BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2   B. Sc. Engineering Examinations 2010-2011

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**.

1. (a) Describe the principle of chain surveying. Write down the procedure of running survey lines in case of chain surveying. **(3+4=7)**

    (b) Describe a suitable method 'to erect a perpendicular to a chain line from a point on it'. **(5)**

    (c) List the uses of the following instruments: **(3×2=6)**

             (i) ranging rod; (ii) offset rod

    (d) Write down the differences between cumulative error and compensating error in case of chain survey. The road from a place to another place is actually 25,325 ft long. This distance was measured by an Engineer's defective chain and was found to be 25,270 ft. How much correction does the chain need? **(4+4=8)**

    (e) List the uses of tacheometry. The following observations were taken in a tacheometric survey using an anallactic tacheometer. The staff was held vertical at all times. **(4+16⅔=20⅔)**

Instrument Station	Staff Station	Whole Circle Bearing	Vertical Angle	Stadia Reading (ft)
P	X	35°	0	2.3, 2.55, 2.8
	Q	20°	–2°	2.6, 3.75, 4.9
	R	50°	1°	1.35, 3.8, 6.25

Given, PX = 50 ft, RL of X = 20 ft

Determine: (i) RL of Q and (ii) horizontal distance QR.

2. (a) List the points on which traverse surveying differs from chain surveying. Suppose you are asked to conduct a traverse survey for a canal. Which type of traversing will you prefer and why? **(4+2=6)**

    (b) Compare between magnetic bearing and arbitrary bearing. List the applications of a theodolite in surveying. **(3+3=6)**

    (c) What is local attraction? Describe a method for eliminating local attraction. The magnetic bearing of a line AB is S 30° 30′ W. Calculate the true bearing if the declination is 6° 30′ East. **(3+4+5=12)**

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Contd ... Q. No. 2

(d) Describe the checks that can be applied in an open traverse. A closed traverse was conducted around an obstacle. The lengths of the lines AB and CD are omitted. The lengths and bearings of the traverse are shown below: **(6+16⅔=22⅔)**

Side	Length (m)	Bearing
AB	---	N 33° 45′ E
BC	300	N 86° 23′ E
CD	---	S 10° 37′ E
DE	450	243° 54′
EA	268	N 42° 30′ W

Assume that there is no closing error. Sketch the traverse and calculate the followings:
   (i) Latitude and departure of each line
   (ii) Length of AB and CD

3. (a) What is levelling? Compare between 'indirect levelling' and 'direct levelling'. **(2+4=6)**

   (b) Differentiate between 'fly levelling' and 'reciprocal levelling'. **(6)**

   (c) List the characteristics of contours. Draw typical contour diagram of the followings: **(4+3×3=13)**
   (i) a hill
   (ii) ridge
   (iii) steep slope and gentle slope

(d) The following data are taken from a level book in which some of the readings were found to be missing. Calculate the missing data (indicated by '?') and reduced level of all stations. Apply usual checks and draw necessary diagrams. **(21⅔)**

Station	Staff reading (ft)			Rise (ft)	Fall (ft)	R.L.	Remarks
	Back	Inter	Fore				
A	1.5						
B		2.1					
C	3.3		1.3				T.P.
D		?				10.5	B.M.
E	4.4		5.9	0.4			T.P.
F	?		3.3				T.P.
G			3.3	0.2			

Note,   R.L. = Reduced level,   T.P. = Turning point/Change point
        B.M. = Bench mark

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4. (a) (i) Describe the features of a field book for chain survey. **(4)**

(ii) List the methods of contouring. **(5)**

(iii) Describe with sketch how to overcome the difficulties in levelling ponds and lakes too wide to be sighted across. **(7⅔)**

(b) Write down the purposes of photogrammetry. List the factors to be considered in selecting camera stations and base line during the reconnaissance of terrestrial photogrammetry. **(3+5=8)**

(c) Define: (i) Vertical photograph; (ii) Tilted photograph; (iii) Oblique photograph. **(2×3=6)**

(d) The following figure shows the photographs taken in a terrestrial photogrammetry with the camera axis horizontal from stations A and B. Camera axis at point A makes an angle of 32° with the base line AB, while the camera axis produce an angle of 21° with AB at a point B. Distance between A and B is 120 m and focal length of the camera is 300 mm.

