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BET-021

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

01268

June, 2014

BET-021 : MATHEMATICS-II

Time : 2 hours *Maximum Marks : 70*

Note : *Question no. 1 is* ***compulsory****. Attempt any* ***four*** *questions out of the remaining questions. Use of scientific calculator is permitted.*

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

(a) If $A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 0 & 0 \\ -1 & 1 \\ 2 & 3 \end{bmatrix}$, find AB.

(b) Find $\frac{dy}{dx}$ if $x^3 + y^3 - 3axy = 0$.

(c) Find $\frac{dy}{dx}$ if $y = \tan^{-1} \frac{2x}{1 - x^2}$.

(d) Find $\int x^2 \log x \, dx$.

(e) Find $\int_1^2 \frac{2x}{1+x^2}\,dx$.

(f) A particle is moving in a straight line according to the formula

$s = t^3 - 9t^2 + 3t + 1$ where s is measured in metres and t in seconds. Find the velocity at the time when t = 3 seconds.

(g) Prove that the function

$f(x) = x^3 - 3x^2 + 3x - 100$

is an increasing function on R.

(h) Find the equation of the normal to the parabola $y^2 = 4ax$ at any point (x_1, y_1).

(i) Find the median of the following observations :

3, 5, 8, 9, 12, 15, 16, 18, 19, 23

(j) Find the principal argument of the complex number $\frac{(1+i)^2}{1-i}$.

2. (a) Show that

$$\begin{vmatrix} x+a & b & c \\ a & x+b & c \\ a & b & x+c \end{vmatrix} = x^2(x+a+b+c) \qquad 7$$

(b) Compute the inverse of the matrix

$$A = \begin{bmatrix} 1 & 2 & 3 \\ -3 & 5 & 0 \\ 0 & 1 & 1 \end{bmatrix}. \qquad 7$$

3. (a) Evaluate :

$$\lim_{x \to 0} \frac{\sqrt{1+x} - \sqrt{1-x}}{2x} \qquad 7$$

(b) If $f(x) = \frac{\sin x}{x} + \cos x, \quad x \neq 0$

$= 2 \qquad\qquad , \quad x = 0$

show that f is continuous at $x = 0$. 7

4. (a) If $y = \sqrt{\frac{1-x}{1+x}}$, prove that

$$(1 - x^2)\frac{dy}{dx} + y = 0. \qquad 5$$

(b) If $y = \tan^{-1}\left(\frac{1 - \tan x}{1 + \tan x}\right)$, find $\frac{dy}{dx}$. 4

(c) Express $\frac{1+2i}{1-3i}$ in the form of

$r(\cos\theta + i \sin\theta)$. 5

5. (a) Evaluate :

$$I = \int \sin^{-1}\sqrt{x}\, dx \qquad 7$$

(b) Evaluate :

$$I = \int_{-2}^{1} |2x + 1| \, dx$$ 7

6. (a) Show that $f(x) = \sin x (1 + \cos x)$ has a maximum value at $x = \frac{\pi}{3}$. 4

(b) If $f(x) = x^2 + 4$ on $[-2, 2]$, can Rolle's theorem be applied to $f(x)$? Find c if it can be applied. 5

(c) Find the intervals in which the function $f(x) = x^4 - 4x^3 + 4x^2 + 15$ is increasing or decreasing. 5

7. (a) Find the mean and standard deviation of first n natural numbers. 7

(b) The weekly observations of cost of living index in a certain city for a particular year are

Cost of living index	Number of weeks
140 – 150	5
150 – 160	10
160 – 170	20
170 – 180	9
180 – 190	6
190 – 200	2

Find the average weekly cost of living. 7