L-4/T-2/NAME **Date : 07/06/2014**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2011-2012

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

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

Assume reasonable value for missing data, if any.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) Write the factors considered for the selection of refrigerant for a system. **(8)**

   (b) Write short note on Economizer in an air-conditioning system. **(7)**

   (c) What is zoned air-conditioning system? List the advantages and disadvantages of All-air systems in zone-airconditioning. **(20)**

2. (a) What do you understand by the term 'psychrometry'? Define the following: **(10)**

   (i) Specific humidity (ii) Absolute humidity (iii) Relative humidity and (iv) Dew point temperature.

   (b) An ideal gas refrigeration cycle using air as the working fluid is to maintain a refrigerated space at 0°F while rejecting heat to the surrounding medium at 80°F. The pressure ratio of the compressor is 4. Determine the maximum and minimum temperature in the cycle, the coefficient of performance and the rate of refrigeration for a mass flow rate of 0.1 lbm/s. **(25)**

3. 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 co-efficient 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. **(35)**

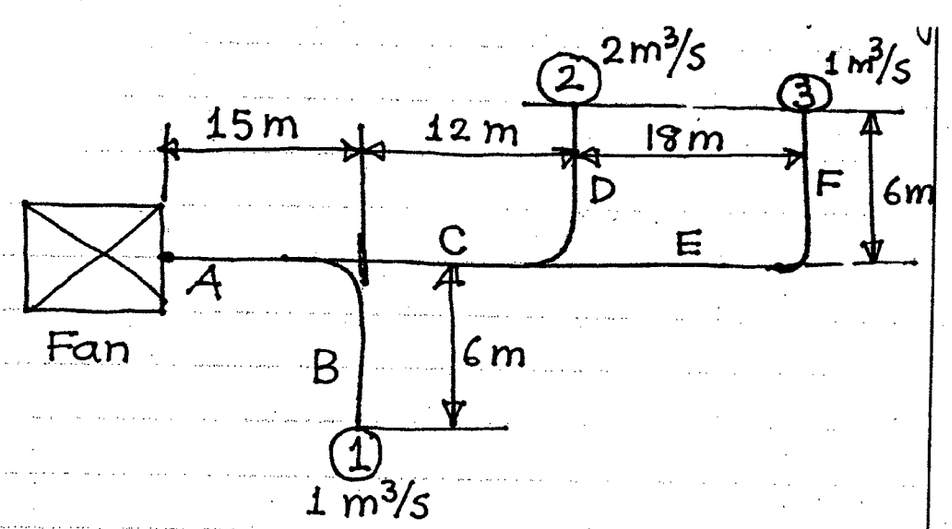

Figure for Question no. 3

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4. (a) A supply of 50 kg of chicken at 6°C contained in a box is to be frozen to –18°C in a freezer. Determine the amount of heat that needs to be removed. The container box is 1.5 kg and the specific heat of the box material is 14 kJ/kg.°C. For chicken, the freezing temperature is –2.8°C, the latent heat of fusion is 247 kJ/kg, the specific heat is 3.32 kJ/kg.°C above freezing and 1.77 kJ/kg.°C below freezing. **(17)**

(b) A typical one-half-carlot-capacity banana room contains 18 pallets of bananas. Each pallet consists of 24 boxes, and thus the room stores 432 boxes of bananas. A box holds an average of 19 kg of bananas and is made of 2.3 kg of fiberboard. The specific heats of banana and the fiberboard are 3.55 kJ/kg.°C and 1.7 kJ/kg.°C respectively. The peak heat of respiration of bananas is 0.3 W/kg. The bananas are cooled at a rate of 0.2°C/h. If the temperature rise of refrigerated air is not to exceed 1.5°C as it flows through the room, determine the minimum flow rate of air needed. Take the density and specific heat of air to be 1.2 kg/m^3 and 1.0 kJ/kg.°C. **(18)**

SECTION – B

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

5. (a) What is 'Steam Traps'? Describe the various types of steam traps. **(20)**

(b) Draw a schematic diagram describing the typical propeller shaft arrangement. **(15)**

6. (a) Describe the various methods used for controlling the shaft arrangement of a marine propulsion system. **(20)**

(b) Describe the major components of a ship's steering gear system. **(15)**

7. (a) Find the $NPSH_A$ for a pump having Q = 1600 g.p.m, h_a = 66.5 ft, $z_1 - z_{pump}$ = –5 ft, elevation = 5000 ft and temperature = 90°F. Neglect pipe friction. **(10)**

If $NPSH_R$ of the pump is 10 ft, will it cavitate? Symbols have their usual meanings.

(b) A centrifugal pump running at 1000 rpm gave the following relation between head and discharge: **(25)**

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

(i) Calculate the discharge in m^3 per minute.

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

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8. A rotodynamic pump, having the characteristics tabulated below, delivers water from a river at elevation 102 m to a reservoir with a water level of 135 m, through a 350 mm diameter cast-iron pipe. The frictional head loss in the pipeline is given by $h_f = 550\ Q^2$, when h_f is the head loss in m and Q is the discharge in m^3s^{-1}. Minor head losses from valves and fittings amount to $50\ Q^2$ in the same units. **(35)**

Q (m^3s^{-1})	0	0.5	0.10	0.15	0.20
H (m)	60	58	52	41	25
η (%)	---	44	65	64	48

[Q is discharge, H is head, η is efficiency]

(i) Calculate the discharge and head in the pipeline (at the duty point).

If the discharge is to be increased by the installation of a second identical pump:

(ii) determine the unregulated discharge and head produced by connecting the pump in parallel and series.

(iii) determine the power demand at the duty point in the case of parallel operation.

