L-2/T-2/NAME **Date: 22/02/2018**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-2 B. Sc. Engineering Examinations 2016-2017

Sub: **HUM 211** (Sociology)

Full Marks: 140 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 socio-economic impacts of globalization on Bangladesh. **(13⅓)**

   (b) How did a simple religious belief- 'protestant ethics' motivate capitalism in Europe? **(10)**

2. (a) In your opinion, was the Industrial Revolution a positive thing or a negative thing for the average person in Europe in the Nineteenth Century. **(13⅓)**

   (b) Critically discuss the Malthusian theory of population. **(10)**

3. (a) List and explain the impacts of international migration in Bangladesh. **(13⅓)**

   (b) Illustrate the sustainable ways to reduce environmental pollution from society. **(10)**

4. Write short notes on any THREE of the following: **(23⅓)**

   (a) Infant mortality
   (b) Permanent settlement
   (c) Water pollution
   (d) Socialism.

SECTION – B

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

5. (a) Explain the factors that contributed to the development of sociology as an independent discipline. **(10)**

   (b) Write the properties of structural functionalism. **(13⅓)**

6. (a) What is social stratification? How various systems of social stratification create social inequality in human relationships? **(10)**

   (b) What are open and closed class systems? Explain vertical mobility and horizontal mobility with suitable examples. **(13⅓)**

7. (a) What is deviance? Illustrate the critical factors for explaining deviant behavior of a society. **(10)**

   (b) Briefly discuss Emile Durkheim's view of anomie of a society. **(13⅓)**

8. (a) Critically explain the changing functions of family as a social organization. **(10)**

   (b) Discuss the recent trend of modern nuclear family. **(13⅓)**

L-2/T-2/NAME **Date: 17/02/2018**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-2 B. Sc. Engineering Examinations 2016-2017

Sub: **MATH 283** (Statistics, Partial Differential Equation and Matrices)

Full Marks: 210 Time: 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks

Symbols used have their usual meaning.

SECTION – A

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

1. (a) Form a partial differential equation by eliminating the arbitrary function φ from $\varphi\left(x^2+y^2+z^2, z^2-2xy\right)=0$. **(11)**

   (b) Find the integral surface of $(x-y)p+(y-x-z)q=z$ which passes through the circle $z=1, x^2+y^2=1$. **(12)**

   (c) Find a complete and singular integral of $2xz-px^2-2qxy+pq=0$. **(12)**

2. Solve the following partial differential equations:

   (i) $\left(D^2+DD'-6D'^2\right)z=y\cos x$ **(11)**

   (ii) $\left(D^2-DD'-2D'^2+2D+2D'\right)z=e^{2x+3y}+xy+\sin(2x+y)$ **(12)**

   (iii) $\left(x^2D^2-y^2D'^2+xD-yD'\right)z=\ln x$ where $D=\frac{\partial}{\partial x}$ and $D'=\frac{\partial}{\partial y}$. **(12)**

3. (a) Using only elementary row transformations, find the inverse of A when **(17)**

$$A=\begin{bmatrix}1 & 2 & 3 & 4\\ 2 & 3 & 4 & 5\\ 3 & 4 & 5 & 7\\ 4 & 5 & 5 & 7\end{bmatrix}$$

   (b) For what values of λ, the following linear equations have a solution and solve them completely in each case: **(18)**

$$\begin{aligned} x+y+z&=1\\ x+2y+4z&=\lambda\\ x+4y+10z&=\lambda^2\end{aligned}$$

4. (a) Find the canonical matrix and hence find the rank of A, where **(18)**

$$A=\begin{bmatrix}-1 & 2 & 0 & 4 & 5 & -3\\ 3 & -7 & 2 & 0 & 1 & 4\\ 2 & -5 & 2 & 4 & 6 & 1\\ 4 & -9 & 2 & -4 & -4 & 7\end{bmatrix}$$

Contd P/2

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Contd... Q. No. 4

(b) Find all eigenvalues and corresponding eigenvectors of the matrix **(17)**

$$A=\begin{bmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -4 & -3 \end{bmatrix}.$$

Also find the matrix P that diagonalizes A and determine $P^{-1}AP$.

SECTION – B

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

5. (a) State and verify Cayley-Hamilton theorem for $A=\begin{bmatrix} 5 & 4 & -1 \\ 4 & 5 & -1 \\ -4 & -4 & 3 \end{bmatrix}$. Hence find A^4 **(17)**

(b) Reduce the real quadratic form $q=4x_1^2+3x_2^2-x_3^2+2x_2x_3-4x_1x_3+4x_1x_2$ to the canonical form and hence find the rank, signature and index of the form. Write down the corresponding equations of transformation as well. **(18)**

6. (a) The mark in a test is assumed to be normally distributed. It is known that 15% of the students have marks under 45 and 24% exceed 80, what percentage of students have marks between 70 and 92? (Necessary chart 1 is attached). **(17)**

(b) Following are the runs obtained by two players A and B in 10 matches: **(18)**

Runs scored byA:	55	80	78	49	52	76	78	76	62	76
Runs scored by B:	54	78	55	66	63	69	74	64	59	85

(i) Measure the Skewness, Kurtosis and hence comment on the shape of the runs scored by A.

(ii) If the consistency of performance is the criterion for awarding a prize, who should get the prize?

7. (a) In testing a certain kind of truck tire over a rugged terrain, it is found that 20% of the trucks fail to complete the test run without a blowout. Of the next 18 trucks tested, find the probability using (both binomial and Poisson distribution) that **(15)**

(i) from 5 to 8 have blowouts;

(ii) fewer than 4 have blowouts;

(iii) more than 6 have blowouts.

