L-3/T-2/NAME **Date : 09/06/2014**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2011-2012

Sub : **NAME 325** (Shipbuilding Technology-II)

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** questions.

1. (a) What do you understand by AWES? Discuss ship contract on the basis of AWES. **(13)**

   (b) Discuss the periodic surveys by CS. Discuss CS weld tests. **(13)**

   (c) Write a short note on mould loft. **(9)**

2. (a) Describe schematically the corrosion control systems. **(17)**

   (b) Discuss different machines that are used for the preparation of plates and sections. **(13)**

   (c) Write a short note on shot blasting. **(5)**

3. (a) Discuss acoustic insulation. **(9)**

   (b) What are plimsoll marks? Explain with figures. **(11)**

   (c) Discuss bilge system. **(9)**

   (d) Write short notes on- **(2×3=6)**

   (i) Sampson posts

   (ii) Scuppers

4. (a) Discuss marks on anchors, anchor certificate, anchor test. **(10)**

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

   (i) CQR anchor

   (ii) Danforth anchor

   (iii) Stockless anchor

   (c) Discuss on- **(13)**

   (i) Kenter lugless joining shackle

   (ii) D-lugged joining shackle.

SECTION – B

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

5. (a) What are the basic ship types? Discuss with figures the features of appearance, Construction, layout and size of any three types of these ships. **(27)**

   (b) With detailed figure, discuss the construction features of machinery space double bottom of ships. **(8)**

Contd P/2

NAME 325

6. (a) What are the functions and characteristics of different decks of a ship from construction point of view? **(10)**

   (b) Discuss 'Deck stiffening' in details with neat sketches. **(20)**

   (c) Define gunwale, sheer strake and stringer plates. **(5)**

7. (a) Explain the terms 'Pounding' and 'panting'. What types of special arrangements are required to resist these? **(20)**

   (b) What are the functions of bulkheads in a ship? Discuss the construction details of bulkheads. **(15)**

8. (a) Define 'Winch', 'Windlass' and 'Capstan'. **(5)**

   (b) Discuss why bilge keel, bulbous bow and bulwark are fitted. Show with figures the construction details of these. **(30)**

Extra

L-3/T-2/NAME **Date : 12/05/2014**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2011-2012

Sub : **MATH 381** (Fourier Analysis, Harmonic Functions, Complex Variable and Laplace Transforms)

Full Marks : 280 Time : 3 Hours

The figures in the margin indicate full marks.

Symbols have their usual meaning.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) Separate $\log\left(-1-\sqrt{3}\,i\right)$ into real and imaginary parts. **(5)**

(b) Find the point where the function $f(z)=x^2+iy^3$ is differentiable. Is this function analytic? Justify your answer. **(5)**

(c) If $f(z)=\begin{cases}\dfrac{(\bar{z})^2}{z}\ ;\ z\neq 0\\ 0\ ;\ z=0\end{cases}$

Show that Cauchy-Riemanm equations are satisfied at z = 0 but f(z) is not differentiable at z = 0. **(10)**

(d) Show that $u(x,y)=x^3+3x^2y-3xy^2-y^3$ is a harmonic function. Find the conjugate function v(x, y) and hence find the analytic function $f(z)=u+iv$. Also express f(z) in terms of z. **(16)**

(e) Find all the roots of the equation sin z = 2. **(10⅔)**

2. (a) Find the image of the semi-infinite strip x > 0, 0 < y < 1 under the map $w=1/z$. Sketch the strip and its image. **(10)**

(b) Evaluate $\int_c (x^2-iy^2)\,dz$ along

(i) the parabola $y=2x^2$ form (1, 2) to (2, 8). **(10)**

(ii) the straight lines from (1, 2) to (1, 8) and then from (1, 8) to (2, 8) **(16)**

(c) Without evaluating the integral show that **(10⅔)**

$$\left|\int_{C_R}\frac{Log\ z}{z^2}\,dz\right| < 2\pi\left(\frac{\pi+\ln R}{R}\right)$$

where C_R is the circle | z | = R (R > 1) described in the counterclockwise direction.

3. (a) Use Cauchy's integral formula (even if other method works) to evaluate the integral $\int_c \frac{dz}{(z^2+4)^2}$ where c is the circle |z – i| =4 taken counterclockwise. **(10)**

(b) Expand f(z) = $\dfrac{z}{(z-1)(z-3)}$ in a

(i) Taylor series in powers of (z – 2) **(10)**

(ii) Laurent series in powers of (z – 1) and state the region of convergence of the series in each case. **(10)**

(c) Evaluate the following integrals using Cauchy's residue theorem, Where C is the circle | z | = 4 taken in positive sense:

(i) $\int_c \frac{\sin h\, z}{z^4}\,dz$ **(8)**

(ii) $\int_c \frac{z+1}{z^2+9}\,dz$ **(8⅔)**

Contd P/2

MATH 381(NAME)

4. (a) Evaluate the following integrals using the method of Contour integration:

(i) $\int_{-\infty}^{\infty} \frac{x \sin ax}{x^4 + 4} dx \quad ; \quad a > 0$ **(23⅔)**

(ii) $\int_{0}^{\pi} \frac{d\theta}{(a + \cos\theta)^2} \quad ; \quad a > 1$ **(23)**

SECTION – B

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

5. (a) If $F(t)$ has period $T > 0$ then prove that $L\{F(t)\} = \dfrac{\int_0^T e^{-st} F(t) dt}{1 - e^{-sT}}$. **(15)**

(b) Find $L\{t(3 \sin 2t - 2 \cos 2t)\}$. **(16⅔)**

(c) Evaluate : $\int_0^{\infty} \frac{e^{-3t} - e^{-6t}}{t} dt$. **(15)**

6. (a) Find $L^{-1}\left\{ln\left(1 + \frac{1}{s^2}\right)\right\}$. **(15)**

(b) Find $L^{-1}\left\{\frac{s^2}{(s^2 + 4)^2}\right\}$. **(13⅔)**

(c) A particle of mass m moves along the X axis and is attracted toward origin 0 with a force numerically equal to kx, $k > 0$. A damping force given by $\beta \frac{dX}{dt}, \beta > 0$, also acts. Discuss the motion, treating all cases, assuming that $X(0) = X_0$, $X'(0) = V_0$ **(18)**

7. (a) Given that $f(x) = x + x^2$ for $-\pi < x < \pi$, find the Fourier expression of $f(x)$. Deduce that $\frac{\pi^2}{6} = 1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \cdots$ **(18⅔)**

(b) Find the Fourier transform of $f(x) = e^{-|x|}, -\infty < x < \infty$. **(12)**

(c) Solve $\frac{\partial U}{\partial t} = \frac{\partial^2 U}{\partial x^2}$, $x > 0$, $t > 0$, subject to the conditions **(16)**

$U(0, t) = 0,\ U(x, 0) = \begin{cases} 1, & 0 < x < 1 \\ 0, & x \geq 1 \end{cases},\ U(x, t)$ is bounded.

