii) Vertical extent from the baseline (v_1): $B/15$ or 6 m, whichever is less (A2.15)

Damage assumptions and stability criteria are established in Chapter III and Chapter II, Regulation 13F. It will be briefly presented with in the following text.

Damage stability criteria shall apply to:

- tankers of more than 225 m in length, anywhere in the ship's length
- tankers of more than 150 m, but not exceeding 225 m in length, anywhere in the ship's length, except involving either after or forward bulkhead bounding the machinery space located aft. The machinery space shall be treated as a single floodable compartment
- tankers not exceeding 150 m in length, anywhere in the ship's length between adjacent transverse bulkheads with the exception of the machinery space.

Damage cases:

- (a) Side damage
 - (i) Longitudinal extent: $\frac{1}{3} L^{2/3}$ or 14.5 m, whichever is less; (A2.16)
 - (ii) Transverse extent: $B/5$ or 11.5 m, whichever is less; (A2.17)
(inboard from the ship's side at right angles to the centreline at the level of the summer load line)
 - (iii) Vertical extent: from the moulded line of the bottom shell plating at centreline, upwards without limit
- (b) Bottom damage For $0.3 L$ from the forward perpendicular Any other part of the ship
 - (i) Longitudinal extent: $\frac{1}{3} L^{2/3}$ or 14.5 m, whichever is less. $\frac{1}{3} L^{2/3}$ or 5 m, whichever is less (A2.18)
 - (ii) Transverse extent: $B/6$ or 10 m, whichever is less $B/6$ ili 5 m, whichever is less (A2.19)
 - (iii) Vertical extent $B/15$ or 6 m, whichever is less, measured from the moulded line of the bottom shell plating at centreline (A2.20)
- (c) Bottom raking damage (for oil tankers of $20,000$ dwt and above)
 - (1) longitudinal extent
 - (i) for ships of $75,000$ dwt and above: $0.6 L$ measured from the forward perpendicular (A2.21)
 - (ii) for ships of less than $75,000$ dwt: $0.4 L$ measured from the forward perpendicular (A2.22)
 - (2) transverse extent: $B/3$ anywhere in the bottom (A2.23)
 - (3) vertical extent: breach of the outer hull. (A2.24)

Damage stability criteria are as follows:

- (a) The final waterline, taking into account sinkage, heel and trim, shall be below the lower edge of any opening through which progressive flooding may take place.
- (b) In the final stage of flooding, the angle of heel due to unsymmetrical flooding shall not exceed 25° , provided that this angle may be increased up to 30° if no deck edge immersion occurs.
- (c) The stability in the final stage of flooding shall be investigated and may be regarded as sufficient if the righting lever curve has at least a range of 20° beyond the position of equilibrium in association with a maximum residual righting lever of at least 0.1 m within the 20° range; the area within this range shall not be less 0.0175 metre radian.

The requirement for minimum volume of ballast tanks is given in Chapter II, Regulation 13 by a definition of minimum ballast draughts. The minimum moulded amidships draught d_m is given as:

$$d_m = 2.0 + 0.02 L \text{ (m)} \quad (\text{A2.25})$$

in association with the maximum aft trim of $0.015 L$ and enabling full immersion of the propeller(s).

Appendix A3: Classification societies' rules having a influence on the general configuration of the ship

Further are presented DNV's requirements, other classification societies have similar requirements.

1) Minimum number of watertight transverse bulkheads

For ships without a longitudinal bulkhead and with the engine room located at the stern, the minimum number of bulkheads is defined by the following table A3.1.

Table A3.1 Minimum number of transverse bulkheads
Tablica A3.1 Minimalni broj poprečnih pregrada

Length of a ship (m)	Number of bulkheads
$85 < L \leq 105$	4
$105 < L \leq 125$	5
$125 < L \leq 145$	6
$145 < L \leq 165$	7
$165 < L \leq 190$	8
$190 < L \leq 225$	9
$L > 225$	considered individually

L (m) – length between perpendiculars (it should not be less than 96% or greater than 97% of the water line length at maximum draught).

The number of watertight transverse bulkheads may be lesser than the minimum number required. If that is case, the ship must satisfy the conditions of damage stability, and the problem of general configuration and strength of the ship should be given due attention.

2) Position of collision bulkhead

The position of collision bulkhead defines the length of the fore peak and the cargo space. It is defined as follows:

The distance from the forward perpendicular (x_c) must be within the values stated below:

Sheet
26.12.12

L-4/T-2/NAME

Date : 26/12/2012

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **NAME 423** (Power and Propulsion Systems)

Full Marks: 210

Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

Assume reasonable value in case of data missing. The symbols have their usual meaning.

SECTION - A

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

1. (a) Prove, (15)
$$\eta_T = \eta_H \cdot \eta_B \cdot \eta_S \cdot \eta_M$$

and define individual efficiency components.
- (b) With figure give definition of (10)
(i) effective power (ii) thrust power (iii) delivered power (iv) shaft power.
- (c) Mention the advantages and disadvantages of using the following propulsion engines for ship powering, (10)
(i) Reciprocating steam engine
(ii) Gas turbine.
2. (a) How the slow speed, medium speed and high speed diesel engines are distinguished? Give a comparison of the size, density and weight per KW between the above mentioned types of diesel engines at a power of about 7000 KW. (15)
- (b) Discuss the choice of medium speed diesel engines for a ship. (10)
- (c) Give some values of reduction gear ratios for propulsion reduction gearing driven by medium speed diesel engines. (10)
3. A vessel is fitted with hydraulic jet propulsion and the inlet water to the pump is taken in from side of the vessel. Derive the following expression for efficiency of propulsion, (35)
$$\eta_{\text{Jet}} = \frac{2(V_J - V_s) \cdot V_s}{V_J^2}$$

Provide definition sketch for efficiency of related propulsion system. Also show that the maximum efficiency attainable is 50%.
4. (a) A vessel is fitted with hydraulic jet propulsion, where the inlet water to the pump is taken in from ahead and the efficiency of the jet is 0.8. If the vessel speed is 8 knots and thrust required is 6 kN, calculate the diameter of the jet. (15)

Contd P/2

NAME 423

Contd Q. No. 4

(b) The open water propeller performance data of a propeller is given below:

(20)

Advance coefficient (J)	Torque coefficient (K_2)
0.0	0.130
0.2	0.114
0.4	0.094
0.6	0.072
0.8	0.050
1.0	0.032
1.2	0.014

Calculate the torque developed in the inclined condition with the shaft inclined at an angle, $\epsilon = 10$ degrees for advance coefficient, $J = 0.65$.

Given:

Propeller diameter, $D = 0.3$ m.

Propeller revolution, $n = 500$ r.p.m.

Density of water, $\rho = 102$ Kg.sec²/m⁴.

SECTION - B

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

5. (a) Describe the salient features of Kort-nozzle propeller.

(15)

(b) A harbour tug fitted with a nozzle propeller has the following particulars:

(20)

Engine power = 900 HP (metric)

Engine revolution = 800 rpm

Gear ratio = 3 : 1

The ship resistance at 6 knots is 555 kg in the service condition. At towing speed of 6 knots, the wake fraction = 0.214 and thrust deduction fraction = 0.095. Using B4-55 screw series in nozzle, calculate

(i) the optimum propeller diameter, pitch and efficiency,

(ii) Thrust developed by the propeller and the nozzle, &

(iii) Tow rope force at towing speed of 6 knots.

6. A controllable pitch propeller of diameter 22 ft is fitted to a ship, calculate the differential component of blade spindle torque about the spindle axis for blade sections at $x = 0.7$ for the following three cases:

(35)

Contd P/3

NAME 423**Contd Q. No. 6**

- (i) Rake angle = 0.0 deg and skew = 0.09 ft,
- (ii) Rake angle = 7.5 deg and skew = 0.09 ft, &
- (iii) Rake angle = 7.5 deg and skew = 0.9 ft.