Calculate (i) horizontal distance of point P form stations A and B, (ii) RL of point P, if RL of the camera axis at station A is 10 m. **(16)**

Photograph from Station A   Photograph from Station B
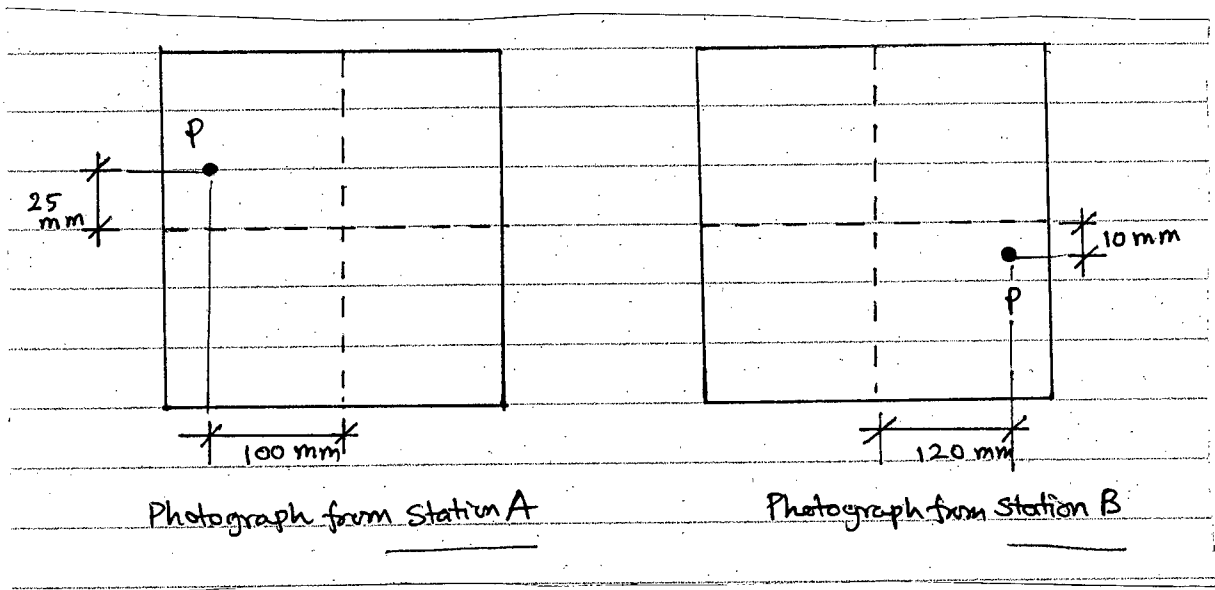
SECTION – B

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

Assume reasonable value of missing data, only if necessary.

5. (a) Determine the volume of earthwork for a 100 m long embankment having two-level section, using the following data, along centre-line: **(18)**

Chainage (m)	Ground Level (m)	Formation level (m)
0	28.0	30.0
50	28.5	30.0
100	27.0	30.0

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Contd ... Q. No. 5(a)

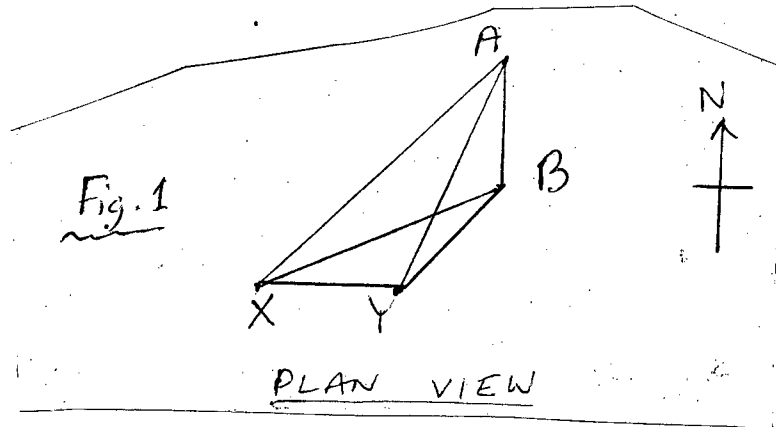Formation level width = 10 m, Side slope = 1V : 2H

