

The figures in the margin indicate full marks.

Assume reasonable value for any missing data. Symbols have their usual meanings.

USE SEPARATE SCRIPTS FOR EACH SECTION

**SECTION – A**

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

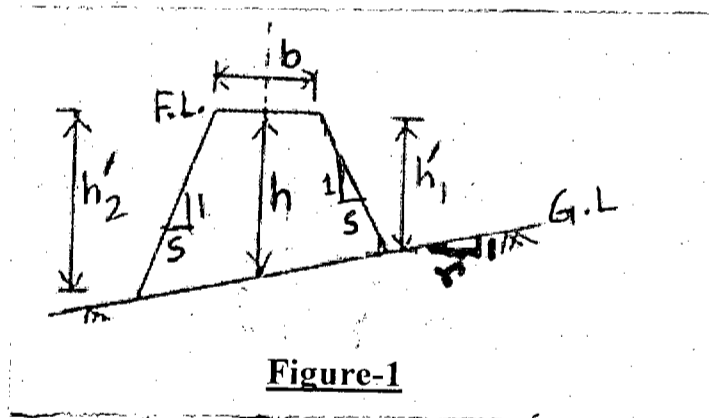
1. (a) Define 'Orientation' of Plane Table and discuss how it is achieved in the field. (2 $\frac{2}{3}$ +5)
- (b) Discuss the advantages and disadvantages of Plane Table Surveying. Make a comparison between Radiation Method and Intersection Method of Plane Table Surveying. (8+6)
- (c) What are the important considerations in selecting the stations for Chain-Survey? Distinguish between – (i) Check Line and Tie Line; (ii) Scale of a Map and Representative Fraction (RF). (6+6)
- (d) Write short notes on 'Record Keeping' in Chain Survey. First half of an Engineer's chain measures 48.50 feet while the second half of that particular chain measures 51.00 feet. A certain distance from point 'A' to 'B' has been measured by this defective chain and found to be 2860.40 feet. What is the exact distance between those two points? (5+8)
2. (a) Write short notes on Independent Equatorial System. With the help of a schematic diagram, prove that Altitude of Pole ( $\alpha_p$ ) = Latitude of Observer's position ( $\theta$ ). (7 $\frac{2}{3}$ +6)
- (b) Write short notes on Crab and Drift with proper illustrations. Define Parallax and derive the Parallax equation for elevation of a point in aerial photogrammetry. (8+2+6)
- (c) An area is 18 miles long and 14 miles wide. It is to be photographed with a lens having 10 inch focal length for the purpose of compiling a topographic map. The photograph size is 8 inch by 8 inch. The average scale is to be 1 : 7500 effective at an average elevation of 600 ft above sea level. The overlaps of the images are to be at least 65%. If speed of aircraft is 180 mph, determine the **flying height. Exposure interval rounded to integral number of seconds and number of photographs per flight line.** (12)
- (d) Define Photogrammetry. State the perspective principles of vertical photographs. (2+3)
3. (a) Define the following terms of Astronomical Surveying (i) Celestial Sphere, (ii) Right Ascension, (iii) Azimuth and (iv) Sidereal Time (16)
- (b) For a particular location on earth,  $\phi = 50^{\circ}25'$  E. Equaiton of time at G.M.N. is 4 m 2.50s and increasing at a rate of 0.28 s/h. Determine Local Apparent Time (L.A.T) if L.M.T. = 15h25m30s. (10)

**CE 103**

**Contd ... Q. No. 3**

- (c) Draw neat sketch showing the Declination ( $\delta$ ) of a star and the Latitude ( $\theta$ ) of the place. Now prove that for the star to be a circumpolar star, Declination ( $\delta$ ) should be greater than co-latitude ( $90^\circ - \theta$ ) of that place. (10 $\frac{2}{3}$ )
- (d) Write short notes on Curvature Correction in calculating volume of Earthwork for construction of a road embankment. (10)
4. (a) Write short notes on Apparent Solar Time and Equation of Time. (5+3)
- (b) Classify Photogrammetry and state the purposes of Photogrammetry. What do you mean by quasi-static photograph and tilted photograph? (2+4+6)
- (c) Make a list of various methods of measuring a linear distance directly. With the help of required illustrations, briefly mention how – (i) a perpendicular from a point on the chain line can be drawn, (ii) chaining can be done across a large obstacle when vision is not obstructed. (3 $\frac{2}{3}$ +8)
- (d) What are the basic assumptions in computing the volume using cross-sections? Show that for the cross section of a two-level section shown in figure-1, area is computed by the following formula. (4+11)

$$\text{Area} = \left[ \frac{r^2bh + s(0.5b)^2 + r^2sh^2}{r^2 - s^2} \right]$$



**Figure-1**

**SECTION - B**

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

5. (a) List the factors influencing the location and configuration of alignment of a horizontal curve. (8)
- (b) Write down the functions of a transition curve with neat sketches. (6 $\frac{2}{3}$ )
- (c) Derive the equation of an ideal transition curve and hence prove that spiral angle,  

$$\Delta_s = \frac{L}{2R}$$
 (7+7=14)

**CE 103**

**Contd ... Q. No. 5**

(d) A parabolic vertical curve is to be set out connecting two uniform grades of +1.5% and -3.5%. The chainage and reduced level of point of vertical curve (pvc) are 1670 metres and 30 metres respectively. The rate of vertical curvature, k is 39. Calculate the chainage and reduced levels of PVI, PVT and midpoint of the curve. (18)

Note: k is the length of curve per percent algebraic difference in intersecting grades.

