BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2   B. Sc. Engineering Examinations 2012-2013

Sub : **MATH 139** (Differential Equations and Statistics)

Full Marks : 210   Time : 3 Hours

The figures in the margin indicate full marks.

Symbols have their usual meaning..

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. Solve the following differential equations

(a) $y\left(1 + e^{\frac{x}{y}}\right)dx + e^{\frac{x}{y}}(y - x)dy = 0$ **(10)**

(b) $\dfrac{dy}{dx} = \dfrac{x - y - 2}{x + y + 6}$ **(15)**

(c) $\sin 2x\left(\dfrac{dy}{dx}\right) - y = \tan x$ **(10)**

2. (a) Find the integrating factor of the differential equation

$\left(2xy^4 e^y + 2xy^3 + y\right)dx + \left(x^2 y^4 e^y - x^2 y^2 - 3x\right)dy = 0$ and solve it.   **(10)**

(b) Using the method of variation of parameters solve the differential equation

$$\dfrac{d^2 y}{dx^2} + 9y = \sec 3x$$ **(13)**

(c) According to Newton's law of cooling, the rate at which a substance cools in moving air is proportional to the difference between the temperature of the substance and that of the air. If the temperature of the air is 300 K and the substance cools from 370 K the 340 K in 15 minutes, find when the temperature will be 310 K.   **(12)**

3. (a) Solve : $\left(D^2 - 6D + 9\right)y = x^2 e^{3x} \cos 2x$ **(15)**

(b) Solve : $\left(x^2 D^2 - xD + 4\right)y = \cos \log x + x \sin \log x$ **(11)**

(c) Find the differential equation arising from $\phi\left(x - y + z, \ x^2 + 2y^2 - 3z^2\right) = 0$ **(9)**

4. (a) Solve: $p\cos(x + y) + q\sin(x + y) - z = 0$ **(12)**

(b) Find the complete solution of the following PDEs

  (i) $px + qy = pq$ **(10)**

  (ii) $2(z + px + qy) = p^2 y$ **(13)**

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SECTION – B

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

5. Solve the followings

  (a) $\left(D_x^2 - 5D_xD_y + 4D_y^2\right)z = sin(4x + y)$ **(11)**

  (b) $\left(D_x - 2D_y + 1\right)\left(D_x + D_y + 5\right)z = x^2 e^{2x+y}$ **(12)**

  (c) $\left(x^2 D_x^2 - y^2 D_y^2\right)z = x^3 y$ **(12)**

6. (a) Calculate the two regression equations and the coefficients of correlation from the data given below: **(15)**

Age of husband:	22	25	28	31	35	32	37	39
Age of wife	19	18	22	29	31	23	30	33

Also estimate the most likely age of wife when husband's age is 34 and the age of husband when wife's age is 21.

(b) Derive the mean and varience of the frequency function for the Gaussian distribution.   **(10)**

(c) For the series $a, (a + d), (a + 2d), \cdots (a + 2nd)$, find mean deviation from the mean and the standard deviation and hence show that the standard deviation is smaller than the mean deviation.   **(10)**

7. (a) For the following incomplete frequency distribution, it is known that the total frequency is 1000 and the median is 418. Estimate the missing frequencies and hence find the modal value of the completed table.   **(15)**

Variable	Frequency
300-325	5
325-350	17
350-375	80
375-400	?
400-425	326
425-450	?
450-475	88
475-500	9

Compute: (i) Pearson's coefficient of skewness,

        (ii) Bowley's coefficient of skewness. Hence comment on the shape of the distribution.

(b) One prominent physician claims that 40% of those with lung cancer are chain smokers. If his assertion is correct, find the probability that of (i) 10 and (ii) 20 such patients recently admitted to a hospital, fewer than half are chain smokers, using binomial distribution and Poisson approximation to the binomial distribution.   **(10)**

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Contd ... Q. No.7

(c) The average score of a sixth grader in a certain school district on a math aptitude exam is 89 with a standard deviation of, 6.4. A random sample of 82 students in one school was taken. The mean score of these students was 84. Does this indicate that the students of this school are significantly slower in their mathematical ability? Use 5% Level of significance. **(10)**

8. (a) A fair coin is tossed until a head appears or it has been tossed three times. Given that the head does not appear on the first toss, what is the probability that the coin is tossed three times? **(10)**

(b) The heights of BUET students are assumed to be normal random variable. It is known that 15% of the students have heights under 65 inches and 10% exceed 73 inches. What percentage of students has heights between 60 and 74 inches? (Necessary chart 1 is attached). **(10)**

(c) 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

   (i) the entire system works.