Table for Question no. 2(b)

Ideal-gas properties of air

T R	h Btu/lbm	P_r	u Btu/lbm	v_r	s° Btu/lbm-R
360	85.97	0.3363	61.29	396.6	0.50369
380	90.75	0.4061	64.70	346.6	0.51663
400	95.53	0.4858	68.11	305.0	0.52890
420	100.32	0.5760	71.52	270.1	0.54058
440	105.11	0.6776	74.93	240.6	0.55172
460	109.90	0.7913	78.36	215.33	0.56235
480	114.69	0.9182	81.77	193.65	0.57255
500	119.48	1.0590	85.20	174.90	0.58233
520	124.27	1.2147	88.62	158.58	0.59173
537	128.10	1.3593	91.53	146.34	0.59945
540	129.06	1.3860	92.04	144.32	0.60078
560	133.86	1.5742	95.47	131.78	0.60950
580	138.66	1.7800	98.90	120.70	0.61793
600	143.47	2.005	102.34	110.88	0.62607
620	148.28	2.249	105.78	102.12	0.63395
640	153.09	2.514	109.21	94.30	0.64159
660	157.92	2.801	112.67	87.27	0.64902
680	162.73	3.111	116.12	80.96	0.65621
700	167.56	3.446	119.58	75.25	0.66321
720	172.39	3.806	123.04	70.07	0.67002
740	177.23	4.193	126.51	65.38	0.67665
760	182.08	4.607	129.99	61.10	0.68312
780	186.94	5.051	133.47	57.20	0.68942
800	191.81	5.526	136.97	53.63	0.69558
820	196.69	6.033	140.47	50.35	0.70160
840	201.56	6.573	143.98	47.34	0.70747
860	206.46	7.149	147.50	44.57	0.71323
880	211.35	7.761	151.02	42.01	0.71886
900	216.26	8.411	154.57	39.64	0.72438
920	221.18	9.102	158.12	37.44	0.72979
940	226.11	9.834	161.68	35.41	0.73509
960	231.06	10.61	165.26	33.52	0.74030
980	236.02	11.43	168.83	31.76	0.74540
1000	240.98	12.30	172.43	30.12	0.75042
1040	250.95	14.18	179.66	27.17	0.76019
1080	260.97	16.28	186.93	24.58	0.76964
1120	271.03	18.60	194.25	22.30	0.77880
1160	281.14	21.18	201.63	20.29	0.78767
1200	291.30	24.01	209.05	18.51	0.79628
1240	301.52	27.13	216.53	16.93	0.80466
1280	311.79	30.55	224.05	15.52	0.81280
1320	322.11	34.31	231.63	14.25	0.82075
1360	332.48	38.41	239.25	13.12	0.82848
1400	342.90	42.88	246.93	12.10	0.83604
1440	353.37	47.75	254.66	11.17	0.84341
1480	363.89	53.04	262.44	10.34	0.85062
1520	374.47	58.78	270.26	9.578	0.85767
1560	385.08	65.00	278.13	8.890	0.86456

T R	h Btu/lbm	P_r	u Btu/lbm	v_r	s° Btu/lbm-R
1600	395.74	71.13	286.06	8.263	0.87130
1650	409.13	80.89	296.03	7.556	0.87954
1700	422.59	90.95	306.06	6.924	0.88758
1750	436.12	101.98	316.16	6.357	0.89542
1800	449.71	114.0	326.32	5.847	0.90308
1850	463.37	127.2	336.55	5.388	0.91056
1900	477.09	141.5	346.85	4.974	0.91788
1950	490.88	157.1	357.20	4.598	0.92504
2000	504.71	174.0	367.61	4.258	0.93205
2050	518.71	192.3	378.08	3.949	0.93891
2100	532.55	212.1	388.60	3.667	0.94564
2150	546.54	223.5	399.17	3.410	0.95222
2200	560.59	256.6	409.78	3.176	0.95919
2250	574.69	281.4	420.46	2.961	0.96501
2300	588.82	308.1	431.16	2.765	0.97123
2350	603.00	336.8	441.91	2.585	0.97732
2400	617.22	367.6	452.70	2.419	0.98331
2450	631.48	400.5	463.54	2.266	0.98919
2500	645.78	435.7	474.40	2.125	0.99497
2550	660.12	473.3	485.31	1.996	1.00064
2600	674.49	513.5	496.26	1.876	1.00623
2650	688.90	556.3	507.25	1.765	1.01172
2700	703.35	601.9	518.26	1.662	1.01712
2750	717.83	650.4	529.31	1.566	1.02244
2800	732.33	702.0	540.40	1.478	1.02767
2850	746.88	756.7	551.52	1.395	1.03282
2900	761.45	814.8	562.66	1.318	1.03788
2950	776.05	876.4	573.84	1.247	1.04288
3000	790.68	941.4	585.04	1.180	1.04779
3050	805.34	1011	596.28	1.118	1.05264
3100	820.03	1083	607.53	1.060	1.05741
3150	834.75	1161	618.82	1.006	1.06212
3200	849.48	1242	630.12	0.955	1.06676
3250	864.24	1328	641.46	0.907	1.07134
3300	879.02	1418	652.81	0.8621	1.07585
3350	893.83	1513	664.20	0.8202	1.08031
3400	908.66	1613	675.60	0.7807	1.08470
3450	923.52	1719	687.04	0.7436	1.08904
3500	938.40	1829	698.48	0.7087	1.09332
3550	953.30	1946	709.95	0.6759	1.09755
3600	968.21	2068	721.44	0.6449	1.10172
3650	983.15	2196	732.95	0.6157	1.10584
3700	998.11	2330	744.48	0.5882	1.10991
3750	1013.1	2471	756.04	0.5621	1.11393
3800	1028.1	2618	767.60	0.5376	1.11791
3850	1043.1	2773	779.19	0.5143	1.12183
3900	1058.1	2934	790.80	0.4923	1.12571
3950	1073.2	3103	802.43	0.4715	1.12955

L-4/T-2/NAME Date : 31/05/2014

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2011-2012

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) What are 'Meridional Parts'? Derive an expression for calculating the meridonal parts between two latitudes of θ_1 and θ_2. **(12)**

   (b) Find the shortest distance and the initial course of the great circle between the following positions. **(23)**

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

   Find also the latitude where the track cuts the longitude of 90° W and the course at this point.