6. (a) What do you understand by GPS? Briefly describe how the exact position of a GPS receiver is computed? (4+8=12)

(b) Classify remote sensing. State five civil engineering applications of "Remote Sensing." (4+5=9)

(c) Briefly describe a method to obtain the constants of tacheometer in the field. (10)

(d) A tacheometer was set up at a station 'A' and the readings on a vertically held staff at 'B' were 2.255, 2.605 and 2.955, the line of sight being at an inclination of +8°24'. Another observation on a vertically held staff at B.M. gave the readings 1.640, 1.920, 2.200, the inclination of line of sight being +1°6'. Calculate the horizontal distance between A and B, and the elevation of 'B' if the R.L. of B.M. is 418.685 metres. The constants of instruments were 100 and 0.3. (15 2/3)

7. (a) Define magnetic declination. List the factors upon which the diurnal variation depends. (3+2=5)

(b) Briefly describe a method for determining local attraction. Assume the magnetic bearing of a line AB in the year 1890 was N26°15'E. The declination at that time in the place was 6°15' east. In the year 2015, the declination at that place was 2°30' west. Determine the magnetic bearing in 2015. (4+7=11)

(c) Compare between the followings: (5×3=15)

- (i) Traverse surveying and levelling
- (ii) Direct Levelling and Indirect levelling
- (iii) Techeometric method of contouring and cross sectional method of contouring.

(d) The following lengths and bearings were recorded in running a traverse ABCDE. The length and bearing of EA was omitted. Sketch the traverse and calculate the length and bearing of line EA. (15 2/3)

Line	Length (m)	Bearing
AB	217.5	120°15'
BC	318.0	62°30'
CD	375.0	322°24'
DE	283.5	335°18'
EA	?	?

**CE 103**

8. (a) Briefly describe differential levelling. Describe with neat sketch how to overcome the difficulties in taking level of an overhead point. **(3+4=7)**
- (b) Describe the effect of curvature and refraction on levelling. Derive the formula for determining the effect of curvature in levelling. **(5+5=10)**
- (c) Draw typical contour map of the followings **(3+5+5=13)**  
 (i) Pond, (ii) Overhanging Cliff, (iii) River
- (d) The following is a page of a level book, where some readings were missing. Calculate the missing data (indicated by '?') and the reduced levels of all the stations. Apply usual checks. **(16 $\frac{2}{3}$ )**

Station	Staff Reading			Rise	Fall	R.L.	Remarks
	Back	Inter	Fore				
1	3.250					249.260	B.M.
2	1.755		?		0.750		T.P.
3		1.950					
4	?		1.920				T.P.
5		2.340		1.500			
6		?		1.000			
7	1.850		2.185				T.P.
8		1.575					
9		?					
10	?		1.895	1.650			T.P.
11			1.350	0.750			

Note: R. L. = Reduced level, B.M. = Bench Mark, T.P. = Turning Point.

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BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2 B. Sc. Engineering Examinations 2015-2016

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)  $\frac{dy}{dx} = \sec(x+y)$  (12)

(b)  $(2\sqrt{xy} - x)dy + ydx = 0$  (11)

(c)  $\frac{dy}{dx} + \frac{y}{x} \log y = \frac{y}{x^2} (\log y)^2$ . (12)

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

$(2xy^4e^y + 2xy^3 + y)dx + (x^2y^4e^y - x^2y^2 - 3x)dy = 0$  and solve it. (12)

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

$\frac{d^2y}{dx^2} + y = \operatorname{cosec} x$  (11)

(c) If the population of a country doubles in 50 years, in how many years will it treble under the assumption that the rate of increase is proportional to the number of inhabitants? (12)

3. Solve the following differential equations:

(a)  $(D^2 - 2D + 1)y = xe^x \sin x$  (11)

(b)  $(1+x)^2 \frac{d^2y}{dx^2} + (1+x) \frac{dy}{dx} + y = 4 \cos \log(1+x)$  (12)

(c)  $y^2 p - xyq = x(z - 2y)$  (12)

4. (a) Solve:  $x(y^2 + z)p - y(x^2 + z)q = z(x^2 - y^2)$  (11)

(b) Find the equation of the integral surface of the differential equation

$(x-y)p + (y-x-z)q = z$  which passes through the circle  $z = 1, x^2 + y^2 = 1$ . (12)

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

**MATH 139(CE)**

**SECTION – B**

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

5. Solve the following:

(a)  $(D_x^2 - D_x D_y - 2D_y^2)z = (y-1)e^x$  (10)

(b)  $(x^2 D_x^2 - xy D_x D_y - 2y^2 D_y^2 + x D_x - 2y D_y)z = \log\left(\frac{y}{x}\right) - \frac{1}{2}$  (12)

(c)  $(D_x^2 - D_y^2 + D_x + 3D_y - 2)z = e^{x-y} - x^2 y$  (13)

6. (a) The following distribution is with regard to weight in grams of mangoes of a given variety. If mangoes of weight less than 443 grams be considered unsuitable for foreign market, what is the percentage of total yield suitable for it? How many mangoes will be more than 443 grams? Assume the given frequency distribution to be typical of the variety? (15)

Weight in grams.	No. of mangoes	Weight in grams.	No. of mangoes
410-419	10	450-459	45
420-429	20	460-469	18
430-439	42	470-479	7
440-449	54		

(b) Measure the Skewness and Kurtosis and hence comment on the shape of the distribution given in question no. 6(a). (10)

(c) Calculate first 4 raw moments and central moments for of the distribution given in question no. 6(a). (10)

7. (a) Derive the mean and variance of the frequency function for the Poisson distribution. (10)

(b) 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 20 trucks tested, find the probability using (both binomial and Poisson distribution) that (15)

- (i) from 3 to 7 have blowouts;
- (ii) fewer than 4 have blowouts;
- (iii) more than 6 have blowouts.