Comment on the effect of inclusion of rake and skew in the design.

Given:

Resultant inflow velocity at the blade section = 50 ft/sec.

Non-dimensional hub radius = 0.3

x	l(ft)	ϕ (deg)	β_i (deg)	C_L	C_D	C_C (% chord from L.E.)	C_M (% chord from L.E.)
0.7	5.112	27.47	25.53	0.285	0.008	45.2	45.0

7. (a) Explain how energy is saved in contra-rotating propeller. (10)
- (b) Design a contra-rotating propeller having the thrusts of front and rear propellers being the same with equal number of revolution: (25)

Ship speed = 14 knots

Wake fraction = 0.16

Number of blades = 3

Shaft horse power = 296

Number of revolutions of the engine = 1800 rpm

Calculate the following items:

- (i) Diameters of front propeller & aft propeller,
- (ii) Pitch of each of front & aft propellers,
- (iii) Optimum efficiency of the system, &
- (iv) Blade area ratios of front & rear propellers.

8. (a) Write a short note on 'cavitating propeller'. (10)
- (b) A fully cavitating propeller is to be designed to develop a thrust of 2400 kg. The particulars required for the design are given below: (25)

Ship speed = 50 knots

Wake fraction = 0.13

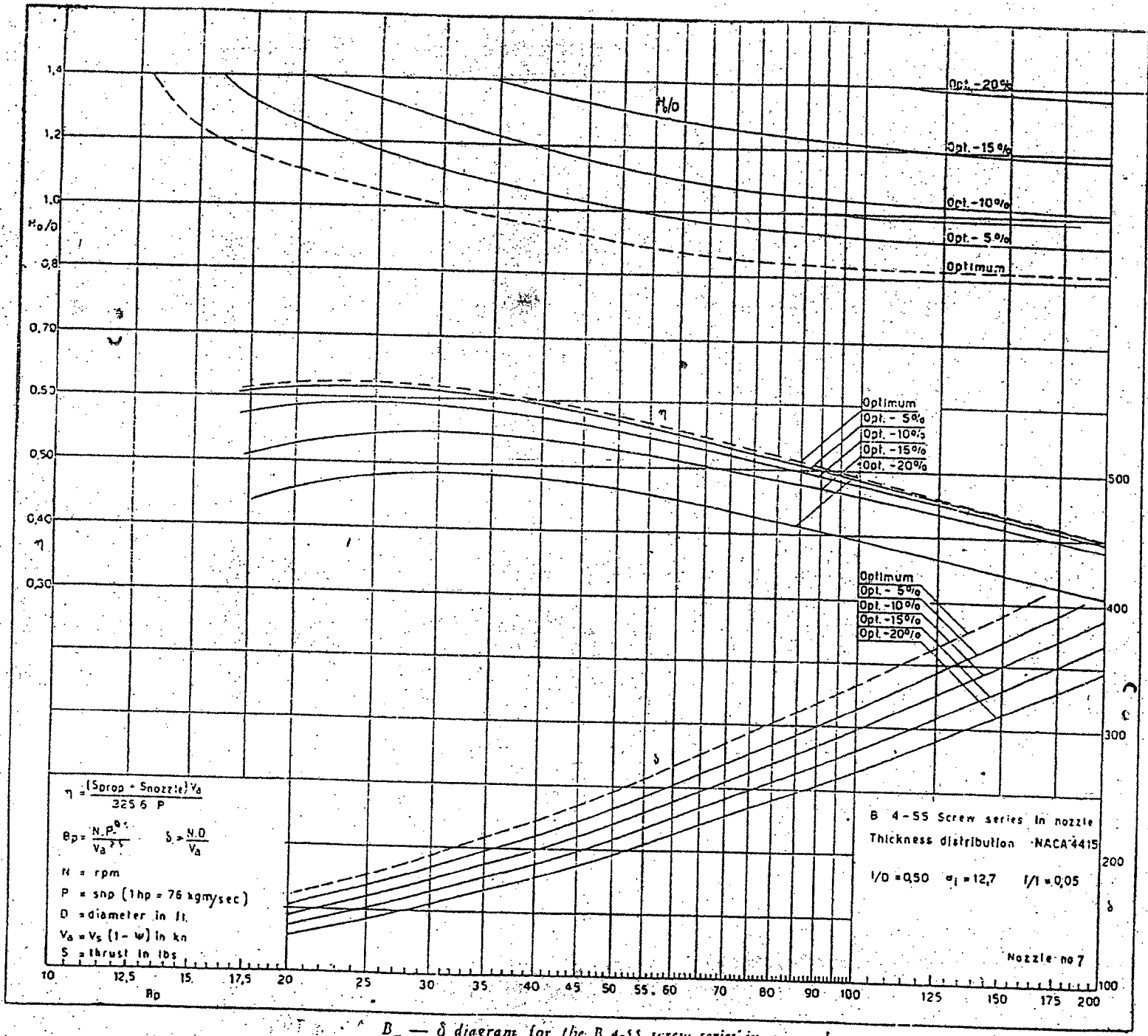
Number of blades = 3

Screw diameter = 0.6 m

Determine:

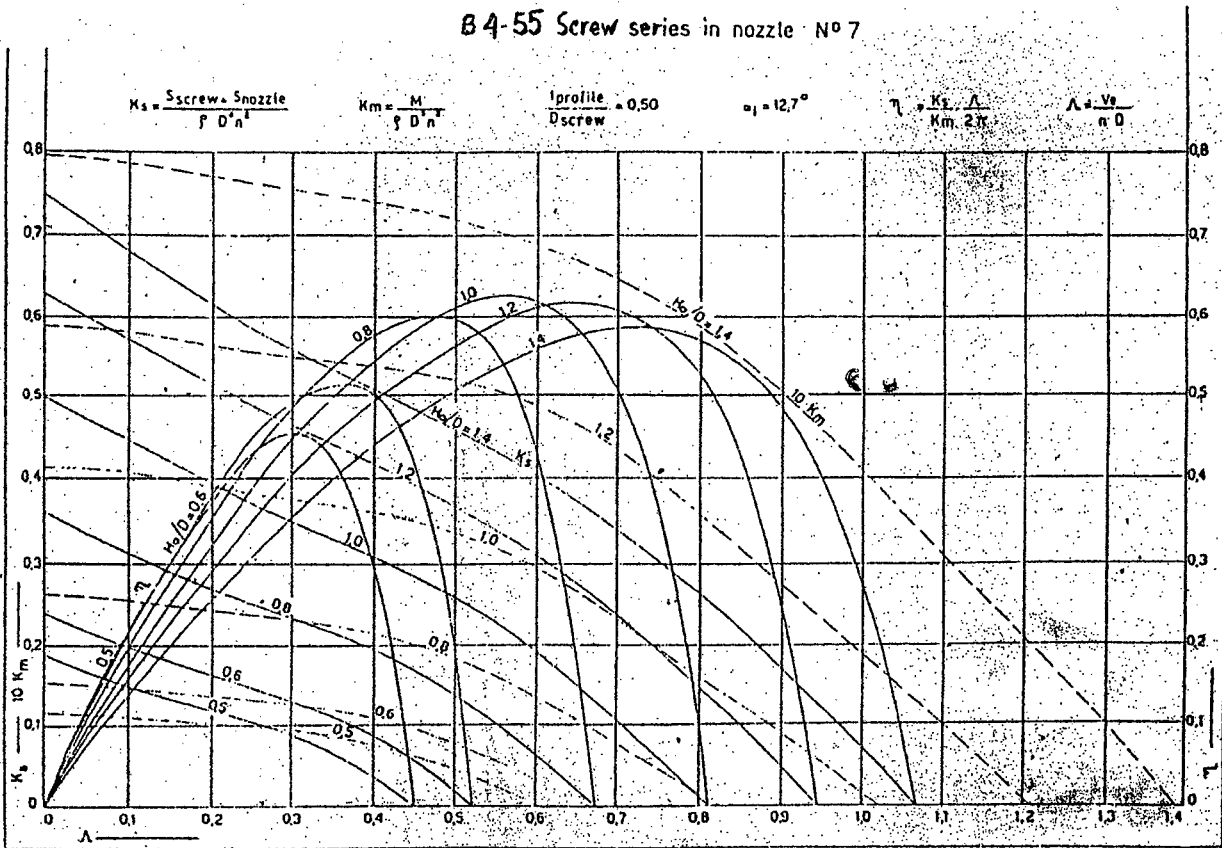
- (i) For maximum efficiency, the required rpm of the propeller,
- (ii) the corresponding pitch of the propeller,
- (iii) the maximum efficiency,
- (iv) the projected area if BAR = 0.65, &
- (v) the thrust per unit projected area.