Ground surface slope = 1V : 5H

Area for two-level section = $\dfrac{r^2bh + s\left(0.5b\right)^2 + r^2sh^2}{r^2 - s^2}$

where, symbols bear their usual meaning.

(b) Two towers are located at points A and B. Readings are taken with a theodolite from two instrument stations X and Y, 30 m apart. Plan view is given in Fig. 1. $(16\tfrac{2}{3})$


Fig. 1

PLAN VIEW

Given the following data, determine the R.L. (elevation) of the top of the towers at A and B.

Line	XA	XB	XY	YA	YB
Whole Circle Bearing	45°	60°	90°	25°	48°

R.L. of instrument centre at X = 20 m. The vertical angle readings from X to the top of the towers at A and B are 22° and 30° respectively.

(c) The contour diagram of the bottom of a circular pond is given in Fig. 2. All contours are also circular. Determine the volume of water, the pond can hold.   **(12)**

Fig. 2 Contour Diagram (Plan View)
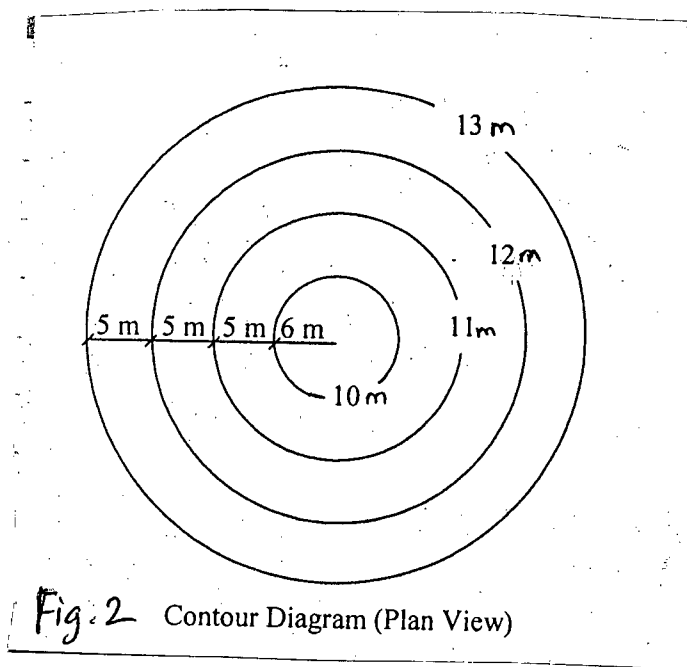
CE 103

6. (a) Define diurnal circle. Draw typical diurnal circles of a star with respect to the horizon as observed in the poles and at the equator. **(9)**

   (b) Write short notes with figure on the following: **(6×2=12)**

        (i) Standard time in Bangladesh and in India.

        (ii) Right Ascension of sun and its variation.

   (c) At a place (longitudinal = 30° E, latitude = 50° N) at 3 PM, the observed altitude of the lower edge of sun is 26°40′. The nautical almanac gives the declination of the sun as 4°58′ N at G.M.N. increasing at a rate of 2′/hour. **(25⅔)**

        (i) Apply all necessary astronomical corrections to the altitude.

        (ii) Determine the azimuth of sun.

        (iii) State the importance of measuring azimuth.

   Given: Horizontal parallax of sun = 8.8″, Semi-diameter of sun = 16′-0″

   Also useful formula $\cos A = \dfrac{\cos a - \cos b \cos c}{\sin b \sin c}$

7. (a) Derive the relation among rate of superelevation, side friction and radius of curvature, **(15)**

   $$e + f = \frac{v^2}{gR}$$

   where symbols bear their usual meaning.