(c) A lot containing 8 components is sampled by a quality inspector; the lot contains 5 good components and 4 defective components. A sample of 4 is taken by the inspector. Find the expected value of the number of good components in this sample. (10)

8. (a) The IQ's of 10 year olds is assumed to be normal random variable. It is known that 12% of the children have IQ's under 90 and 28% exceed 135, what percentage of children have IQ's between 115 and 130? (Necessary chart 1 is attached). (15)

**MATH 139(CE)**

**Contd ... Q. No. 8**

(b) The mean weekly sale of the KAT bars in candy stores was 159.7 bars per store. After an advertising campaign, the mean weekly sale in 26 stores for a typical week increased to 179.4 and showed a standard deviation of 29.7. Was the advertising successful? Use a 5% level of significance. (Necessary chart 2 is attached).

**(10)**

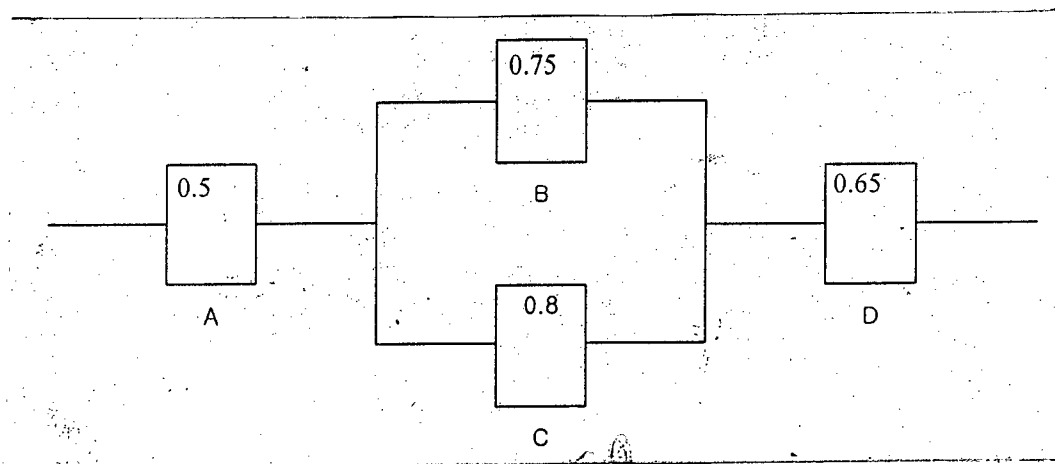
(c) An electrical system consists of 4 components as shown in the following figure. The system works if the components A and D work and either of the components B or C work. The reliability (the probability of working) of each component is also shown in the following figure. Find the probability that

**(10)**

(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.



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= 4 =

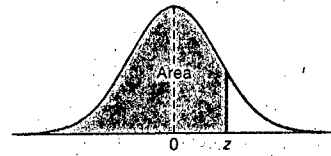


Table A.3 Areas under the Normal Curve

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. no 8(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



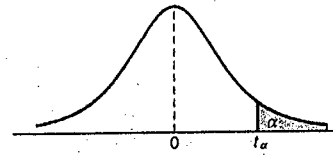


Table A.4 Critical Values of the *t*-Distribution

<i>v</i>	$\alpha$						
	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
$\infty$	0.253	0.524	0.842	1.036	1.282	1.645	1.960

Chart 2 for a no 8(b)

*[Handwritten signature]*

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

<i>v</i>	$\alpha$						
	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
$\infty$	2.054	2.170	2.326	2.432	2.576	2.807	3.290

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2 B. Sc. Engineering Examinations 2015-2016

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 any one of the following: (8)
- (i) He turned a little pale, for he had saved just this sum.
- (ii) “But we can’t possibly have a garden party with a man dead just outside the front gate.”
- (b) Answer any one of the following questions: (10)
- (i) Comment on the portrayal of women in the story “The Diamond Necklace”.
- (ii) How would you look at life after reading the story “The Bet”?
- (c) Answer any three of the following: (12)
- (i) Write a short note on the imagery used in the story “The Garden Party”.
- (ii) Why did the banker intend to kill the lawyer captivated in his garden lodge?
- (iii) What didactic message can you derive from the story “The Diamond Necklace”?
- (iv) What social dichotomy do you find in the story “The Garden Party”?
- (v) “Perception of life changes from time to time” – Explain it with examples from “The Bet”.
2. Recast and correct any ten of the following sentences: (20)
- (i) This is the kind of a day that makes Aman lazy.
- (ii) Samir will try and skate on the street.
- (iii) They spoke with Dr. Shamsur Rahman, M. D.
- (iv) The girl ate pizza, pastry, and also ice cream.
- (v) If you convey this message back to your company, we shall obtain a solution to our problem.
- (vi) When the private detective and the guard were finally alone, they spoke to each other in a relaxed manner.
- (vii) The child talked, stood, and recognized the neighbour before he was one year old.
- (viii) Shanu likes to cook, reading novels, and watching films.
- (ix) The widow woman was seeking a job.
- (x) The new dish in the Thai restaurant tasted extra good.
- (xi) The actors are going to repeat the performance again.
- (xii) A box of eggs are on the dining table.