Fig. No. Q.N. 5(b)

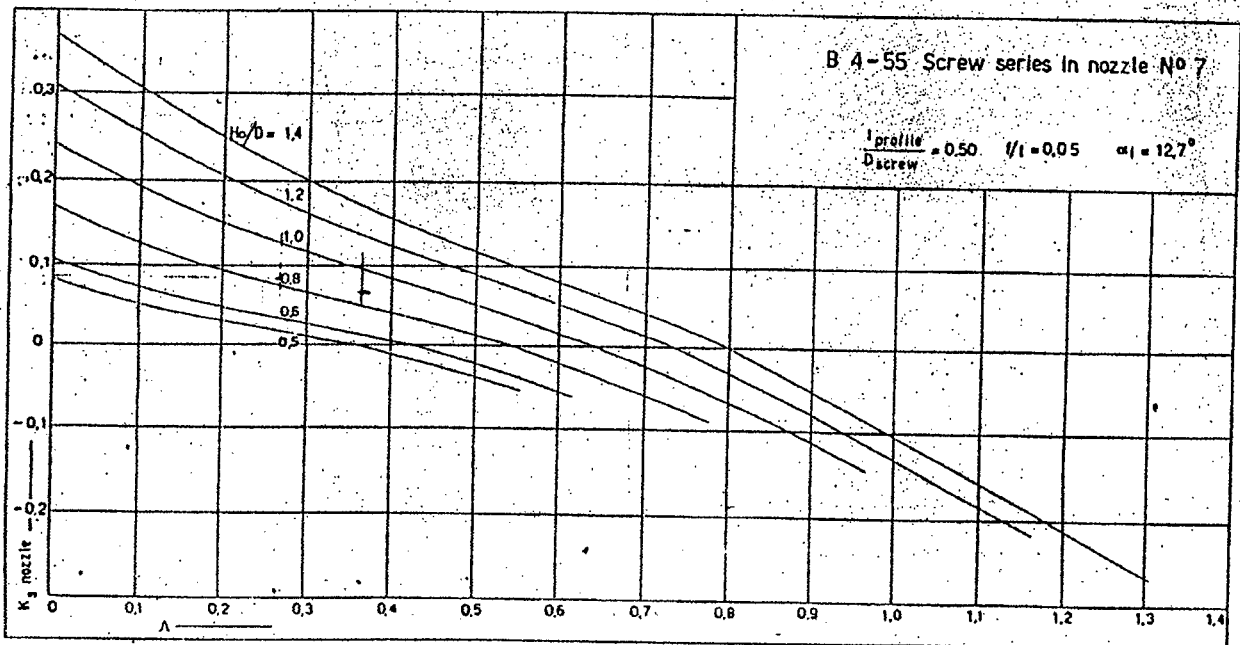


$B_p - \delta$ diagram for the B 4-55 screw series in a nozzle

B 4-55 Screw series in nozzle N° 7



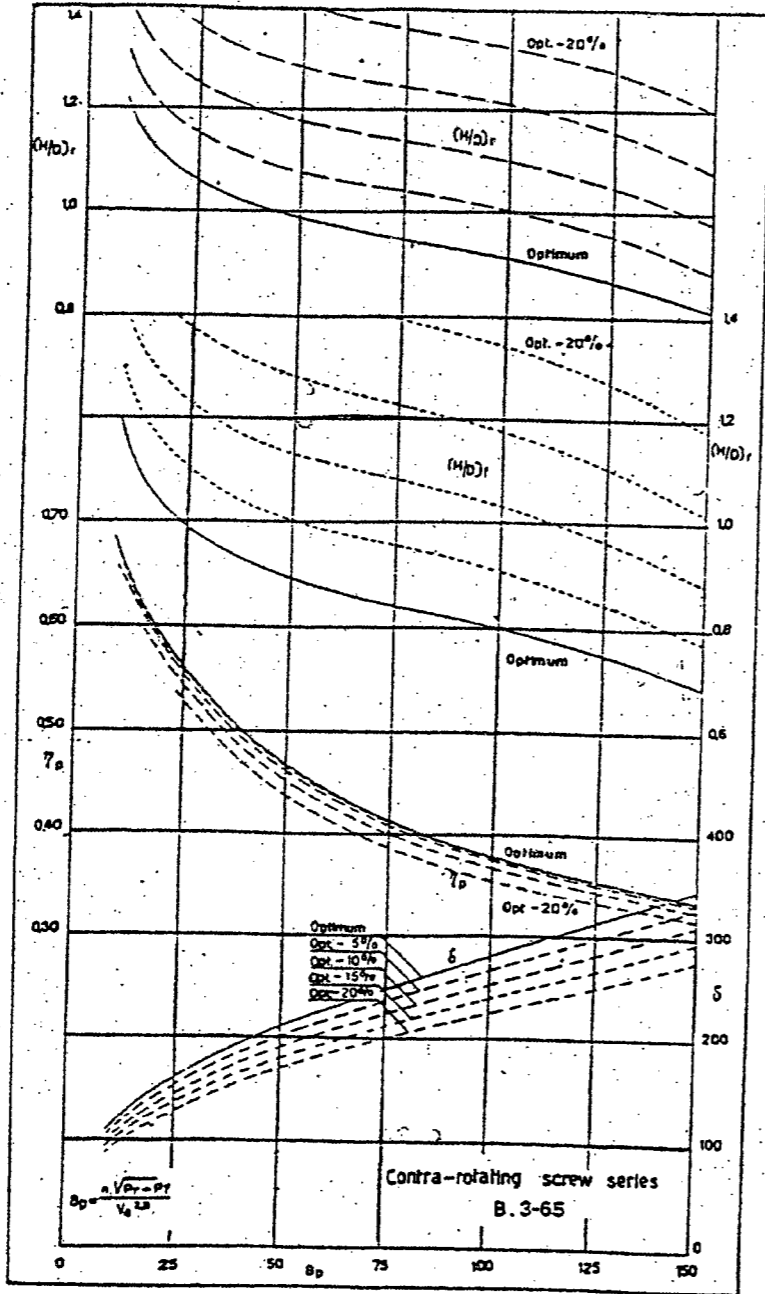
Results of open water tests with the B 4-55 screw series in a nozzle