   (b) Describe the procedure of setting out the transition curve. **(16⅔)**

   (c) Explain the use of GPS, GIS and remote sensing in car navigation system. **(15)**

8. (a) Define superelevation. Explain the necessity of transition curve in road alignment. **(11⅔)**

   (b) Derive the equation for length of transition curve $L = V^3/RC$; symbols bear their usual meaning. **(10)**

   (c) A sag vertical curve is to be designed with following data: **(25)**

        R.L. of PVI = + 8.250 m

        Chainage of PVI = 1500 m

        Initial grade = – 8%

        Final grade = – 4%

        Length of curve = 60 m

   Determine the elevation of road at chainage 1460 m, 1470 m, 1500 m, 1530 m and 1550 m.

L-1/T-2/CE   **Date : 10/03/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2 B. Sc. Engineering Examinations 2010-2011

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 any **THREE** question including **Q. No. 1** as compulsory.

1. (a) Explain with reference to the context any <u>one</u> of the following: **(08)**

    (i) "... To live anyhow is better than not at all".

    (ii) 'How singular is life, and how full of changes! How small a thing will ruin or save one!'

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

    (i) Who, in your perspective, is the ultimate winner in the story "The Bet"? Justify your answer.

    (ii) What message do you get from the story "The Diamond Necklace"?

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

    (i)   Who is Circe? What is her role in the story "Circe's Garden"?

    (ii) How did the Loisel family compensate for the lost necklace?

    (iii) Why did the lawyer finally renounce everything of this mundane world?

    (iv) "I am sure you are Odysseus, the man whom nothing defeats" — Who said this, when and why?

    (v)   What did the lawyer feel after learning several languages?

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

    (i)   A lapse of time occurred before we reached the scene.

    (ii)   Our work is the most vital in the entire program.

    (iii) Hasan and me are the first in line.

    (iv)   If we can work slow and steady, we can finish by noon.

    (v)   In April, we are liable to have rain often.

    (vi)   I am certain that Mukul will loan you ten thousand taka.

    (vii) Last week our clergyman reminded us that living the upright life was a discipline.

    (viii) Between Aman, Angshu and Adib, the controversy was finally settled.

    (ix)   The data (information) are certainly interesting.

    (x)   Prior to the winter, we repaired the roof.

    (xi)   When the child disobeys, does the parent chastise him severely?

    (xii) Sunny is to be the first choice, and Boby and Mimi the second and third.

HUM 185

3. (a) Give the meaning of any ten of the following words: **(10)**

Alleviate, beneficiary, cataclysm, decrepit, emulate, facile, grudge, hoarse, incidental, luminous, massive, oblivious.

(b) Make sentences with any ten of the following words: **(10)**

Outrageous, peek, prolific, quest, rebut, retard, simulate, sultry, throng, tyro, blandishment, compassion.

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

From the moment an animal is born it has to make decisions. It has to decide which of the things around it are for eating and which are to be avoided; when to attack and when to run away. The animal is, in effect, playing a complicated and potentially very dangerous game with its environment, a game in which it must make decisions for which the reward is survival and the penalty for a mistake discomfort or obliteration.

This is a difficult and unpleasant business and few animals would survive if they had to start from scratch and learn about the world wholly by trial and error, for there are too many possible decisions which would prove fatal. So we find, in practice, that the game is always rigged in favour of the young animal in one way or another. All species cheat in some way. Either the animal is protected during the early stages of its learning about the world around it, or the knowledge of which way to respond is built into its nervous system from the start.