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Contd... Q. No. 7

(b) The mean weekly sale of the BD chocolate bar in candy stores was 145.7 bars per store. After an advertising campaign, the mean weekly sale in 26 stores for a typical week increased to 165.4 and showed a standard deviation of 14.7. Was the advertising successful? Use a 5% level of significance. (Necessary chart 2 is attached). **(10)**

(c) Find the mean and the variance of the Poisson distribution. **(10)**

8. (a) Calculate two regression equations and regression coefficients from the data given below: **(17)**

Marks in Economics (Out of 50):	47	38	34	44	32	41	35	32	42	30
Marks in Business (Out of 50):	38	34	42	39	34	33	30	41	38	28

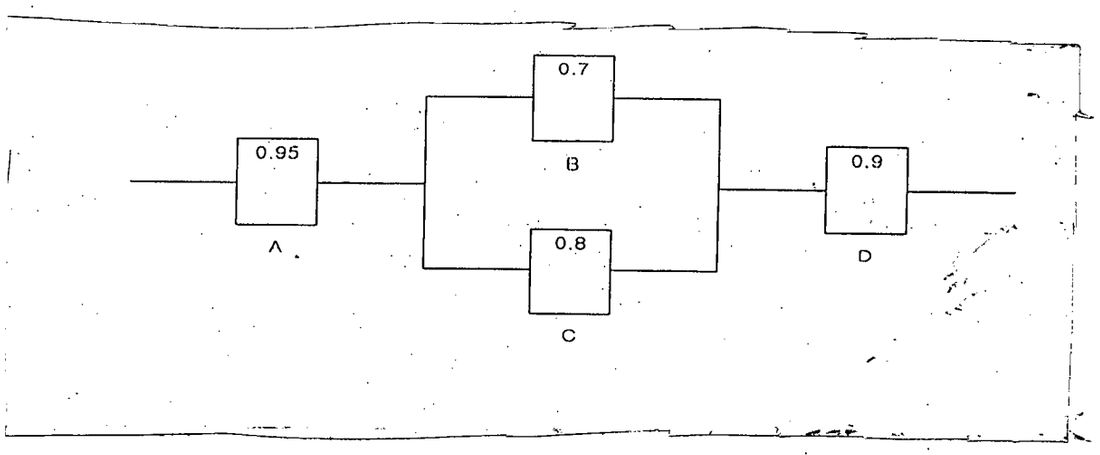
Estimate the mark in economics if a student has scored 36 in business and the mark in business if another student has scored 44 in economics. Also comment on the correlation of the above mentioned marks obtained in economics and business.

(b) An electrical system consists of 4 components as shown in the following figure. The system works if the components A and D work and either of the components B or C work. The reliability (the probability of working) of each component is also shown in the following figure. Find the probability that **(18)**

(i) the entire system works.

(ii) the component B does not work, given that the entire system works.

Assume that the 4 components work independently.



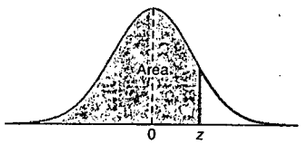


Table A.3 Areas under the Normal Curve

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
−3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
−3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
−3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
−3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
−3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
−2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
−2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
−2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
−2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
−2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
−2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
−2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
−2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
−2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
−2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
−1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
−1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
−1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
−1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
−1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
−1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
−1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
−1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
−1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
−1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
−0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
−0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
−0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
−0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
−0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
−0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
−0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
−0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
−0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
−0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641

Chart 1 for Q. 6(a).

Table A.3 (continued) Areas under the Normal Curve

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998

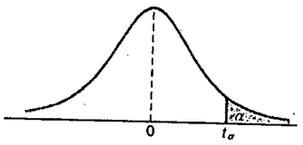


Table A.4 Critical Values of the t-Distribution

	α						
v	**0.40**	**0.30**	**0.20**	**0.15**	**0.10**	**0.05**	**0.025**
1	0.325	0.727	1.376	1.963	3.078	6.314	12.706
2	0.289	0.617	1.061	1.386	1.886	2.920	4.303
3	0.277	0.584	0.978	1.250	1.638	2.353	3.182
4	0.271	0.569	0.941	1.190	1.533	2.132	2.776
5	0.267	0.559	0.920	1.156	1.476	2.015	2.571
6	0.265	0.553	0.906	1.134	1.440	1.943	2.447
7	0.263	0.549	0.896	1.119	1.415	1.895	2.365
8	0.262	0.546	0.889	1.108	1.397	1.860	2.306
9	0.261	0.543	0.883	1.100	1.383	1.833	2.262
10	0.260	0.542	0.879	1.093	1.372	1.812	2.228
11	0.260	0.540	0.876	1.088	1.363	1.796	2.201
12	0.259	0.539	0.873	1.083	1.356	1.782	2.179
13	0.259	0.538	0.870	1.079	1.350	1.771	2.160
14	0.258	0.537	0.868	1.076	1.345	1.761	2.145
15	0.258	0.536	0.866	1.074	1.341	1.753	2.131
16	0.258	0.535	0.865	1.071	1.337	1.746	2.120
17	0.257	0.534	0.863	1.069	1.333	1.740	2.110
18	0.257	0.534	0.862	1.067	1.330	1.734	2.101
19	0.257	0.533	0.861	1.066	1.328	1.729	2.093
20	0.257	0.533	0.860	1.064	1.325	1.725	2.086
21	0.257	0.532	0.859	1.063	1.323	1.721	2.080
22	0.256	0.532	0.858	1.061	1.321	1.717	2.074
23	0.256	0.532	0.858	1.060	1.319	1.714	2.069
24	0.256	0.531	0.857	1.059	1.318	1.711	2.064
25	0.256	0.531	0.856	1.058	1.316	1.708	2.060
26	0.256	0.531	0.856	1.058	1.315	1.706	2.056
27	0.256	0.531	0.855	1.057	1.314	1.703	2.052
28	0.256	0.530	0.855	1.056	1.313	1.701	2.048
29	0.256	0.530	0.854	1.055	1.311	1.699	2.045
30	0.256	0.530	0.854	1.055	1.310	1.697	2.042
40	0.255	0.529	0.851	1.050	1.303	1.684	2.021
60	0.254	0.527	0.848	1.045	1.296	1.671	2.000
120	0.254	0.526	0.845	1.041	1.289	1.658	1.980
∞	0.253	0.524	0.842	1.036	1.282	1.645	1.960

Chart 2 for Q. 7(b)