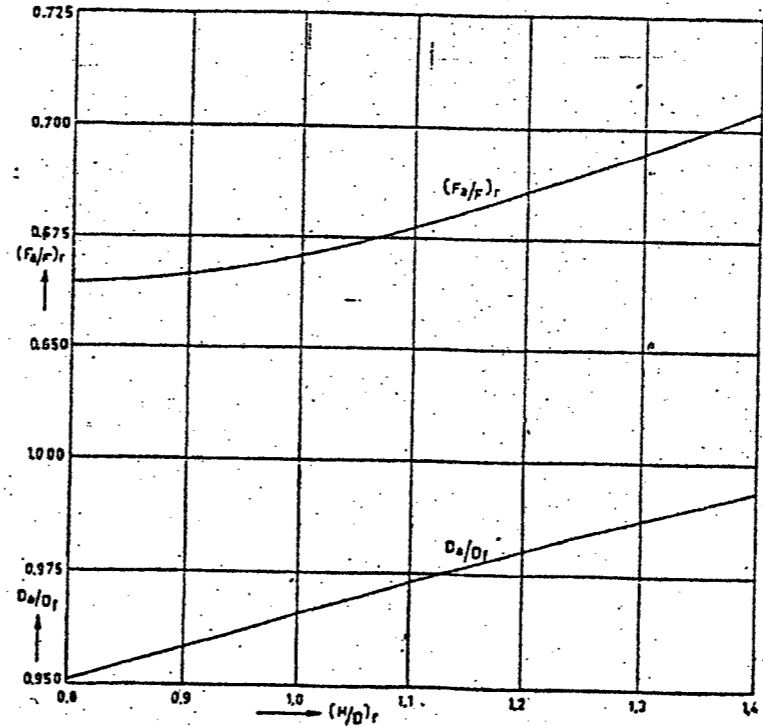
Axial forces acting on a nozzle with the B 4-55 screw series

Fig. for R. N. 5(b)

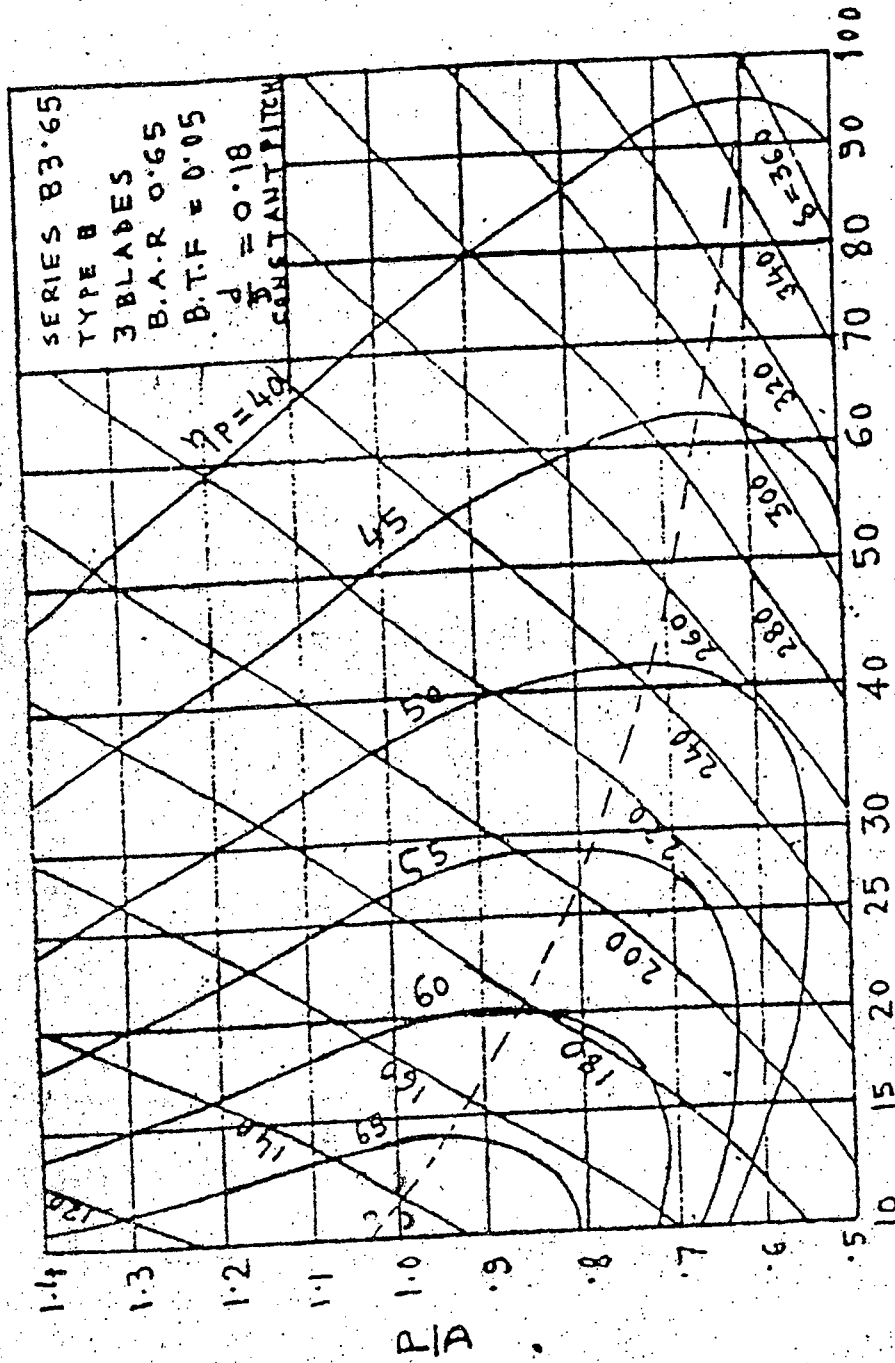
Fig. for R.N. 7(b)



$B_p - \delta$ chart for a three-bladed contra-rotating propeller series



Diameter ratio of front and rear propellers and blade-area ratio F_a/F_r of the rear propeller in terms of the pitch ratio of the rear propeller



BP
BP-8 diagram 3 bladed screw type B3-65.

Fig. for Q.N. 8

Fig. for Q.N. 8 (b)