**HUM 185(CE)**

3. Give the meanings of and make sentences with any ten of the following words: (20)

Brush up on, call on, wrath, vanity, transcend, thrifty, spill, subsequent, resolute, reconcile, probe, tumult, freak.

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

There are some people who actually enjoy work- in fact, they love to work. These workaholics people are almost addicted to their jobs. The lives of workaholics are usually stressful, and this tension and worry can cause some health and family problems. But workaholism is not always dangerous. Some studies show that many workaholics have great energy and interest in life. Their work is so pleasurable that they are actually very happy. For most workaholics, work and entertainment are the same thing. Their jobs provide them with a challenge: this keeps them busy and creative. Other people retire from work at age sixty-five, but workaholics usually prefer not to quit. They are still enthusiastic about work – and life – in their eighties and nineties. Why do workaholics enjoy their jobs so much? There are several advantages to work. It provides people with pay-checks, of course, and this is important. But it offers more than financial security. It provides people with self-confidence; they have a feeling of satisfaction when they've produced a challenging piece of work and are able to say, "I made That". Psychologists claim that work gives people an identity: Through participation in work, they get a sense of self and individualism. In addition, most jobs provide people with a socially acceptable way to meet others. Perhaps some people are compulsive about their work, but their addiction seems to be a safe - even an advantageous – one.

**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)

Some cities have made history by being destroyed. Aleppo, once Syria's largest metropolis, will soon join their ranks. Its 1000-year-old Muslim heritage has turned to dust; Russian aircraft have targeted its hospitals and schools; its citizens have been shelled, bombed, starved and gassed. Nobody knows how many of the tens of thousands who remain in the last Sunni Arab enclave will die crammed inside the ruins where they are sheltering. But even if they receive the safe passage they have been promised, their four-year ordeal in Aleppo has blown apart the principles that innocent people should be spared the worst ravages of war. Instead, a nasty, brutish reality has taken hold and it threatens a more dangerous and unstable world.

## HUM 185(CE)

### Contd ... Q. No. 1

To gauge the depth of Aleppo's tragedy, remember that the first protest against Syria's president, Bashar at-Assad, in 2011 saw Sunnis marching cheerfully along-side Shias, Christians and Kurds. From the start, with extensive help from Iran, Mr. Assad set out to destroy the scope for peaceful resistance by using violence to radicalise his people. Early on, his claim that all rebels were terrorists was outrageous. Today some are. There were turning-points when the West might have stepped in by establishing a no-fly zone, say; or a haven where civilians could shelter; or even a full-scale programme of arming the rebels. But paralyzed by the legacy of Iraq and Afghanistan, the West held back. As the fighting became entrenched, the need to intervene grew, month by bloody month. But the risk and complexity of intervening grew faster. As Mr. Assad was about to topple, Russia joined the fray, acting without conscience and to devastating effect. Aleppo's fall is proof that Mr. Assad has prevailed and of Iran's influence. But the real victory belongs to Russia, which once again counts in the Middle East.

Likewise, the defeat is not just a blow to Mr. Assad's opponents, but also to the Western conviction that, in foreign policy, values matter as well as interests. After the genocide in Rwanda in 1994, when Tutsis were slaughtered as the world turned its back, countries recognized that they have a duty to constrain brute force. When members of the UN accepted responsibility to protect the victims of war crimes, wherever they are, conventions against the use of chemical weapons and the reckless killing of civilians took on a new relevance. The desire to promote freedom and democracy was not far behind.

Questions:

- (i) How is Aleppo going to make history?
  - (ii) Does the writer blame President Assad for Aleppo tragedy? Why?
  - (iii) Why, according to the writer, are the two countries-Iran and Russia- to be blamed for Aleppo tragedy?
  - (iv) Why does the writer say that the West might have intervened in the Syrian crisis?
  - (v) What is the writer's attitude towards war? Explain in 2/3 sentences.
6. (a) Write a letter to a firm complaining against the supply of defective goods. (10)
- (b) Write phonetic transcription of the following words (any five): (10)  
Amateur; Awkward; Extempore; Façade; Invitation; Sagacious; Monetary.
7. (a) Write a dialogue between two friends on brain drain. (10)
- (b) Write a short composition on any one of the following: (10)  
(i) Facebook mania (ii) Unplanned globalization. (iii) Entrepreneurship

**HUM 185(CE)**

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

- (i) Though the company runs up huge debts, it will not go bankrupt. (Simple)
- (ii) Surprised and shaken by Donald Trump's victory, America's allies are hoping for the best (Compound)
- (iii) As soon as I went out in the street the rain began to fall fast. (Negative without changing the meaning)
- (iv) Many students could not understand the questions properly, so they beat about the bush. (Complex)
- (v) The prospect of a bit more money was welcomed by health and social workers.
- (vi) If Mr. Trump fails to strike his bargain with Russia, the two countries could rapidly fall out. (Simple)

(b) Write short notes on any two of the following: **(10)**

- (i) Intonation (ii) Structure of a report (iii) Importance of learning the IPA.
-

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2 B. Sc. Engineering Examinations 2015-2016