Table A.4 (continued) Critical Values of the t-Distribution

	α						
v	**0.02**	**0.015**	**0.01**	**0.0075**	**0.005**	**0.0025**	**0.0005**
1	15.894	21.205	31.821	42.433	63.656	127.321	636.578
2	4.849	5.643	6.965	8.073	9.925	14.089	31.600
3	3.482	3.896	4.541	5.047	5.841	7.453	12.924
4	2.999	3.298	3.747	4.088	4.604	5.598	8.610
5	2.757	3.003	3.365	3.634	4.032	4.773	6.869
6	2.612	2.829	3.143	3.372	3.707	4.317	5.959
7	2.517	2.715	2.998	3.203	3.499	4.029	5.408
8	2.449	2.634	2.896	3.085	3.355	3.833	5.041
9	2.398	2.574	2.821	2.998	3.250	3.690	4.781
10	2.359	2.527	2.764	2.932	3.169	3.581	4.587
11	2.328	2.491	2.718	2.879	3.106	3.497	4.437
12	2.303	2.461	2.681	2.836	3.055	3.428	4.318
13	2.282	2.436	2.650	2.801	3.012	3.372	4.221
14	2.264	2.415	2.624	2.771	2.977	3.326	4.140
15	2.249	2.397	2.602	2.746	2.947	3.286	4.073
16	2.235	2.382	2.583	2.724	2.921	3.252	4.015
17	2.224	2.368	2.567	2.706	2.898	3.222	3.965
18	2.214	2.356	2.552	2.689	2.878	3.197	3.922
19	2.205	2.346	2.539	2.674	2.861	3.174	3.883
20	2.197	2.336	2.528	2.661	2.845	3.153	3.850
21	2.189	2.328	2.518	2.649	2.831	3.135	3.819
22	2.183	2.320	2.508	2.639	2.819	3.119	3.792
23	2.177	2.313	2.500	2.629	2.807	3.104	3.768
24	2.172	2.307	2.492	2.620	2.797	3.091	3.745
25	2.167	2.301	2.485	2.612	2.787	3.078	3.725
26	2.162	2.296	2.479	2.605	2.779	3.067	3.707
27	2.158	2.291	2.473	2.598	2.771	3.057	3.689
28	2.154	2.286	2.467	2.592	2.763	3.047	3.674
29	2.150	2.282	2.462	2.586	2.756	3.038	3.660
30	2.147	2.278	2.457	2.581	2.750	3.030	3.646
40	2.123	2.250	2.423	2.542	2.704	2.971	3.551
60	2.099	2.223	2.390	2.504	2.660	2.915	3.460
120	2.076	2.196	2.358	2.468	2.617	2.860	3.373
∞	2.054	2.170	2.326	2.432	2.576	2.807	3.290

L-2/T-2/NAME **Date: 27/02/2018**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-2 B. Sc. Engineering Examinations 2016-2017

Sub: **NAME 217** (Theoretical Ship Design)

Full Marks: 210 Time: 3 Hours

The figures in the margin indicate full marks.

Assume reasonable value for any missing data.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) An oil tanker of 155 m freeboard length has following particulars: **(25)**

Depth Moulded 11.458 m

Actual bow height 6.894 m

Block co-efficient 0.830

Total length of enclosed superstructure 71.278 m

The difference between actual mean sheer and standard mean sheer is 650 mm.

The tabular freeboard for this vessel is 2.048 m. Calculate the Summer freeboard and the Summer Loaded Waterline (SLWL) considering the minimum statutory requirements.

(b) "Oil tankers are permitted to have more summer freeboard than general cargo ships with a similar LBP" — justify this. **(10)**

2. (a) The particulars for a General cargo basic ship and a new design are as follows **(25)**

Item	Basic ship	New ship
LBP (m)	133	137
Br. Mld (m)	18.36	19.50
Depth Mld (m)	11.55	12.20
SLWL (m)	8.95	9.52
C_B @ SLWL	0.745	0.753
Length of amidships	19.50	19.93
Machinery space (m)	-	-
Tank top height (m)	1.25	1.42
Upper Deck Camber (m)	0.34	0.38
Deck sheer for d (m)	2.75	2.76
Deck sheer aft (m)	1.45	1.38
Tank top ceiling (m)	0.065	0.065
Grain capacity (m^3)	17850	XXXX

Determine the Grain and Bale capacity of the new design. What will be insulated capacity of the vessel taking insulation thickness as 250 mm.

(b) If the C_B@SLWL is 0.692 for a general cargo ship, estimate the approximate C_B at 85% of the depth moulded. **(10)**

Contd P/2

NAME 217

3. (a) The following information is known for a basic General Cargo ship and a similar new design. **(20)**

Items	Basic ship	New design
LBP (m)	140	145
Br. Mld (m)	19.5	20.5
Depth Mld (m)	12.6	12.3
C_B @ SLWL	0.726	0.735
Aft deck sheer (m)	1.52	1.43
For'd deck sheer (m)	3.20	2.94
Residual steel addition (tonne)	—	+39

The total finished steel weight of basis ship is 4035 tonnes. Estimate the steel weight for the new design after modifications have been made to the basic ship's steel weight for main dimensions, C_B, proportions, sheer and residual additions.

(b) Briefly describe the requirements of sounding pipes and air pipes at ship. **(15)**

4. (a) For a new design, it has found from towed ship model test that the naked effective power (P_{NE}) for the prototype was 3200 kW. Using a basic ship, it was decided to use the following data for this new design: **(20)**

Hull efficiency = 99.2%; propeller efficiency = 70.85%; shaft losses = 4.75%; Engine efficiency = 86.13%; weather and appendage allowances = +10%

Steam turbine machinery installed with thrust block fitted aft of Engine Room.

Calculate all the powers from propeller tips to the Engine Room.

(b) Sketch the line diagram for solving ship resistance problems. Label the important points on the diagram. **(10)**

(c) A ship's propeller has a pitch of 4.76 m and revolves at 107 rpm. Calculate the theoretical speed of the propeller. **(5)**

SECTION – B

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

5. (a) Describe the role of entities involved in ship design. **(15)**

(b) Illustrate a comparative study of sequential design process and concurrent engineering while designing a complex marine structure. **(20)**

Contd P/3

NAME 217

6. (a) Three new standard General Cargo vessels are being considered. They are to have deadweights of 4500, 8500 and 12500 tonnes respectively. As a first approximation, estimate the Length Between Perpendicular (LBP) for each of these ships using both Ayre and Posdunine formula. **(25)**

(b) In the early design stages to increase the displacement of a vessel, describe the effects of the following: **(10)**

(i) Increase of LBP

(ii) Increase of B

(iii) Increase of Depth and Draught

(iv) Increase in C_b

7. (a) A basic General Cargo ship is 134 m LBP and 18.12 m Bmld with a final Wood and Outfit (W&O) weight of 700 tonnes. A new similar ship has LBP of 138.5 m and Bmld of 18.70 m. Estimate the W&O coefficient and the new W&O weight of the new design. **(17)**

(b) A ship of 9500 tonnes DWT has power at the thrust block of 5000 kW (either P_B or P_S). Estimate the total machinery weight when diesel machinery is fitted or when Steam Turbine machinery is installed in this ship. Consider the ship is twin screwed. **(18)**

8. (a) A box shaped vessel 170 m long and 15 m beam is floating on an even keel in salt water at a draft of 4.0 meters. A forward end compartment 10 m long and full breadth of the ship is bilged. Calculate the new drafts if the moment to change trim one centimeter is 100 tonnes-meters. **(20)**

(b) A General Cargo ship is 122 m × 16.45 m × 9.20 m depth moulded. She has a finished steel weight of 2700 tonnes. The new ship has preliminary dimensions of 131 m × 17.08 m × 10.10 m depth moulded. Calculate the steel weight for the new design after correcting for the main dimensions only. **(15)**

Contd... P/4

NAME 217
L2/T2
27/2/2018

For Q.No. 1(a)

Sheet for Ques No 1 (a)

Depth correction

If Depth D exceeds $L_F/15$, the freeboard is to be increased.

