L-4/T-2/NAME **Date : 19/08/2017**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 | B. Sc. Engineering Examinations 2015-2016

Sub : **NAME 425** (Shipyard Management)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. How the management of shipyard projects is related with shipyard management? Discuss how the good contracting strategies is equally important as good ship design for success of a project. **(35)**

2. Name ten actors who influence the successful implementations of a shipbuilding/ship repair project. Describe their roles. How unusual contracting bring risks to both Owners and Builders? **(35)**

3. Describe clearly what possibilities and prospect you see for the shipyards of the future during the tenure of your career. **(35)**

4. Discuss the problems that are associated with site selection of a shipyard. Describe the factors that must be taken into account in solving layout problems of shipyard. **(35)**

SECTION – B

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

5. (a) Show a typical layout of the preparation shop for plates in a shipyard. **(10)**

   (b) Briefly describe the activities involved in section preparation area. **(10)**

   (c) Distinguish between sub-assembly and assembly for steel work fabrication. **(15)**

6. (a) With the help of a flow chart show various stages in ship production process. **(11)**

   (b) Briefly discuss the influence of following factors on shipyard layout **(24)**

   (i) Range of ship types to be built and number/year.

   (ii) Space required

   (iii) Amount of mechanization

   and (iv) Construction methods employed

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7. Schematically present the main divisions and organisation structure for a typical large shipyard. Also briefly describe the functions of these divisions in the organisation structure. **(35)**

8. Write short notes on the following in context to shipyard operation: **(35)**

   (i) Planning and Scheduling

   (ii) Fabrication and erection

   (iii) Lofting

   and (iv) Launching the ship.

L-4/T-2/NAME **Date : 19/08/2017**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2015-2016

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

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**.

The symbols have their usual meaning.

Assume reasonable value in case of missing data.

1. (a) With figure give definition of effective power, shaft power, delivered power and thrust power. **(12)**

   (b) Provide block diagram of the ship's various drive train elements and the power at each interface. What is propulsive efficiency? **(13)**

   (c) Increase in deadweight does not necessarily need higher power. Defend the statement with data in case of tanker and bulk carrier. **(10)**

2. (a) Give a comparison of the size, density and weight per KW for slow speed diesel and marine gas turbine having same output power. **(6)**

   (b) Write short note on **(10×2=20)**

   (i) Medium speed diesel engine.

   (ii) High speed diesel engine.

   (c) Mention the advantages and disadvantages of geared diesel propulsion machinery installations. **(9)**

3. A ship is to be propelled by a fully-cavitating propeller. The following data are known. **(35)**

   Ship speed = 50 knots

   Wake fraction = 0.12

   Number of blades = 3

   Propeller diameter = 1.9 ft

   Propeller revolution = 2700 r.p.m.

   Density of water = 102 $kg.sec^2/m^4$

   Calculate:

   (i) for optimum efficiency, the thrust developed by the propeller.

   (ii) the pitch of the propeller.

   (iii) the thrust per unit projected area, if the BAR = 0.65.

   (iv) the resistance if the ship at speed of 50 knots, if the thrust deduction fraction, t = 0.18.

   (v) the shaft power requirement of the ship, if the propulsive coefficient is 0.8.

Contd P/2

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4. The following data are taken from the open-water performance curve of a horizontal shaft propeller. **(35)**

   Advance coefficient, J = 1.05

   Thrust coefficient, K_T = 0.147

   Thrust grading, $dK_T/dJ = -0.48$

   Torque coefficient, $K_Q = 0.035$

   Torque grading, $dK_Q/dJ = -0.086$

   Calculate the inclined open water efficiency, η_ϵ for shaft inclination, ϵ = 6 degree and 10 degree.

   Draw a curve of efficiency versus shaft inclination for, ϵ = 0 degree, 6 degree and 10 degree.

SECTION – B

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

5. (a) A vessel of length 35 m 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 80%. If the vessel speed is 6.80 knots and the thrust required is 5 KN, determine the diameter of the jet. **(15)**

   (b) The following data of a harbour tug are given below: **(20)**

   Engine power = 800 HP

   Engine RPM = 750

   Number of revolution of the screw with reduction gear = 250 rpm

   A calculation of the resistance shows that the ship resistance at 6 knots is 550 kg in the service condition. At towing speed of 6 knots, the wake fraction, ω = 0.20 and the thrust deduction fraction, t = 0.10.

   Using B 4-55 screw series in nozzle, find

   (i) the propeller diameter, pitch and efficiency at optimum condition.

   (ii) thrust on the propeller and the nozzle and

   (iii) tow rope force at towing condition.

6. (a) Develop the mathematical expressions of hydrodynamic components of blade spindle torque of a controllable pitch propeller. **(20)**

   (b) A ship has a speed of 20 knots. The ship is propeller by a single screw propeller of diameter 6.50 m. The blade section used in this propeller is the NACA 66 section with parabolic tail, and a = 0.8 mean line. **(15)**

   $x_n = 0.35$, $C_6 = 45.2$, $C_M = 45$, $\delta = 7.5°$, $C_D = 0.008$ and $\rho = 1025.9$ kg/m^3.

   For a blade section at X = 0.7, calculate the differential hydrodynamic components of blade spindle torque about spindle axis.

X	l (m)	S_k (m)	ϕ (deg)	1 - ω_x	β (deg)	P_i (deg)	C_L
0.70	1.82	0.03	27.50	0.8	19.9	25.5	0.285

Contd P/3

NAME 423

7. (a) For design of a contra-rotating propeller having thrust of front and rear propellers being the same with equal number of revolution, the condition are given below: **(25)**

Ship speed = 15 knots

Wake fraction = 0.15

No. of blade = 3

Shaft power = 225 KW

Engine RPM = 1800

Calculate:

(i) Diameter and pitch of front and rear propeller.

(ii) Optimum efficiency of the system.

(iii) Blade area ratios of front and rear propellers.

(b) Compare the efficiency of the above mentioned contra-rotating propeller with a single screw and twin screw design at the same design condition. **(10)**

8. Write short notes on: **(35)**

(i) Jet propeller.

(ii) Vertical axis propeller and

(iii) Controllable pitch propeller.

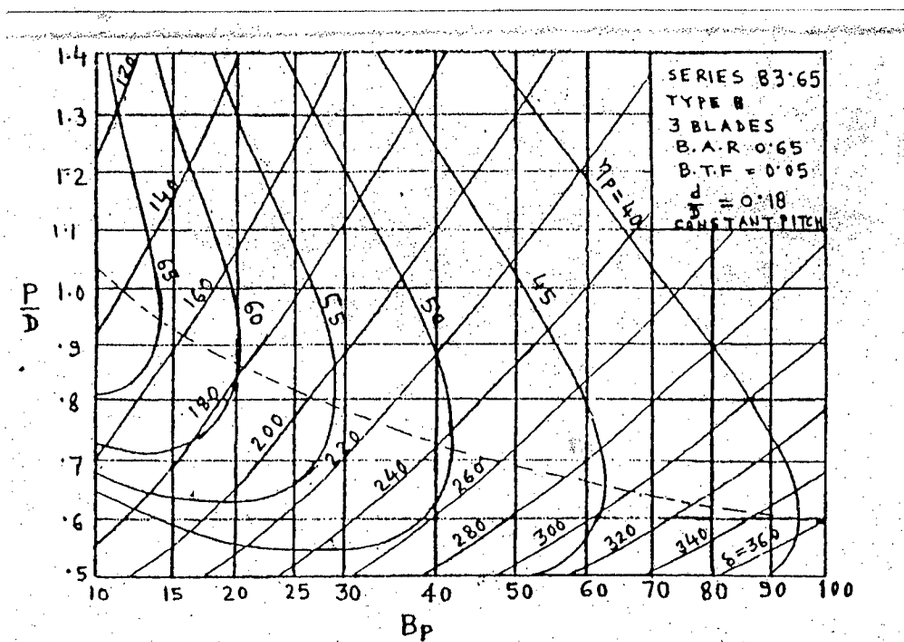

FIG. B4. Bp-δ diagram 3 bladed screw type B3-65.