2. (a) By mercator sailing find the course and distance between the following positions: **(12)**

A	20° 35′ N	32° 15′ W
B	16° 24′ S	39° 55′ W

   (b) Two vessels A and B are in different latitudes on the same course. A is in latitude 17° N and is travelling twice as fast as B. The rate of change of longitude of A is $1\frac{1}{2}$ times that of B. Find the latitude of B. **(15)**

   (c) On a mercator chart, the spacing between parallels of 40° N and 45° N is 5.8 cm. Find the scale of longitude and the spacing between parallels of 30° N and 33° N. **(8)**

3. (a) Briefly describe 'Global Positioning System' and its major segments. **(17)**

   (b) What are the factors affecting the range and characteristics of Fixed Lights? Differentiate between Lateral and Cardinal Buoyage system. Describe IALA isolated danger marks. **(18)**

4. (a) Discuss the types of LORAN accuracy. What are the limitations of LORAN system? **(15)**

   (b) Briefly describe the components and their functions (with block diagrams) of a basic pulse-modulated radar system. **(20)**

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SECTION – B

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

Q. No. 8 is compulsory. Assume reasonable value in case of missing data.

Necessary Regulations are enclosed.

5. (a) Define the following terms in light of UN convention on the law of the sea: **(10)**

   (i) Exclusive Economic Zones (ii) Territorial Waters

   (iii) Contiguous Zone (iv) Continental Shelf

   (v) Internal Waters

   (b) Mention the classification of dangerous goods according to Shipping Rules. What precautions need to be taken during loading and unloading of dangerous goods? **(15)**

   (c) Mention the characteristics of navigational lights. **(10)**

6. (a) Discuss the characteristics of the following fire fighting equipment in the light of Shipping Regulation: **(20)**

   (i) Fixed CO_2 system (ii) Fire pipe and hydrants

   (iii) Fire pump (iv) Portable Fire Extinguisher

   (b) Briefly mention the general requirements of Life Saving Appliances (LSA) for an inland passenger vessel whose carrying capacity is 350. **(15)**

7. (a) Write short notes on: **(20)**

   (i) Load on Top (ii) COW

   (iii) Ballast Water Management (iv) Hong Kong convention

   (b) Justify how MARPOL Regulation 13F ensure safety of oil tanker. **(15)**

8. Determine freeboards for the following ship: **(35)**

   Ship type : Dry Cargo (B)

   L_{BP} : 120 m

   B : 19.50 m

   D : 10.00 m

   L_{WL} : 126.0 m (At 0.85 D)

   t : 25 mm (Deck plating thickness)

   C_B : 0.722 (at 0.85 D)

   T_{PC} : 9.0

Superstructure

	Length (m)	Height (m)
Poop	23.16	2.60
Raised Quarter Deck	21.40	1.50
Forecastle	13.00	2.80

The ship's sheer profile is as follows:

A.P.	L/6	L/3	L/2	2L/3	5L/6	F.P.
750 mm	340 mm	85 mm	0	300 mm	1200 mm	2500 mm

(d) the ship, when loaded to its summer load water line, will remain afloat in a satisfactory condition of equilibrium after flooding of any single damaged compartment at an assumed permeability of 0.95 excluding the machinery space; and

(e) in such a ship, if over 225 m in length, the machinery space shall be treated as a floodable compartment but with a permeability of 0.85.

The relevant calculations may be based upon the following main assumptions:

- the vertical extent of damage is equal to the depth of the ship;
- the penetration of damage is not more than B/5;
- no main transverse bulkhead is damaged;
- the height of the centre of gravity above the base line is assessed allowing for homogeneous loading of cargo holds, and for 50 per cent of the designed capacity of consumable fluids and stores, etc.

(6) In calculating the freeboards for Type `B' ships which comply with the requirements of subsection (7) of this Regulation, the values from Table B of Regulation 28 shall not be reduced by more than 60 per cent of the difference between the `B' and `A' tabular values for the appropriate ship lengths.

(7) The reduction in tabular freeboard allowed under subsection (8) of this Regulation may be increased up to the total difference between the values in Table A and those in Table B of Regulation 28 on condition that the ship complies with the requirements of Regulations 26(1), (2), (3), (5) and (6), as if it were a Type `A' ship, and further complies with the provisions of paragraphs (7)(a) to (d) inclusive of this Regulation except that the reference in paragraph (d) to the flooding of any single damaged compartment shall be treated as a reference to the flooding of any two adjacent fore and aft compartments, neither of which is the machinery space. Also any such ship of over 225 m in length, when loaded to its summer load water line, shall remain afloat in a satisfactory condition of equilibrium after flooding of the machinery space, taken alone, at an assumed permeability of 0.85.

(8) Type `B' ships, which in position 1 have hatchways fitted with hatch covers which comply with the requirements of Regulation 15, other than subsection (7), shall be assigned freeboards based upon the values given in Table B of Regulation 28 increased by the values given in the following table:

Regulation 29 *Correction to the Freeboard for Ships under100 m in length*

The tabular freeboard for a Type `B' ship of between 24 m and 100 m in length having enclosed superstructures with an effective length of up to 35 per cent of the length of the ship shall be increased by:

$$7.5(100-L)\left(0.35-\frac{E}{L}\right) \text{ mm}$$

where L = length of ship in metres,
where E = effective length of superstructure in metres defined in Regulations 35:

Regulation 30 *Correction for Block Coefficient*

Where the block coefficient (C_b) exceeds 0.68, the tabular shall be multiplied by the factor

$$\frac{C_b+0.68}{1.36}$$

Regulation 31 *Correction for Depth*

(1) Where D exceeds $\frac{L}{15}$ the freeboard shall be increased by $\left(D-\frac{L}{15}\right)R$ millimetres, where R is $\frac{L}{0.48}$ at length less than 120 m and 250 at 120 m length and above.

(2) Where D is less than $\frac{L}{15}$, no reduction shall be made except in a ship with an enclosed superstructure covering at least 0.6 L amidships, with a complete trunk, or combination of detached enclosed superstructures and trunks which extend all fore and aft, where the freeboard shall be reduced at the rate prescribed in paragraph (1) of this Regulation.

(3) Where the height of superstructure or trunk is less than the standard height, the reduction shall be in the ratio of the actual to the standard height as defined in Regulation 33.