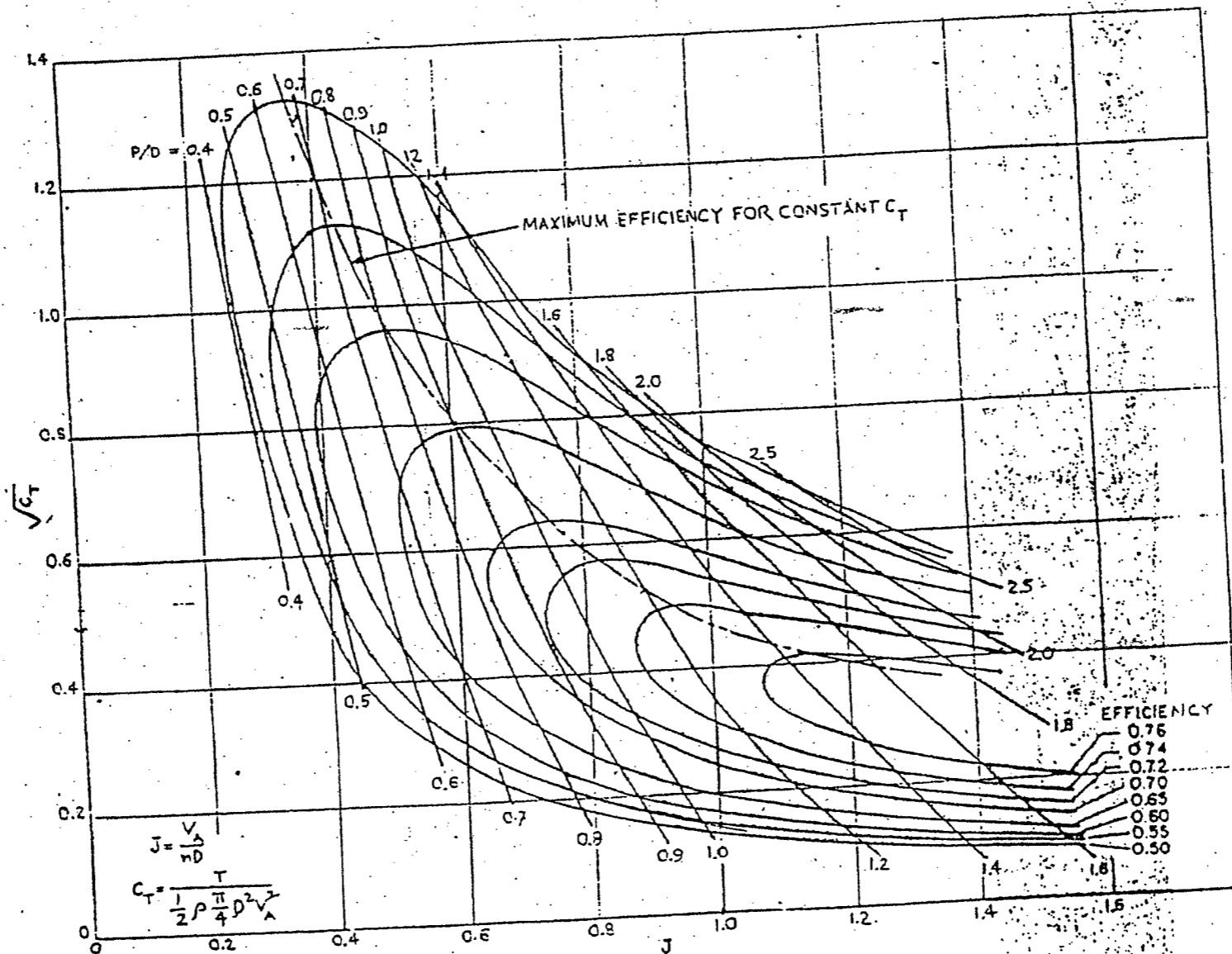


Fig. A Propeller design chart for fully-cavitating propellers

L-4/T-2/NAME

Date : 18/12/2012

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **NAME 427** (Maritime system and Management)

Full Marks : 210

Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

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SECTION – A

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

Assume suitable values for missing data, if any.

1. What are the economic complexities involved in shipbuilding and shipping industries? Describe in brief. Draw a figure showing the annual income of a ship owner. (35)

2. An offshore support vessel costing £ 6 M cash on delivery is to built for charter at a rate averaging £ 5000 per day. Annual operating costs are expected to be 14.25% of the first cost. Annual off hire days is 25. Taking vessel life as 15 years with zero residual value calculate NPV at 10% discount rate with corporation tax at 35% under the taxation system, declining balance at 25% (single slip or New Entry) should you go for building the vessel? (35)

3. (a) A 100,000 tonne tanker operating in a consortium with a 12 year time charter. The slip price is \$ 100 million with 80% load for eight years at 8% interest. In a tax situation of U.K. new entry with declining balance the calculation found that the ship owner gets an 11% rate of return after tax against his expectation of at least 12% in money terms. How can the ship owner improve the situation? (20)
(b) Draw ^{and} explain a sample Figure showing the curves illustrating the effect on NPV of alternative economic conditions applying to the same ship design. (15)

4. Draw and explain an integrated ship Design Process. Discuss the procedure for comparing alternative ship designs. (35)

SECTION – B

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

5. (a) Discuss how the supply and demand for marine transport are controlled by the freight market. (18)
(b) Show in a tabular form some differences between deep sea liner and bulk shipping. (17)

NAME 427

6. (a) With a neat sketch, illustrate the divisions of responsibility for operating economics between charterer and owner in different types of chartering. (18)
- (b) What is 'permissible price' as used in ship design economics? Cite examples where it can be used for evaluation. (17)
7. (a) Develop the expressions for various interest relationships. (20)
- (b) In your opinion, which economic criteria is the best for comparison of alternative ship design? Why? (15)
8. (a) What do you understand by irregular cash flow? Point out the important irregular cash flows in cases of ship investment. (10)
- (b) Consider a 40,000 tonne deadweight oil products carrier bought by a flag-of-convenience ship owner, for a total of £ 18,000,000 cash. It is operated on a five-year time charter at £ 9.00 per tonne deadweight per month after commissions, and then sold for £ 13,000, 000 cash. Assume that ^{crew}new costs are £ 700,000 in the first year, rising by 10% per annum and other operating costs are fixed at £ 600,000 per annum. Calculate NPV at 10% discount rate to ^{asses} whether the investment is profitable. Assume 11.5 months trading per annum. ^{assess} (25)
-

L-4/T-2/NAME

Date : 18/12/2012

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L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **NAME 427** (Maritime system and Management)

Full Marks : 210

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USE SEPARATE SCRIPTS FOR EACH SECTION

Amr
18/12/12

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Contd P/2

NAME 427

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- (b) In your opinion, which economic criteria is the best for comparison of alternative ship design? Why? (15)
8. (a) What do you understand by irregular cash flow? Point out the important irregular cash flows in cases of ship investment. (10)
- (b) Consider a 40,000 tonne deadweight oil products carrier bought by a flag-of-convenience ship owner, for a total of £ 18,000,000 cash. It is operated on a five-year time charter at £ 9.00 per tonne deadweight per month after commissions, and then sold for £ 13,000, 000 cash. Assume that ^{e new} new costs are £ 700,000 in the first year, rising by 10% per annum and other operating costs are fixed at £ 600,000 per annum. Calculate NPV at 10% discount rate to asses ^{assess} whether the investment is profitable. Assume 11.5 months trading per annum. (25)
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L-4/T-2/NAME

Date : 26/12/2012

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **NAME 465** (Marine Production and Planning)

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. What are the different types of building berths? With neat sketches, describe the traditional and novel approaches for hull erection on building berths with sequence of events in both practices. (35)
2. (a) Describe group technology in the case of ship production. (12)
(b) Explain the coding system used in group technology in the light of basic features of BSRA system. (23)
3. (a) What are the elements of a product-oriented work breakdown structures (PWBS) in shipbuilding? With a figure, illustrate the three dimensional nature of PWBS. (23)
(b) In tabular form, show typical groupings of product aspects for Hull Block Construction Method (HBCM). (12)
4. (a) What do you understand by critical path analysis in ship production? (7)
(b) Consider a project with activities and associated details as shown in the table below. Draw the network diagram, make an analysis, determine the critical path and find out how long will it take to complete the project. (28)

Activities	Earliest start	Length	Type	Dependent on
A	Week 0	1 week	Sequential	
B	Week 1	1 day	Sequential	A
C	Week 1.2	2 weeks	Parallel	B
D	Week 1	2 weeks	Sequential	A
E	Week 3	2 weeks	Sequential	D
F	Week 3	2 weeks	Sequential	D
G	Week 5	3 weeks	Sequential	E
H	Week 5	1 week	Sequential	F
I	Week 8	1 week	Sequential	G
J	Week 6	1 day	Parallel	C, H
K	Week 5	1 week	Parallel	E
L	Week 5	1 week	Parallel	E
M	Week 6	1 week	Sequential	L
N	Week 9	1 week	Sequential	I, J, K, M

NAME 465

SECTION - B

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

Assume suitable values for missing data, if any.

5. Draw the ideal basic hull steel work flow as required in a shipyard. In case the ideal arrangement is not obtainable in a real life shipyard what alternatives could be visualised. Draw and explain the above. (35)

6. From an analysis of world trade a shipbuilding industry has designed a standard bulk carrier to meet a particular demand. An analysis of the total plate material was derived for the ship into machine groups and together with average machine operating conditions, the following table was formulated. (35)

Machine	Plate Loading Factor	Average Hours per operation	Number of Plates per ship	Number of Piece parts per ship
3 Axis Flame Profiler	1.75	1.00	1500	
2 Axis Flame Profiler	1.75	2.00	1300	
Flame Planer	1	0.60	1200	
Guillotine	—	0.10		600
Rolls	—	0.50		1000
Large Flanger	—	0.50		1100
Brake Press	—	0.20		1200

If the company, as part of their corporate plan, are considering building 5 ships per year, calculate the number of plate preparation machines required for the proposed tonnage throughput per annum, assuming an 80% utilisation factor. The company operates for 47 weeks per annum with two 8 hour shift for 5 days/week and no overtime. Draw the layout of the preparation ship you would recommend in such case.