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Figure for Qs. no. 7(b)

Contd. ... P/4

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Figure for
Qn. no. 3

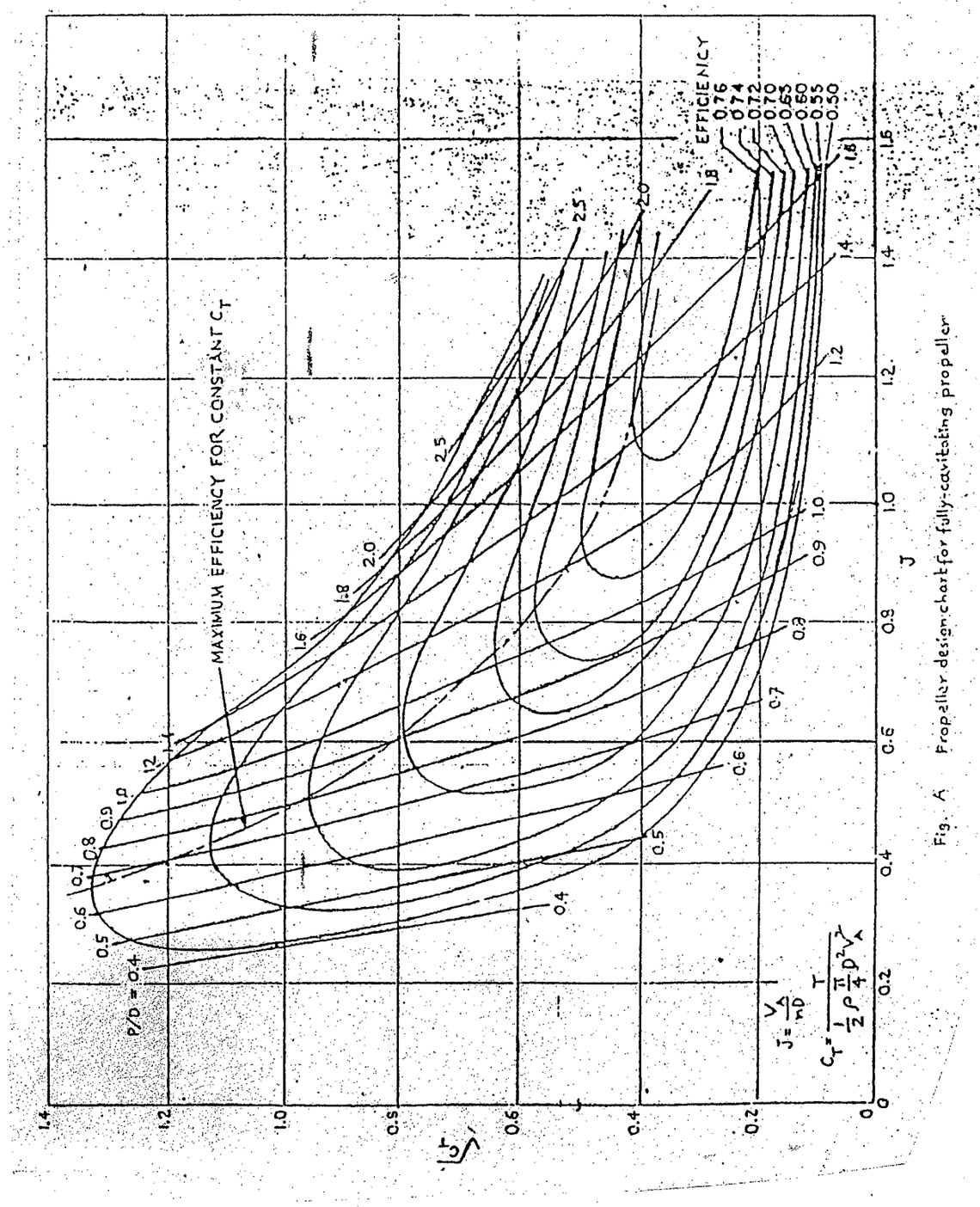

Fig. A Propeller design chart for fully-cavitating propeller

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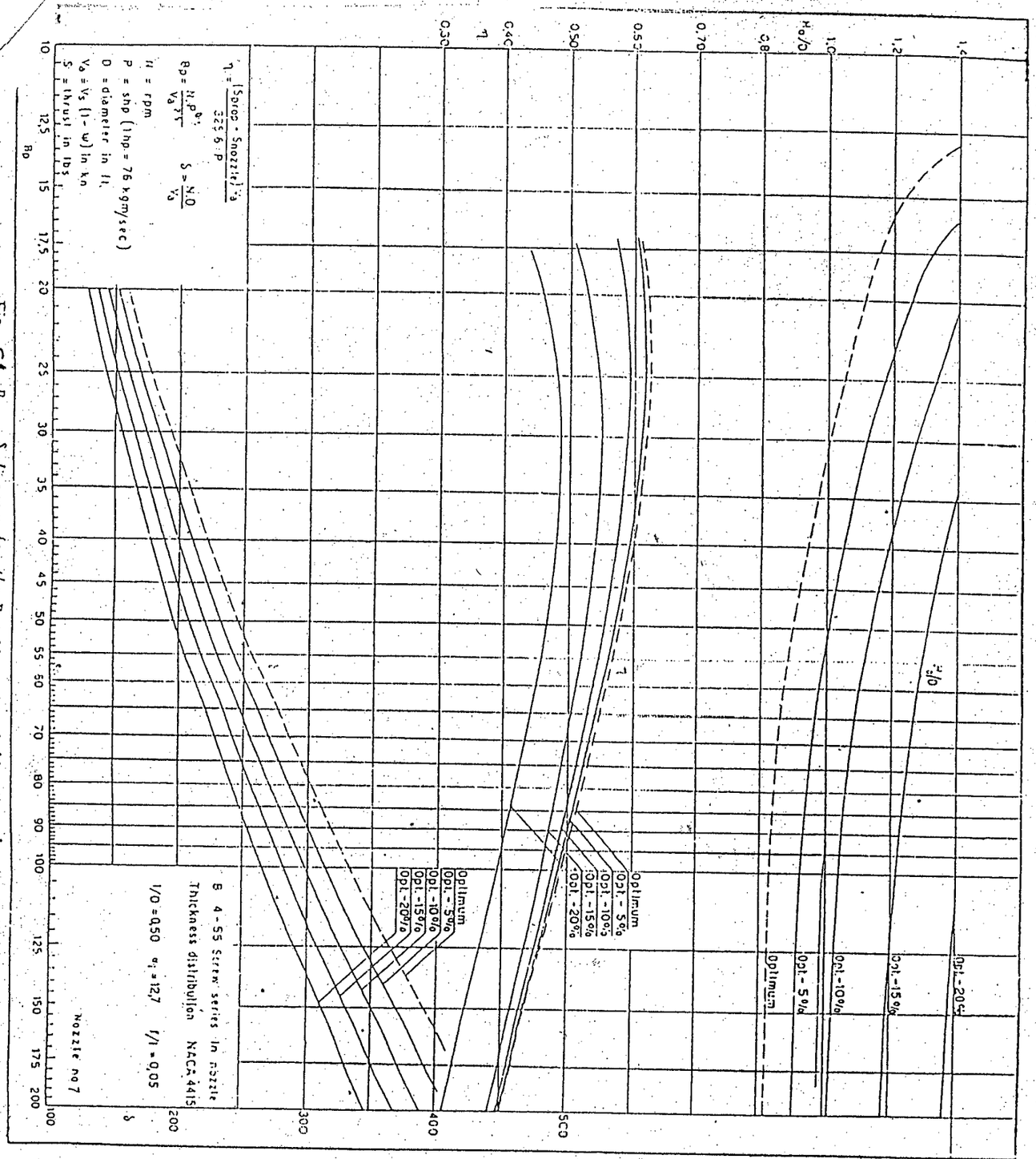