8. (a) Temperature distribution v inside a homogeneous solid satisfies the equation $\frac{\partial v}{\partial t} = h^2 \nabla^2 v$ where h^2 is the diffusivity of the substance and a constant. Determine the steady state temperature within the plate subject to the conditions. **(26⅔)**

$$\left.\begin{matrix} v = 0 \\ x = 0 \end{matrix}\right\} \quad \left.\begin{matrix} v = 0 \\ y = 0 \end{matrix}\right\} \quad \left.\begin{matrix} v = 0 \\ x = s \end{matrix}\right\} \quad \left.\begin{matrix} v = F(x) \\ y = l \end{matrix}\right\}$$

(b) Find the potential of the region inside and outside about a spherical surface. **(20)**

L-3/T-2/NAME **Date : 19/05/2014**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2011-2012

Sub : **NAME 347** (Design of Special Ships)

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) Derive the force and pitching moment equations for a planning hull using Savitsky's method. **(15)**

(b) Consider a vessel with displacement Δ = 70 tonnes, mean chine beam b = 6.5 m. dead rise β = 20° and LCG = 10 m forward of transom. The speed of the vessel v_s = 45 knots and C_v = 2.899.

Calculate l_m. R_T (thrust T) and trim τ . **(20)**

2. (a) Define moulded capacity. Grain capacity, bale capacity and insulated volume. **(10)**

(b) For a basic and a new similar design, the following particulars are known:

Item	Basic ship	New design
LBP (m)	134.0	137.0
Br. Mld.(m)	18.50	19.50
Depth Mld. (m)	12.00	12.20
Grain capacity (m^3)	17600	-
Tank top (m)	1.25	1.4
C_B@ SLWL	0.76	0.745
Deck Sheer for'd (m)	2.52	3.20
Deck Sheer aft (m)	1.20	1.46
Deck camber (m)	0.38	0.46
Tank ceiling (m)	0.06	0.06
Non cargo spaces (m^3)	3700	4490

Estimate the final grain and bale capacities for the new design. **(20)**

(c) Draw an overall flow path for ship design process. **(5)**

3. (a) How do you classify the tugs according to their duties? What are the basic requirements for each class of tug? **(10)**

(b) Determine the following parameters for a dock tug having engine power 1000 kw. **(25)**

(i) L_{BP} by Grieg's formula, k_g = 42

(ii) Displacement of the vessel using Posdunine's expression and $\frac{v}{\sqrt{L_{BP}}} = 1.2$.

(iii) Depth moulded by Barnaby's formula taking bollard pull 25 tons and C_{dm} = 185 for Kurt rudder.

(iv) Breadth, draught and Cp, Cm of the vessel.

Contd P/2

NAME 347

4. (a) A heavy duty slurry pump is required for the following duty:

65 tonnes per hours of sand	
Specific gravity of solid S	2.65
Average particle size d50	211 microns (0.211 mm)
Concentration of solids C_w	30% by weight
Static discharge head z_d	20 metres
Suction head z_s	1 metre (position)
Length of pipeline	100 metres
Valves and fitting	5 × 90° long radius bends

The pump will be gravity fed from a hopper and be arranged generally as known in Fig. for Q. No. 4(a).

Determine using the Fig. 9, the pump size, speed, shaft power and recommended size of delivery pipeline. **(25)**

(b) What are the factors affecting the choice of machinery for a ship? **(10)**

SECTION – B

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

Assume reasonable values for missing data, if any.

5. Estimate the dimension for a Container ship to meet the following requirement.

1400 Containers 6.05 × 2.43 × 2.43 m made up of 1000 is holds and 400 on deck

service speed 23 knots

service draft 9.0m.

The containers are to the 7 high in each cell with 10 cells across the ship and engine room length is ($0.2L_{bp}$ - 10.75 m) and length of fore peak tank and after peak tank are $0.05L_{bp}$ and 0.35 L_{bp} respectively. **(35)**

6. An Aircraft carrier has a deep displacement of 32,274 tonf made up of as follows:

Hull = 10903 tonf

Equipment = 1090 tonf

Machinery 2636 tonf

Fuel = 371 tonf

Side protection = 3811 tonf

Deck protection = 2969 tonf.

Aircraft and armament = 6500 tonf

Margin = 654 tonf

A new design is to be built but is required to carry 1000 tonf less is the form of payload. Calculate the new displacement and group weights assuming ship varies as displacement to the power 0.6 at full speed and to the power $\frac{2}{3}$ at endurance speed.

Contd P/3

NAME 347

Contd ... Q. No. 6

It should be assumed that the weight of the side protections varies as the linear dimension of the ship and deck protection as the square of the linear dimensions. **(35)**

7. What are the factors which influence the design of a fishing vessel other than fishing gear and methods?

   Determine the fishing gear and methods as used in fishing vessel with sketches wherever required. **(35)**

8. Draw the profile of an oil tanker and explain the necessities and location of various items in the profile. How do you determine the dimension of a VLCC? **(35)**