If this is so then the correction = $(D - L_F/15) \times R$
where

$R = L_F/0.48$ if L_F is less than 120 m
$R = 250$ if L_F is 120 m and above

If L_F is 155 m and the Depth D is 11.518 m, then:

Depth correction = $(11.518 - 155/15) \times 250 = +296$ mm

If Depth D is less then $L_F/15$, then no reduction is to be made.

Bow height correction

If the bow height on the actual vessel is *less* than the standard bow height, then the freeboard must be *increased*.

If the bow height on the actual vessel is *greater* than the standard bow height, then there is *no correction* to be made to the freeboard.

The minimum bow height (mBH) for ships is as follows:

If L_F is <250 m, then mBH = $56L\{1 - L/500\} \times 1.36/(C_b + 0.680)$ mm.
If L_F = 250 m or is >250 m, then mBH = $7000 \times 1.36/(C_b + 0.680)$ mm.

C_b correction

If the C_b is greater than the standard 0.680, then the freeboard is to be increased by the following:

Correction = $\{(C_b + 0.680)/1.360\} \times$ Tabular freeboard figure

If the ship's C_b is 0.830 and the Tabular freeboard figure is 2.048 m, then:

C_b correction is $\{(0.830 + 0.680)/1.360\} \times 2.048 = 2.274$ m
Hence addition for actual C_b value = $2.274 - 2.028$
= +0.226 m or +226 mm

Contd... P/5

NAME 217
L2|T2
27/2/2018

For Q. No. 1(a)

Superstructure correction

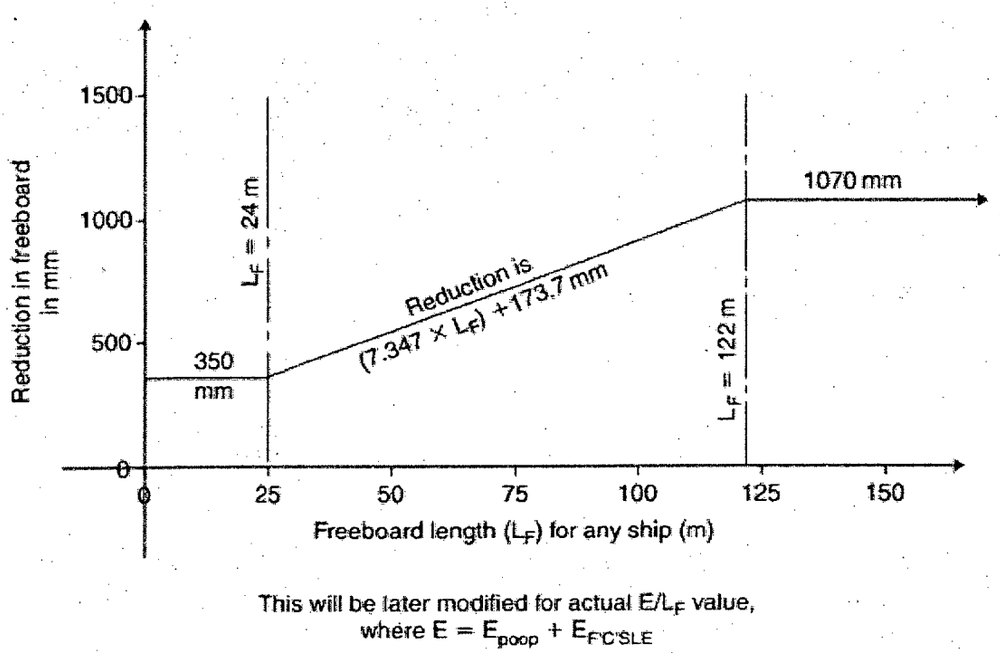
Where the effective lengths of the superstructure and trunks is **100% × L_F**, the freeboard can be reduced by:

350 mm	when L_F is 24 m
860 mm	when L_F is 85 m
1070 mm	when L_F is 122 m and above

These values are shown graphically in Figure 28.4.

However, if less than 100% of the vessel's length is superstructure length, then the following multiple factors should be determined.

Let the actual length of superstructure be denoted as the effective length (E).
Let ratios for E/L_F range from 0 to 1.00.



This will be later modified for actual E/L_F value, where $E = E_{poop} + E_{F'C'SLE}$

Fig. 28.4 Reduction in freeboard for superstructure, when E/L_F is 100%, for any ship.

Table 28.1 Freeboard reduction against effective length/freeboard length ratios for Type 'A' ships.

E/L_F ratio	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Freeboard reduction	0	7%	14%	21%	31%	41%	52%	63%	75.3%	87.7%	100%

Percentages at intermediate ratios of superstructures shall be obtained by linear interpolation.

Contd... P/6

NAME 217
L2/T2
27/2/2018

For Q.No. 1(a)

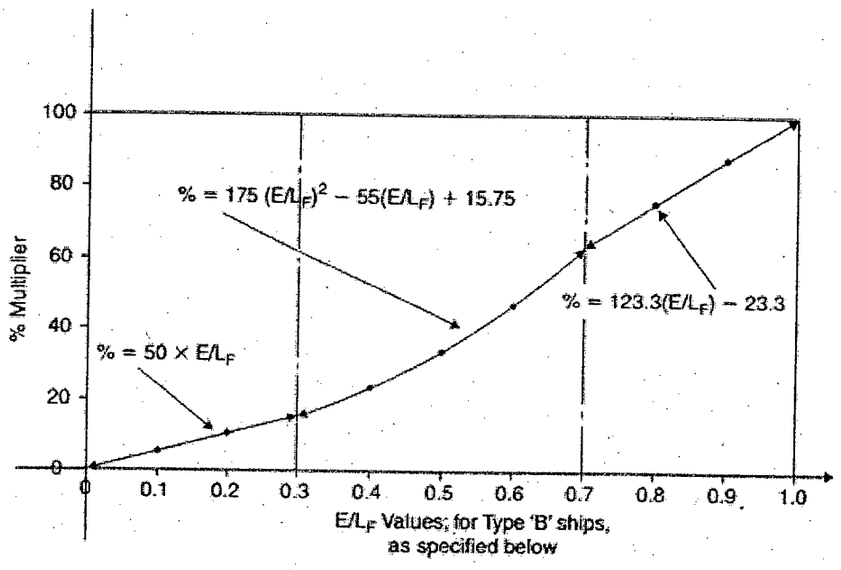


Fig. 28.6 % multipliers for superstructure length 'E' for Type 'B' vessels with forecastle but no bridge.