Fig. C1 $B_p - \delta$ diagram for the B 4-55 screw series in a nozzle

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Figure for Qn. no. 5(b)

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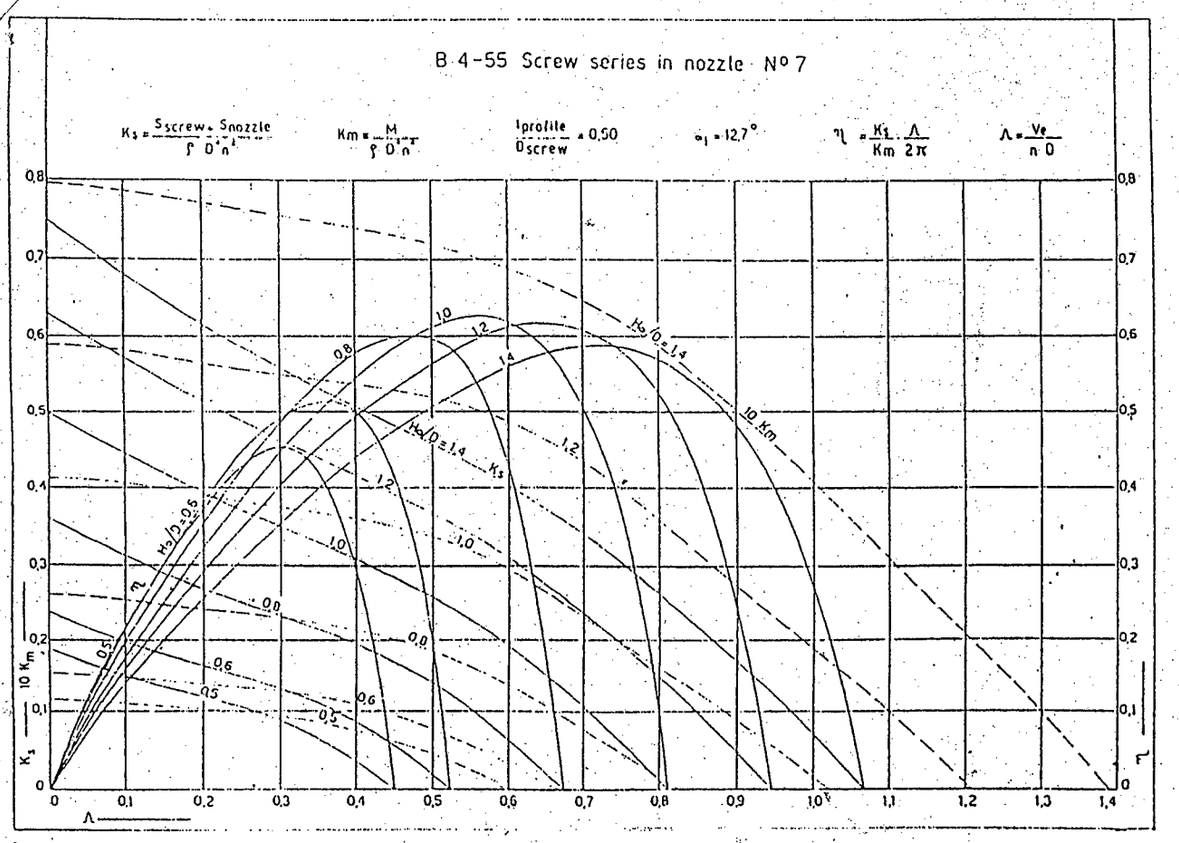

Fig. C2 *Results of open water tests with the B 4-55 screw series in a nozzle*

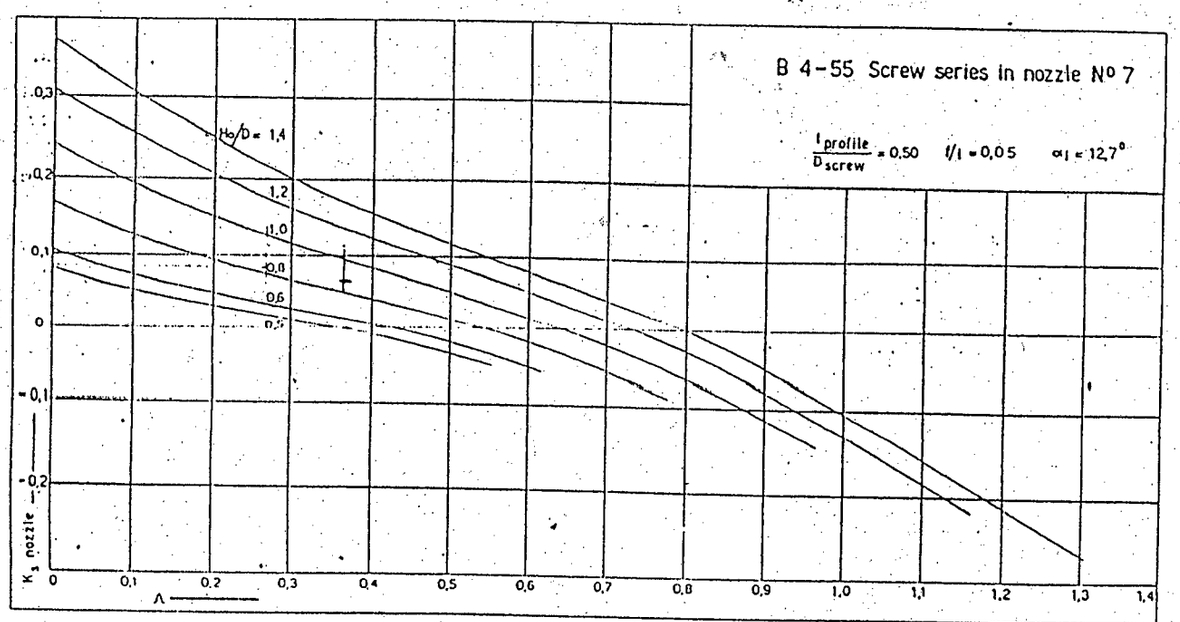

Fig. C3 *Axial forces acting on a nozzle with the B 4-55 screw series*

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Figure for Qn. no. 5(b)