   (ii) the component C does not work, given that the entire system works. Assume that the 4 components work independently. **(15)**
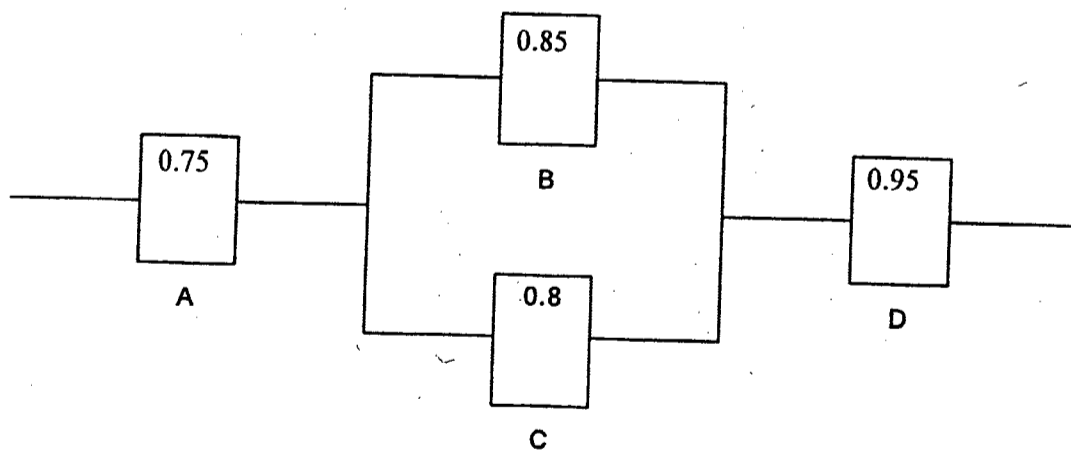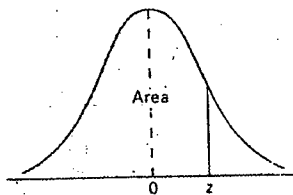

Figure for Q. No. 8(c)

Area

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	0.0017	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	0.0352	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	0.0722	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

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	0.9278	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

Chart 1 for Q. no. 8(b)

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA
L-1/T-2 · B. Sc. Engineering Examinations 2012-2013
Sub : **HUM 185** (English)

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 Q. No. 1 and any **TWO** from the rest.

1. (a) Explain with reference to the context <u>any one</u> of the following: **(8)**

   (i) "She danced with enthusiasm, with passion, in a kind of cloud of happiness that come of all this."

   (ii) "The sate is not God. It has not the right to take away what it cannot restore when it wants to."

   (b) Answer <u>any one</u> of the following: **(10)**

   (i) How is "The Diamond Necklace" a representation of a social reality?

   (ii) Make a character study of Odysseus.

   (c) Answer <u>any three</u> of the following: **(12)**

   (i) Why did the prisoner decide to renounce the bet wager and the world?

   (ii) How did Matilda and her husband suffer to repay the loan?

   (iii) "We were so moved that we all wept for happiness." Who were moved and why?

   (iv) Give a brief description of the party arranged by the banker.

   (v) How did Circe know that the man she was confronting was Odysseus?

2. Recast and correct <u>any ten</u> of the following sentences: **(20)**

   (i) I don't like to hear a fire whistle blow because they really upset me.

   (ii) He must of known the answer.

   (iii) She should have liked to have heard Caruso sing.

   (iv) I have no appetite at all to study.

   (v) He was absent one time or two times.

   (vi) We are sick of all this paper work.

   (vii) Johnson and me are the first in line.

   (viii) Erosion is where the soil is washed away.

   (ix) This is Mr. George, who serves as my assistant, and who handles all matters of Publicity.

   (x) The reason I am ill is because I ate too much.

   (xi) Mr. Hardy is a professional cashier.

   (xii) He suspicioned that something was amiss.

HUM 185(CE)

3. (a) Write down meaning of <u>any ten</u> of the following words: **(10)**

Anomalous, Brawl, Deride, Exasperate, Garrulous, Holocaust, Limpid, Mumble, Oration, Pilfering, Ramble, Tumult.

(b) Make sentences with <u>any ten</u> of the following words: **(10)**

Altruism, Bicker, Cataclysm, Demolish, Equitably, Fealty, Grouchy, Indictment, Meddle, Obstinate, Pauper, Retard.