Sub : **PHY 151** (Electricity and Magnetism, Structure of Matter 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) What do you mean by electric flux? (4)
- (b) State and explain Gauss's law in electrostatics. (5)
- (c) What is a Gaussian surface? Find an expression for the electric field  $E$  at a distance 'r' from an infinitely long rod, the charge per unit length  $\lambda$  C/m being constant for all points on the rod. (18)
- (d) A uniformly charged conducting sphere of 2.4 m diameter has a surface charge density of  $80 \mu\text{C}/\text{m}^2$ . (i) Find the charge on the sphere. (ii) What is the total electric flux leaving the surface of the sphere? (8)
2. (a) Define current density. Prove that the current flowing in a conductor is proportional to drift velocity of free electrons. (10)
- (b) If a straight metal wire of length 'l' carrying a current 'i' is placed at right angles to a uniform magnetic field  $\vec{B}$  show that the deflecting force on it is given by  $\vec{F} = i\vec{l} \times \vec{B}$ . (17)
- (c) A silver wire 1 mm in diameter carries a charge of 90 C in 1 hour and 15 minutes. Silver contains  $5.8 \times 10^{28}$  free electron per  $\text{m}^3$ . Calculate (i) the current in the wire and (ii) the drift velocity of the electrons in wire. (8)
3. (a) State and explain Curie's law in magnetism. (5)
- (b) Define the terms: (9)
  - (i) Magnetic permeability (ii) magnetic domain, and (iii) magnetic susceptibility
- (c) Explain the phenomenon of hysteresis in magnetic materials. Draw a hysteresis loop showing remanence and coercive force. What does the area of the loop represent? (14)
- (d) Distinguish between soft and hard ferromagnetic materials. (7)
4. (a) Why the interatomic or intermolecular bonds exist in solids? Briefly describe various types of bonds in solids. (12)
- (b) Draw a typical unit cell of KCl crystal and explain its crystal structure. (8)
- (c) What is lattice energy of a ionic crystal? Derive an expression for lattice energy of KCl crystal. (15)



**PHY 151(CE)**

**SECTION – B**

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

5. (a) Distinguish between crystalline and amorphous solids. Among them which one is more stable and why? (8)

(b) What is Bravais lattices? How many Bravais lattices and crystal systems are in 3D? Write down the lattice parameters and number of space lattices in all crystal systems in 3D. (18)

(c) What is the crystalline nature of silver? Draw a typical unit cell of silver crystal. Derive the relationship between atomic radius and lattice constant of silver crystal. The atomic radius of silver is 0.1441 nm. Calculate the lattice constant and density for silver. The atomic weight of silver is 108 g/mole. (9)

6. (a) What are Miller indices? How the Miller indices can be obtained? Show that in a crystal of cubic structure, the distance between the planes with Miller indices (*hkl*) is equal to

$$d = \frac{a}{\sqrt{h^2 + k^2 + l^2}}$$

where, *a* is the lattice constant. (16)

(b) What is planar density of atoms in a crystal? Sketch (100, (110) and (111) crystal planes in a unit cell of a typical body centered cubic crystal. Compute and compare planar density of atom values for these planes for  $\alpha$ -Fe crystal. Atomic radius of  $\alpha$ -Fe is 0.1243 nm. (12)

(c) What is crystalline nature of Niobium (Nb)? The density of Nb is 8.57 g/cm<sup>3</sup>. Calculate number of atoms/mm<sup>2</sup> of (110) plane of Nb crystal, For Nb, atomic mass  $M_A = 92.91$  g/mole. (7)

7. (a) Show that the Galilean transformation fails to prove the 'Principle of constancy of speed of light' in special theory of relativity whereas, Lorentz transformation can prove it. (9)

(b) Explain the time dilation using the inverse Lorentz transformation. A certain particle has lifetime of 0.1  $\mu$ s when measured at rest. How far does it go before decaying if its speed is 0.99c when it is created? (10)

(c) Derive Einstein's mass-energy relation,  $E = mc^2$ . where the symbols have their usual meanings. (16)

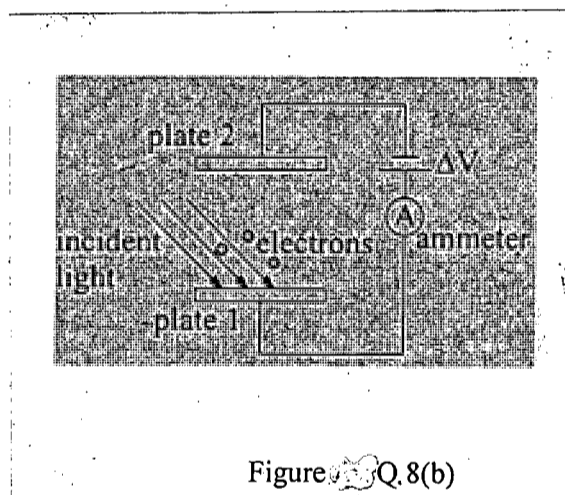
**PHY 151(CE)**

8. (a) What is Photoelectric effect? Explain the limitations of the classical wave theory and the success of the quantum theory in explaining the results of the Photoelectric effect. **(15)**

(b) Using the experimental apparatus shown in figure (Fig. Q. 8b), when ultraviolet light with a wavelength of 240 nm shines on a particular metal plate, electrons are emitted from plate 1, crossing the gap to plate 2 and causing a current to flow through the wire connecting the two plates. The battery voltage is gradually increased until the current in the ammeter drops to zero, at which point the battery voltage is 1.40 V. **(12)**

(i) What is the energy of the photons in the beam of light, in eV? (ii) What is the maximum kinetic energy of the emitted electrons, in eV? (iii) What is the work function of the metal, in eV? (iv) What is the longest wavelength that would cause electrons to be emitted for this particular metal? (v) Is this wavelength in the visible spectrum? If not, in what part of the spectrum is this light found?