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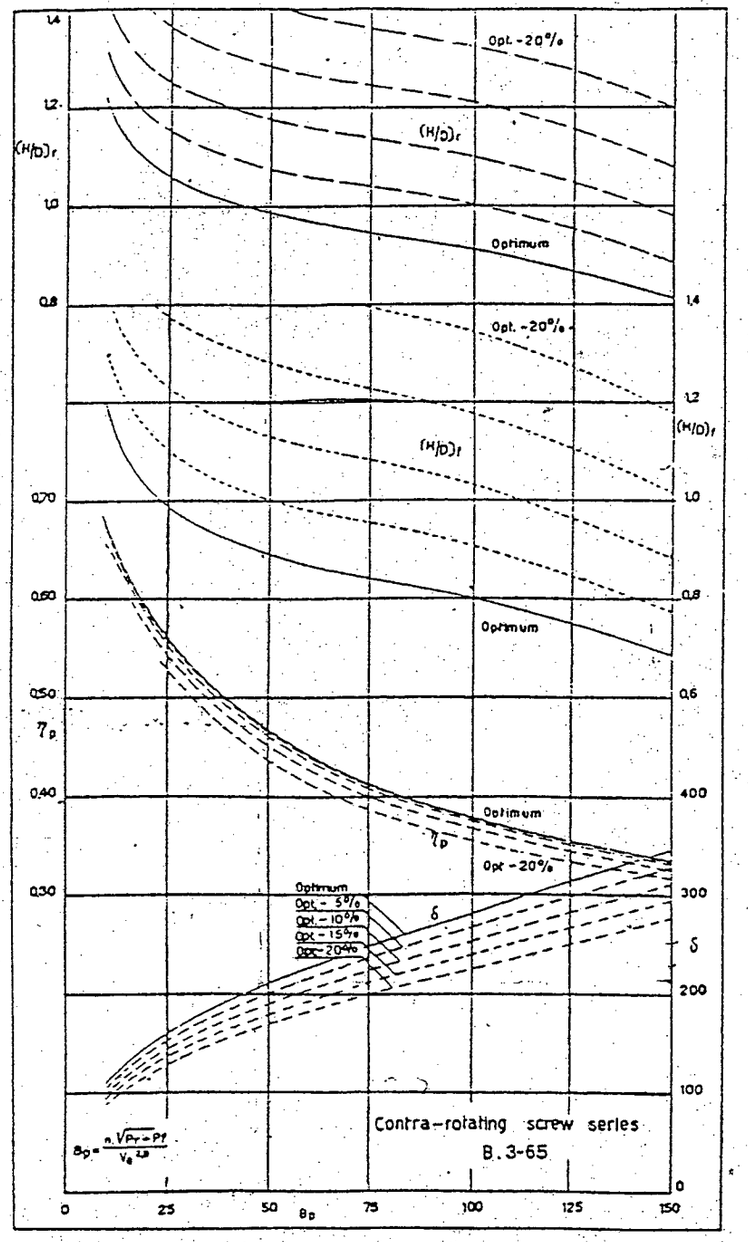

Fig. B1 $B_p - \delta$ chart for a three-bladed contra rotating propeller

NAME 423
Figure for Q. no- 7(b)

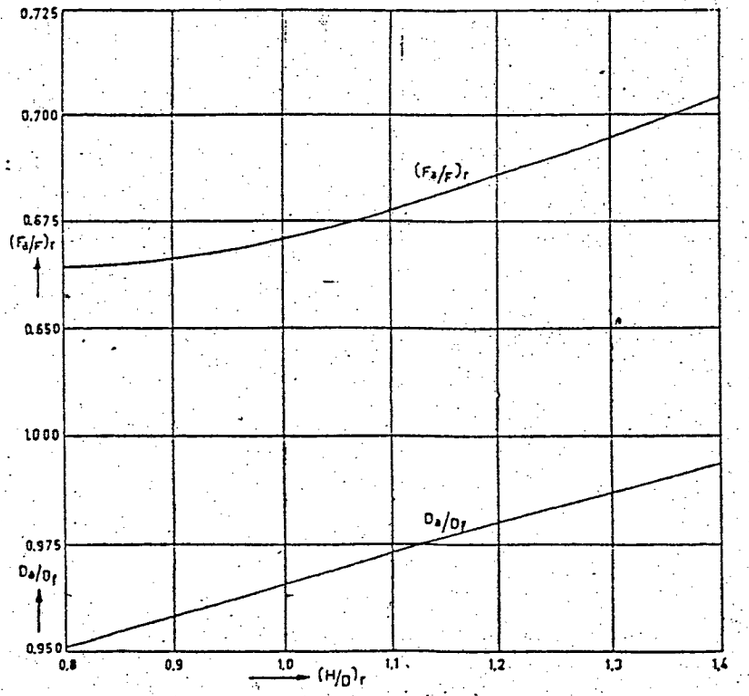

Fig. B2 *Diameter ratio of front and rear propellers and blade-area ratio F_a/F of the rear propeller in terms of the pitch ratio of the*

— X —

L-4/T-2/NAME **Date : 15/07/2017**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2015-2016

Sub : **NAME 467** (Control Engineering)

Full Marks: 210 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

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

1. (a) Describe three most widely used singularity functions with necessary figures. **(15)**

   (b) Find the free response and the forced response of the following system: **(20)**

$$\frac{d^2y}{dt^2}+4\frac{dy}{dt}+4y=3\frac{du}{dt}+2u$$

   Consider $u(t)=e^{-3t}, t\geq 0$ and also $y(0)=0$, $\left.\frac{dy}{dt}\right|_{t=0}=1$ (For free response)

2. (a) Define steady state response and Transient response of a system. Draw necessary diagrams and explain. **(15)**

   (b) Consider the following open-loop continuation system transfer function: **(20)**

$$GH(s)=\frac{1}{s+1}$$

   Draw a polar plot of the system and explain each step.

3. (a) Reduce the block diagram of the system shown in Fig. 3(a) to unity feedback form and find the system characteristic equation. **(17½)**

   (b) Reduce the block diagram of the system shown in Fig. 3(b) to canonical form and find the output transform C. Here, K is constant. **(17½)**

4. (a) What is the transfer function of the system whose input and output are related by the following differential equation? **(15)**

$$\frac{d^2y}{dt^2}+3\frac{dy}{dt}+2y=u+\frac{du}{dt}$$

   (b) Determine the transfer function of a system with a gain factor of 3 and the pole-zero map shown in Fig. 4(b). Evaluate the unit step response of the system. **(20)**

Contd P/2

NAME 467/NAME

SECTION – B

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

Symbols have usual meanings.

5. (a) What is a control system? How a control system is classified as open-loop and closed-loop? **(5)**

(b) What is feedback in control system? Why negative feedback is preferred in the control system and what is the effect of positive feedback in the control system? **(10)**

(c) (i) Explain the operation of ordinary traffic signals which control automobile traffic at roadway intersections. (ii) Why are they open-loop control systems? (iii) How can traffic be controlled more efficiently? (iv) Why is the system of (iii) closed-loop? **(10)**

(d) Derive a control system for positioning the rudder of a ship from a control room located far from the rudder. The objective of the control system is to steer the ship in a desired heading. **(10)**

6. (a) Consider the following equations in which x_1, x_2, ..., x_n are variables and a_1, a_2, ..., a_n are general coefficients or mathematical operators: **(15)**

(i) $x_3 = a_1 x_1 + a_2 x_2 - 5$

(ii) $x_n = a_1 x_1 + a_2 x_2 + \cdots + a_{n-1} x_{n-1}$

Draw a block diagram for each equation, identifying all blocks, inputs and outputs.