4. (a) Write a précis of the following passage with a suitable title. **(20)**

In the age of globalization, collaboration and strategic alliances may be essential to success. Of course, there have traditionally been a number of ways to cooperate, including merger in which two companies form a legal union, or a joint venture where several companies pool resources to create a separate entity. However, a strategic alliance is much less involved than either a merger or a joint venture. Quite simply, a strategic alliance is a mutual agreement between two or more companies in order to work more effectively towards their goals. This usually involves a plan to share resources for mutual benefit. For example, one company may have financial resources and another company may have technical expertise. By combining these resources, both companies would increase profit. In some cases, one company may possess a brand name that would provide a marketing advantage to another company whose product is relatively unknown but has huge sales potential. In other cases, international strategic alliances open new markets abroad to companies that have a product but lack expertise in advertising for that market segment. As compared with other options for cooperation, the major advantage of strategic alliances is that they may be easily formed and easily dissolved, which makes them a perfect vehicle in a rapidly changing business environment. When a mutual goal has been attained, the alliance may no longer be beneficial, and unlike mergers or joint ventures, which have more long term implications, partners in an alliance can come together for short-term collaboration and then realign themselves with other strategic partners when the markets shift or new technologies require different strategies.

SECTION – B

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

5. Read the following passage carefully and answer the questions that follow: **(30)**

Great books do not spring from something accidental in the great men who wrote them. They are the affluence of their very core, the expression of the life itself of the authors. And literature cannot be said to have served its true purpose until it has been translated into the actual life of him who reads. It does not succeed until it becomes the

HUM 185(CE)

Contd ... Q. No. 5

vehicle of the vital. Progress is the gradual result of the unending battle between human reason and human instinct in which it forms slowly but surely wins. The most powerful engine in this battle is literature. It is the vast reservoir of true ideas and high emotions and life is constituted of ideas and emotions. In a world deprived of literature, the intellectual and emotional activity of all but a few exceptionally gifted men would quickly sink and react to a narrow tend to disappear for want of accessible storage. And life would be correspondingly degraded because the fallacious idea and the pretty emotion would never feel the upward pull of the ideas and emotions of genius. Only by conceiving a society without literature can it be clearly realized that the function of literature is to raise the plain towards the top level of the peaks? Literature exists so that where one man has lived finely, ten thousand may afterwards live finely. It is a means of life; it concerns the living essence.

Questions:

(i) How would you define literature, according to the passage?

(ii) What is the main idea of the passage?

(iii) How does the writer substantiate his view about literature?

(iv) What happens to a world deprived of literature?

(v) Write down the meaning of the following words: Reservoir, affluence, deprived, fallacious, accidental, conceive.

6. (a) Write a complaint letter to the General Manager of BTTB drawing his attention to the fact that you did not get telephone connection in due time despite completing necessary formalities. **(10)**

(b) Write phonetic transcription for the following words: (any five) **(10)**
Education, Short, school, think travel, local.

7. (a) Write a dialogue between two friends - one a believer, and other a disbeliever in ghost stories. **(10)**

(b) Write a short composition on any one of the following: **(10)**

(i) Compromise in life;

(ii) Students and social service;

(iii) Prospect of Civil Engineering in career fields.

8. (a) Transform the following sentences as directed: (any five) **(10)**

(i) He said that he was innocent. (Simple)

(ii) He confessed this crime (Complex)

(iii) The man died in the village where he was born. (Simple)

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Contd ... Q. No. 8(a)

     (iv) I have found the book that I had lost. (Compound)

     (v) He must work very hard to make up for the lost time. (Compound)

     (vi) Till my arrival, wait here. (Complex)

(b) Write short notes on <u>any two</u> of the following: **(10)**

     (i) Back Matter of a Formal Report.

     (ii) Diphthongs;

   (iii) Dos and don'ts in a written dialogue.

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2   B. Sc. Engineering Examinations 2012-2013

Sub : **EEE 165** (Basic Electrical Technology)

Full Marks : 210   Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) The current entering the positive terminal of a device is $i(t) = 10(1 - e^{-0.5t})$ A and the

   voltage across the device is $v(t) = 5\dfrac{di}{dt}$ V.   **(8)**

   (i) Calculate the power absorbed

   (ii) Determine the energy absorbed in 3s.