7. Describe the nature and construction sequence of sub assemblies used in ship construction. What are the different types of assemblies is steel work fabrication? Draw the sketch of a sample-Pallet loading conveyer used in a shipyard. (35)

8. Describe the principal factors which affect shipyard layouts. What data you would like to have of an age old conventional shipyard of Bangladesh wants to be modernized? How the recent global recession has hit the shipyard expansion? Draw a typical layout plan for a shipyard in Bangladesh compatible with construction requirement of ships in Bangladesh. (35)

L-4/T-2/NAME

Date : 08/01/2013

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **NAME 447** (Design of Inland Water ways Transportation system)

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 the difference between intermodalism and multimodalism? (8)
(b) What are the factors that affect intermodalism? List the advantages and disadvantages of intermodal transport. (17)
(c) Describe the intermodal transport chain. (10)
2. (a) Describe the performance indicators of intermodal transport chain. (12)
(b) Draw the relationship between Significant Sustainable Competitive Advantages (SSCA) and Market Entry Ability (MEA) of intermodal transportation Systems design. (23)
3. (a) Define Articulated Tug Barge (ATB) system. List the advantages of ATB over Towed Barges. (15)
(b) Draw the schematic view of the midship section of typical barge types on the basis of cargo carried. (10)
(c) Write a short note on Jack up rig. (10)
4. (a) Mention the advantages of Inland water ways transport. (12)
(b) How would you classify the inland waterways Bangladesh? (11)
(c) Describe the limitations of inland waterways of Bangladesh. (12)

SECTION – B

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

5. (a) List the organizations related to the inland water transportation in Bangladesh. Briefly discuss their functions. (27)
(b) Write a short note on Salvage Tug. (8)
6. (a) Define marine salvage. Describe the various classifications of marine salvage system. (15)
(b) Draw schematic illustrations of self-stabilizing systems for fully submerged hydrofoils. (10)
(c) Draw the schematic diagram of the following types of hydrofoils. (10)
(i) Surface-piercing.
(ii) Fully submerged

Contd P/2

NAME 447

7. (a) Briefly discuss the importance of hydrographic survey. Describe with necessary figures the effects of heave, roll and pitch motions of vessels on hydrographic survey. (25)
- (b) Describe tidal streams. (10)
8. Write short notes on: (35)
- (i) Pontoon - mounted grabbing.
 - (ii) Bucket dredging
 - (iii) Environmental impacts of dredging.
-

L-4/T-2/NAME

Date : 08/01/2013

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **NAME 469** (Ship Performance)

Full Marks : 210

Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

Amman
08.01.13

SECTION - A

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

Necessary document is enclosed.

1. (a) What is "Weather Margin"? Mention and explain various factors that are responsible for loss of speed in a seaway. (15)
- (b) How is added resistance predicted by experimental methods? (8)
- (c) Briefly discuss the economical aspects of routeing of ships. (12)

2. (a) Following results are available from a model test: (21)
 $L = 4.8 \text{ ft}$ $B = 0.684 \text{ ft}$ $v = 1.415 \text{ Knots}$
 $\nabla = 0.7106 \text{ ft}^3$ $L_w = L$, $\omega = 6.49 \text{ rad/sec (deep water)}$
 $\zeta_a = 0.05 \text{ ft}$ $z_a = 0.0307 \text{ ft}$ $\theta_a = 0.0404 \text{ rad}$
 $\int b_n(\xi) d\xi = 3.171 \text{ lb - sec/ft}$ 0.0404
 $\int b_n(\xi) \xi d\xi = 0.045 \text{ lb - sec}$
 $\int b_n(\xi) \xi^2 d\xi = 8.815 \text{ lb - sec - ft}$
 $\cos \epsilon = 0.0122$, $\rho = 1.9905 \text{ lb - sec}^2/\text{ft (salt water)}$
Determine the added resistance of the model due to motion in a regular seaway.
- (b) Explain how added resistance of regular seaway in Q. No. 2(a) can be converted to added resistance in irregular seaway. (8)
- (c) What conclusions can be drawn regarding the added resistance on the basis of analytical investigations? (6)

3. (a) Briefly discuss the radiated energy approach for predicted added resistance of ship in a seaway. (16)
- (b) List the categories of design parameters that need to be considered for seakeeping design. Assess the effects of Length, draft and freeboard on seakeeping performance of a ship. (19)

4. Write short notes on : (35)
 - (a) Voluntary speed reduction
 - (b) Speed polar plot
 - (c) Resistance due to steering and yawing
 - (d) QNM and TNM for predicting power increase in irregular waves.

Contd P/2

NAME 469

SECTION - B

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

Assume reasonable value in case of missing data.

5. (a) Describe the effect of propeller roughness on ship speed and power. (15)
 (b) How do you assess the propeller roughness? Explain briefly. Discuss also the causes of propeller roughness. (20)
6. (a) Explain a typical power diagram of a ship. (10)
 (b) Define permanent and temporary roughness of hull surface. How is the Average Hull Roughness (AHR) measured? Explain how the temporary roughness can be removed or reduced. (25)
7. A ship has the following particulars. $L_{BP} = 300$ m, $\nabla = 290,000$ m³ $v = 12$ knots (35)
 (a) Calculate the frictional resistance co-efficient increase (∇C_F) due to hull roughness of 160 μ m. Use the "Townsin Formula" with ITTC correction.
 (b) Find also the fractional power increase at constant speed of 12 knot from a smooth AHR 75 μ m to rough AHR 160 μ m. Consider the ship is Tanker and $C_T = 2.049 \times 10^{-3}$
8. A single screw ship (medium speed cargo ship) has the following particulars: (35)

$v = 16$ knot	$L_{WL} = 136$ m,	$L_{BP} = 133.048$ m
$B = 19.5$ m	$v = 1.1883 \times 10^{-6}$,	$T = 6$ m
$\nabla = 8776$ m ³	$C_B = 0.552$	$C_p = 0.576$
$C_M = 0.957$	$C_W = 0.823$	$C_{WP} = 0.670$

Hull roughness 260 microns, Days out of dock = 182.5 days. Added resistance due to wind = 48.965 kN. Added resistance due to wave = 42.630 kN. The total clean hull resistance = 314.734 kN, where hull roughness was considered 70 microns.

- (a) Find the total resistance of the ship including fouling and hull roughness.
 (b) Find the fractional power increase at a constant speed of 16 knots from a smooth AHR 70 micron to rough AHR 260 micron.
 (c) Find also the residuary resistance co-efficient (C_R) of the ship using Approximation by Fisher.
-

For. & No. 2(a)