(b) Show the sine function $\sin t$ is Laplace transformable and determine its Laplace transform. **(20)**

7. (a) Describe the Routh Stability Criterion for systems with an nth-order characteristic equation of the form: **(20)**

$$a_n s^n + a_{n-1} s^{n-1} + \cdots + a_1 s + a_0 = 0$$

(b) Construct a Routh table and determine if the following characteristic equation represents a stable system: **(15)**

$$s^3 + 4s^2 + 8s + 12 = 0$$

8. (a) Describe the Hurwitz Stability Criterion for systems with an n-th-order characteristic equation of the forms: **(20)**

$$a_n s^n + a_{n-1} s^{n-1} + \cdots + a_1 s + a_0 = 0$$

(b) Determine the Hurwitz conditions for stability of the following general fourth-order characteristic equation, assuming a_4 is positive. **(15)**

$$a_4 s^4 + a_3 s^3 + a_2 s^2 + a_1 s + q_0 = 0$$

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NAME 467 (Control Engineering)

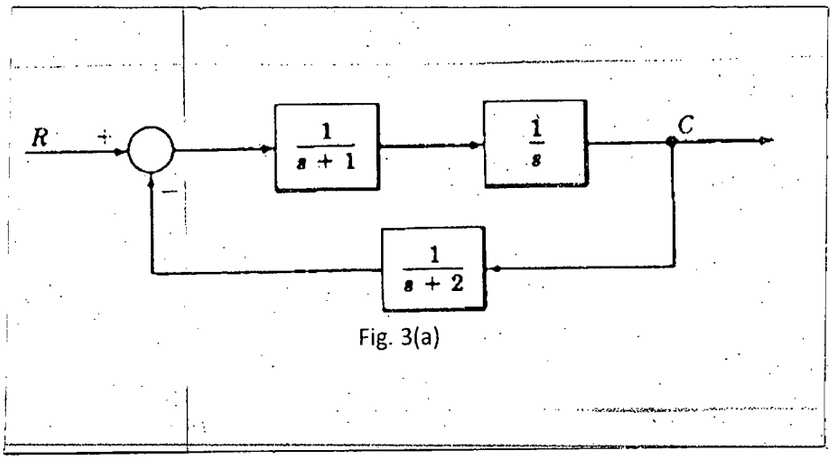

Fig. 3(a)

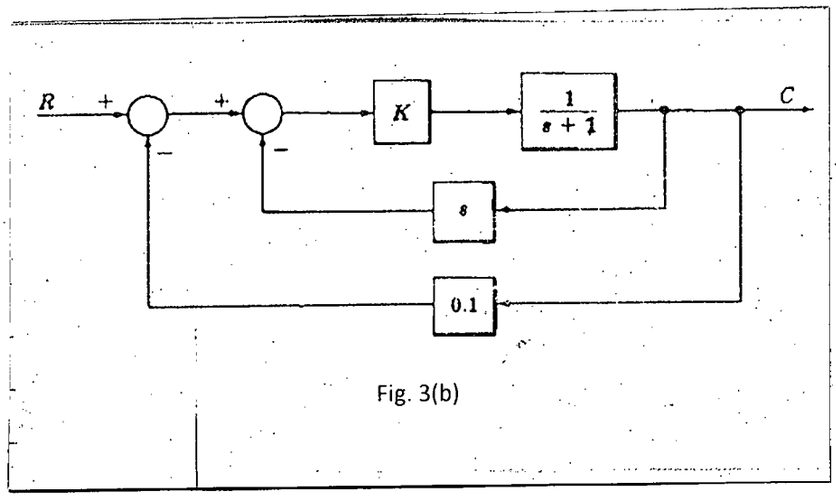

Fig. 3(b)

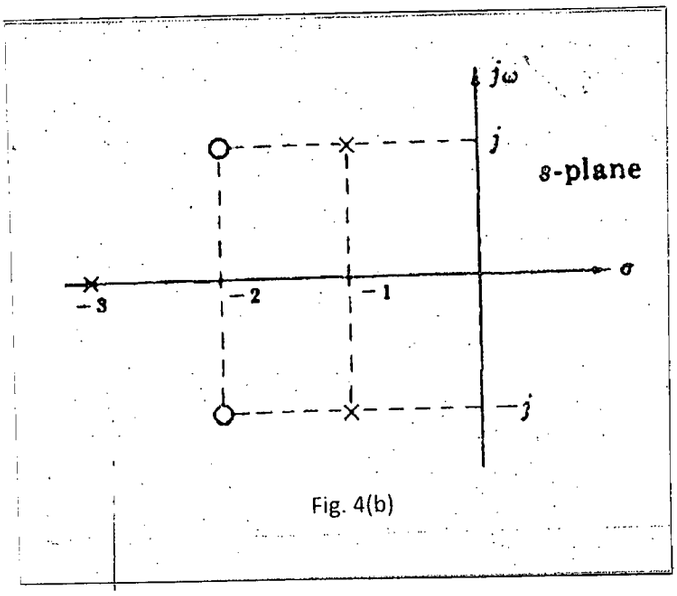

Fig. 4(b)

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BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2015-2016

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

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**.

Necessary diagrams are attached.

1. (a) Underline the basic principles and different approaches for determining the added resistance of a ship in regular waves. **(15)**

   (b) Derive in detail the expression, Gerritsma and Beukelman obtained for estimation of added resistance of a ship in waves and hence distinguish two extreme cases. **(20)**

2. Give a description of Maruo's method for predicting added resistance of a ship in waves. How Beck obtained different components of added resistance from Maruo's theory? Prepare a graphical representation of the components of added resistance and hence evaluate the importance of different components. **(35)**

3. (a) Develop analytically a simplified method for estimating the speed loss at constant power and power increase at constant speed due to added resistance of a ship. Derive also an expression for a change in propeller open water efficiency due to added resistance. **(23)**

   (b) Following values are given: **(12)**

J	K_T	η	
0.20	0.234	0.299	
0.25	0.216	0.360	
0.30	0.196	0.420	$\leftarrow J_0, K_{T_0}, \eta_0$
0.35	0.177	0.480	
0.40	0.157	0.536	
0.45	0.136	0.581	

Construct a diagram of $\left(\frac{1}{1+\frac{\Delta\eta}{\eta_0}}\right)$ against $\left(1+\frac{\Delta R}{R_0}\right)$.

The symbols have usual meanings.

Contd P/2

NAME 469/NAME

4. (a) With a definition diagram, describe the equations of axial force, lateral force and yawing moment of a ship experiencing an oblique wind in a seaway. **(15)**

(b) (i) Obtain the curves of wind coefficients for axial force, side force and yawing moment on a base of relative angle from the attached diagram for a tanker of following dimensions: **(20)**

L = 225 m	$C_B = 0.80$
B = 34 m	$A_T = 410\ m^2$
T = 13 m	$A_L = 1450\ m^2$

(ii) Calculate the direct wind resistance for:

Ship speed, V = 15.5 knots

Heading = 55°

True wind speed = 15 m/s

True wind direction = NW = –45°

(iii) Estimate the rudder angle to compensate for this wind (use approximate formula).

(iv) Estimate the rudder resistance for steady condition given that rudder area = 52 m^2.

(v) Estimate the yawing resistance if the yawing amplitude is 2.5°.

SECTION – B

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

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

5. A single screw Cargo ship has the following particulars: **(35)**

L_{WL} = 136 m	L_{BP} = 133 m	B = 19.5 m
T = 6.0 m	$C_B = 0.552$	Cp = 0.576
$C_M = 0.957$	$C_W = 0.823$	

Welted surface area = 2839 m^2, V = 16 knot

Hull roughness = 150 micron

Days out of dock = 182 days

(i) Calculate total frictional resistance including the roughness and fouling due to out of docks in service. Use ITTC formulation.

(ii) Using modified Townsin formula, calculate ΔC_F where ΔHR = 150 μm, $\gamma = 1.004 \times 10^{-6} m^2/s$ (water).

6. (a) Discuss the importance of hull roughness on resistance of a ship. **(8)**

(b) Define mean hull roughness and average hull roughness. **(15)**

(c) Discuss the causes of hull roughness of a ship. **(12)**

Contd P/3

NAME 469/NAME

7. (a) Discuss the causes of surface roughness on propeller with reference to the following: **(25)**

   (i) Corrosion
   (ii) Impingement attack
   (iii) Cavitation erosion
   (iv) Improper maintenance

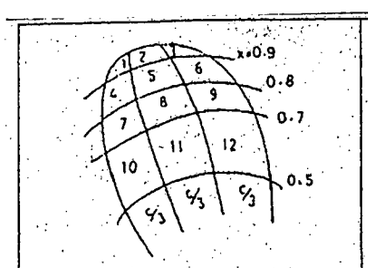
   (b) Write short notes on resistance due to fouling. **(10)**

8. A cargo ship propeller has following particulars: **(35)**

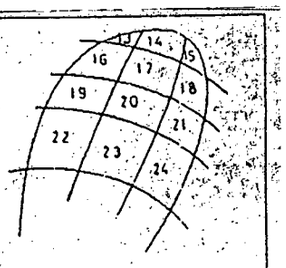
   D = 5.5 m $\frac{P}{D} = 0.865$

   No. of Blades, N = 4.