   (b) For the network in Fig. for Q. No. 1(b), find the current, voltage, and power
   associated with the 20 kΩ resistor.   **(12)**
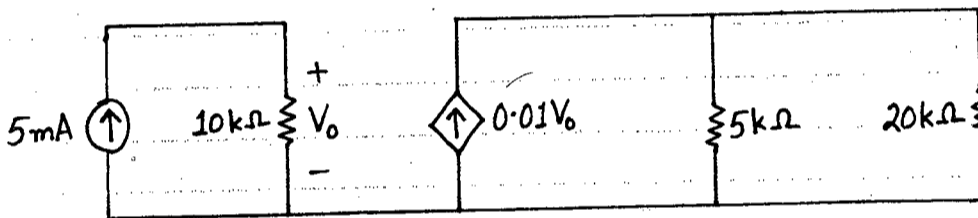
Fig. for Q. No. 1(b)

   (c) Determine R_{eq} and I_o in the circuit of Fig. for Q. No. 1(c).   **(15)**
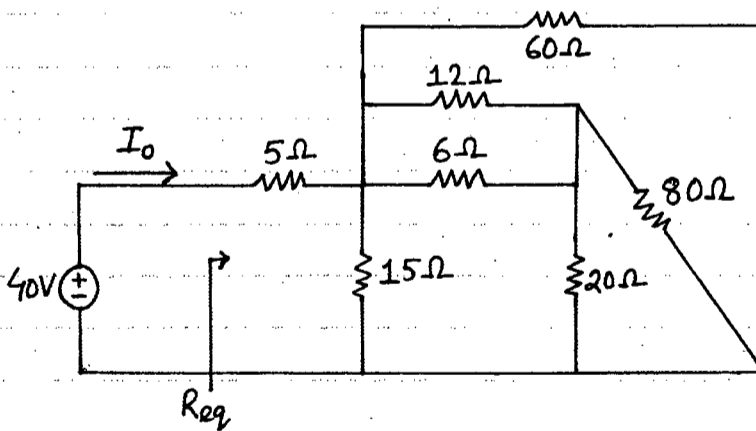
Fig. for Q. No. 1(c)

2. (a) Using mesh analysis, find v_0 and i_0 in the following circuit (Fig. for Q. No. 2(a)).   **(18)**
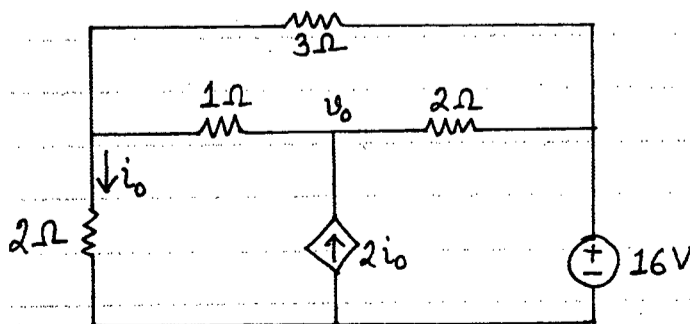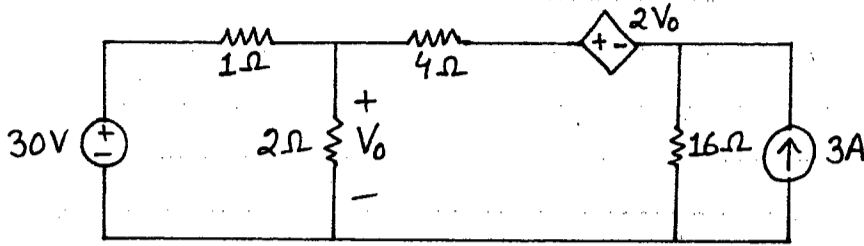

Fig. for Q. No. 2(a)

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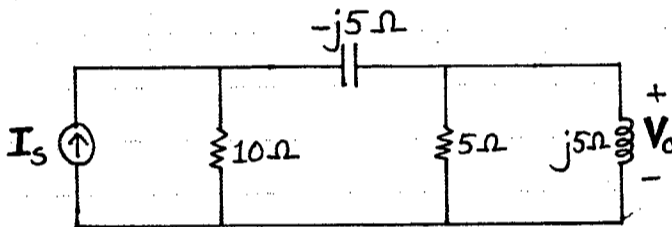(b) Use nodal analysis to find V_o in the following circuit (Fig. for Q. No. 2(b)). **(17)**

Fig. for Q. No. 2(b)

3. (a) A series RLC circuit has R = 80 Ω, L = 240 mH, and C = 5 mF. If the input voltage is

v(t) = 10 cos2t V, find the current flowing through the circuit. **(8)**

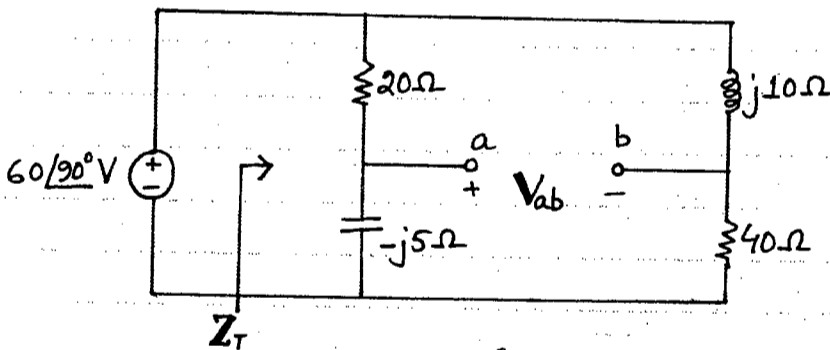(b) If $V_o = 20\angle45°$ V in the following circuit (Fig. for Q. No. 3(b), find I_s. **(13)**

