BET-011

DIPLOMA IN CIVIL ENGINEERING (DCLE(G))/ DIPLOMA IN MECHANICAL ENGINEERING (DME) / DCLEVI / DMEVI / DELVI / DECVI / DCSVI / ACCLEVI / ACMEVI / ACELVI / ACECVI / ACCSVI

00767 **Term-End Examination**
December, 2017

BET-011 : MATHEMATICS – I

Time : 2 hours   *Maximum Marks : 70*

Note : Question number 1 is **compulsory**. *Attempt any* **four** *questions out of the remaining questions. Use of scientific calculator is permitted.*

1. Attempt any *seven* questions :   *7×2=14*

    (a) Find the value of antilog $\bar{1}\cdot2$.

    (b) Find the sum of the A.P.

         1, 4, 7, ... up to 23 terms.

    (c) Find the value of

         $cosec\ 30° \cot 45° \tan^2 60°$.

    (d) What is the meaning of the following shape in a flow chart ?

(e) Find the equation of a line passing through $(3, -5)$ and parallel to the line joining $(1, 2)$ and $(-3, 4)$.

(f) Find the co-ordinates of the point which divides the join of $(3, -4)$ and $(-5, -3)$ externally in the ratio of $3 : 4$.

(g) Express $\sqrt[4]{16/27}$ in the simplest form.

(h) Find the equation of a circle with centre $(3, -2)$ and touches the x-axis.

(i) The vertices of a triangle are at the points

$$a = (2, -1, 3);\ b = (4, 2, 3);\ c = (6, 3, 4).$$

Find the direction cosines of the vector $\overrightarrow{AB}$.

2. (a) Solve the following quadratic equation :

$$\frac{1}{a+b+x} = \frac{1}{a} + \frac{1}{b} + \frac{1}{x},\ a+b \neq 0$$

(b) Prove that

$$\frac{1}{\log_a abc} + \frac{1}{\log_b abc} + \frac{1}{\log_c abc} = 1.$$

(c) Find the term independent of x in the expansion $\left(x - \dfrac{1}{x}\right)^{12}$.

5+5+4

3. (a) Find the 2nd term of an A.P. whose 6th term is 12 and 8th term is 22.

(b) The sum of 6 terms of a G.P. is nine times the sum of the first three terms. Find the common ratio.

(c) If two G.M.'s g_1 and g_2 are inserted between two numbers whose A.M. is A, then

$$2A = \frac{g_1^2}{g_2} + \frac{g_2^2}{g_1} .$$
4+5+5

4. (a) Solve the equation
$$\sin 2x + \sin 6x + \sin 4x = 0.$$

(b) If $\cos \theta = \dfrac{3}{5}$, find the value of $\cot \theta + \operatorname{cosec} \theta$.

(c) Prove that
$$\sec^4 \theta - \sec^2 \theta = \tan^4 \theta + \tan^2 \theta.$$
4+5+5

5. (a) The angle of elevation of the top of a tower from two points at a distance of x and y metres from the base and in the same straight line with it, are complementary. Prove that the height of the tower is $\sqrt{xy}$ metres.

(b) In a triangle ABC, given a = 20 cm, b = 30 cm, c = 21 cm, find $\tan \dfrac{C}{2}$.

(c) Find the principal value of $\operatorname{cosec}^{-1} (-1)$.   6+5+3

6. (a) Find equation of the line passing through the point (2, 2), the sum of whose intercepts on co-ordinate axes is 9.

(b) Prove that the tangent to the circle $x^2 + y^2 = 5$ at the point $(1, -2)$ also touches the circle

$$x^2 + y^2 - 8x + 6y + 20 = 0.$$

(c) Find the equation of a parabola whose focus is $(-1, -2)$ and directrix is the line $x - 2y + 3 = 0$. *4+5+5*

7. (a) Find the eccentricity, foci, length of the latus rectum of the ellipse

$$3x^2 + 4y^2 - 12x - 8y + 4 = 0.$$

(b) If

$$\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}$$

$$\vec{b} = \hat{i} - 3\hat{k},$$

find $|\vec{b} \times 2\vec{a}|$.

(c) If $\vec{a} = 3\hat{i} - \hat{j} - 4\hat{k}$

$$\vec{b} = -2\hat{i} + 4\hat{j} - 3\hat{k}$$

$$\vec{c} = \hat{i} + 2\hat{j} - \hat{k},$$

find $\vec{a}$ unit vector parallel to $3\vec{a} - 2\vec{b} + 4\vec{c}$. *5+4+5*