Added Resistance

in regular head waves is as follows:

$$\frac{R_{AW}}{\rho g \zeta_a^2 (B^2/L)} = \frac{L^2}{32B^2} \left[\left(\frac{z_a}{\zeta_a} \right)^2 P_1 + \frac{\pi^2 L^2}{L_w^2} \left(\frac{\theta_a L_w}{2\pi \zeta_a} \right)^2 P_3 - \frac{2\pi L}{L_w} \left(\frac{L_w \theta_a}{2\pi \zeta_a} \right) \left(\frac{z_a}{\zeta_a} \right) P_2 \cos \epsilon \right] \quad (11.3)$$

where

$$P_1 = \frac{\omega_e^3}{\rho g^2} \frac{2}{L} \rho \nabla \sqrt{\frac{g}{L}} B_{33}$$

$$P_2 = \frac{\omega_e^3}{\rho g^2} \frac{2}{L} \rho \nabla \sqrt{\frac{g}{L}} (B_{35} + B_{53})$$

$$P_3 = \frac{\omega_e^3}{\rho g^2} \frac{2}{L} \rho \nabla \sqrt{\frac{g}{L}} 4B_{55}$$

and

$$\epsilon = |\epsilon_s - \epsilon_\theta|$$

Heave displacement, $z = z_a \cos \omega_e t$

and

Pitch displacement, $\theta = \theta_a \cos(\omega_e t + \epsilon)$

The damping coefficients used in (11.3) are given as

$$B_{33} = \frac{1}{\omega_e \nabla} \sqrt{\frac{g}{L}} \int b_n d\xi$$

$$B_{35} + B_{53} = \frac{2}{\omega_e \nabla} \sqrt{\frac{g}{L}} \int \xi b_n d\xi$$

and

$$B_{55} = \frac{1}{\omega_e \nabla} \sqrt{\frac{g}{L}} \int \xi^2 b_n d\xi$$

where

ω_e = frequency of encounter [rad/sec]

∇ = volume of displacement [ft³]

b_n = sectional damping coefficient

$\xi (= 2x/L)$ = nondimensional longitudinal coordinate [ft]

NAME - 469

L-4/T-2/NAME

Date : 20/11/2012

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **NAME 429** (Marine Engineering)

Full Marks : 210

Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

Signature
15.01.13

SECTION - A

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

Assume any reasonable value for missing data.

1. (a) Write the short notes on the following deck machineries: (25)
 - (i) Mooring widlass
 - (ii) Anchor capstan
 - (iii) Winch
 - (iv) Derrick
 - (v) Deck crane
- (b) What are the requirements that should be fulfilled by anchor windlasses? (10)
2. (a) What are the types of winches? Write the advantages of different types of winches. (10)
- (b) A 650 tonne ship is to be hoisted on a slipway having slope 1:20. There is one pulley between the boom iron and the winch barrel. Calculate- (25)
 - (i) Pulling force
 - (ii) Diameter of winch barrel, if rope dia is 20 mm
 - (iii) Length of the rope, if the maximum number of rope layer is 15.
3. (a) Classify pumps according to their purposes. (5)
- (b) What are the general requirements for the pipelines of shipboard systems? (10)
- (c) Calculate the pump capacity for a drencher at 12 m above the main deck of a vessel having the nozzle dia 16 mm. (20)
4. (a) Which safety equipments are used in a ship? (5)
- (b) Discuss the fixed installation of fire extinguisher system. (15)
- (c) What are the types of smoke detectors used for safety of a ship? Discuss their theory of operation. (15)

NAME 429

SECTION - B

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

Please submit the psychrometric chart with answer script if used. Assume any missing data.

5. (a) What is the difference between a refrigerator and a heat pump? Derive an expression for the coefficient of performance for both if they are running on reversed Carnot cycle. (15)
- (b) Derive the expression for the coefficient of performance of a Ball-Columan cycle refrigeration system when T_2 and T_3 are the temperature of air at the inlet and discharge of compressor respectively. Explain the working of this cycle. (20)
6. (a) An ammonia refrigerating machine fitted with an expansion valve works between the temperature limits of -10°C and 30°C . The vapour is 95% dry at the end of isentropic compression and the fluid leaving the condenser is at 30°C . Assuming actual C.O.P. as 60% of the theoretical, calculate the kilograms of ice produced per kW hour at 0°C from water at 10°C . Latent heat of ice is 335 kJ/kg. Ammonia has the following properties. (17)

Temperature $^\circ\text{C}$	Liquid heat (h) kJ/kg	Latent heat (L) kJ/kg	Liquid entropy (s_l) kJ/kg $^\circ\text{K}$	Total entropy of dry saturated vapour kJ/kg $^\circ\text{K}$
+30	323.08	1145.8	1.2037	4.9842
-10	135.37	1297.68	0.5443	5.4770

Specific heat of water is 4.187 kJ/kg $^\circ\text{k}$.

- (b) A vapour compression refrigerator uses R-12 as refrigerant and the liquid evaporates in the evaporator at -15°C . The temperature of this refrigerant at the delivery from the compressor is 15°C when the vapour is condensed at 10°C . Find the coefficient of performance if (18)
- (i) there is no undercooling and
- (ii) the liquid is cooled by 5°C before expansion by throttling.

Take specific heat at constant pressure for the superheated vapour as 0.64 kJ/kg $^\circ\text{k}$ and that for liquid as 0.94 kJ/kg $^\circ\text{k}$. The other properties of refrigerant are as follows:

Temperature $^\circ\text{C}$	Enthalpy in kJ/kg		Specific entropy in kJ/kg $^\circ\text{K}$	
	Liquid	Vapour	Liquid	Vapour
-15	22.3	180.88	0.0904	0.7051
+10	45.4	191.76	0.1750	0.6921

NAME 429

7. (a) Describe, with the helps of schematic and p-h diagrams, the working of a two-stage compression system with water intercooler, liquid sub-cooler and flash intercooler. (15)
- (b) What are the desirable properties of an ideal refrigerant? (6)
- (c) Explain the designation system for refrigerants. What are the number of the following refrigerants? (14)

- (i) Tetra chloro-ethane ($C_2H_4Cl_4$)^c
- (ii) Mono Chloro-difluor^o-methane ($CHClF_2$)^c and
- (iii) Ammonia

8. (a) The atmospheric air at 30°C dry bulb temperature and 75% relative humidity enters a cooling coil at the rate of 200 m³/min. The coil dew point temperature is 14°C and the by-pass factor of the coil is 0.1. Determine (i) the temperature of air leaving the cooling coil, (ii) the capacity of the cooling coil in tons of refrigeration and in kilowatt, (iii) the amount of water vapour removed per minute, and (iv) the sensible heat factor for the process. (18)
- (b) A galvanised steel duct of 0.4 m diameter and 20 m long carries air at 20°C and 1.013 bar. If the flow rate of air through the duct is 60 m³/min, determine the pressure loss due to friction in (i) N/m² and (ii) in mm of water. (17)
-