Fig. for Q. No. 3(b)

(c) For the following circuit (Fig. for Q. No. 3(c), calculate Z_T and V_{ab}. **(14)**

Fig. for Q. No. 3(c)

4. (a) Find the impedance of an electrical circuit when P = 1500 W, Q = 2000 VAR

(inductive), I_{rms} = 12 A. **(8)**

(b) A load Z draws 12 kVA at a power factor of 0.856 lagging from a 120-V rms

sinusoidal source. Calculate: **(15)**

    (i) the average and reactive powers delivered to the load,

    (ii) the peak current, and

    (iii) the load impedance.

(c) A 240 V rms 60 Hz supply serves a load that is 10 kW (resistive), 15 kVAR

(capacitive) and 22 kVAR (inductive). Find the kVAR rating and capacitance required to

improve the power factor to 0.96 lagging. **(12)**

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SECTION – B

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

5. (a) The circuit in the Fig. for Q. No. 5(a) excited by a balanced three-phase source of positive sequence with a line voltage of 210 V. If Ze = 1 + 2 j Ω, Z_Δ = 24 – 30 j Ω and Z_Y = 12 + 5 j Ω, determine the magnitude of the line currents of the combined load. Also, determine the power factor of the source and the total complex power absorbed by the load. **(18)**
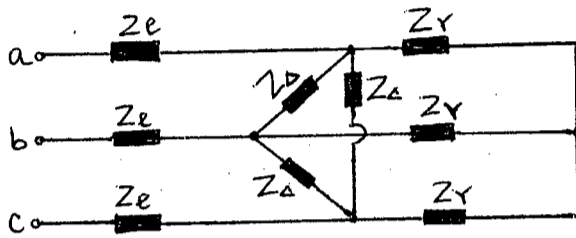

Fig. for Q. No. 5 (a)

(b) Write some reasons for which you are required to learn three phase systems. If you are including in your answer that three phase system is more economical than single-phase system for power transmission, justify that statement mathematically. **(17)**

6. (a) Data from short circuit and open circuit tests of a 25-kVA, 6900-230 V, 60 Hz transformer are:

Open Circuit test (Low Side Data)	Short Circuit test (High Side Data)
V_{OC} = 230 V	V_{SC} = 513 V
I_{OC} = 5.4 A	I_{SC} = 3.6 A
P_{OC} = 260 W	P_{SC} = 465 W

Determine-

the equivalent high side parameters of the transformer and draw the appropriate equivalent circuit. **(15)**

(b) The equivalent low-side parameters of a 250 kVA, 4160-480 V, 60 Hz, transformer are $R_{eq,LS}$ = 0.0092 Ω and $X_{eq,LS}$ = 0.0433 Ω. The transformer is operating in step down mode and delivering 75% of its rated current at rated voltage with 0.84 power factor lagging. Determine - (a) the no-load voltage, (b) the voltage regulation. **(15)**

(c) In the open circuit test, generally which side of a transformer is kept open and why? **(5)**

7. (a) For an Induction Motor, prove that

P_{conv} = (1– S) P_{AG}

where the symbols bear their usual meaning. **(10)**

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(b) A 440 V, 50 Hz, two pole, Y-connected induction motor is rated at 75 kW. The equivalent circuit parameters are **(18)**

$R_1 = 0.075 \, \Omega$ $R_2 = 0.065 \, \Omega$ $X_M = 7.2 \, \Omega$

$X_1 = 0.17 \, \Omega$ $X_2 = 0.17 \, \Omega$

$P_{F\&W} = 1.0 \, kW$ $P_{misc} = 150W$ $P_{core} = 1.1 \, kW$

For a slip of 4% , find:

(i) the line current, I_L

(ii) the stator copper losses

(iii) the air gap power

(iv) the power converted from electrical to mechanical power, P_{conv}

(v) the induced torque

(vi) the load torque

(c) Draw the equivalent circuit of an induction motor, where the effect of mechanical load is separated from the electrical resistance which causes the rotor copper loss. **(7)**