Sheer correction

A vessel with greater than standard sheer will have a reduction in the freeboard.

A vessel with less than standard sheer will have an addition in the freeboard:

$$\text{Sheer correction} = \text{Mean sheer difference} \times (0.75 - S/2) \times L_F$$

The mean sheer difference is the actual mean sheer for the ship relative the mean sheer for the standard ship. For both cases:

$$\text{Mean sheer} = (\text{Aft sheer @ AP} + \text{Forward sheer @ FP})/6 \text{ mm}$$

The denominator of 6 is the sum of Simpson's 1st Rule multipliers (1,4,1) to give a mean sheer value along each vessel's length.

Deck sheer can also be measured at AP, 1/6 L, 2/6 L, 3/6 L, 4/6 L, 5/6 L and at FP. L is LBP. These sheers are then put through Simpson's multipliers to obtain an area function.

For both vessels, the mean sheer = area function/16

The denominator of 16 is the sum of Simpson's 2nd Rule multipliers (1,3,3,2,3,3,1) to give a mean sheer value along each vessel's length.

S = Total length of enclosed superstructures.

Maximum reduction in freeboard allowed for excess sheer = $1.25 \times L_F$ mm

Contd.. P/7

NAME 217
L2/T2
27/2/2018

For Q. No. 1(a)

For E/L_F of 0 to 0.3, the multiple factor is $70 \times E/L_F$ per cent.
For E/L_F of 0.3 to 1.0 factor $= 27.78(E/L_F)^2 + 76.11(E/L_F) - 3.89$ per cent.

These values are shown graphically in Figure 28.5.

Secondly, consider *Type 'B' vessels* with a forecastle and without a detached bridge (for example, general cargo ships).

If E/L_F is 0 to 0.3, then the multiple factor $= 50(E/L_F)$ per cent.
If E/L_F is 0.3 to 0.7, then the factor $= 175(E/L_F)^2 - 55(E/L_F) + 15.75$ per cent.
If E/L_F is 0.7 to 1.0 then the multiple factor $= 123.3\ E/L_F - 23.3$ per cent.

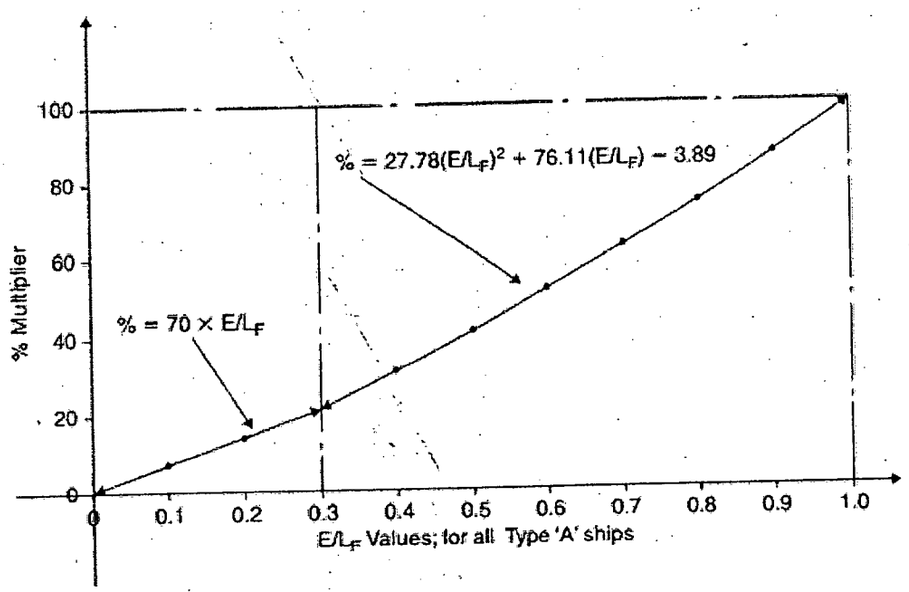


Fig. 28.5 % multipliers for superstructure length 'E' for all Type 'A' ships.

Table 28.2 Freeboard reduction against effective length/freeboard length ratios for Type 'B' vessels.

E/L_F ratio	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Freeboard reduction	0	5%	10%	15%	23.5%	32%	46%	63%	75.3%	87.7%	100%

Percentages at intermediate ratios of superstructures shall be obtained by linear interpolation.

L-2/T-2/NAME **Date: 05/03/2018**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-2 B. Sc. Engineering Examinations 2016-2017

Sub: **EEE 261** (Electrical and Electronic Technology for Marine Engineers)

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.

Write your answers briefly and **TO THE POINT**.

1. (a) What is armature reaction in a synchronous generator? Explain with the help of appropriate figures. **(10)**

(b) The internal generated voltage of a 2-pole, Δ-connected, 50 Hz, three phase synchronous generator is 14.4 kV, and the terminal voltage is 12.8 kV. The synchronous reactance of this machine is 4 Ω, and the armature resistance can be ignored. **(10)**

(i) If the torque angle of the generator $\delta = 18°$, how much power is being supplied by this generator?

(ii) What is the power factor of the generator?

(iii) Sketch the phasor diagram under these circumstances.

(iv) Ignoring losses in this generator, what torque must be applied to its shaft by the prime mover at these conditions?

(c) A generating station of a power system consists of four 300-MVA, 15-kV, 0.85-PF-lagging synchronous generators with identical speed drop characteristics operating in parallel. The governors on the generators' prime movers are adjusted to produce a 3-Hz drop from no load to full load. Three of these generators are each supplying a steady 200 MW at a frequency of 60 Hz, while the swing generator handles all incremental load changes on the system, maintaining the system's frequency at 60 Hz. **(15)**

(i) At a given instant, the total system loads ae 650 MW at a frequency of 60 Hz. What are the no load frequencies of each of the system's generators?