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

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

When the world becomes unstable, conflict prevails here and there in every country; "might is right" becomes the only slogan of the world and then we feel the need of peace. Global peace means the peace prevailing in every country of the world, in other words, global peace means the world without conflict. When we see any conflict or dispute among the countries or any war occurs in the world, the world passes its worst time. Its inhabitants do not feel any security of their lives, their dreams become a mirage, a shaking situation stays everywhere in the world. Unstable situation is found in every country and it brings frustration among the young generation. Terrorism captures the whole world and it drives away the peace and happiness of common people. So this scarcity of peace compels us to think about the alternatives. If it is possible to soothe all the countries and to make them satisfied with their own possessions, then peace will be found everywhere in the world. In order to get a secured life both in domestic and international field, we need to have peace globally. Only the global peace can ensure the sustainable development of a country and this sustainable development can make the world fit for survival of the people and their next generations. We expect that all the countries of the world will think themselves as global members and will work for the global benefit.

HUM 185

<u>Contd ... Q. No. 5</u>

Questions:

(i) What, according to you, are some of the reasons of our world turning into an 'unstable' one?

(ii) "Global peace means the world without any conflict" can we really have a world 'without any conflict'?

(iii) What, do you think, might be the possible consequences of 'frustration among the younger generation'?

(iv) How terrorism 'drives away the peace and happiness of common people'?

(v) Why is global peace a precondition for ensuring peace for all the countries of the world?

6. (a) As an Assistant Engineer of a developing company you have recently bought some construction materials. Since they have been found sub-standard, write a letter of complaint to the relevant authority for the replacement of those materials. **(10)**

(b) Write phonetic transcription of the following words (any five): **(10)**

Child, blood, enjoy, thank, divine, happy.

7. (c) Write a dialogue between you and your friend about global warming and its consequences. **(10)**

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

(i) Unplanned Housing in Dhaka City,

(ii) Uses and abuses of Social Networks,

(iii) English: a lingua franca

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

(i) We all are born with a divine fire in us. (Complex)

(ii) I had been in London in Winter. (Complex)

(iii) It is certain that he will come. (Simple)

(iv) They are so nice that they cannot be used now. (Simple)

(v) I went to bed after I had had my dinner. (Compound)

(vi) We work hard to prosper in life. (Compound)

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

(i) Diphthongs,

(ii) Parts of business letter,

(iii) Illustration in a formal report.

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA
L-1/T-2   B. Sc. Engineering Examinations 2010-2011

Sub : **PHY 105** (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) Describe the Michelson – Morley experiment.   **(20)**

   (b) What are the main consequences of this experiment?   **(7)**

   (c) Calculate the expected fringe shift in Michelson – Morley excrement if the effective length of each path be 6 m, speed of earch is 3×10^4 m/s and the wavelength of the monochromatic light used is 600 nm.   **(8)**

   (Given : speed of light = 3×10^8 m/s and 1 nm = 10^{-9} m)

2. (a) What are meant by time dilation and length contraction?   **(6)**

   (b) What is relativity of mass? Obtain the expression for the relativistic mass. **(21)**

   (c) A stationary body explodes into two fragments each of rest mass 1.5 kg that move a part at speed of 0.7 c relative to the original body. Find the rest mass of the original body.   **(8)**

3. (a) Explain the phenomenon of photoelectric effect.   **(7)**

   (b) Discuss the important results of photoelectric effect and hence establish the Einstein's photoelectric equation.   **(20)**

   (c) A light of wavelength 400 nm is incident on a metal surface of work function 1.51 eV. Find (i) the maximum kinetic energy of the photoelectrons and (ii) the stopping potential.   **(8)**

4. (a) (i) Write down the definitions of current density and drift velocity of an electron. **(10)**

   (ii) State and explain Ampere's law.