8. (a) For a balanced Y-Δ connection, obtain the expression for line currents and phase currents. Assume 'bca' sequence. Also, draw the phasor diagram depicting the relationship between per phase and line currents. **(18)**

(b) A 75 kVA, 4800-240 V, 60 Hz single phase transformer has the following parameters:

$R_{LS} = 0.006 \, \Omega$ $R_{HS} = 2.488 \, \Omega$ $R_{fe,HS} = 44,202 \, \Omega$

$X_{LS} = 0.0121 \, \Omega$ $X_{HS} = 4.8384 \, \Omega$ $X_{M,HS} = 7798.6 \, \Omega$

It is operating in step down mode, delivering rated load at 0.96 pf lagging. Determine - **(17)**

(i) equivalent impedance referred to low side

(ii) the input impedance when the load is disconnected

(iii) the actual input voltage of high side when load is connected.

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA
L-1/T-2   B. Sc. Engineering Examinations 2012-2013
Sub : **CE 103** (Surveying)
Full Marks : 280   Time : 3 Hours
The figures in the margin indicate full marks.
USE SEPARATE SCRIPTS FOR EACH SECTION

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

1. (a) Classify surveying based on instrument used? Write down the sources of errors in surveying.   (4+3=7)

    (b) List the obstacles in chain surveying. Describe the procedure to overcome an obstacle to ranging if both ends of the line are not visible from intermediate paint.   (3+8=11)

    (c) A surveying line BAC crosses a river. A and C being on the near and distant banks respectively. Standing at D, a point 50 meters measured perpendicularly to AB. From A, the bearings of C and B are 320° and 230°, respectively. Find the width of the river if AB = 25 m. Draw necessary diagram.   ($8\frac{2}{3}$)

    (d) Compare between 'mistake' and 'compensating error' in case of chain survey. How can you correct a chain for 'sag'?   (6+6=12)

    (e) For what type of project(s) 'tacheometry' is suitable? Write down the principle sources of errors in 'Stadia tacheometry'.   (4+4=8)

2. (a) Define the following terms: (3×4=12)

    (i) Forward bearing, (ii) Backward bearing, (iii) Closing error, (iv) Local attraction.

    (b) Describe a method for detecting local attraction. Assume the magnetic bearing of a line AB read in the year 1890 was N26°15' E. The declination at that time in the place was 6°15' east. In the year 2012, the declination at the place was 2°15' west. Determine the magnetic bearing in 2012.   (4+9=13)

    (c) Differentiate between 'levelling' and 'contouring'.   (6)

    (d) During a traverse survey, following observations were made. Find out the missing lengths. Plot the traverse in a plain graph paper.   ($15\frac{2}{3}$)

Side	Length(m)	Bearing
AB	?	N33°45' E
BC	300	N86°23' E
CD	?	169°23'
DE	450	S63°54' W
EA	268	N42°30' W

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3. (a) Differentiate between 'traverse surveying' and 'chain surveying'. **(6)**

(b) Compare between 'trigonometric levelling' and 'spirit levelling'. Write down the sources of natural and personal errors in levelling. **(8+5=13)**

(c) The following data are taken form a level book. Some of the data are missing in the level book. Calculate the missing data and reduced level of all stations. Apply usual checks and draw necessary diagram. **(18⅔)**

Station	Staff reading (m)			Rise (m)	Fall (m)	R.L. (m)	Remarks
	Back	Inter	Fore				
A	?						
B		2.1			0.6	13.5	B.M.
C	3.3		1.3	?			T.P.
D		?			3.0		
E	?		6.0	?			T.P.
F	3.6		3.5	0.9			T.P.
G			?	0.3			

Note: R.L. = Reduced level, T.P. = Turning point/change point and B.M. = Bench Mark.

(d) Draw typical contour diagram of the followings: **(2+3+4=9)**

(i) Hill, (ii) Overhanging Cliff, (iii) Saddle

4. (a) Write down the purposes of aerial photogrammetry. Explain 'navigation in correct course', 'drift' and 'crab' in case of photogrammetry. **(5+9=14)**

(b) Describe the principle of terrestrial photogrammetry. List the factors to be considered in selecting camera stations during the reconnaissance of terrestrial photogrammetry. **(3+5⅔=8⅔)**

(c) List the characteristics of contour. Compare between 'Grid Method' and 'Tacheometric Method' of contouring. **(5+4=9)**

(d) The following readings were taken in a tacheometric survey with an anallactic telescope. The staff was held vertically at all times. **(15)**