(ii) If the system load rises to 725 MW and the generator's governor set points do not change, what will be the new system frequency?

(iii) To what frequency must the no-load frequency of the swing generator be adjusted in order to restore the system frequency to 60 Hz?

(iv) If the system is operating at the conditions described in part (iii), what would happen if the swing generator were tripped off the line?

Contd P/2

2. (a) Explain the synchronous motor starting problem. How can it be overcome using amortisseur windings? Use appropriate figures to explain. **(8)**

(b)A 500 kVA, 600 V, 0.8-PF-leading, Y-connected synchronous motor has a synchronous reactance of 1.0 per unit and an armature resistance of 0.1 per unit. Given: $\mathbf{E_A} = 1.00\angle 12°$ pu and $V_\Phi = 1\angle 0°$ pu. **(7)**

(i) Is this machine acting as a motor or a generator?

(ii) How much power P is this machine consuming from or supplying to the electrical system?

(iii) How much reactive power Q is this machine consuming from or supplying to the electrical system?

(iv) Is this machine operating within its rated limits?

(c) A 480-V, 500-kVA, 0.8-PF-lagging, Y-connected synchronous generator has a synchronous reactance of 0.4 Ω and a negligible armature resistance. This generator is supplying power to a 480-V, 80-kW, 0.8-PF-leading, Y-connected synchronous motor with a synchronous reactance of 2.0 Ω and a negligible armature resistance. The synchronous generator is adjusted to have a terminal voltage of 480 V when the motor is drawing the rated power at unity power factor. **(20)**

(i) Calculate the magnitudes and angles of $\mathbf{E_A}$ for both machines.

(ii) Draw the combined phase diagram taking internal generated voltage in the generator as reference.

(iii) If the flux of the motor is increased by 10 percent, what happens to the terminal voltage of the generator? What is its new value?

(iv) What is the power factor of the motor after the increase in motor flux?

3. (a) Graphically derive the induction motor torque-speed characteristic. Draw the curve, showing the characteristic regions, and explain it briefly. **(8)**

(b) The equivalent circuit model parameters for an induction motor are found by performing a series of tests on them. For **each** of these tests: **(17)**

(i) Draw the test circuit, mentioning under what conditions each test is carried out.

(ii) Draw the resulting motor equivalent circuit.

(iii) Write the assumptions in the mathematical evaluation of these tests, if any.

(c) A 208-V six-pole Y-connected 25-hp design class B induction motor is tested in the laboratory, with the following results: **(10)**

No load: 208 V, 24.0 A, 1400 W, 60 Hz

Locked rotor: 24.6 V, 64.5 A, 2200 W, 15 Hz

DC test: 13.5 V, 64 A

Find the equivalent circuit of this motor.

Contd P/3

4. (a) Explain the effect of increasing the (i) governor's set points and (ii) field current on a generator operating in parallel with an infinite bus with the help of house diagrams and phase diagrams. **(11)**

(b) The infinite bus in Figure for q. 4(b) operates at 480 V. Load 1 is an induction motor consuming 100 kW at 0.78 PF lagging, and load 2 is an induction motor consuming 200 kW at 0.8 PF lagging. Load 3 is a synchronous motor whose real power consumption is 150 kW. **(12)**

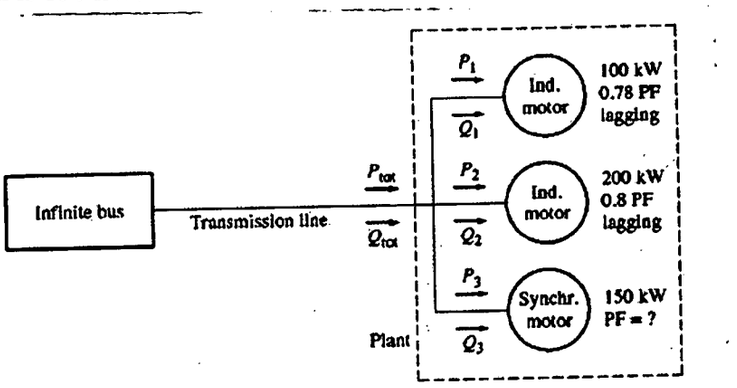


Fig. for Q4(b)

(i) If the synchronous motor is adjusted to operate at 0.85 PF lagging, what is the transmission line current in this system?

(ii) If the synchronous motor is adjusted to operate at 0.85 PF leading, what is the transmission line current in this system?

(iii) Using results calculated above, explain mathematically how PF correction using synchronous motor helps the power system above.

(c) Draw a three-step resistive starter for an induction motor and explain briefly its different features. **(12)**

SECTION – B

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

5. (a) For the circuit shown in Fig. for Q. 5(a), determine R_{in}, R_{ib}, A_v, A_{vo}, R_{out}, G_v; where the symbols have their usual meanings. **(18)**

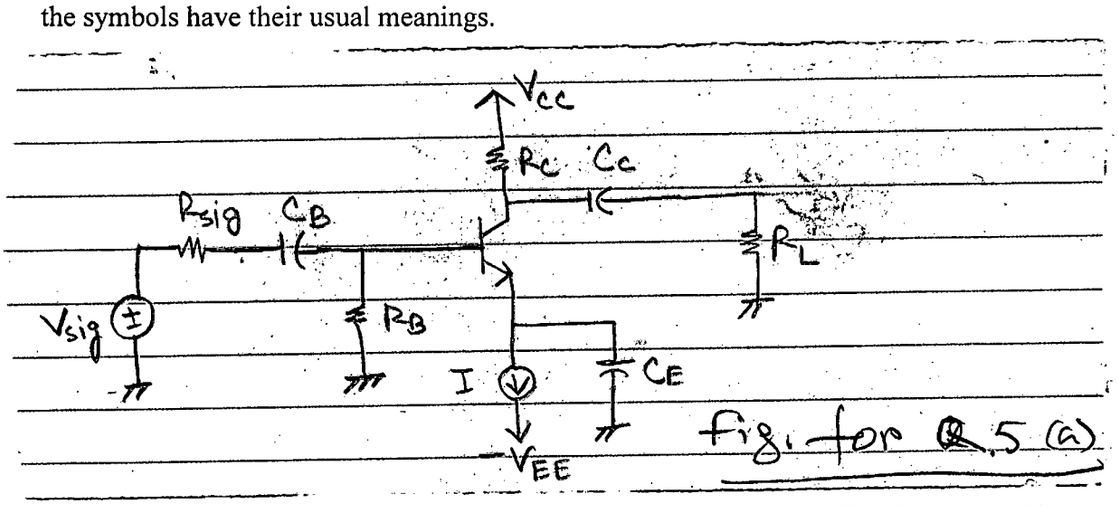


Fig. for Q.5 (a)