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TABLE B. Freeboard Table for Type 'B' Ships

L [m]	f [mm]	L [m]	f [mm]	L [m]	f [mm]	L [m]	f [mm]	L [m]	f [mm]	L [m]	f [mm]
24	200	81	905	138	2065	195	3185	252	4045	309	4726
25	208	82	923	139	2087	196	3202	253	4058	310	4736
26	217	83	942	140	2109	197	3219	254	4072	311	4748
27	225	84	960	141	2130	198	3235	255	4085	312	4757
28	233	85	978	142	2151	199	3249	256	4098	313	4768
29	242	86	996	143	2171	200	3264	257	4112	314	4779
30	250	87	1015	144	2190	201	3280	258	4125	315	4790
31	258	88	1034	145	2209	202	3296	259	4139	316	4801
32	267	89	1054	146	2229	203	3313	260	4152	317	4812
33	275	90	1075	147	2250	204	3330	261	4165	318	4823
34	283	91	1096	148	2271	205	3347	262	4177	319	4834
35	292	92	1116	149	2293	206	3363	263	4189	320	4844
36	300	93	1135	150	2315	207	3380	264	4201	321	4855
37	308	94	1154	151	2334	208	3397	265	4214	322	4866
38	316	95	1172	152	2354	209	3413	266	4227	323	4878
39	325	96	1190	153	2375	210	3430	267	4240	324	4890
40	334	97	1209	154	2396	211	3445	268	4252	325	4899
41	344	98	1229	155	2418	212	3460	269	4264	326	4909
42	354	99	1250	156	2440	213	3475	270	4276	327	4920
43	364	100	1271	157	2460	214	3490	271	4289	328	4931
44	374	101	1293	158	2480	215	3505	272	4302	329	4943
45	385	102	1315	159	2500	216	3520	273	4315	330	4955
46	396	103	1337	160	2520	217	3537	274	4327	331	4965
47	408	104	1359	161	2540	218	3554	275	4339	332	4975
48	420	105	1380	162	2560	219	3570	276	4350	333	4985
49	432	106	1401	163	2580	220	3586	277	4362	334	4995
50	443	107	1421	164	2600	221	3601	278	4373	335	5005
51	455	108	1440	165	2620	222	3615	279	4385	336	5015
52	467	109	1459	166	2640	223	3630	280	4397	337	5025
53	478	110	1479	167	2660	224	3645	281	4408	338	5035
54	490	111	1500	168	2680	225	3660	282	4420	339	5045
55	503	112	1521	169	2698	226	3675	283	4432	340	5055
56	516	113	1543	170	2716	227	3690	284	4443	341	5065
57	530	114	1565	171	2735	228	3705	285	4455	342	5075
58	544	115	1587	172	2754	229	3720	286	4467	343	5086
59	559	116	1609	173	2774	230	3735	287	4478	344	5097
60	573	117	1630	174	2795	231	3750	288	4490	345	5108
61	587	118	1651	175	2815	232	3765	289	4502	346	5119
62	601	119	1671	176	2835	233	3780	290	4513	347	5130
63	615	120	1690	177	2855	234	3795	291	4525	348	5140
64	629	121	1709	178	2875	235	3808	292	4537	349	5150
65	644	122	1729	179	2895	236	3821	293	4548	350	5160
66	659	123	1750	180	2915	237	3835	294	4560	351	5170
67	674	124	1771	181	2933	238	3849	295	4572	352	5180
68	689	125	1793	182	2952	239	3864	296	4583	353	5190
69	705	126	1815	183	2970	240	3880	297	4595	354	5200
70	721	127	1837	184	2988	241	3893	298	4607	355	5210
71	738	128	1859	185	3007	242	3906	299	4618	356	5220
72	754	129	1880	186	3025	243	3920	300	4630	357	5230
73	769	130	1901	187	3044	244	3934	301	4642	358	5240
74	784	131	1921	188	3062	245	3949	302	4654	359	5250
75	800	132	1940	189	3080	246	3965	303	4665	360	5260
76	816	133	1959	190	3098	247	3978	304	4676	361	5268
77	833	134	1979	191	3116	248	3992	305	4686	362	5276
78	850	135	2000	192	3134	249	4005	306	4695	363	5285
79	868	136	2021	193	3151	250	4018	307	4704	364	5294
80	887	137	2043	194	3167	251	4032	308	4714	365	5303

Freeboards at intermediate lengths of ship shall be obtained by linear interpolation.

Freeboards for type A ships with length of between 365 metres and 400 metres should be determined by the following formula

$$f = -587 + 23L - 0.0188L^2$$

where f is the freeboard in mm. Freeboards for type A ships with length of 400 metres and above should be the constant value, 5605 mm.

Regulation 33 *Standard Height of Superstructure*
The standard height of a superstructure shall be as given in the following table:

L (metres)	Standard Height (in metres)	
	Raised Quarter Deck	All other Superstructures
≤ 30	0.90	1.80
75	1.20	1.80
≥ 125	1.80	2.30

The standard heights at intermediate lengths of the ship shall be obtained by linear interpolation.

Regulation 34 *Length of Superstructure*
(1) Except as provided in subsection (2) of this Regulation, the length of a superstructure (S) shall be the mean length of the parts of the superstructure which lie within the length (L).

Regulation 35 *Effective Length of Superstructure*
(1) Except as provided for in subsection (2) of this Regulation, the effective length (E) of an enclosed superstructure of standard height shall be its length.
(2) In all cases where an enclosed superstructure of standard height is set in from the sides of the ship as permitted in subsection 3(10) the effective length is the length modified by the ratio of b/Bs, where
"b" is the breadth of the superstructure at the middle of its length, and
"Bs" is the breadth of the ship at the middle of the length of the superstructure, and
where a superstructure is set in for a part of its length, this modification shall be applied only to the set in part.
(3) Where the height of an enclosed superstructure is less than the standard height, the effective length shall be its length reduced in the ratio of the actual height to the standard height. Where the height exceeds the standard, no increase shall be made to the effective length of the superstructure.
(4) The effective length of a raised quarter deck, if fitted with an intact front bulkhead, shall be its length up to a maximum of 0.6 L. Where the bulkhead is not intact, the raised quarter deck shall be treated as a poop of less than standard height.
(5) Superstructures which are not enclosed shall have no effective length.