   (b) Show that force exerted on a current carrying conductor is $\overline{F} = i\overline{l} \times \overline{B}$. Where symbols have their usual meaning.   **(10)**

   (c) What is the drift velocity of electrons in a copper conductor having a cross-sectional area of 5×10^{-6} m^2 if the current is 10 A? Assume that there are 8×10^{28} electrons / cm^3.   **(7)**

   (d) Draw a B – H hysteresis loop and discuss its significance.   **(8)**

PHY 105

SECTION – B

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

5. (a) What is an electric dipole and dipole moment? **(06)**

(b) Show that the torque of an electric dipole placed in a uniform electric field E is given by $\bar{\tau} = \bar{P} \times \bar{E}$, where P is the electric dipole moment. Show that the potential energy U stored in the system is given by $U = -\bar{P}.\bar{E}$ **(20)**

(c) An electric dipole consists of two opposite charge of magnitude 3.0×10^{-6} separated by a distance $1 = 1.0$ cm placed in an external electric field of 3.0×10^5 N/C. a) What is the maximum torque on the dipole? (b) How much work must an external agent do to turn the dipole from its initial alignment given by $\theta = 0°$ to final alignment $\theta = 90°$? **(09)**

6. (a) Distinguish between polar and non-polar dielectrics. **(06)**

(b) Show that the capacitance of a parallel plate capacitor with a compound dielectric is $C = \dfrac{K\varepsilon_{\circ}A}{t + K(d-t)}$, where K is the dielectric constant of the slab and ε_0 is the permittivity of air t is the thickness of the slab and d is the separation between the two plates. **(20)**

(c) A parallel plate capacitor has a capacitance of 100 μF, a plate area of 100 cm^2 and a mica sheet of dielectric constant K = 5.4. If the potential difference in between the parallel plates is 50 V, calculate (a) Electric field in the mica sheet, (b) The free charge on the plates, and the induced charge. **(09)**

7. (a) Write down the properties of a crystalline solid. **(04)**

(b) Draw the crystal structure of CsCl. **(06)**

(c) Construct a primitive cell within a face centred cubic cell. How many atoms are there in the primitive cell and how does this compare with the number of atom in the original cell? **(10)**

(d) Show that in an ideal hexagonal close packed (hcp) structure, the ratio $\dfrac{c}{a}$ is 1.633. Where c and a are unit cell edge length. **(07)**

(e) Define packing factor. Find the packing factor for hcp structure. **(08)**

8. (a) What are the different types of point defects in crystals? **(04)**

(b) What are the advantages of having defects in crystals? **(05)**

(c) Discuss the formation of metallic bond in alkali metals with an appropriate example. **(08)**

(d) Define cohesive energy. Show that the total lattice energy of an ionic crystal is $U_{total} = -\dfrac{N\alpha q^2}{R_0}\left[1 - \dfrac{P}{R_0}\right]$, where the symbols have their usual meanings. **(18)**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2   B. Sc. Engineering Examinations 2010-2011

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

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) Find the differential equation of all parabolas having latus rectum 4 a and whose axes are parallel to x-axis. **(10)**

    (b) Solve: $(2x - 5y + 3)dx - (2x + 4y - 6)dy = 0$. **(15)**

    (b) Solve: $\dfrac{dy}{dx} + \dfrac{xy}{1 - x^2} = x\sqrt{y}$. **(10)**

2. (a) Find the integrating factor of the differential equation $(3x^2y^4 + 2xy)dx + (2x^3y^3 - x^2)dy = 0$ and solve. **(10)**

    (b) The body of a murder victim was discovered at 11.00 p.m. The doctor took the temperature of the body at 11.30 p.m which was 94.6°F. He again took the temperature after one hour when it showed 93.4°F and noticed that the temperature of the room was 70°F. Estimate the time of death (Normal temperature of human body = 98.6°F). Apply $\dfrac{dT}{dt} = k(T - T_0)$. **(12)**

    (c) Apply the method of variation of parameters to solve $\dfrac{d^2y}{dx^2} - y = \dfrac{2}{1 + e^x}$. **(13)**

3. (a) Find the general solution of the following higher order differential equations
    (i) $(D^2 + 1)y = x^2 e^{2x} \cos 2x$ **(12)**
    (ii) $(x^2 D^2 - 3xD + 4)y = x^2$ **(10)**

    (b) Find a surface satisfying $s + r = 0$ and touching the elliptic paraboloid $Z = 4x^2 + y^2$ along its section by the plane $2x - y + 1 = 0$. **(13)**