   The roughness (μm) of blade section has been measured and given in the following Table:



Face



Back

Location	R_a	P_c	Location	R_a	P_c
1	13.5	43	13	20.3	29
2	15.6	22	14	16.6	19
3	18.3	24	15	20.0	27
4	19.1	19	16	21.1	28
5	26.7	24	17	46.8	17
6	24.5	10	18	24.9	10
7	28.0	32	19	21.0	15
8	10.9	15	20	22.1	19
9	10.0	34	21	17.8	27
10	6.7	17	22	22.5	36
11	5.0	51	23	8.0	56
12	10.2	39	24	8.2	46

Calculate APR considering the following weightage factor of propeller blade section:

Region	Weight
0.2 ~ 0.5	0.07
0.5 ~ 0.7	0.21
0.7 ~ 0.8	0.22
0.8 ~ 0.9	0.26
0.9 ~ Tip	0.24

Use following approximate equation

$$h' = 0.0147\ R_a\ (2.5)^2\ P_c.$$

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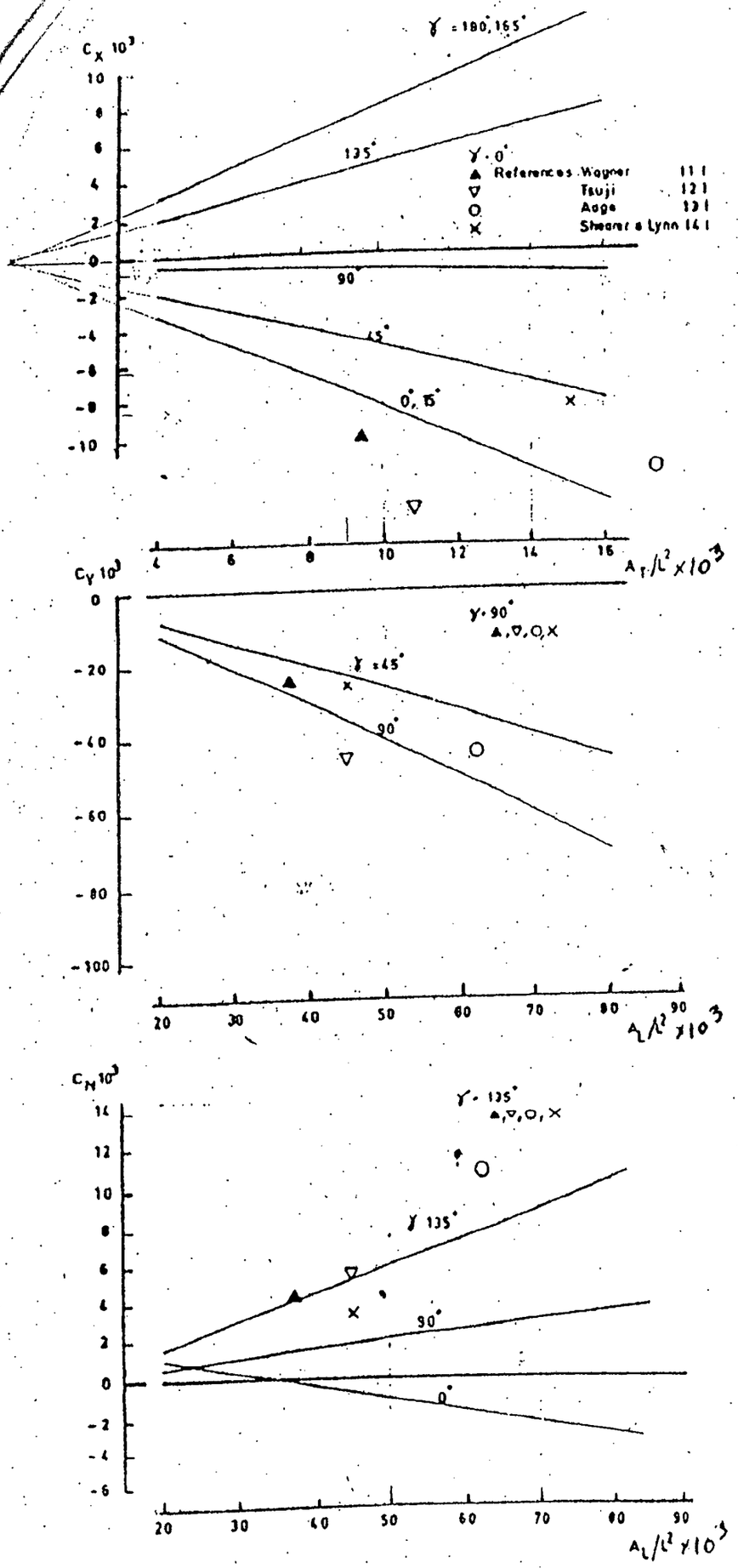

Fig. for Q. No. 4(b)

Fig. ---Level of wind coefficients for tankers

L-4/T-2/NAME **Date : 13/08/2017**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2015-2016

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

SECTION – A

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

1. Describe in details how would you determine the optimal speed for a ship size mentioning the ship data, operational data and economic data that you would need as input data. **(35)**

2. Compare the economic performance of a self unloading bulk carrier of 60,000 tonnes d.w. with a conventional ship of 60,000 tonnes d.w. using existing shore discharging plant for transporting 1.25 M tonnes of mineral ore per annum required to be transported between two ports 2000 miles (nautical) apart, in terms of RFR. Assume suitable values for missing data that you would need in solving the problem and mention those. **(35)**

3. Describe the various steps that are there in an integrated design process for ship building before you can draw and finalize the General Arrangement Plan.
   Draw the Design Spiral for ships and explain the important features of it. **(35)**

4. The calculations for building account and operating account are shown in Tables (for Q. No. 4) for a 100,000 Cubic meter liquefied gas carrier operating in a consortium with a 12 year time charter. The ship price is $100,000,000/- with a 80% loan for eight years at 8% interest, the tax situation is U.K. new entry with declining balance. Show thorough calculation of the following: **(35)**
   (a) Whether the ship owner should charter the ship if he wishes to get IRR after tax of at least 12%.
   (b) In case the answer to a) above is negative, what conditions he should seek for in getting his desired IRR.
   (c) In case the answer to (a) above is positive calculate the NPV of the Project at 10% discount rate.

Contd P/2

NAME 427

SECTION – B

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

The symbols have their usual meaning.

5. (a) Show that sinking Fund Factor (SFF) can be expressed as $SFF = \frac{i}{(1+i)^N - 1}$ and hence, also show that CRF = SFF + i

where CRF is the capital Recovery Factor. **(20)**

(b) A flag-of-convenience ship owner buys a 200,000 ton-dwt. Bulk carrier for $30,000,000 cash (no loans for taxes). He is offered a 15-year time charter by a steel company. What is the rate of return if the minimum hire rate per ton dead weight per month is $2.50. Assume 11.5 months trading per annum and annual operating cost $2,000,000. **(15)**

6. (a) Write short note on the followings criteria:

NPV, RFR, IRR and permissible price and also draw a decision chart for choice of economic criterion. **(15)**

(b) A company invests in one of the two mutually exclusive alternatives. The life period of both the alternatives is estimated to be 15 years with the following investments, annual equal returns and salvage values: **(20)**

Particulars	Alternative 1	Alternative 2
First cost	$100,000	$110,000
Annual equal returns	$70,000	$80,000
Salvage value	$10,000	$20,000

Determine the lowest alternative based on the annual equivalent method by assuming i = 20% compounded annually.