Regulation 36 *Trunks*
(1) A trunk or similar structure which does not extend to the sides of the ship shall be regarded as efficient on the following conditions:
(a) the trunk is at least as strong as a superstructure;
(b) the hatchways are in the trunk deck, and the hatchway coamings and covers comply with the requirements of Regulations 13 to 16 inclusive and the width of the trunk deck stringer provides a satisfactory gangway and sufficient lateral stiffness. However, small access openings with watertight covers may be permitted in the freeboard deck;
(c) a permanent working platform fore and aft fitted with guard-rails is provided by the trunk deck, or by detached trunks connected to superstructures by efficient permanent gangways;
(d) ventilators are protected by the trunk, by watertight covers or by other equivalent means;
(e) open rails are fitted on the weather parts of the freeboard deck in way of the trunk for at least half their length;
(f) the machinery casings are protected by the trunk, by a superstructure of at least standard height, or by a deckhouse of the same height and of equivalent strength;
(g) the breadth of the trunk is at least 60 per cent of the breadth of the ship; and
(h) where there is no superstructure, the length of the trunk is at least 0.6 L.
(2) The full length of an efficient trunk reduced in the ratio of its mean breadth to B shall be its effective length.
(3) The standard height of a trunk is the standard height of a superstructure other than a raised quarter deck.
(4) Where the height of a trunk is less than the standard height, its effective length shall be reduced in the ratio of the actual to the standard height. Where the height of the hatchway coamings on the trunk deck is less than that required under Regulation 15(1), a reduction from the actual height of trunk shall be made which corresponds to the difference between the actual and the required height of coaming.

Regulation 37 *Deduction for Superstructures and Trunks*

(1) Where the effective length of superstructures and trunks is 1.0 L, the deduction from the freeboard shall be 350 mm at 24 m length of ship, 860 mm at 85 m length, and 1,070 mm at 122 m length and above; deductions at intermediate lengths shall be obtained by linear interpolation.

L [m]	f_e [mm]
24	350
85	860
≥122	1070

(2) Where the total effective length of superstructures and trunks is less than 1.0 L the deduction shall be a percentage obtained from one of the following tables:

Percentage of Deduction for Type 'A' ships

Total Effective Length of Superstructures and Trunks	0L	0.1L	0.2L	0.3L	0.4L	0.5L	0.6L	0.7L	0.8L	0.9L	1.0L
Percentage of deduction for all types of superstructures	0	7	14	21	31	41	52	63	75.5	87.7	100

Percentages at intermediate lengths of superstructures and trunks shall be obtained by linear interpolation.

Percentage of Deduction for Type 'B' ships

Total Effective Length of Superstructures and Trunks	0L	0.1L	0.2L	0.3L	0.4L	0.5L	0.6L	0.7L	0.8L	0.9L	1.0L
Ships with forecastle and without detached bridge	0	5	10	15	23.5	32	46	63	75.3	87.7	100
Ships with forecastle and with detached bridge	0	6.3	12.7	19	27.5	36	46	63	75.3	87.7	100

Percentages at intermediate lengths of superstructures and trunks shall be obtained by linear interpolation.

(3) For ships of Type 'B':

(a) where the effective length of a bridge is less than 0.2 L, the percentages shall be obtained by linear interpolation between lines I and II;
(b) where the effective length of a forecastle is more than 0.4 L, the percentages shall be obtained from line II; and
(c) where the effective length of a forecastle is less than 0.07 L, the above percentages shall be reduced by:

$$5 \times \frac{0.07L - f}{0.07L}$$

where f is the effective length of the forecastle.

Regulation 38 ***Sheer***

(1) The sheer shall be measured from the deck at side to a line of reference drawn parallel to the keel through the sheer line amidships.
(2) In ships designed with a rake of keel, the sheer shall be measured in relation to a reference line drawn parallel to the design load water line.
(3) In flush deck ships and in ships with detached superstructures the sheer shall be measured at the freeboard deck.

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(4) In ships with topsides of unusual form in which there is a step or break in the topsides, the sheer shall be considered in relation to the equivalent depth amidships.

(5) In ships with a superstructure of standard height which extends over the whole length of the freeboard deck, the sheer shall be measured at the superstructure deck. Where the height exceeds the standard the least difference (Z) between the actual and standard heights shall be added to each end ordinate. Similarly, the intermediate ordinates at distances of 1/6 L and 1/3 L from each perpendicular shall be increased by 0.444 Z and 0.111 Z respectively.

(6) Where the deck of an enclosed superstructure has at least the same sheer as the exposed freeboard deck, the sheer of the enclosed portion of the freeboard deck shall not be taken into account.

(7) Where an enclosed poop or forecastle is of standard height with greater sheer than that of the freeboard deck, or is of more than standard height, an addition to the sheer of the freeboard deck shall be made as provided in subsection (12) of this Regulation.

Standard Sheer Profile

(8) The ordinates of the standard sheer profile are given in the following table:

Standard Sheer Profile (Where L is in metres)

	Station	Ordinate (in millimetres)	Factor
After Half	After Perpendicular	$25\left(\frac{L}{3}+10\right)$	1
	1/6 L from A.P.	$11.1\left(\frac{L}{3}+10\right)$	3
	1/3 L from A.P.	$2.8\left(\frac{L}{3}+10\right)$	3
	Amidships	0	1
Forward Half	Amidships	0	1
	1/3 L from F.P.	$5.6\left(\frac{L}{3}+10\right)$	3
	1/6 L form F.P.	$22.2\left(\frac{L}{3}+10\right)$	3
	Forward Perpendicular	$50\left(\frac{L}{3}+10\right)$	1

Measurement of Variation from Standard Sheer Profile

(9) Where the sheer profile differs from the standard, the four ordinates of each profile in the forward or after half shall be multiplied by the appropriate factors given in the table of ordinates. The difference between the sums of the respective products and those of the standard divided by eight measures the deficiency or excess of sheer in the forward or after half. The arithmetical mean of the excess or deficiency in the forward and after halves measures the excess or deficiency of sheer.

