No. of Printed Pages : 4

**BET-011**

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

## Term-End Examination

01255

**June, 2015**

## BET-011 : MATHEMATICS – I

*Time : 2 hours* *Maximum Marks : 70*

***Note :*** *Question number 1 is **compulsory**. Attempt any **four** more questions out of the remaining questions. Use of calculator is permitted. Assume any missing data suitably.*

**1.** Answer any ***seven*** of the following questions : *7×2=14*

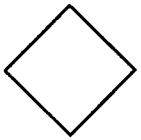
(a) If $x = \frac{\sqrt{7}+\sqrt{3}}{\sqrt{7}-\sqrt{3}}$ and $xy = 1$, find the value of $x^2 + y^2$.

(b) Show that $\log_2 \log_2 \log_2 16 = 1$.

(c) If $\alpha$ and $\beta$ be the roots of $ax^2 + bx + c = 0$, find the value of $\alpha^2 + \beta^2$.

(d) If 5, x, y, z, 405 are the first five terms of a G. P., find the values of x, y, z.

(e) What is the meaning of the following box in a flow chart ?



(f) Determine the $11^{th}$ term in the expansion of $\left(x - \frac{1}{x}\right)^{20}$.

(g) Find the value of tan 75°.

(h) Find the slope of the straight line joining the points (4, 8) and (– 6, – 2).

(i) Find the co-ordinates of the centre and the length of radius of the circle

$$x^2 + y^2 - 4x - 6y - 3 = 0.$$

(j) If $\vec{a} = 2i + 5j$ and $\vec{b} = i - j$, find $\vec{a} + \vec{b}$ and $|\vec{a} - 2\vec{b}|$.

**2.** (a) If $\frac{\log x}{ry - qz} = \frac{\log y}{pz - rx} = \frac{\log x}{qx - py}$, show that $x^p y^q z^r = 1$. *5*

(b) The $3^{rd}$ term of an A.P. is $\frac{1}{5}$ and the $5^{th}$ term is $\frac{1}{3}$. Show that the sum of the first 15 terms of the A.P. is 8. *5*

(c) Determine the coefficients of $x^4$ in the expansion of $\left(x^4 + \frac{1}{x^3}\right)^{15}$. 4

3. (a) Prove that $\sqrt{\frac{\sec\theta - 1}{\sec\theta + 1}} = \text{cosec}\,\theta - \cot\theta$. 5

(b) Show that 5

$\text{cosec}^2 22° \cot^2 68° = \sin^2 22° + \sin^2 68° + \cot^2 68°$.

(c) From the top of a cliff 200 metres high, the angles of depression of the top and bottom of a tower are observed to be 30° and 60° respectively. Find the height of the tower. 4

4. (a) A straight line is perpendicular to the straight line defined by $3x - 4y = 6$ and passes through (2, 1). Find its equation. 5

(b) Show that the points (3, 0), (6, 4) and (–1, 3) are the vertices of a right-angled isosceles triangle. 5

(c) Find the slope of the straight line $2x - 3y + 5 = 0$. Also find the length of the portion of the line intercepted between the co-ordinate axes. 4

5. (a) Show that the radii of the following circles are in A.P. :

$x^2 + y^2 = 1$, $x^2 + y^2 + 6x - 2y - 6 = 0$ and

$x^2 + y^2 - 12x + 4y - 9 = 0$. 5

(b) Find the co-ordinates of the vertex and the focus of the parabola $y^2 = 4(x + y)$. 5

(c) Find the centre and the equations of the directrices of the ellipse whose equation is $3x^2 + 4y^2 + 12x - 8y - 32 = 0$. *4*

**6.** (a) Find the value of 'a' for which the vectors $3\hat{i} + 2\hat{j} + 9\hat{k}$ and $\hat{i} + a\hat{j} + 3\hat{k}$ are perpendicular. *5*

(b) If $\vec{a} = 2\hat{i} + \hat{j} - \hat{k}$ and $\vec{b} = \hat{i} - 2\hat{j} + 2\hat{k}$, then find $\vec{a} \times \vec{b}$ and $|\vec{a} \times \vec{b}|$. *5*

(c) If $\vec{a} = 2\hat{i} + 5\hat{j} + 3\hat{k}$ and $\vec{b} = \hat{i} - 2\hat{j} - 4\hat{k}$, then find the values of $\vec{a} \cdot \vec{b}$ and $|3\vec{a} + 2\vec{b}|$. *4*