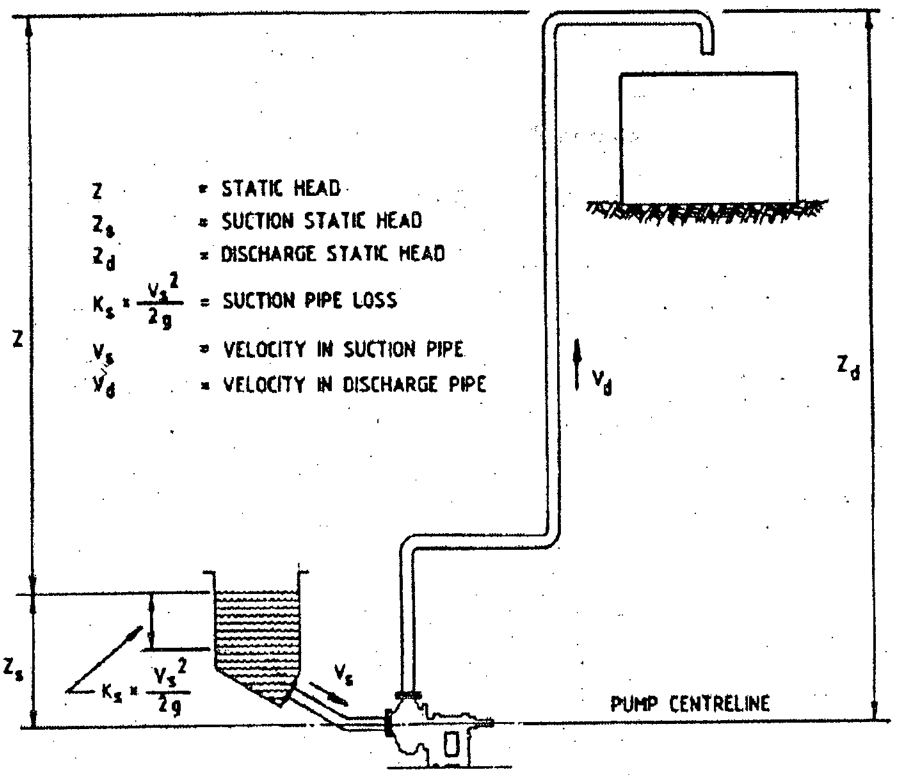
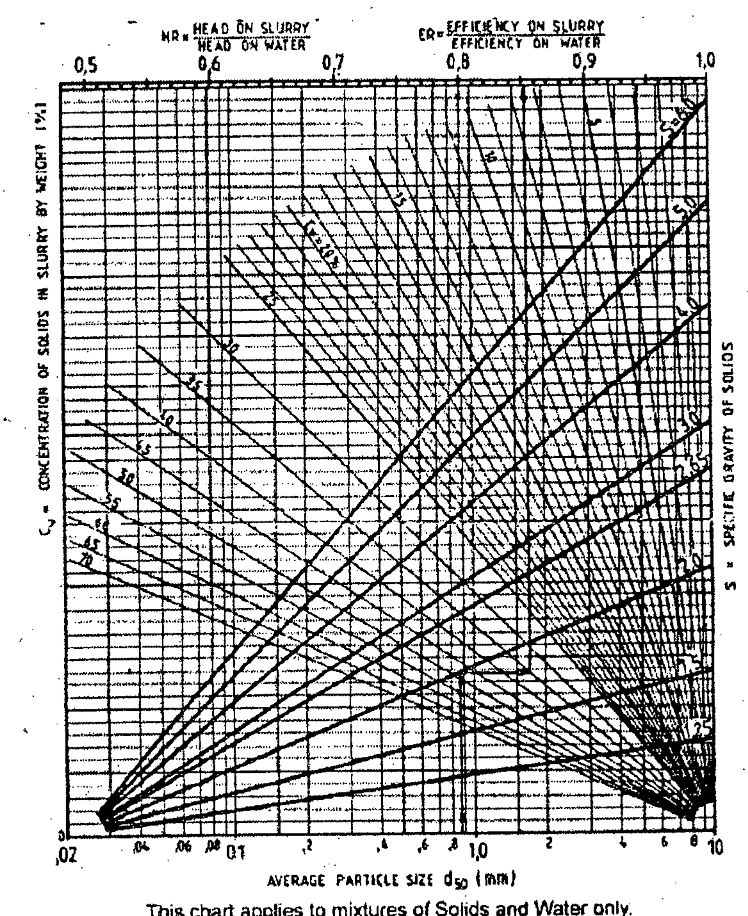


Fig. for Question No. 4 (a)



This chart applies to mixtures of Solids and Water only.
For mixtures of Solids and Heavy Media or with Liquids
other than Water refer to Warman Office.