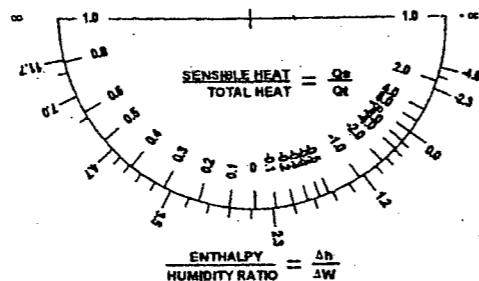


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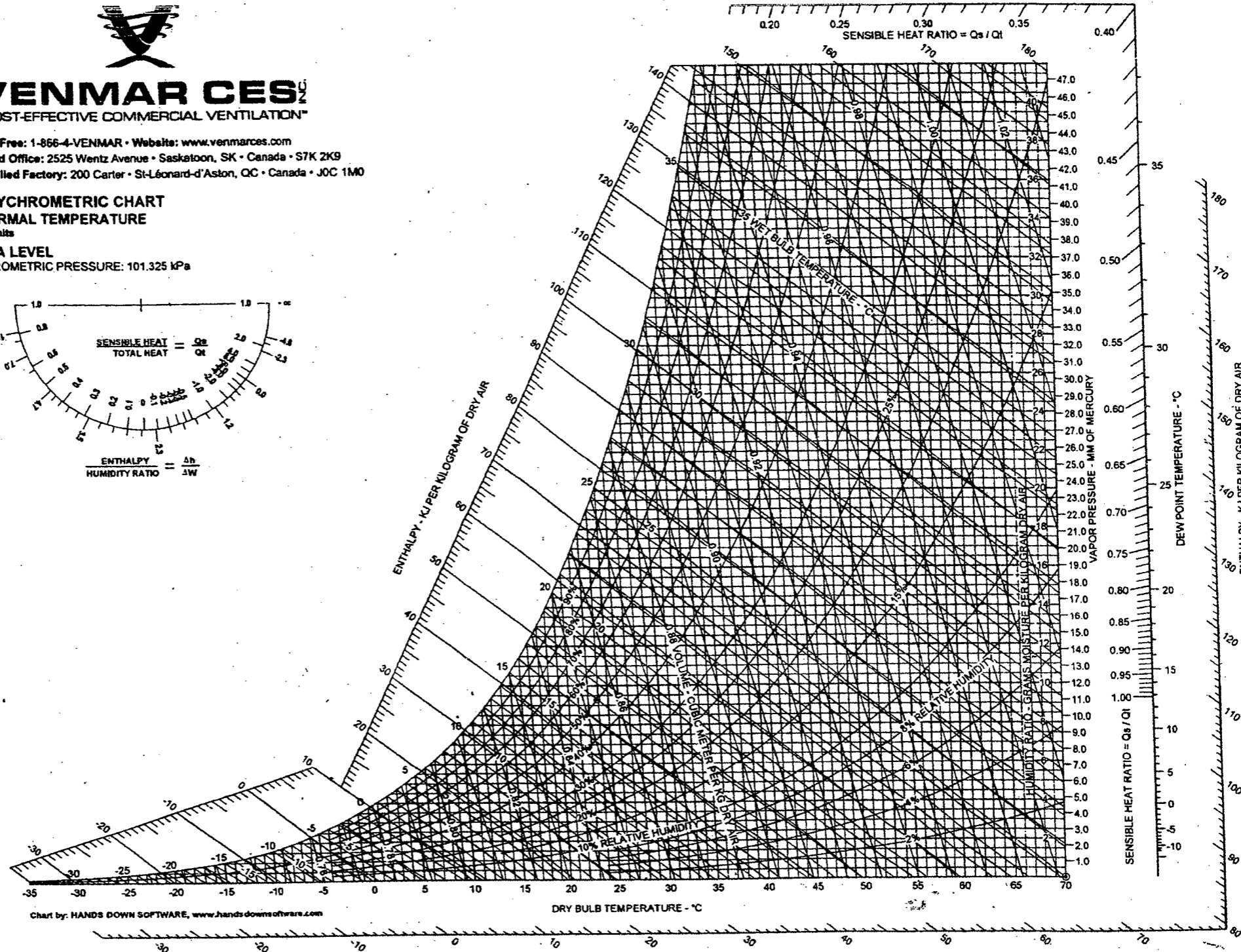
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PSYCHROMETRIC CHART
 NORMAL TEMPERATURE
 SI Units

SEA LEVEL
 BAROMETRIC PRESSURE: 101.325 kPa



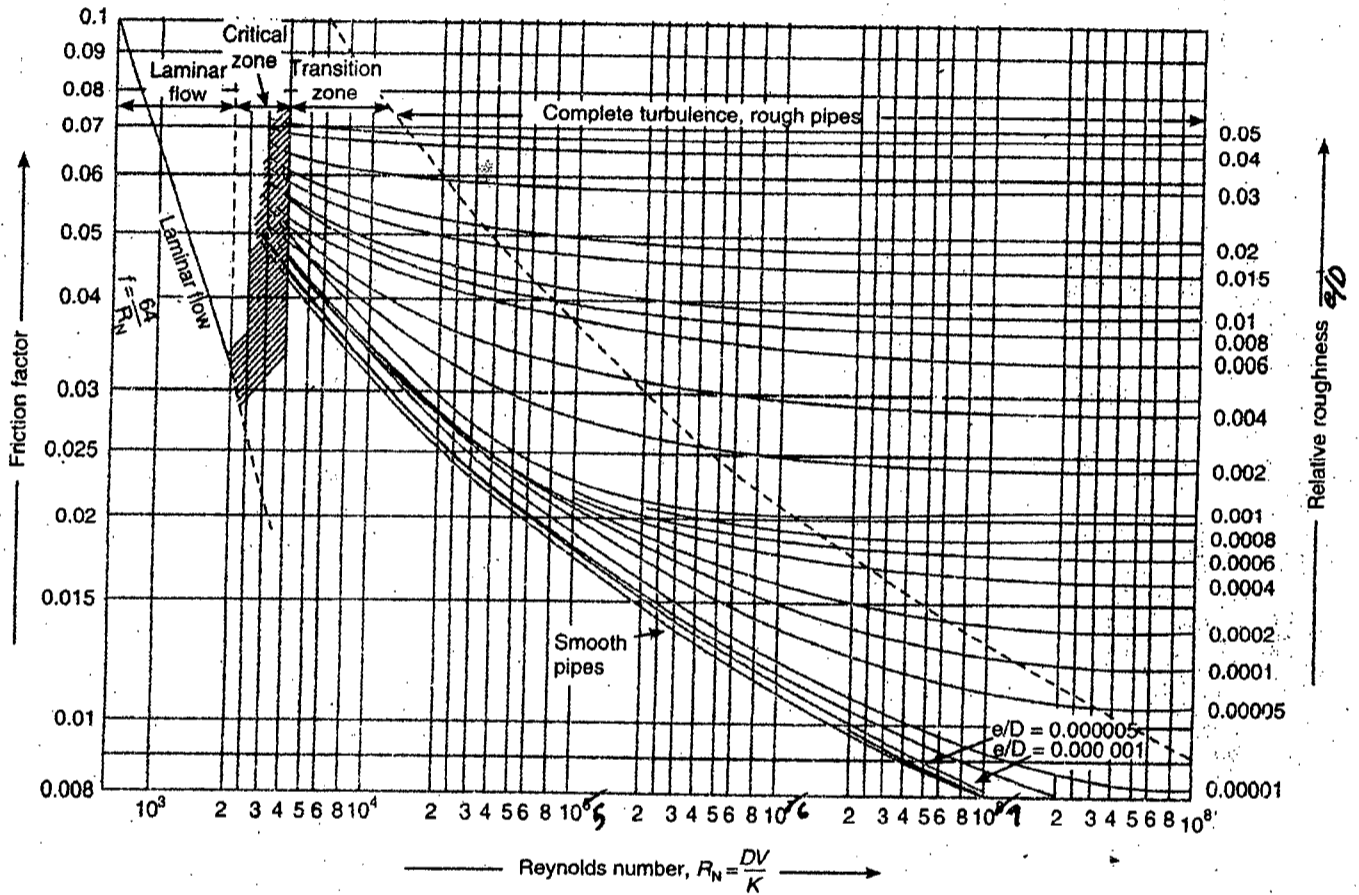
NAME 429



NAME-429

Values of absolute viscosity and density of air at different temperatures. and at atmospheric pressure (1.013 bar)

Temperature in °C	Absolute or dynamic viscosity (μ) in N-s / m ²	Density in kg / m ³
0	17.24×10^{-6}	1.29
10	17.71×10^{-6}	1.25
20	18.18×10^{-6}	1.20
30	18.65×10^{-6}	1.16
40	19.12×10^{-6}	1.13
50	19.60×10^{-6}	1.09



Moody chart showing friction factors for fluid flow in circular pipes or ducts.

Recommended surface roughness (e) for different material pipes or ducts.

Types of pipe or duct	Absolute surface roughness (e) in mm
Smooth-drawn tubes (glass, brass and lead)	0.0015
Commercial steel or wrought iron pipe	0.045
Galvanised iron or steel air ducts	0.15
Cast iron	0.255
Riveted steel (light weight, small rivets)	0.9
Riveted steel (heavy weight, large rivets)	9.0
Smooth concrete	0.3
Average concrete	1.2
Very rough concrete	3.0
Brick conduits	9.0
Wood-stave conduits	0.9