Instrument station	Staff Station	Whole Circle Bearing	Vertical angle	Stadia Readings
	A	32°	0	3.3, 4.02, 4.74
P	B	12°	2°	3.2, 4.7, 6.2
	C	102°	−5°	2.3, 4.8, 7.3

Given : R.L. of A = 20 ft

R.L. of B = 30 ft

Determine the followings :

(i) Tacheometric constants

(ii) R.L. of C

(iii) Horizontal distance BC

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SECTION – B

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

5. (a) On a proposed highway two straight roads intersect at chainage 900 m with a total deflection angle of 40°. Design speed is 90 km/h. Design the alignment of highway so that only circular curve will be used and radius of curvature of circular curve is 900 m. Calculate apex distance, chainage of point of curve and point of tangent and total length of curve. Given that road width is 12 m, maximum rate of super-elevation is 0.06 and maximum side friction coefficient is 0.12. Check the safety of vehicle at zero speed and at speed 150 km/h. Check the safety of vehicle at 150 km/h if e = 0.   (26⅔)

(b) Write down names of some modern tools for surveying. Explain some uses of remote sensing and GIS in surveying.   (10)

(c) What are the elements of GPS? Describe function of each element of GPS.   (10)

6. (a) An equal tangent sag vertical curve has initial and final slope of 1/10. The rate of vertical curvature is 45. Chainage and elevation of PVI is 1500 m and +30.000 m respectively. Calculate the elevations at chainage 1100 m, 1300 m, 1400 m, 1600 m, 1700 m and 2000 m.   (26⅔)

(b) Explain the basic principle of plane table survey. What are instruments used in plane table survey.   (10)

(c) Why is transition curve necessary between a straight road and circular curved road?   (10)

7. (a) A tower is located on a hilltop at T. Angular readings are taken with a theodolite from two instrument station A and B, which are 40 m apart. Given that the following data, determine the R.L. of hilltop at T and the tower height. Height of instrument at A = 10 m. Vertical angle readings from A to the top and bottom of the tower at T is 35° and 28° (upward) respectively. Whole circle bearing of line AT, AB and BT is 25°, 110°and 5° respectively.   (18)

(b) Determine the volume of earthwork for a 100 m long embankment with two level cross-section shown in Figure 1. Use trapezoidal rule first and then apply prismoidal correction. The center line data is given below: (18)

Chainage (m)	0	50	100
Ground level (m)	8.4	9.1	8.2
Formation level (m)	12.0	12.0	12.0

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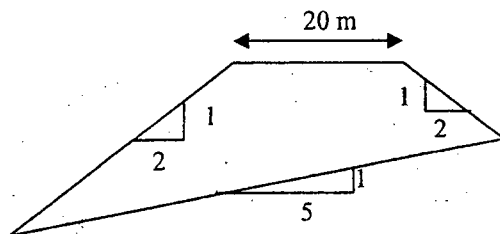### Contd ... Q. No. 7 (b)

Figure 1: Cross-section of embankment [Question no. 4(b)]

Given that:
$$A = \frac{r^2 bh + s(0.5b)^2 + r^2 sh^2}{r^2 - s^2}$$
$$C_p = \frac{Lr^2 s(h_1 - h_2)^2}{6(r^2 - s^2)}$$

(c) What do you mean by curvature correction for volume computation? How would you apply curvature correction for curved embankment with two end cross-section with areas A_1 and A_2 at a distance L apart (along centerline).   (10⅔)

8. (a) Distinguish between (i) Azimuth and whole circle bearing and (iii) Hour Angle and Right Ascension.   (16)

(b) Explain why it is so hot in the month of June in Dhaka (90°E, 23.5°N). Draw diagram in support of your explanation.   (8⅔)

(c) The altitude of the lower limb of the sun near Dhaka (90°E, 23.5°N) is measured to be 68°14'. The Nautical Almanac gives the following information. (i) Apply necessary astronomical correction and determine the corrected altitude. (ii) Determine the Azimuth of the sun.   (22)

Given that:

declination of sun = 2°4'30"N increasing at a rate of 1'/hr, semi-diameter of sun = 16', horizontal parallax of sun = 8.8" and $cosa = cosb\ cosc + sinb\ sinc\ cosA$

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2   B. Sc. Engineering Examinations 2012-2013

Sub : **PHY 151** (Structure of Matters, Electricity and Magnetism and Modern Physics)

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) Why did Michelson and Morley intend to show the existence of the hypothetical medium "Ether"? **(10)**

    (b) Describe the Michelson and Morley experiment. What are the consequences of this experiment? **(20)**