(10) Where the after half of the sheer profile is greater than the standard and the forward half is less than the standard, no credit shall be allowed for the part in excess and deficiency only shall be measured.

(11) Where the forward half of the sheer profile exceeds the standard, and the after portion of the sheer profile is not less than 75 per cent of the standard, credit shall be allowed for the part in excess, where the after part is less than 50 per cent of the standard, no credit shall be given for the excess sheer forward. Where the after sheer is between 50 per cent and 75 per cent of the standard, intermediate allowances may be granted for excess sheer forward.

(12) Where sheer credit is given for a poop or forecastle the following formula shall be used:

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$$s = \frac{y}{3}\frac{L'}{L}$$

where s = sheer credit, to be deducted from the deficiency or added to the excess of sheer,
y = difference between actual and standard height of superstructure at the end of sheer,
L' = mean enclosed length of poop or forecastle up to a maximum length of 0.5 L,
L = length of ship

The above formula provides a curve in the form of a parabola tangent to the actual sheer curve at the freeboard deck and intersecting the end ordinate at a point below the superstructure deck a distance equal to the standard height of a superstructure. The superstructure deck shall not be less than standard height above this curve at any point. This curve shall be used in determining the sheer profile for forward and after halves of the ship.

Correction for Variations from Standard Sheer Profile

(13) The correction for sheer shall be the deficiency or excess of sheer (see subsections (9) to (11) inclusive of this Regulation), multiplied by

$$0.75 - \frac{S}{2L}$$

where S is the total length of enclosed superstructures.

Addition for Deficiency in Sheer

(14) Where the sheer is less than the standard, the correction for deficiency in sheer (see subsection (13) of this Regulation) shall be added to the freeboard.

Deduction for Excess Sheer

(15) In ships where an enclosed superstructure covers 0.1 L before and 0.1 L abaft amidships, the correction for excess of sheer as calculated under the provisions of subsection (13) of this Regulation shall be deducted from the freeboard; in ships where no enclosed superstructure covers amidships, no deduction shall be made from the freeboard; where an enclosed superstructure covers less than 0.1 L before and 0.1 L abaft amidships, the deduction shall be obtained by linear interpolation. The maximum deduction for excess sheer shall be at the rate of 125 mm per 100 m of length.

Regulation 39. *Minimum Bow Height*

(1) The bow height defined as the vertical distance at the forward perpendicular between the water line corresponding to the assigned summer freeboard and the designed trim and the top of the exposed deck at side shall be not less than:

for ships below 250 m in length,

$$56L\left(1 - \frac{L}{500}\right)\frac{1.36}{C_b + 0.68}\ \text{mm}$$

for ships of 250 m and above in length,

$$7000\frac{1.36}{C_b + 0.68}\ \text{mm}$$

where L is the length of the ship in metres, Cb is the block coefficient which is to be taken as not less than 0.68.

(2) Where the bow height required in subsection (1) of this Regulation is obtained by sheer, the sheer shall extend for at least 15 per cent of the length of the ship measured from the forward perpendicular. Where it is obtained by fitting a superstructure, such superstructure shall extend from the stem to a point at least 0.07 L abaft the forward perpendicular, and it shall comply with the following requirements:

(a) for ships not over 100 m in length it shall be enclosed as defined in Regulation 3(10); and
(b) for ships over 100 m in length it shall be fitted with satisfactory closing appliances.

(3) Ships which, to suit exceptional operational requirements, cannot meet the requirements of subsections (1) and (2) of this Regulation may be given special consideration by the Administration.

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11.05.2014

L-4/T-2/NAME Date : 10/05/2014

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2011-2012

Sub : **NAME 447** (Design of Inland Waterways 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) Briefly describe various design approaches for inland navigation waterways. **(20)**

   (b) How would you determine the width of a two-ways inland navigation channel for passing ships? **(15)**

2. (a) "Despite the vital role, inland waterways transportation sector has not yet reached its full potential in Bangladesh" – discuss briefly. **(20)**

   (b) Write a short note on 'energy efficiency aspect of inland waterways transport'. **(15)**

3. (a) Briefly discuss various influencing factors in support of reclassification for inland waterways of Bangladesh. **(15)**

   (b) Distinguish between the functions of BIWTA and BIWTC. **(10)**

   (c) Name various methodologies currently in use to carry out hydrographic survey. **(10)**

4. (a) Differentiate between capital dredging and maintenance dredging. **(10)**

   (b) Mention the advantages and disadvantages of a cutter suction dredger. **(10)**

   (c) Describe various methods for disposal of dredged sediments. **(15)**

SECTION – B

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

5. (a) What is intermodalism? What are the major factors that affect intermodalism? **(10)**

   (b) Describe the major functions that define an intermodal transport chain. **(13)**

   (c) Draw the flow chart showing intermodal transport system design and evaluation process. **(12)**

6. (a) What do you understand by SSCA and MEA? Discuss the relationship between SSCA and MEA of intermodal transportation system design. **(21)**

   (b) What is the main task of 'Research Vessel'? Discuss on different types of research vessel. **(14)**

Contd P/2

NAME 447

7. (a) Write short notes on – **(4×4=16)**

   (i) ConRO

   (ii) Afloat salvage

   (iii) Contract salvage

   (iv) Pure salvage

   (b) Discuss the operation of a self-stabilizing system for fully submerged hydrofoils. **(10)**

   (c) Draw the schematic diagram of the following types of hydrofoils – **(4 ½ ×2=9)**

   (i) Surface piercing

   (ii) Fully submerged

8. (a) Write short notes on salvage tug. **(10)**

   (b) Discuss briefly the tug/barge connection systems. **(13)**

   (c) Define Articulated Tug Barge (ATB) system. Describe the advantages of ATB over Towed Barges. **(12)**

Extra

L-4/T-2/NAME Date : 10/05/2014

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2011-2012

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

SECTION – A

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

1. (a) Discuss briefly the basic principles and different approaches for prediction of added resistance of a ship in waves. **(15)**

   (b) In a situation when a ship is experiencing an oblique wind in a seaway, describe the equations of axial force, lateral force and yawing moment. **(20)**

2. Give a detail derivation of the expression for estimation of additional resistance of a ship in a seaway as per Havelock's work. Mention the shortcomings of Havelock's formula. **(35)**

3. Give a detail derivation of the method of Gerritsma and BeuKelman for prediction of added resistance of a ship in regular head waves. Hence describe two extreme cases. **(35)**

4. Describe analytically a simplified method for estimating 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. **(35)**

SECTION – B

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

Assume reasonable value for any missing data.