FIGURE 2.3 PERFORMANCE OF CENTRIFUGAL PUMPS ON SLURRY

6

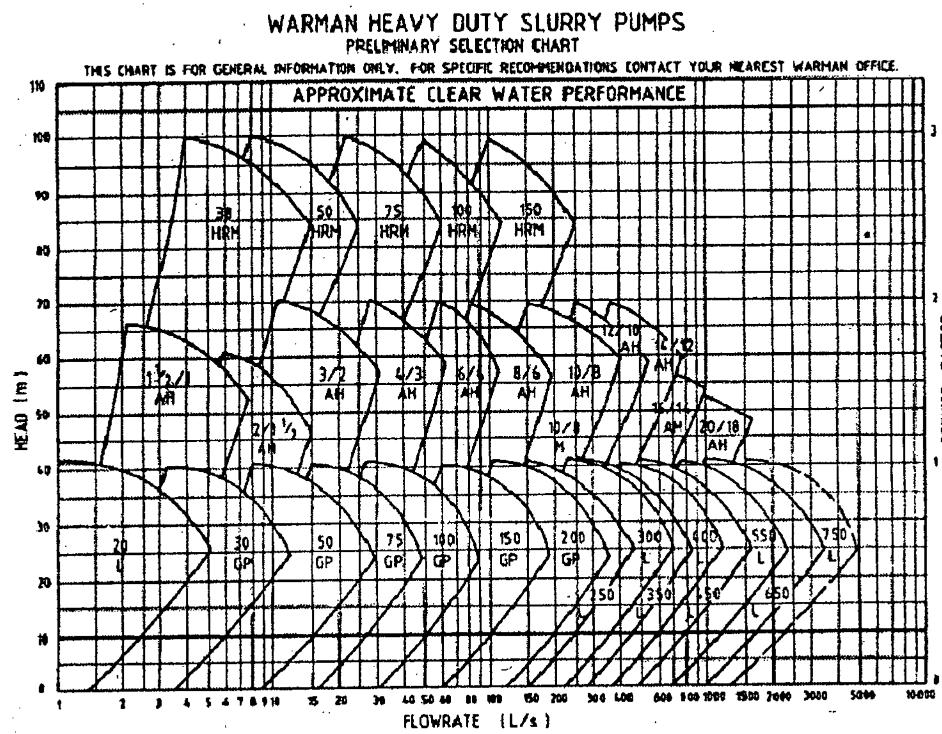


FIGURE 3-1 TYPICAL WARMAN PRELIMINARY SELECTION CHART

2 9

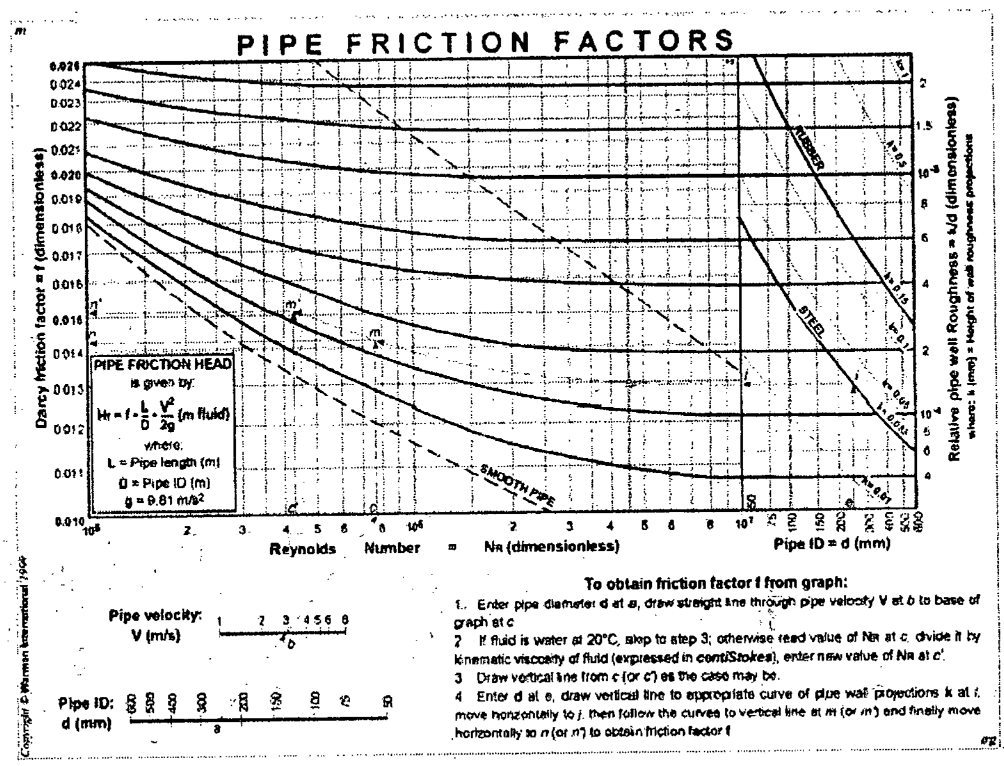


FIGURE A3-2 WARMAN PIPE FRICTION CHART

3

6

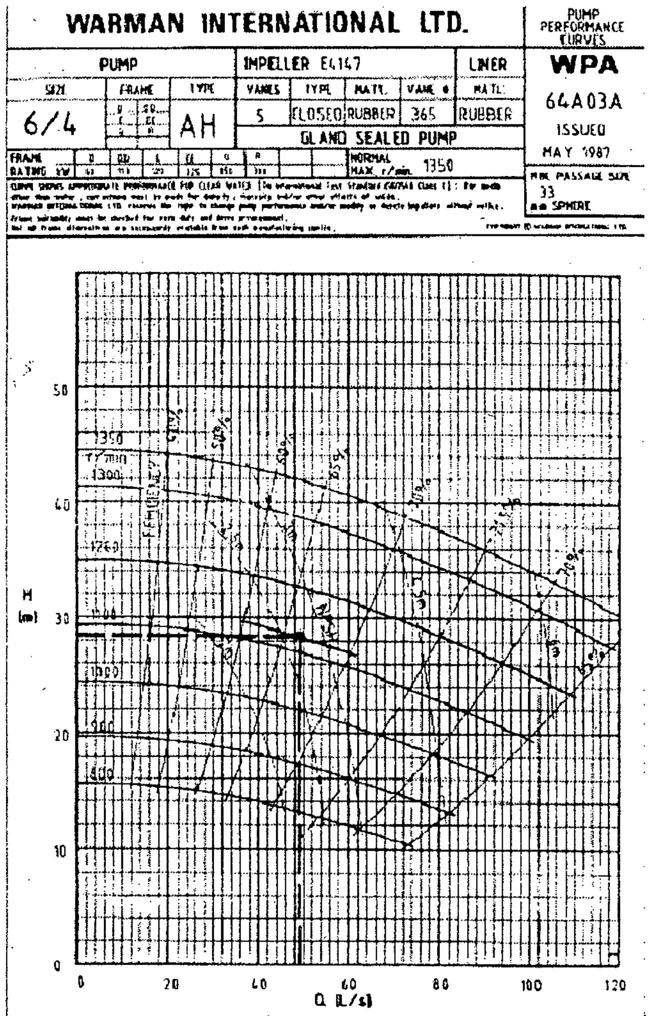
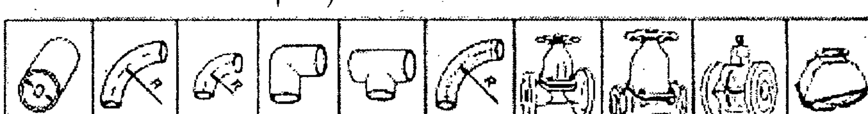


FIGURE 3.4 WARMAN PUMP PERFORMANCE CURVE



INTERNAL DIAMETER or N.B. mm	90° Long Radius Bend (Radius More Than 3 x N.B.)	90° Short Radius Bend (Radius is 2 x N.B.)	Elbow	Tee	Rubber Hose (Minimum Radius 10 x N.B.)	Diaphragm Valve Full Open	Full Bore Valve Round Way	Plug-Lub Valve Rect. Way	* "Tech-Taylor" Valve Ball Type
	EQUIV. LENGTH IN m OF STRAIGHT PIPE GIVING EQUIVALENT RESISTANCE TO FLOW								
25	0·52	0·70	0·82	1·77	0·30	2·56	—	0·37	—
32	0·73	0·91	1·13	2·38	0·40	3·29	—	0·49	—
40	0·85	1·10	1·31	2·74	0·49	3·44	1·19	0·58	—
50	1·07	1·40	1·68	3·35	0·55	3·66	1·43	0·73	—
65	1·28	1·65	1·98	4·27	0·70	4·60	1·52	0·85	—
80	1·55	2·07	2·47	5·18	0·85	4·88	1·92	1·04	0·20
90	1·83	2·44	2·90	5·79	1·01	—	—	1·22	—
100	2·13	2·77	3·35	6·71	1·16	7·62	2·19	1·40	0·23
115	2·41	3·05	3·66	7·32	1·28	—	—	1·58	—
125	2·71	3·66	4·27	8·23	1·43	13·11	3·05	1·77	0·30
150	3·35	4·27	4·88	10·06	1·55	18·29	3·11	2·13	0·37
200	4·27	5·49	6·40	13·11	2·41	19·81	7·92	2·74	0·82
250	5·18	6·71	7·92	17·07	2·99	21·34	10·67	3·47	0·61
300	6·10	7·92	9·75	20·12	3·35	28·96	15·85	4·08	0·76
350	7·01	9·45	10·97	23·16	4·27	28·96	—	4·88	0·91
400	8·23	10·67	12·80	26·52	4·88	—	—	5·49	1·04
450	9·14	12·19	14·02	30·48	5·49	—	—	6·22	1·16
500	10·36	13·11	15·85	33·53	6·10	—	—	7·32	1·25

* "TECH-TAYLOR" VALVE IS A BALL TYPE CHANGEOVER DEVICE USED ONLY ON THE DELIVERY SIDE OF THE PUMP

NOTE: 1. FOR 135° BEND, USE 50 % OF EQUIVALENT LENGTH FOR 90° BEND.