7. (a) Describe the type of charter and the division of responsibility for cost and ship's time between ship owner and charterer. **(15)**

(b) Consider a 40,000 ton dwt. Oil products carrier bought by a flag-of-convenience for a total of $18,000,000 cash. It is operated on a five-year time-charter at $ 9.0 per ton dwt. per month after commissions and then sold for $13,000,000 cash. Assume that crew cost 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 assess whether the investment is profitable. Assume 11.5 months trading per annum and also calculate the actual rate of return. **(20)**

Contd P/3

NAME 427

8. (a) A large anchor-handling tug costing $6,000,000 cash on delivery is to be built for charter. The owner anticipates a time charter hire rate averaging $5000 per day. Annual operating costs are expected to be $855,000. Annual on-hire days 340. Vessel life 15 years, zero residual value. Calculate NPV at 10% discount rate with corporation tax at 35% under **(30)**

(i) straight line depreciation

(ii) declining balance at 25%

(b) Show that accumulated depreciation to year N = 100 $[1 - (1 - R)^N]$

where R = declining balance rate = $1-\left(\frac{S}{p}\right)^{1/N}$ **(5)**

TABLE

For Question No. 4

BUILDING ACCOUNT

Thousands of Dollars

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Year	Building Instalments	Owner's 20%	Loan Drawdown	Owner's Expenses & Fees	Loan Repayments	Loan Outstanding	Loan Interest 8%	Owner's Cash Outflow	Present Worth Factor	DCF
0	50000	50000		500				5500	1.0000	5500
0.5	100000		100000	500		100000	0	500	0.9449	472
1	100000	50000	50000	500		150000	400	5900	0.8929	5268
1.5	150000		150000			300000	600	600	0.8437	506
2	200000	50000	150000	500		450000	1200	6700	0.7972	5341
2.5	200000		200000			650000	1800	1800	0.7533	1356
3	200000	50000	150000	1000		800000	2600	8600	0.7118	6121
4					100000	700000	6400	16400	0.6355	10422
5					100000	600000	5600	15600	0.5674	8851
6					100000	500000	4800	14800	0.5066	7498
7					100000	400000	4000	14000	0.4523	6332
8					100000	300000	3200	13200	0.4039	5331
9					100000	200000	2400	12400	0.3606	4471
10					100000	100000	1600	11600	0.3220	3735
11					100000	0	800	10800	0.2875	3105
Total	1000000	200000	800000	3000	800000		35400	138400		74309

Contd... P/4

NAME 427 = 4 = L-4/T-2/NAME

TABLE For Question No. 4..

OPERATING ACCOUNT

Thousands of Dollars

(1) Year	(2) Annual Income	(3) Crew Costs	(4) Upkeep Costs	(5) Other Costs	(6) Annual Operating Costs	(7) Cash Flow Before Tax	(8) TAX Interest	(9) ALLOWANCES 25% Annual	(10) Max. Cum.	(11) Actual Annual	(12) Actual Cum.	(13) Total Tax Allowances	(14) Taxable Profit	(15) Tax at 35%	(16) Cash Flow After Tax	(17) Present Worth Factor 12%	(18) DCF
4	22667	1200	1496	1702	4398	18269	13000	25750	25750	5269	5269	18269	0	0	18269	0.6355	11610
5	22667	1200	1616	1838	4654	18013	5600	19313	45063	12413	17682	18013	0	0	18013	0.5674	10221
6	22667	1200	1745	1985	4930	17737	4800	14484	59547	12973	30619	17737	0	0	17737	0.5066	8986
7	22667	1200	1885	2144	5229	17438	4000	10863	70410	13438	44057	17438	0	0	17438	0.4523	7887
8	20667	1200	2036	2315	5551	15115	3200	8147	78557	11915	55972	15115	0	0	15115	0.4039	6105
9	22667	1200	2199	2500	5899	16768	2400	6111	84668	14368	70340	16768	0	0	16768	0.3606	6047
10	22667	1200	2375	2700	6275	16392	1600	4583	89251	14792	85132	16392	0	0	16392	0.3220	5278
11	22667	1200	2565	2916	6681	15986	800	3437	92688	7556	92688	8356	7636	0	15986	0.2875	4596
12	22667	1200	2770	3150	7120	15547	--	2578	95266	2578	95266	2578	12969	2673	12874	0.2567	3305
13	18667	1200	2991	3402	7593	11073	--	1933	97199	1933	97199	1933	9140	4539	6534	0.2292	1498
14	22667	1200	3231	3674	8105	14562	--	1450	98649	1450	98649	1450	13112	3199	11363	0.2046	2325
15	22667	1200	3489	3968	8657	14010	--	1088	99737	1088	99737	1088	12922	4589	9421	0.1827	1721
16	30000					30000				+3263	103000	3263	26737	4523	25477	0.1631	4155
17														9358	-9358	0.1456	-1362
Total	296002	14400	28398	32294	75092	220910	35400			103000		138400	82516	28881	192029		72371

L-4/T-2/NAME **Date : 08/08/2017**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2015-2016

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

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

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

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) What do you mean by NPSHA and NPSHR? If you find a pump working under cavitation, which of the above parameters will you modify and how? **(12)**

   (b) A centrifugal pump running at 1000 rpm gave the following relation between head and discharge: **(23)**

Discharge (m^3/min)	0	4.5	9.0	13.5	18.0	22.5
Head (m)	22.5	22.2	21.6	19.5	14.1	0

   The pump is connected to suction and delivery pipe having total length of 69 m and the pipe diameter is 300 mm. The discharge is to atmosphere which is 15 m above the sump level. The entrance loss is equivalent to an additional 6 m of pipe and f is assumed as 0.024.

   (i) Calculate the discharge in m^3/min.

   (ii) If it is required to adjust the flow by regulating the pump speed, estimate the speed to reduce the flow to one-half.

2. (a) Describe fire fighting piping system of ship. **(15)**

   (b) What is steam trap? Briefly explain the operating principle of different types of steam trap with figure. **(20)**

3. (a) Discuss four most popular method of controlling shaft alignment. **(17)**

   (b) Write short notes on the following: **(18)**

   (i) Anchor windlass (ii) Causes of pipe failure (iii) Two ram hydraulic steering gear.

4. (a) What is zoned air-conditioning system? Draw a schematic diagram of an air-conditioning plant with economizer and state the functions of each component. **(15)**

   (b) Figure below shows a typical duct layout. Design the duct system using equal friction method. Take the velocity of air in the main duct (A) as 8 m/s. Assume a dynamic loss coefficient of 0.3 for upstream to downstream and 0.8 for upstream to branch and for the elbow. The dynamic loss coefficients for the outlets may be taken as 1.0. Also find the Fan Total Pressure (FTP) required and the amount of dampering required. **(20)**

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Contd ... Q. No. 4(b)