5. (a) Discuss the importance of hull roughness in respect of resistance of ship. Also describe the steps for measuring average hull roughness. **(20)**

   (b) What is fouling? Classify different types and categories of fouling and its effect on hull resistance. **(15)**

Contd P/2

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6. 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,

C_P : 0.576 C_m : 0.957, C_w = 0.823

Wetted area: 2839 m^2,

v = 16 knot, Days out of dock: 182 days

Hull roughness: 150 micron

Calculate frictional resistance including the roughness and fouling due to out of docks in service.

7. (a) Define power margin. Describe with a simplied chart for establishing power margin. **(15)**

(b) A ship has the following particulars: **(20)**

L : 330 m, ∇ = 300,000 m^3, v = 15 knot

$R_n = 2.14 \times 10^9$

Calculate the fractional power increase at constant speed of 15 knot from a smooth average hull roughness 75 micron to rough average hull roughness 260 microns.

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

(i) Resistance increase due to fouling

(ii) Propeller roughness measurement

(iii) The effect of propeller roughness on performance.

L-4/T-2/NAME **Date : 17/05/2014**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2011-2012

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

Full Marks : 210 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

The questions are of equal value.

Assume suitable values for missing data, if any.

1. (a) In a real life cash flow example of shipbuilding and operation Bangladesh Shipping Corporation (BSC) wants to procure a 30,000 tons capacity tanker and has been offered a contract price of Tk. 500 crore with a 80% loan for eight years at 8% interest by a consortium of local shipyard and bank. The ship will be operated with a 10 years time charter. The calculation shows that the NPVs of the project including design, construction, operation and resale at 8% and 12% discount rate are US $ + 540000 and US $ – 1080000 respectively. Should BSC advance with the project if the management has decided that they would need a rate of return of at least 10%? Support your answer through calculation.

   (b) Explain with examples the term 'Negotiation' as used in maritime business.

2. How do you compare alternative ship designs? Describe the common pitfalls in evaluating alternative ship design?

3. A licensee owner plans to build a 150 TEU container vessel for Dhaka-Chittagong route costing Tk. 30 crore cash on delivery. The owner anticipates a revenue averaging Tk. 10,000/TEU/single trip and one round trip loaded wayage per week. Annual operating costs are expected to be 20% of the first cost, annual off hire days 30, vessel life 20 years with zero residual value.

   (a) Calculate NPV using SPW, at 10% discount rate with corporation tax at 35% for free depreciation (full depreciations in first year).

   (b) Support your result through a complete year by year calculation.

4. Explain the following terms with examples as used in shipbuilding and shipping.

   (a) Escalation (c) Unequal lines

   (b) Loans (d) Subsidies and Instrument grants

Contd P/2

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SECTION – B

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

5. (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)**

6. (a) Deduce the following expressions **(22)**

$$CR = \frac{i(1+i)^N}{(1+i)^N - 1}$$

   where the symbols have their usual meaning.

   (b) Which economic criteria you think is the best for comparison of alternative ship design? Describe the criterion and mention why that is the best. **(13)**

7. (a) Show in tabular form some differences between deep sea liner and bulk shipping. **(18)**

   (b) In order to encourage initial sales, the manufacturer of a novel type of deck crane offers a 'buy now, pay later' deal. The equipment would cost £ 120,000 if purchased now, but the manufacturer is willing to accept instead a lump sum of £ 135,000 paid in three years time. What rate of interest is implied? Does it look a good deal financially? Why? **(17)**

8. (a) What do you understand by irregular cash flow? Point out the important irregular cash flows in case 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 £ 18,500,000 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 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 assess whether the investment is profitable. Assume 11.5 months trading per annum. **(25)**

L-4/T-2/NAME **Date : 24/05/2014**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2011-2012

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

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) Describe the principal equipment that are needed for plate and section treatment. **(20)**

   (b) Draw a typical plate and section treatment line layout and identify the equipment. **(15)**

2. From an analysis of world trade, a shipbuilding company 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/ship	Number of piece Parts/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		1,000
Large Flanger	---	0.50		1,100
Brake Press	---	0.20		3,000

   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% machine utilization factor. The company operates for 47 weeks per annum with two 8 hour shifts for 5 days/week and no overtime. Draw the layout of the preparation shop you would recommend in such case.

3. Give a detail description of the classifications of product-oriented work breakdown structures (PWBS) in shipbuilding. With a suitable figure, illustrate the three dimensional nature of PWBS. **(35)**

Contd P/2

NAME 465

4. (a) What do you understand by critical path analysis in ship production? **(5)**

   (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. **(30)**

Activity	Preceded by	Followed by	Duration (week)
A	---	B, C	1
B	A	D, E	6
C	A	E	5
D	B	F, G	4
E	B, C	F, G	7
F	D, E	H	10
G	D, E	H	4
H	F, G	---	2

SECTION – B

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

5. (a) Describe the nature and construction sequence of sub-assemblies used in steel work fabrication. List the activities of work stations on the panel conveyor line. **(20)**

   (b) Illustrate the process for curved panel unit construction in automatic assembly system. Also describe the sequence of one sided welding process. **(15)**

6. (a) Describe and sketch the layout of a fabrication shop for medium and large ships. **(18)**

   (b) How the area for assembly of main units can be established? Describe each of the methods in brief. **(17)**

7. (a) What are the advantages of advanced outfitting? **(10)**

   (b) What factors influence the area required for panel line installation? **(10)**