2. L_f IS THE AGGREGATE OF EQUIVALENT LENGTHS FOR ALL PIPELINE FITTINGS AND VALVES IN A GIVEN PIPELINE

FIGURE A4-3 EQUIVALENT LENGTHS OF PIPE FITTINGS AND VALVES

GROUPS 1 TO 5 IN TABLE SHOW THE APPROXIMATE PROPORTIONS OF VELOCITY HEAD, $H_v = \frac{V^2}{2g}$, WHICH APPLY TO CERTAIN CONDITIONS.

V IS USED TO INDICATE THE UPSTREAM VELOCITY AND V_1 THE DOWNSTREAM VELOCITY.

GROUP	ITEM	HEAD LOSS (m)
1.	Loss of head at inlet Hi From pump hopper to pump or from storage tank to pump.	
	(a) Flush Connections.	$0.5 \frac{V_1^2}{2g}$
	(b) Projecting connection and dredge suction pipes.	$1.0 \frac{V_1^2}{2g}$
	(c) Rounded Connection.	$0.05 \frac{V_1^2}{2g}$
2	Loss of head due to conical enlargement from pump discharge flange to discharge pipeline Included angle θ: 6° / 65° Factor K_e: 0.14 / 1.15 *	$K_e \frac{(V-V_1)^2}{2g}$
3. (d_1, d_2)	Loss of head due to sudden contraction: Kc is a factor depending on ratio $\frac{d_1}{d_2}$ where d_1 is the large diameter and d_2 the small diameter as illustrated.	$K_c \frac{V_1^2}{2g}$
4 ($V \to V_1$)	Loss of head due to sudden enlargement:	$\frac{(V-V_1)^2}{2g}$
5	Loss of head due to conical contraction i.e. Jet Nozzles SEE CAMERON PAGE 3-110	$K_g \frac{(V-V_1)^2}{2g}$

Ratio d_1/d_2	1.2	1.4	1.6	1.8	2.0	2.5	3.0	4.0	5.0
Factor Kc	0.08	0.17	0.26	0.34	0.37	0.41	0.43	0.45	0.46

* FOR CONICAL ENLARGEMENTS, MAXIMUM HEAD LOSS OCCURS WHEN INCLUDED ANGLE IS 65°, WHEN $K_e = 1.15$. MINIMUM HEAD LOSS OCCURS WHEN INCLUDED ANGLE IS 6°, WHEN $K_e = 0.14$.

FIGURE ~~A4-1~~ 6a HEAD LOSSES AT INLET, CONTRACTION AND ENLARGEMENT

NOTE: F_L INCREASES WITH INCREASING C_v, TO ABOUT C_v = 30%. BEYOND C_v = 30%, F_L DECREASES WITH INCREASING C_v, DUE TO INCREASING INTERFERENCE OF PARTICLES WITH EACH OTHER. (SEE EXAMPLE AT RIGHT OF GRAPH)

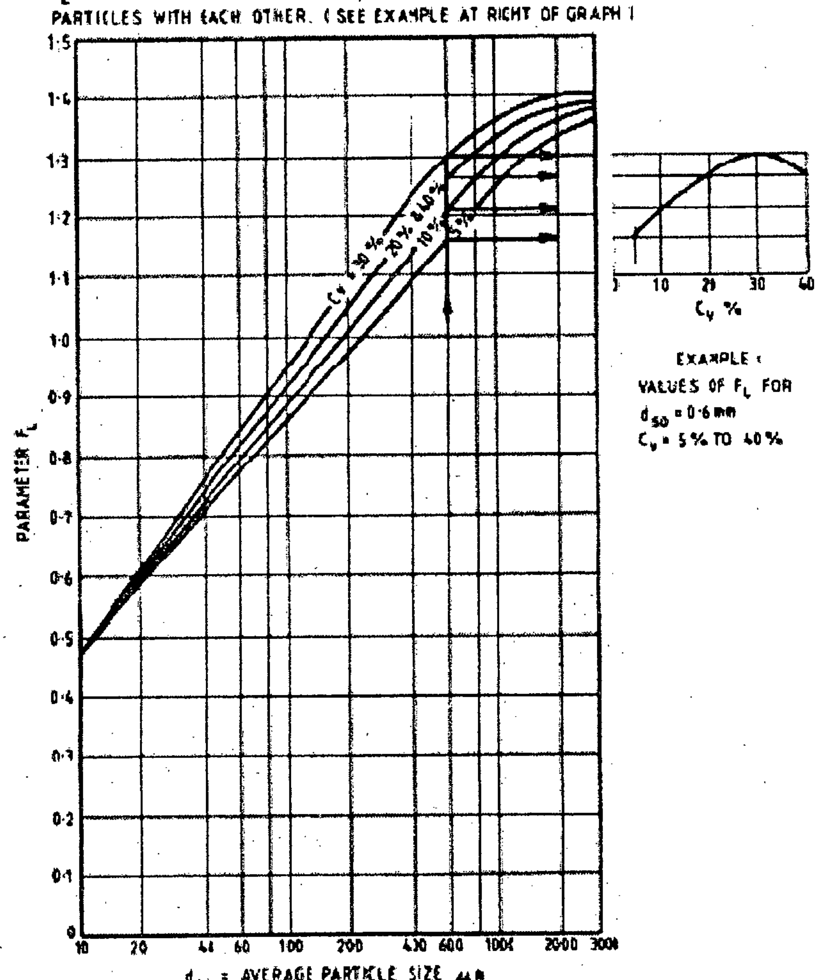


FIGURE ~~A4-2~~ 7 MODIFIED DURAND'S LIMITING SETTLING VELOCITY PARAMETER
(For particles of widely graded sizing)