(c) What is binding energy of a nucleus? Define binding energy per nucleon and explain the binding energy curve. **(8)**

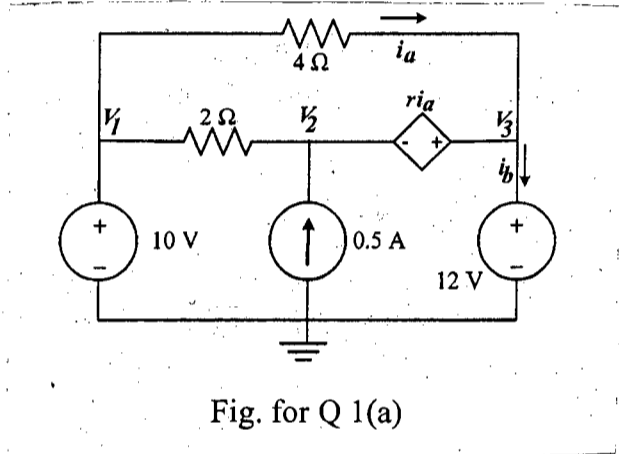


**SECTION - A**

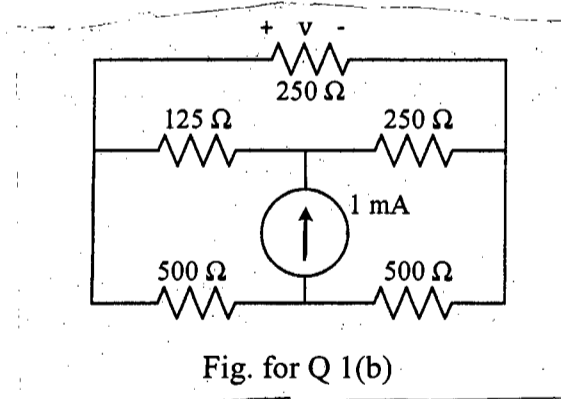
There are **FOUR** questions in this Section. Answer any **THREE**.

1. (a) In Fig. for Q 1(a) the node voltages have been calculated as follows :  $V_1 = 10$  V,  $V_2 = 14$  V and  $V_3 = 12$  V, (8+7)

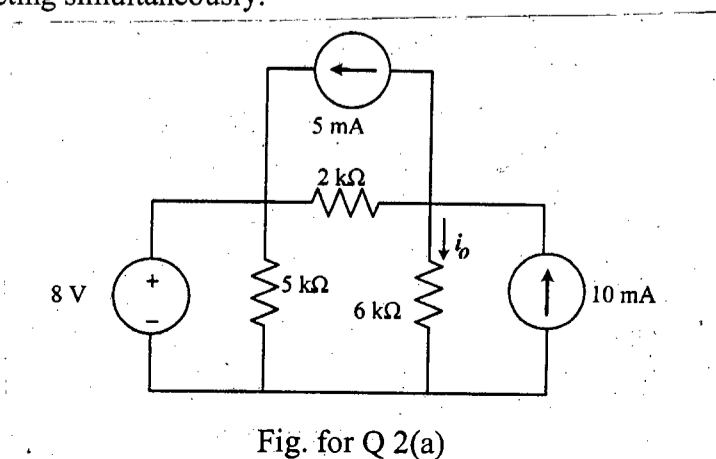
- (i) Determine the value of gain  $r$  of the CCVS.  
 (ii) Determine the value of the current  $i_b$ .



- (b) Find the voltage  $v$  for the circuit shown in Fig. for Q. No. 1(b). Also find the power consumed by the  $125 \Omega$  resistor. (12+8)



2. (a) Find the value of the current  $i_0$  given in the circuit of Fig. for Q. 2(a) using superposition theorem. Verify your solution by finding  $i_0$  when all the three sources are acting simultaneously. (10+10)

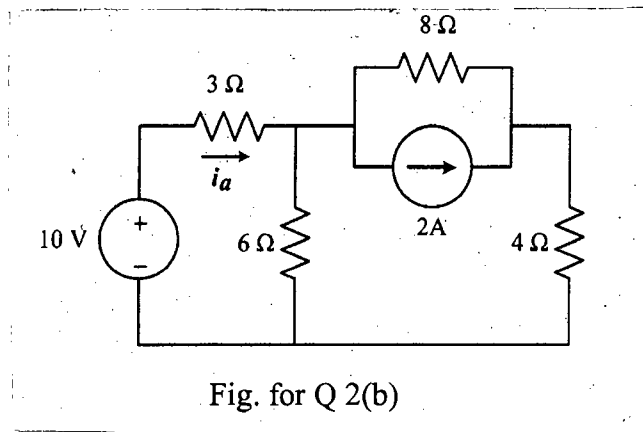


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**EEE 165(CE)**

**Contd ... Q. No. 2**

(b) Convert the circuit in Fig. for Q 2(b) into a single loop circuit and find the current  $i_a$ . **(10+5)**