EEE 261/NAME

Contd... Q. No. 5

(b) Analyze the circuit shown in Fig. for Q. 5(b) to determine the voltages at all nodes and current through all branches. Given that β = 100. **(17)**

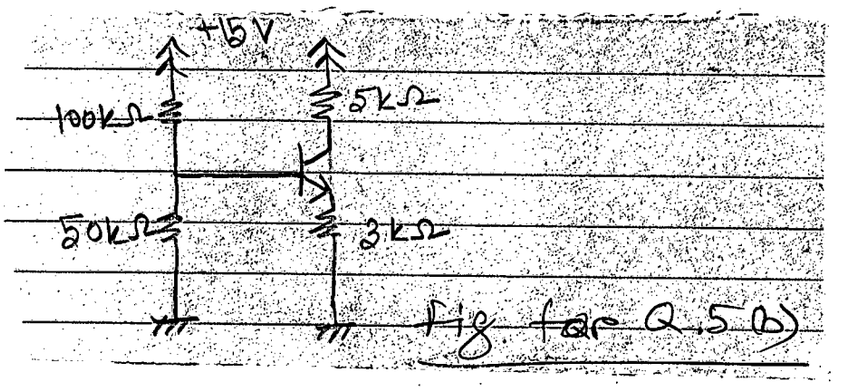


Fig. for Q.5(b)

6. (a) For the circuit shown in Fig. for Q. 6(a), determine R_{in}, A_v, A_{vo}, G_v, R_{out}; where symbols have the usual meanings. **(15)**

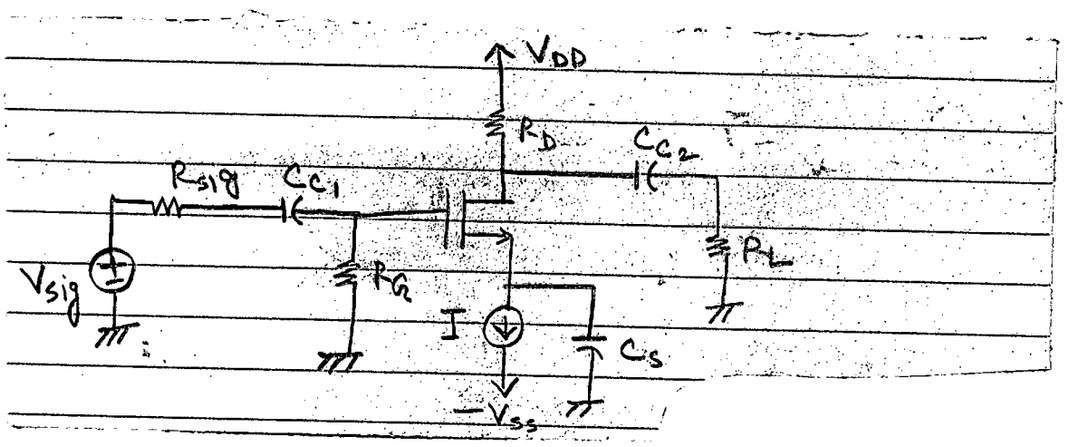


Fig. for Q6(a)

(b) Design the circuit shown in Fig. for Q. 6(b) for $|V_t| = 1v, \lambda = 0$ and $k_p'(W/L) = 1\,mA/V^2$. What can be the largest value of R_D while maintaining saturation region operation? **(20)**

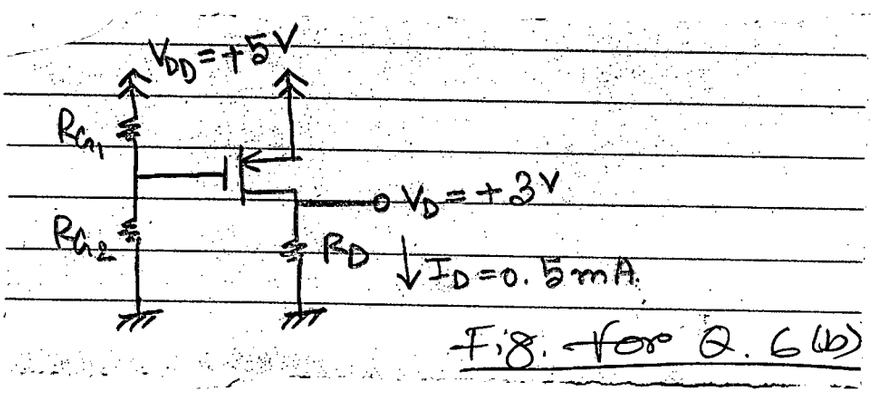


Fig. for Q.6(b)

EEE 261/NAME

7. (a) Draw the waveshape of V_o. Assume ideal diode. **(10)**

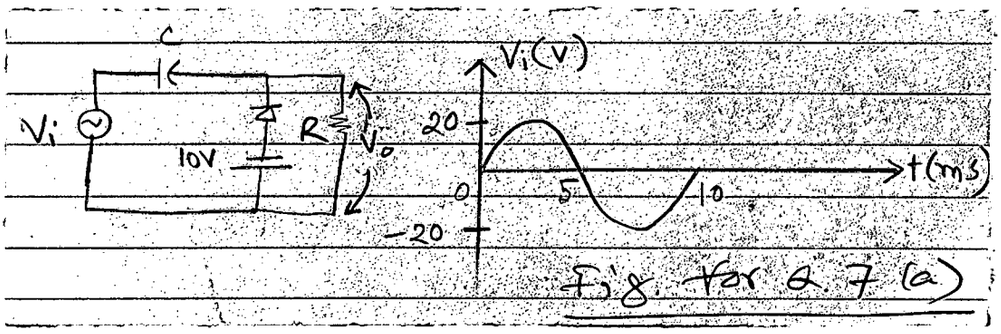


Fig. for Q. 7 (a)

(b) Design a circuit with diodes which will have the input-output characteristics shown in Fig. for Q. 7(b). Assume ideal diode. **(15)**