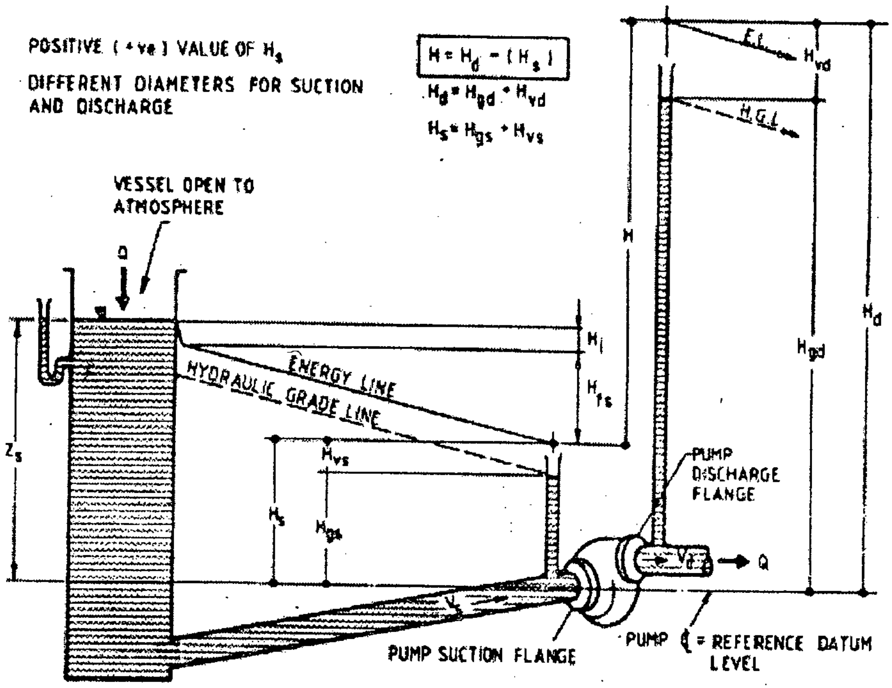


FIGURE A4-1 TOTAL DYNAMIC HEAD WITH POSITIVE INTAKE HEAD

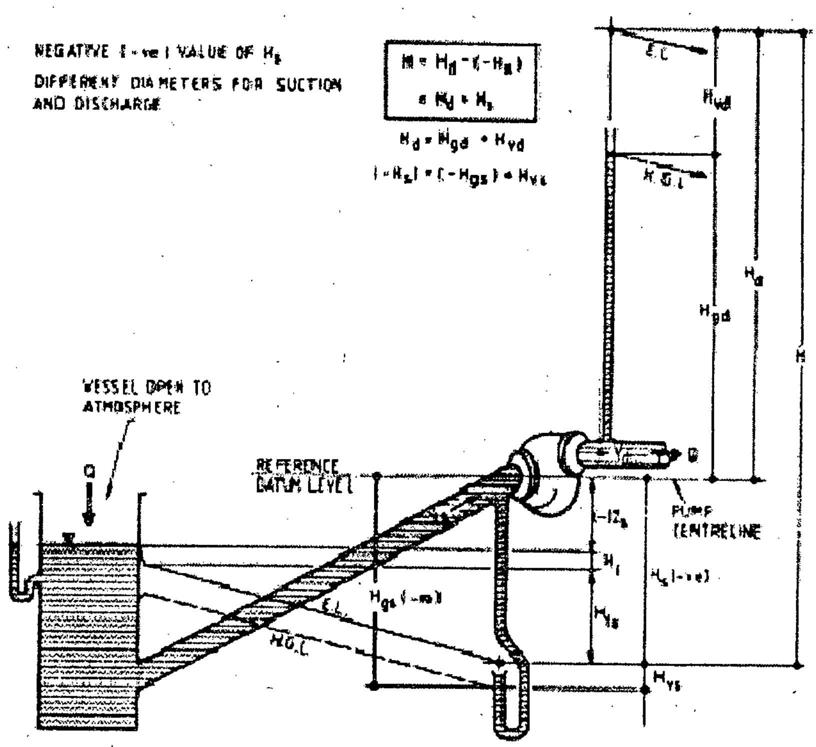


FIGURE A4-2 TOTAL DYNAMIC HEAD WITH NEGATIVE INTAKE HEAD

L-3/T-2/NAME **Date : 19/05/2014**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2011-2012

Sub : **NAME 363** (Computational Fluid Dynamics)

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**.

The symbols have their usual meaning.

1. (a) What is CFD? Derive the integral and differential form of continuity equation in fixed control volume approach. **(18)**

   (b) Write down the conservation form of continuity momentum and energy equation. Show that they all have the same generic form given by **(17)**

$$\frac{\partial U}{\partial t}+\frac{\partial F}{\partial x}+\frac{\partial G}{\partial y}+\frac{\partial H}{\partial z}=J$$

   where the symbols have the usual significance.

2. (a) Derive the five point difference formula for Laplace's equation. **(10)**

   (b) Solve the Poisson equation by Finite difference method **(15)**

$$\nabla^2 f = 2x^2y^2$$

   over the square domain $0 \le x \le 3$ and $0 < y \le 3$ with $f = 0$ on the boundary. The domain is to be divided into square of one unit size.

   (c) Show that $\text{grad}\,\delta F \cdot \text{grad}\,F = \frac{1}{2}\delta|\text{grad}\,F|^2$. **(10)**

3. (a) Derive the Euler-Lagrange equation. **(15)**

   (b) Solve the following boundary value problem **(20)**

$$\frac{d^2y}{dx^2}+y=-x \qquad 0<x<1$$

$$y_{x=0}=y_{x=1}=0$$

   Using the Rayleigh-Ritz method and choosing the trial function $\phi_1(x)=x(1-x)$ and $\phi_2(x)=x^2(1-x)$.

4. Solve the Poison equation by finite element method **(35)**

$$\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=-2 \qquad 0<x\le 1 \text{ and } 0<y\le 1$$

   with $u = 0$ on the boundary of the square. $0<x\le 1$, $0<y\le 1$. The domain is to be divided into eight triangular elements.

