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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

01565

Term-End Examination

December, 2014

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 numbered 2 to 6. Use of calculator is permitted.*

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

(a) $\sqrt[8]{81}$ is equal to

(i) $3\sqrt{3}$

(ii) $\sqrt{3}$

(iii) 3

(iv) 9

(b) Root of the equation

$ix^2 - 4x - 4i = 0$

(i) $\pm 2i$

(ii) $2i$

(iii) $-2i$

(iv) $\pm \sqrt{2}\, i$

(c) Find the middle term in the expansion of $\left(x - \frac{1}{2y}\right)^{10}$.

(d) Find the equation of a straight line cutting off an intercept 3 from the positive side of y-axis and inclined at 45° to x-axis.

(e) Evaluate : sin 75°

(f) Find the centre and radius of the circle $x^2 + y^2 - 2x + 4y - 4 = 0$.

(g) Find the equation of the line whose intercepts on the axes of x and y respectively are – 4 and 7.

(h) Find the scalar product of
$\vec{r}_1 = 2\hat{i} + 2\hat{j} - \hat{k}$ and
$\vec{r}_2 = 6\hat{i} - 3\hat{j} + 2\hat{k}$.

(i) Find the vector product of
$\vec{r}_1 = \hat{i} - 3\hat{j} + 2\hat{k}$ and $\vec{r}_2 = -\hat{i} + 2\hat{j}$.

(j) Show that
$\sec^4 \theta - \sec^2 \theta = (\sec \theta \cdot \tan \theta)^2$

2. (a) Show that the roots of the equation $2(a^2 + b^2)x^2 + 2(a + b)x + 1 = 0$ are imaginary. *6*

(b) Which term of A.P. 5, 13, 21, ... is 181 ? *4*

(c) Find the middle terms in the expansion of $\left(3x - \frac{x^3}{6}\right)^7$. *4*

3. (a) If the position vectors of the points A, B, C, D are respectively $\hat{i} + \hat{j} + \hat{k}$, $2\hat{i} + 5\hat{j}$, $3\hat{i} + 2\hat{j} - 3\hat{k}$ and $\hat{i} - 6\hat{j} - \hat{k}$, then find the angle between the vectors $\overrightarrow{AB}$ and $\overrightarrow{CD}$. *6*

(b) Find the projection of the vector $\hat{i} - 2\hat{j} + \hat{k}$ on the vector $4\hat{i} - 4\hat{j} + 7\hat{k}$. *4*

(c) Given $\vec{a} = \hat{i} + 2\hat{j} - 3\hat{k}$ and $\vec{b} = 3\hat{i} - \hat{j} + 2\hat{k}$, show that $(\vec{a} + \vec{b})$ is perpendicular to $(\vec{a} - \vec{b})$. *4*

4. (a) If the straight line $y = mx + c$ passes through the points (3, 7) and (– 2, 6), find the values of m and c. *4*

(b) Find the equation of the circle whose centre is (2, –1) and which passes through the point (3, 6). *4*

(c) Find the length of major and minor axes, coordinates of foci, vertices and eccentricity of the ellipse $16x^2 + 25y^2 = 400$. *6*

5. (a) Show that

$$\tan A + \cot A = 2 \operatorname{cosec} 2A$$ *4*

(b) Prove that

$$\frac{\tan (45° + x)}{\tan (45° - x)} = \left[\frac{1 + \tan x}{1 - \tan x}\right]^2$$ *4*

(c) Show that

$$\tan^{-1} \frac{1}{5} + \tan^{-1} \frac{1}{7} + \tan^{-1} \frac{1}{3} + \tan^{-1} \frac{1}{5} = \frac{\pi}{4}$$ *6*

6. (a) The angle of elevation of a ladder leaning against a house is 58° and the foot of the ladder is 9·6 m from the house. Find the length of the ladder. *4*

(b) For what point of the parabola $y^2 = 18x$, is the ordinate equal to three times the abscissa ? *4*

(c) Find the sum of the series

$51 + 50 + 49 + ... + 21.$ *6*