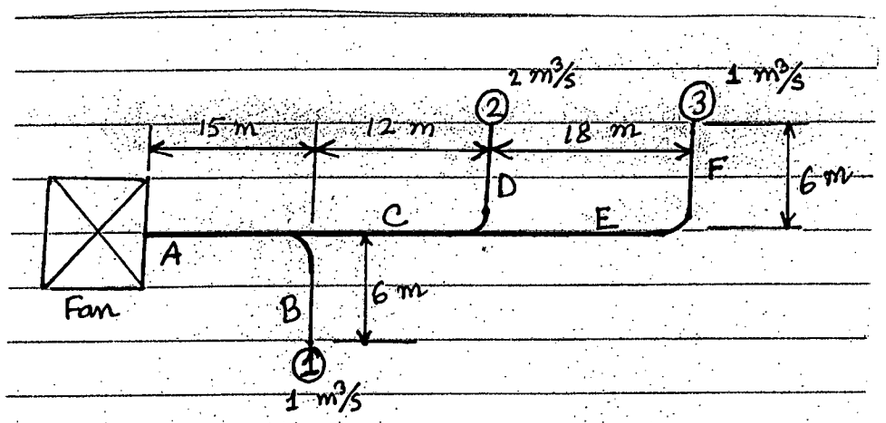

Figure for Question No. 4(b)

SECTION – B

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

5. (a) Find the equivalent diameter of a circular duct for a rectangular duct with the same pressure loss per unit length: (i) when the quantity of air passing through the rectangular and circular duct is same (ii) when the velocity of air passing through the rectangular and circular duct is the same. **(20)**

(b) A rectangular duct section of 500 mm × 350 mm size carries 75 m^3/min of air having density 1.15 kg/m^3. Determine the equivalent diameters of a circular duct if **(15)**

(i) The quantity of air carried in both case is the same.

(ii) The velocity of air in both cases is the same.

If the friction factor is 0.01, find the pressure loss per 100 m length of duct.

6. (a) The atmospheric air at pressure 1 bar and temperature – 5°C is drawn in the cylinder of the compressor of a Bell-Coleman refrigerating machine. It is compressed isentropically to a pressure of 5 bar. In the cooler, the compressed air is cooled to 15°C, pressure remaining the same. It is then expanded to a pressure of 1 bar in an expansion cylinder, from where it is passed to the cold Chamber. Find, **(20)**

(i) The work done per kg of air

(ii) COP of the plant.

For air, assume law of expansion, $pv^{1.2}$ = constant; law for compression, $pv^{1.4}$ = constant and specific heat of air at constant pressure = 1 kJ/kgK.

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Contd ... Q. No. 6

(b) Two refrigerators A and B working on reversed Carnot cycle operates in series. The refrigerator A absorbs energy at the rate of 1 kg/s from a body at temperature 300 k and rejects energy as heat to a body at temperature T. The refrigeration B absorbs the same quantity of energy which is rejected by the refrigeration A from the body at temperature T and rejects energy as heat to a body at temperature 1000 k. If both the refrigerators have the same COP calculate: (i) the temperature T of the body, (ii) COP of the refrigerators, and (iii) The rate at which energy is rejected as heat to the body at 1000 k. **(15)**

7. (a) 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 (i) there is no undercooling (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/kgK and that for liquid as 0.94 kJ/kgK. The other properties of refrigerant are in the following table: **(20)**

Temperature in °C	Enthalpy in kJ/kg		Specific entropy in kJ/kgK	
	Liquid	Vapour	Liquid	Vapour
– 15	22.3	180.88	0.0904	0.7051
10	45.4	191.76	0.1750	0.6921

(b) Draw and explain the temperature entropy diagram of an actual vapour compression cycle. **(15)**

8. (a) Describe and explain a compound vapour compression refrigeration system having two stage compression with water intercooler, liquid subcooler and liquid flash chamber. **(20)**

(b) Discuss the thermodynamic properties of refrigerants. **(15)**

L-4/T-2/NAME Date : 02/08/2017

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2015-2016

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

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) Categories IMO conventions according to its functions. Mention their role for promoting overall maritime safety effectively. **(20)**

   (b) Discuss the characteristics of the following fire fighting equipment in light of shipping regulation: **(15)**

   (i) Fixed CO_2 System

   (ii) Portable Fire Extinguisher

   (iii) Fire Pipe and Hydrants.

   (iv) Fire Pumps

2. (a) Differentiate among different types of tank cleaning process. What conclusions can be drawn from the effectiveness of their operation? **(13)**

   (b) On the basis of minimum GZ curve for a vessel's damaged condition discuss the main points of minimum damage stability criteria. **(10)**

   (c) Define Ergonomics. Organize Ergonomics principles to reduce fatigue of crew in relation to their work environment. **(12)**

3. (a) Define "Criteria of Service Number" (Cs) and "Factor of Subdivision" (F). Formulate the equation of "Factor of Subdivision" for both type A and type B ship as a function of "Criteria of Service Number". **(12)**

   (b) Determine the "Criteria of Service Number" (Cs) and the "Factor of Subdivision" (F) for a ship having particulars as follows: **(10)**

   Volume of machinery space = 5221 m^3

   Volume of passenger space = 3302 m^3

   Total volume of ship = 23333 m^3

   Subdivision length, L = 141 m

   (c) With a typical sketch, describe the characteristics of different types of navigation lights that must be installed in all vessels irrespective of type, size or propulsion system. **(13)**

Contd P/2

NAME 449

4. (a) Prepare a schematic diagram illustrating different zones of sea according to UNCLOS II. Mention the importance of each zone. **(12)**

(b) A double skin segregated ballast crude oil tanker has the following particulars: **(6)**

L_{BP} = 223 m

L_{WL} = 230 m at 85% D

B = 32.23 m

D = 20.5 m

deadweight = 70,000 tonnes

In addition tanker has 6 nos. of cargo oil tank with centerline longitudinal bulkhead dividing each tank port and starboard side.

The total length of the cargo tank = 171 m

Width of wing tank space = 2.1 m

According to MARPOL Annex J, Regulation 24 the length limit of cargo tanks is defined by following:

$$\text{Length limit} = \left(\frac{0.25 \times bi}{B} + 0.15\right) \times L$$

Where the symbols have their usual meanings.

Based on this regulation and provided data evaluate whether the limiting size and arrangement of tanks are okay or not? Justify.

(c) Write short notes on following: **(10)**

(i) Approval of design and plan of inland ship according to Inland Shipping Ordinance

(ii) General requirements of life-saving appliances according to Inland Shipping Ordinance

(d) According to inland shipping fire safely rules, point out the requirements regarding the distribution of fire fighting equipment in case of cargo vessel having total engine power more than 450 KW but not exceeding 800KW. **(7)**

SECTION – B

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

5. (a) Define "Great Circle Sailing". Find the shortest distance, and the initial course of the great circle between the following positions: **(30)**

A	41°00′ S	175°00′ E
B	33°00′ S	71°30′ W

Also find the latitudes where the track cuts the longitudes of 9° W, 110°W, 130°W, 150°W, and 170°W and the course of these points.

(b) Differentiate among different types of "Range Lights". **(5)**

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6. (a) Deduce mathematically that the middle latitude sailing and mercator sailing will produce exactly the same result. **(10)**

   (b) Demonstrate the use and limitations of the Mercator Projection". **(10)**

   (c) Discuss different types of LORAN accuracy with examples. **(10)**

   (d) What are the different types of "IALA Maritime Buoyage System"? **(5)**

7. (a) A ship leaves a position in latitude 49°00′ N longitude 160°00′ W and steams 000° T for 90 miles, 090°T for 90 miles, 180° T for 90 miles, and 270° T for 90 miles. What is her final position? **(13)**

   (b) Discuss the functions of all specific equipment for basic pulse-modulated radar system, with necessary black diagram. **(12)**

   (c) Write short notes on the following: **(10)**

   i. Lights and sound signals on Buoys.

   ii. System capabilities of GPS.

8. (a) Describe three major systems of GPS. **(13)**

   (b) A mercator chart covers the area between latitude 50° N and 56° N and between longitudes 170° E and 180° E. If the total length of the longitude scale is 100 centimeters, find the length of the latitude scale, and the position in which the diagonals of the chart intersect. **(12)**

   (c) Explain the factors affecting the maximum range of RADAR. **(10)**