Contd P/2

NAME 363

SECTION – B

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

5. (a) What is mesh generation? Explain why need a mesh in CFD? **(7)**

(b) What are the grid/cell shapes used in CFD? **(10)**

(c) Compare the advantages and disadvantages of structure grid, unstructure grid and hybrid grid. **(18)**

6. (a) Define mesh quality. What are the criteria used for judging the quality of a mesh, explain with figure? **(20)**

(b) Explain the grid generation techniques with a block diagram. **(15)**

7. (a) Formulate the three dimensional transformation parameters ($\xi_x, \xi_y, \xi_z, \eta_x, \eta_y, \eta_z, \zeta_x, \zeta_y, \zeta_z$) from the physical domain (x, y, z) to computational domain (ξ, η, ζ). **(15)**

(b) What is free surface? What are the specific difficulties in handling the free surface flows? **(10)**

(c) What is mesh free method? Explain briefly the importance of mesh free method. **(10)**

8. (a) Briefly describe the Level Set Method (LSM) and Volume of Fluid Fraction (VOF) method for free surface modeling. **(20)**

(b) Describe the properties of Reynolds Time Averaging (RTA). **(15)**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2011-2012

Sub : **NAME 329** (Heat Transfer)

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** questions.

1. (a) Define Lumped heat capacity system. Mention its applicability. **(10)**

(b) Deduce the following expression for transient heat flow

$$\frac{T - T_\infty}{T_o - T\infty} = e^{-\left[\frac{hA}{\rho c v}\right]\tau}$$

where symbols have their usual meaning. **(15)**

(c) A copper sphere having a diameter of 4.0 cm is initially at a uniform temperature of 60C. It is suddenly exposed to an air stream of 10C with h = 10 W/m^2°C. How long does it take the sphere temperature to drop to 25°C? Given that ρ = 8954 kg/m^3 c = 0.383 kJ/kg °C, k = 38.6 W/m^2°C. **(20)**

2. (a) Air at 27°C and 1 atm flows over a flat plate at a speed of 2 m/s. If the plate is heated over its entire length at 60C, calculate the heat transfer in the first 30 cm and 45 cm of the plate. Given $Nu_x = 0.332\ Re_X^{0.5}\ Pr^{0.3}$, $\nu = 17.36 \times 10^{-6}$ m^2/S k = 0.0275 W/m°C, Pr = 0.7 **(20)**

(b) Define the following dimensionless numbers and their significances **(15)**

(i) Prandtle number

(ii) Nusselt number

(iii) Reynold's number

3. (a) Briefly explain the mechanism of Natural Convection. **(12)**

(b) What is fouling factor? How it can affect the heat exchanger? **(10)**

(c) A large vertical plate 4 m high is mentioned at 60°C and exposed to atmosphere air at 10°C. Calculate the heat transfer if the plate is 10 m wide. Given: **(13)**

$$\beta = \frac{1}{T_\infty}, \quad K = 0.02685\ W/mk$$

$$\nu = 16.5 \times 10^{-6}, \quad Pr = 0.7, \quad Nu = 0.1 Ra^{1/3}$$

$$Ra = Gr\ Pr$$

Contd P/2

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4. (a) Deduce the LMTD expression for parallel flow condition. **(15)**

(b) Water at the rate of 68 kg/min is heated from 35 to 75°C by an oil having a specific heat of 1.9 kJ/kg°C. The Fluids are used in a counterflow double pipe heat exchanger, and the oil enters the exchanger at 110°C and leaves at 75°C. The overall heat transfer co-efficient is 320 $W/m^2{}^\circ C$. Calculate the heat exchanger area. **(20)**

Instead of double-pipe heat exchanger, if it is desired to use a shell-tube exchanger with the water making one shell pass and the oil making two tube pass, what will be the change in required area. [Chart for correction factor is supplied]

SECTION – B

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

5. (a) Define critical thickness of insulation. Derive the expression of critical thickness of insulation on a wire of circular cross-section. Analyze the expression if the outer radius of a pipe is greater or less than the critical value. **(20)**

(b) A thick -walled tube of stainless steel (k = 19 W/m.°C) with 2-cm inner diameter and 4-cm outer diameter is covered with 2.5 cm asbestos insulation (k = 0.2 W/m.°C). If the inside wall temperature of the pipe is maintained at 600°C, calculate the heat loss per meter of length. Also calculate the tube-insulation interface temperature. **(15)**

6. (a) Derive the expression of heat transfer for a cylinder with heat sources. **(15)**

(b) What do you mean by fin efficiency and fin effectiveness? **(8)**

(c) A very long copper-rod (K = 372 W/m.°C) 2.5 cm in diameter has one end maintained at 90°C. The rod is exposed to a fluid whose temperature is 50°C. The heat transfer coefficient is 3.5 $W/m^2.{}^\circ C$. Calculate the heat given up by the rod. **(12)**

7. (a) How does thermal radiation differ from the other types of electromagnetic radiation? **(8)**

(b) Define radiation shape factor. **(12)**

(c) Derive the expression of shape factor for radiation of a small area dA_1 to a circular flat disc A_2 of diameter 'D' placed vertically and centrally above it at a distance of R. **(15)**

8. (a) What is a gray body? **(8)**

(b) Derive the expression of the net heat transfer between two infinite parallel planes (non-black) kept at different temperatures. **(17)**

(c) Two very large parallel planes with emisivities 0.3 and 0.7 exchange heat. Find the percentage reduction in heat transfer when a polished aluminium radiation shield with emisivity 0.04 is placed between them. **(10)**