4. (a) Solve the following first order PDEs
    (i) $xzp + yzq = xy$ **(7)**
    (ii) $(Z^2 - 2yz - y^2)p + (xy + xz)q = xy - xz$ **(8)**

    (b) Solve the following PDEs by Charpit's method:
    (i) $p(1 + q^2) = q(Z - a)$ **(9)**
    (ii) $(p + q)(px + qy) - 1 = 0$ **(11)**

MATH 139

SECTION – B

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

5. Solve the following:

   (a) $(2D_x - 3D_y + 1)(4D_x + 2D_y - 3)z = e^{x-2y}x^2y^2$ **(14)**

   (b) $(12D_x^2 - 5D_xD_y - 3D_y^2)z = y^2\sin(x - 3y)$ **(11)**

   (c) $(x^2D_x^2 + 2xyD_xD_y + y^2D_y^2)z = x^m y^n$ **(10)**

6. (a) An incomplete distribution is given below: **(18)**

Marks:	10–20	20–30	30–40	40–50	50–60	60–70	70–80
No. of students	11	31	?	67	?	24	21

   Given that the median value is 46 and the total frequency is 229.

      (i) Using the median formula fill up the missing frequencies.

      (ii) Calculate the modal value of completed table. Hence comment on the shape of the frequency distribution.

   (b) The IQ's of 10 year olds is assumed to be normal random variable. It is known that 10% of the children have IQ's under 95 and 25% exceed 145, what percentage of children have IQ's between 110 and 135? (Necessary chart 1 is attached).   **(17)**

7. (a) 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) 8 and (ii) 16 such patients recently admitted to a hospital, fewer that half are chain smokers, using binomial distribution and Poisson approximation to the binomial distribution.   **(15)**

   (b) The mean weekly sale of the BD chocolate bar in candy stores was 153.7 bars per store. After an advertising campaign, the mean weekly sale in 29 stores for a typical week increased to 169.4 and showed a standard deviation of 19.7. 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 Gaussian distribution.   **(10)**

8. (a) The personnel manager of a factory wants to find a measure, which he can use to fix the monthly income for persons applying for a job in production department. As an experimental project, he collected the following data of 9 persons form that department referring to years of service and their monthly income. Calculate   **(15)**

MATH 139

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

(i)   the two regression equations and the coefficients of correlation.

(ii) what initial start would you recommend for a person applying for a job after having served in a similar capacity in another factory for 15 years?

Year of Service	10	8	9	5	7	6	12	11	13
Income in '000	17	12	14	8	10	9	20	18	22

(b) Suppose that the measured voltage in a certain electric circuit has a normal distribution with mean 120 and standard deviation 2. If 3 independent measurements of the voltage are made, what is the possibility that all three measurements will lie between 116 and 118? **(10)**

(c) The probability that a married man watches a certain TV show is 0.18 and the married woman watches the show is 0.25. A study revealed that for couples where the husband watches the program regularly, 85% of the wives also watch regularly. Find **(10)**

(i)   the probability that a married couple watches the show.

(ii) the probability that a husband watches the show given that his wife does not.

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	0.1219	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

(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

Chart 1 for Q. no. 6(b) (Math 139)
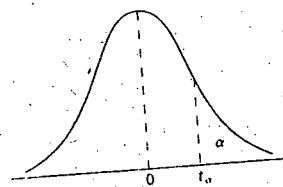
TABLE A.4 Critical Values of the t-Distribution

v	α						
	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	0.537	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

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

v	α						
	0.02	0.015	0.01	0.0075	0.005	0.0025	0.0005
1	15.895	21.205	31.821	42.434	63.657	127.322	636.590
2	4.849	5.643	6.965	8.073	9.925	14.089	31.598
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	3.849
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	3.690
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	3.659
30	2.147	2.278	2.457	2.581	2.750	3.030	3.646
40	2.125	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	3.291

Chart 2 for Q. no. 7(b) Math 139

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