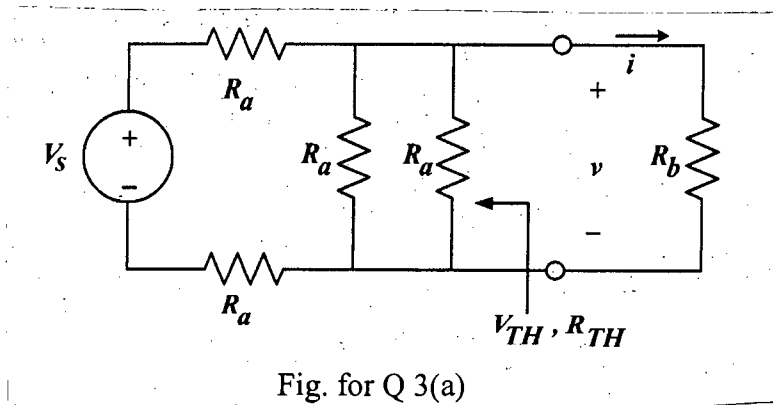
3. (a) The resistance  $R_b$  is attached to a circuit as shown in Fig. for Q 3(a). The Thevenin voltage and resistance as seen without the resistance  $R_b$  are calculated to be, **(10+5+5)**

$$V_{TH} = 15 \text{ V}$$

$$R_{TH} = 60 \Omega$$

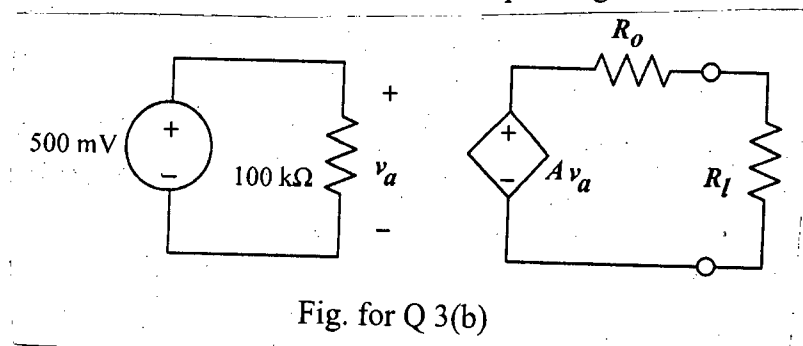
Determine the following:

- (i) The values of  $V_s$  and  $R_a$ .
- (ii) The value of  $R_b$  required to cause  $i = 0.2 \text{ A}$ .
- (iii) The value of  $R_b$  required to cause  $v = 12 \text{ V}$ .



(b) A 500 mV source connected to a load through a dependent sources as shown in Fig. for Q 3(b). Consider the cases: **(7+8)**

- (i)  $A = 20 \text{ V/V}$  and  $R_o = 10 \Omega$ . Determine the value of  $R_L$  that maximizes the power delivered to the load and the corresponding maximum load power.
- (ii)  $A = 20 \text{ V/V}$  and  $R_L = 8 \Omega$ . Determine the value of  $R_o$  that maximizes the power delivered to the load and the corresponding maximum load power.



Contd ..... P/3

**EEE 165(CE)**

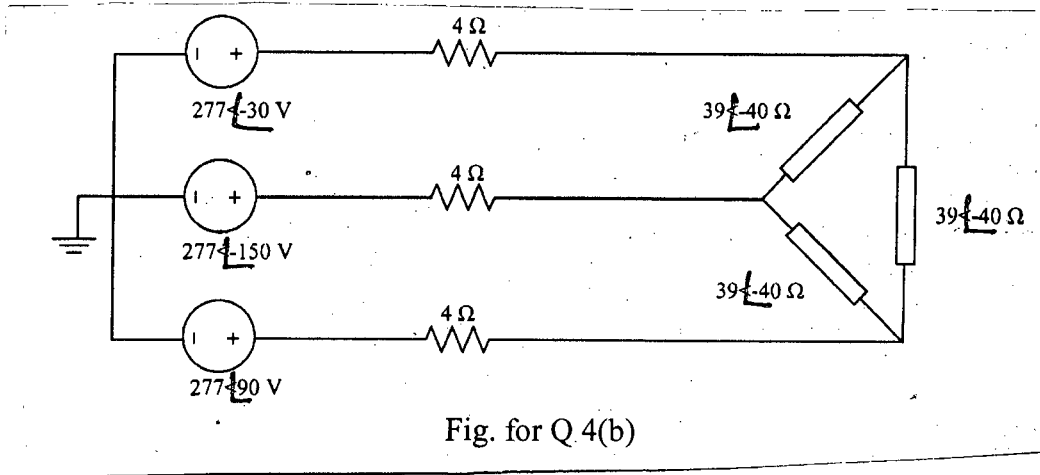
4. (a) A three phase system with phase voltage 230 V is driving the following loads: **(10+5+5+5)**

- (i) 35 KVA, 0.8 pf lagging Y-Connected load.
- (ii) 25 KVA, 0.9 pf leading  $\Delta$ -Connected load.

Find:

- (i) Branch impedance of each of the loads.
- (ii) Total line current.
- (iii) Total real power, reactive power and apparent power consumed by the loads.
- (iv) Combined power factor of the loads

(b) A  $\Delta$ -Connected load. is connected by three wires, each with  $4 \Omega$  resistance, to a Y-Connected source as shown in Fig. for Q 4(b). All the phases and angles are given in degrees. Find the line current, phase current and total apparent power consumed by the load.