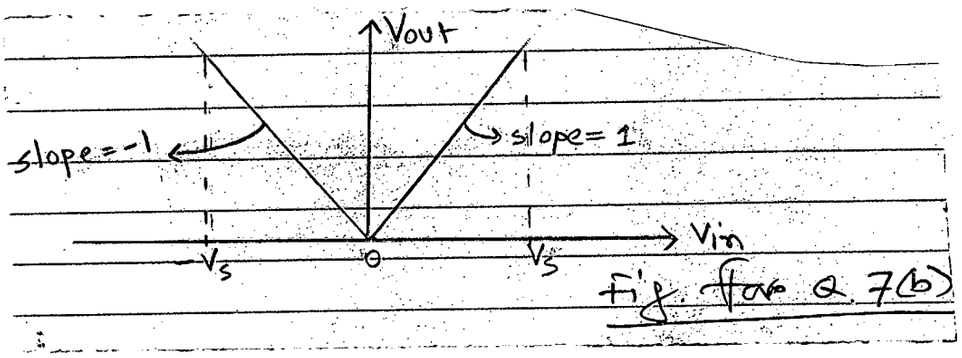


fig. for Q. 7(b)

(c) Find the values of I and V in the circuit shown in Fig. for Q. 7(c). **(10)**

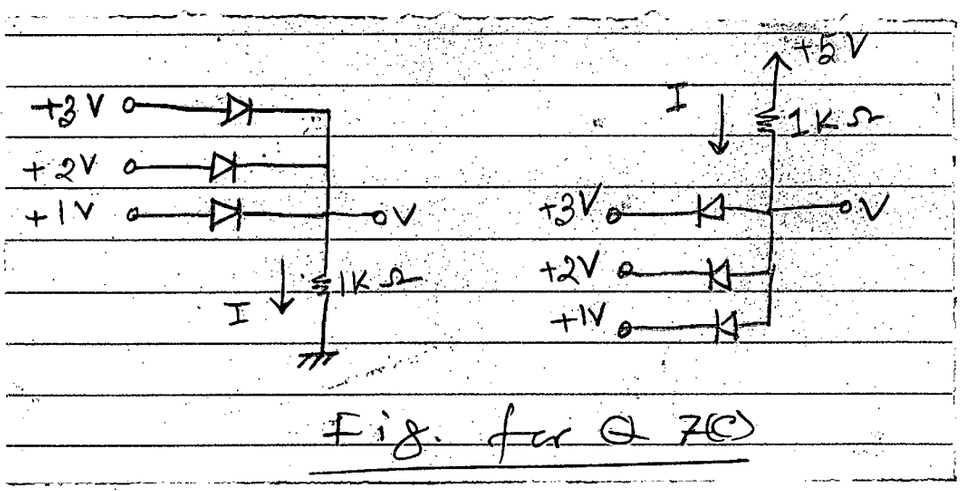


Fig. for Q 7(c)

8. (a) Draw the equivalent circuit of an SCR and explain its operation. **(10)**

(b) Draw the V-I characteristics of SCR and explain. **(10)**

(c) Design a full wave rectifier using SCRs and explain its operation. Draw the input-output voltage waveforms. **(15)**

L-2/T-2/NAME **Date: 11/03/2018**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-2 B. Sc. Engineering Examinations 2016-2017

Sub: **NAME 223** (Marine Hydrodynamics)

Full Marks: 210 Time: 3 Hours

The figures in the margin indicate full marks.

Symbols have their usual meaning. Assume reasonable data, where missing.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) Define simple source and sink. With figure demonstrate the flow pattern due to a source at point $P(x_1, y_1)$. Derive the expression for Ψ and Φ. **(15)**

   (b) What do you mean by irrotational vortex? Prove for irrotational vortex, **(20)**

   $$v_\theta . r = \text{constant}.$$

2. (a) Give a detail explanation of "boundary layer separation" with example. **(15)**

   (b) Write short notes on- **(20)**

   (i) Vortex pair

   (ii) Spiral vortex

   (iii) Uniform flow

   (iv) Flow past a cylinder with circulation

3. (a) Show that a combination of source and uniform flow constitutes the flow past a half-body. Also determine the expressions for profile, width and pressure distribution of the half-body. **(20)**

   (b) If $w = z^2$, evaluate ϕ and ψ in terms of x and y. Determine the point in the w-plane corresponding to the point $z = x + iy = 1.67 + i0.89$ in the z-plane and show the result in the graph. **(15)**

4. (a) Derive the Cauchy-Riemann equation and prove that it satisfies Laplace equation. **(20)**

   (b) Following Blassius's theorem for two-dimensional flow past a profile of any cross-section, with circulation, show that the drag force is zero and the lift force is $-\rho U\Gamma$. **(15)**

Contd P/2

NAME 223

SECTION – B

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

5. (a) Consider first one-dimensional fluid flow and hence derive the equation of continuity for one-dimensional flow. **(11)**

(b) What are the boundary conditions used for the analysis of fluid flow? Derive the condition for boundary surface. **(12)**

(c) Given the function $\psi = 4xy$, determine the flow pattern. Show that the flow is irrotational and determine the φ-function. **(12)**

6. (a) Show that the existence of a velocity implies that flow is irrotational. **(10)**

(b) The stream function $\psi = U\left(r - \frac{2a^2}{r}\right)\sin\theta$ represents the pattern of steady flow of an infinite fluid in the x-direction past a cylinder of radius $\sqrt{2}a$ at the origin, the fluid velocity at infinity being U. **(25)**

(i) Determine the velocity distributions in non-dimensional form along the x- and y-axes and on the cylinder boundary.

(ii) At what distance in terms of the cylinder radius from the origin along the x- and y-axes are the velocities within 1 percent of the undisturbed velocity, U?

7. (a) Derive the interrelationship of φ, ψ and two dimensional velocity components in polar coordinate system. **(10)**

(b) Define rotational and irrotational flows. Derive the condition for irrotational flow. **(10)**

(c) The velocity at the boundary of a cylinder immersed in a fluid is shown to be $V' = 2U\sin\theta$. Where U is the undisturbed velocity of the fluid and θ is measured from the direction of flow. If the pressure in the undisturbed flow is p_o, determine the pressure distribution around the cylinder, the location of the stagnation points and the stagnation pressure. **(15)**

8. (a) Derive Euler's equation of motion for a non-viscous fluid. **(20)**

(b) How can you convert Euler's equations of motion into Navier-Stokes equations considering viscous effect? **(15)**