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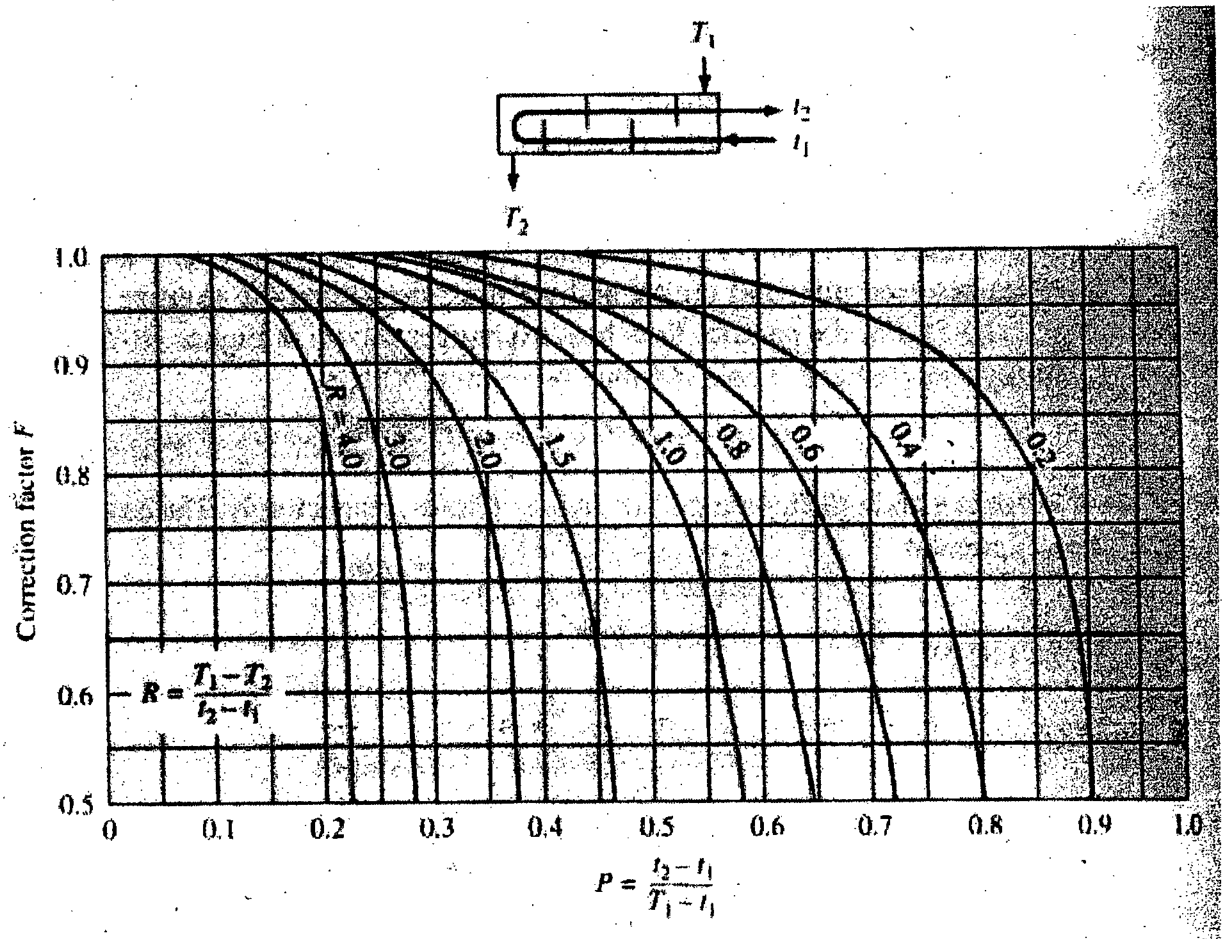

Fig For 4(b)

L-3/T-2/NAME **Date : 02/06/2014**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2011-2012

Sub : **NAME 323** (Resistance and Propulsion of Ships)

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** questions.

1. (a) Group in four distinct categories, the successful types of propulsive devices presently in use. **(8)**

(b) Write short notes on : **(27)**

(i) Contra - rotating propeller

(ii) Fully cavitating propeller

(iii) Controllable pitch propeller.

2. Describe the Momentum Theory of propeller action and derive the expression for ideal efficiency as **(35)**

$$\eta_i = \frac{V_a}{V_A + u_A}$$

Also prove that, $\eta_i = \dfrac{2}{1+\sqrt{1+C_{TH}}}$ where the symbols have their usual meaning.

3. A typical full scale trial measurement data of an ocean-going vessel is provided in Table below: **(35)**

Run No.	Mean Ship speed corrected for wind and tide Vs (knots)	Mean Revolutions n (r.p.m)	Mean Shaft Power Ps (kW)	Mean Thrust T (kN)
1-3	18.13	78.9	5902	565.8
4-6	21.52	99.8	1,3049	998.1

The open-water values for the related model propeller are provided in Table below:

Advance Coefficient (J)	0.0	0.2	0.4	0.6	0.8	1.0
Thrust Coefficient (K_T)	.451	.372	.298	.224	.149	.060
Torque Coefficient (K_Q)	.066	.058	.049	.039	.028	.014

Propeller diameter = 6.5 m

Shaft transmission efficiency = 0.97

Water density = 1.025 kN. S^2/m^4

Calculate:

(i) mean torque wake fraction.

(ii) mean thrust wake fraction

(iii) overall mean wake fraction.

Contd P/2

<u>NAME 323</u>

4. (a) Define cavitation phenomena. Discuss the effects of ship propeller cavitations. **(8)**

   (b) A propeller is to be designed for a single screw cargo ship to give a service speed of 15 knots. **(27)**

   Calculate:

   (i) dynamic pressure at 0.7 tip radius

   (ii) local cavitation number at 0.7 tip radius

   (iii) necessary expanded area of the propeller in order to avoid excessive cavitation and erosion under average service condition at sea.

   (iv) projected blade area of the propeller.

   Given:

   Diameter of the propeller = 5 m

   Taylor wake fraction = 0.2

   Pitch - diameter ratio = 1.1

   Shaft immersion = 3.5 m

   Propeller revolution = 105 r.p.m

   Thrust developed by the propeller = 475 kN.

<u>SECTION – B</u>

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

5. (a) Describe briefly the additional components of ship resistance. **(20)**

   (b) Draw a figure denoting the components of specific resistance of ships. **(15)**

6. (a) Describe Froude's method of predicting the Ship resistance from the result of model test. **(15)**

   (b) The principal particulars and model experimental results of a model is given below: **(20)**

   Length between perpendiculars = 6.1 m

   Wetted surface area = 4.312 m^2

   Model speed = 4.115 m/s

   Model resistance = 218.574 N

   Tank water density = 997.52 kg/m^3

   Tank water kinematic viscosity = 1.0111×10^{-6} m^2/s

   Calculate the frictional resistance and residuary resistance using ATTC (Schoenherr) and ITTC formulations.

7. (a) Deduce a relationship between wave-making resistance and speed. **(15)**

   (b) Analyze the wave phenomena and wave making resistance for a body of simple form. **(20)**

Contd P/3

NAME 323

8. (a) Determine the positions of humps and hollows. Using Z-theory and the p theory. **(20)**

(b) The trial data and model experimental results of a ship are provided below: **(15)**

Run No.	1-3	4-6
Ship power from ship trial (kW)	5901	8910
Mean speed knots	18.13	20.21
Propulsive co-efficient from model test	0.755	0.730
Residuary resistance co-efficient	0.807×10^{-3}	1.009×10^{-3}

From model test

Ship length = 159.54 m

Ship wetted surface area = 4288.74 m^2

Density of sea water = 1025 kg/m^3

Kinematic viscosity of sea water = 1.28×10^{-6} m^2/s

Calculate the model-ship correlation allowance, C_p and also estimate the ship trial and service power.

Assume service allowance, $1+C_2 = 1.27$.