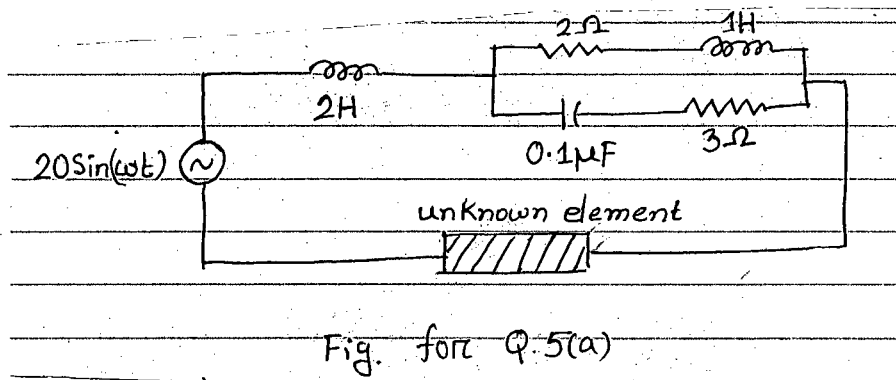
**(10)**

**SECTION - B**

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

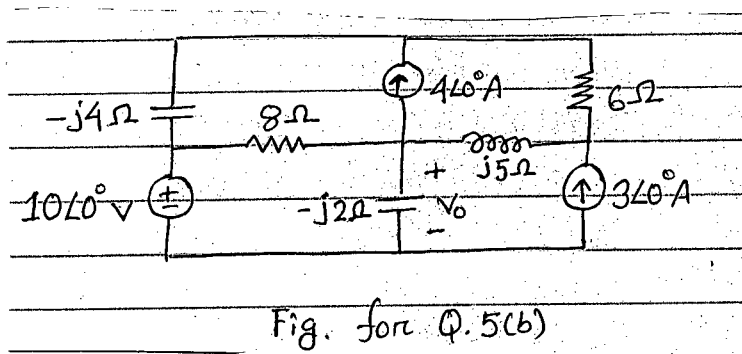
5. (a) Find the unknown reactive circuit component in Fig. for Q. 5(a) which makes the power factor of the load unity. Assume the source frequency to be 50 Hz.

**(10)**



(b) Use the superposition theorem to find  $v_0$  for the circuit shown in Fig. for Q. 5(b).

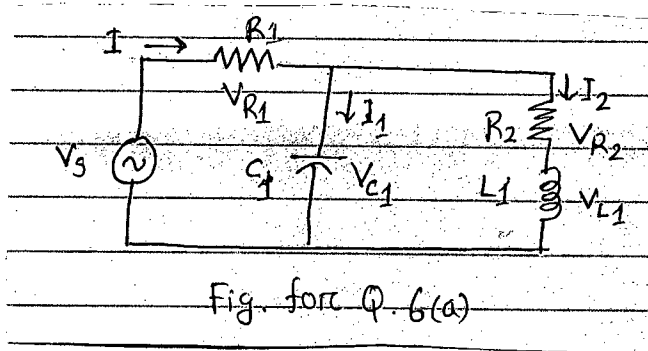
**(20)**



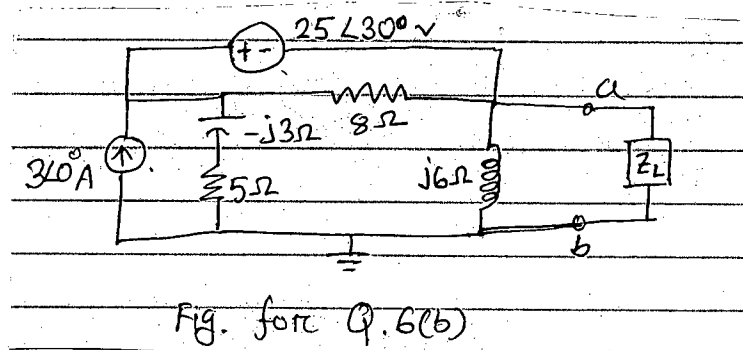
Contd ..... P/4

**EEE 165(CE)**

6. (a) Draw the phasor diagram for the circuit given in Fig. for Q. 6(a). Consider  $I_2$  as reference. (15)



- (b) For the circuit shown in Fig. for Q. 6(b), obtain the Thevenin's equivalent circuit at terminal a-b. Also find the value of  $Z_L$  that will absorb maximum power and the value of maximum power. (20)



7. (a) Describe how open circuit test and short circuit test are performed to determine parameters of a single-phase transformer, show necessary figures. (15)

- (b) A 15 kVA, 2300/230 V transformer has an efficiency of 98% and a voltage regulation of 2.1% at full load with a power factor of 0.8 lagging and a core loss of 53 W, then find the values of  $R_c$  and  $R_{eq}$  referred to high voltage side. (20)

8. (a) Using the formula  $\bar{\tau}_{ind} = k\bar{B}_R \times \bar{B}_{Net}$  graphically develop an induction motor torque speed characteristics. (15)

- (b) A 460 V, 25 hp, 60 Hz, four pole, Y-connected wound rotor induction motor has the following impedances in ohms per phase referred to the stator circuit. (20)

$$R_1 = 0.641 \Omega, R_2 = 0.332 \Omega, X_1 = 1.106 \Omega, X_2 = 0.464 \Omega \text{ and } X_M = 26.3 \Omega.$$

- (i) What is the maximum torque of this motor? At what slip does it occur?
- (ii) What is the starting torque of this motor?
- (iii) When the rotor resistance is halved, what is the new starting torque of the motor?