    (c) In the Michelson and Morley experiment, the wavelength of a monochromatic light used is 800 nm. What will be the expected fringe shift on the basis of stationary ether hypothesis if the effective length of each path be 15 m? (Speed of light = 3×10^8 m/s and speed of the earth = 3×10^4 m/s. **(5)**

2. (a) Discuss the phenomena photoelectric effect, Compton effect and pair production. **(10)**

    (b) Explain the different experimental observations of photoelectric effect on the basis of quantum theory and hence obtain the Einstein's photoelectric equation. **(20)**

    (c) Light of wavelength 450 nm is incident on (i) a nickel surface of work function 5.0 eV and (ii) a potassium surface of work function 2.3 eV. Calculate, if electrons are ejected, and if so, the maximum velocity of the ejected electrons in each case - (1 eV = 1.6×10^{-19} J, h = 6.63×10^{-34} J-s and c = 3×10^8 m/s) **(5)**

3. (a) Explain the considerations that led de Broglie to postulate matter waves and hence obtain an expression for such waves. **(15)**

    (b) Discuss the Bohr atom model from matter wave concept. **(15)**

    (c) Find the de Broglie wavelength of the 40 keV electrons used in a certain electron microscope. (h = 6.63×10^{-34} J - s and Electron rest mass = 9.1×10^{-31} Kg). **(5)**

4. (a) Briefly discuss various types of primary bonds in solids. **(11)**

    (b) Draw a typical unit cell of NaCl crystal. Show that for NaCl crystal the lattice energy is given by **(20)**

$$V = -\frac{\alpha e^2}{4\pi\varepsilon_o r_o}\left(1 - \frac{1}{n}\right)$$

where the symbols have their usual meanings.

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Contd ... Q. No. 4

(c) The covalent bond energy between two carbon atoms is 370×10^3 J/mole. What wavelength of light is required to break C - C bond? **(4)**

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

5. (a) Define coordination number. What are the co-ordination numbers of (i) Simple cubic, (ii) body centered cubic and (iii) face centered cubic crystals? Explain with the help of neat sketches. **(12)**

(b) What do you mean by defects in crystal? Briefly discuss various types of point defects in solids. **(10)**

(c) Assuming the atoms are hard spheres, show that for simple cubic, body centered cubic and face centered cubic crystal structures the lattice constants are related to the radius of the atoms, r, by the relation. **(13)**

(i) $a_{sc} = 2r$ (for simple cubic)

(ii) $a_{bcc} = \dfrac{4r}{\sqrt{3}}$ (for body centered cubic)

(iii) $a_{fcc} = \dfrac{4r}{\sqrt{2}}$ (for face centered cubic)

6. (a) Explain space lattice and basis of a crystal. **(6)**

(b) What is a unit cell? What do you understand by the lattice parameters of a unit cell? Write down the lattice parameters for cubic, orthorhombic and hexagonal crystal system with their lattice types. Draw unit cells of each lattice types. **(19)**

(c) What are the Miller indices? Show that the Miller indices and interplaner distance are related for a cubic crystal system by **(10)**

$$\frac{1}{d^2} = \frac{1}{a^2}\left(h^2 + k^2 + l^2\right),$$

where the symbols have their usual meanings.

7. (a) Assume a conducting sphere of radius 'R' having charge 'Q' in it. Using Gauss's law of electrostatics obtain expressions for electric field '$\vec{E}$' at a distance r from the centre of that conducting sphere for following cases: **(15)**

(i) outside ($r > R$),

(ii) inside ($r < R$) and

(iii) surface ($r = R$) of the sphere.

Draw schematically $E(r)$ as function of r.

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Contd ... Q. No. 7

(b) Find electric potential at

   (i) outside ($r>R$)

   (ii) surface ($r=R$) and

   (iii) inside ($r<R$) of the sphere.

   for the conducting sphere of Q 7(a) draw schematically $V(r)$ as function of r. **(15)**

(c) What is the capacitance 'C' of the sphere of Q 7(a)? **(5)**

8. (a) Write down the mathematical statement of Gauss's law of magnetism and Faraday's law of electromagnetic induction. What is the physical significance of these equations? **(8)**

(b) A cylindrical conducting wire of radius 'R' carries current 'I' distributed uniformly across the cross-section. Using Ampere's law calculate the magnetic field '$\vec{B}$' at a distance 'r' from the center of the wire for following cases: **(17)**

   (i) outside ($r>R$),

   (ii) inside ($r<R$) and

   (iii) surface ($r=R$) of the wire.

Draw schematically $B(r)$ as function of r.

(c) A close conducting loop is caused to move with uniform velocity with respect to a uniform magnetic field. Obtain an expression for the emf induced in the loop. **(10)**