   (c) Write a short on "Block Assemblies". **(15)**

8. Describe in detail the traditional methods for hull erection. What are the novel approaches for hull erection? Describe in brief. **(35)**

24-5-14

L-4/T-2/NAME **Date : 24/05/2014**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2011-2012

Sub : **NAME 481** (Optimum Structural Design)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) What is structural optimization? **(5)**

   (b) Describe main steps generally followed in the process of designing a project. **(10)**

   (c) Considering cross-sectional areas A_1 and A_2 as design variables, construct an optimization problem for minimization of the total weight of two-bar system subject to stress constraint as shown in Fig. for Q. 1(c) and solve it. Assume $F > 0$; $0 \le \alpha \le 90°$. **(20)**

2. (a) Describe different types of structural optimization problems. **(10)**

   (b) Consider a cantilever beam as shown in Fig. for Q. 2(b)(1). The beam consists of 2 segments each having a follow cross-section form as shown in Fig. for Q. 2(b)(2). Taking cross-sectional size x_1 and x_2 as design variables, construct an optimization problem for minimizing the weight of the beam subject to tip displacement, $\delta < \delta_0$ and solve it for $t \le x_A$. **(25)**

3. Consider the three-bar truss shown in Fig. for Q. 3. The bars have Young's modulus E and the lengths are $l_1 = L$, $l_2 = L$, $l_3 = L/\beta$, where $\beta > 0$. Taking cross-sectional areas A_1, A_2 and A_3 as the design variables construct the optimization problem of minimizing the weight under stress constraints. Assume $A_1 = A_3$ and $F > 0$. **(35)**

4. (a) State the Kuhn-Tucker conditions and describe its geometric interpretation. **(15)**

   (b) Consider the following optimization problem: **(20)**

   Minimize $f(x_1, x_2) = x_1^2 + x_2^2$

   subject to $x_1 + 2x_2 \le 15$

   $1 \le x_i \le 10; \qquad i = 1, 2$

   Derive the conditions to be satisfied at the point $X_1 = \{1, 7\}^T$ by the search direction $S = \{s_1, s_2\}^T$ if it is a (i) usable direction, and (ii) feasible direction.

Contd P/2

NAME 481

SECTION – B

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

The symbols have their usual meanings.

5. (a) Explain the procedure of ship structural strength evaluation. **(15)**

   (b) What are the basic stress patterns? Show the stress distribution acting on a small element in the case of a combination of normal stress and shearing stress. **(20)**

6. (a) With an example, show the effect of ballast tank arrangement on the still water bending moment in full load condition. **(18)**

   (b) Discuss the application of high tensile steel in ships. **(7)**

   (c) Discuss the arrangement of longitudinal strength members. **(10)**

7. (a) Discuss the ship structural vibration induced by propeller and main engine. **(15)**

   (b) Discuss the current boundary conditions of hull structure vibration. **(20)**

8. (a) Explain why a high value of factor of safety is not always enough in preventing structural failure. **(10)**

   (b) Define stress concentration factor and stress intensity factor. **(5)**

   (c) Discuss the superposition of stress intensity factors. **(5)**

   (d) Determine the fracture and collapse stresses in a double-edge crack for a panel assuming a/w = 0.4, panel width 2w = 8 in. and plane-strain fracture toughness of 65 ksi.in$^{1/2}$. The yield strength of the panel material is 36 ksi. **(15)**

Contd P/3

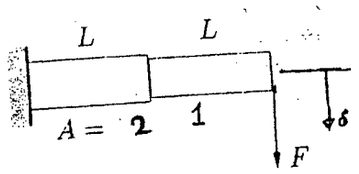
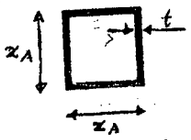


Fig. for Q. 2(b).1



Cross-section of segment A.

Fig. for Q. 2(b).2

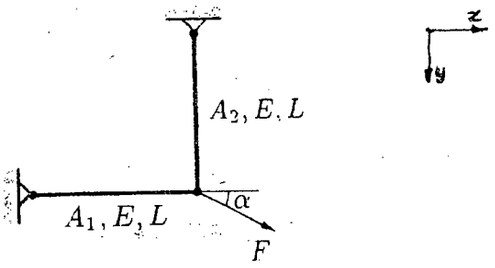


Fig. for Q. 1(c)

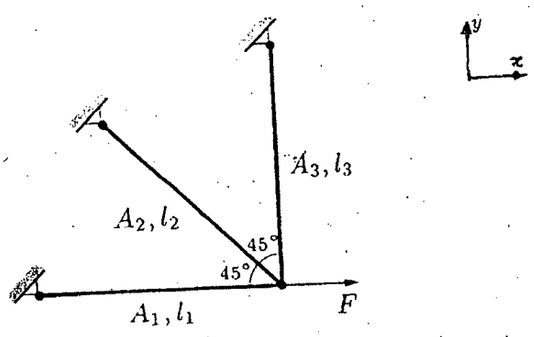
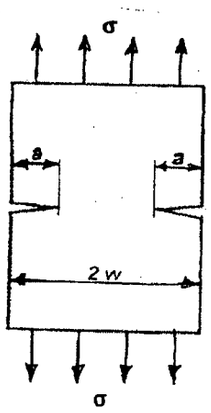
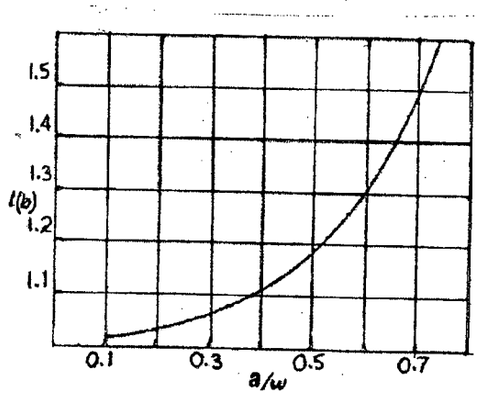


Fig. for Q.3



(a)



Secant correction factor for a central crack in a finite plate.

(b)

Figures for Q. No. 8 (d)