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BET-021

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

Term-End Examination

June, 2016

01450

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 calculator is permitted.*

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

(a) If $X = \begin{bmatrix} 4 & 2 \\ -1 & 3 \end{bmatrix}$ and $Y = \begin{bmatrix} 3 & -1 \\ 5 & 2 \end{bmatrix}$, show that $XY \neq YX$.

(b) Integrate :

$$\int \frac{dx}{x^2 + x + 1}$$

(c) For what value of x will $(x - 1)(3 - x)$ have its maximum ?

(d) Show that the function $(x^3 - 3x^2 + 3x)$ increases with x.

(e) Evaluate :

$$\int_0^{\pi/2} \cos^2 x \, dx$$

(f) Find the mean and the standard deviation for the following numbers :

1, 2, 3, 4, 5, 6, 7, 8, 9.

(g) Express $(2 + 3i)(3 - i)(1 + 2i)$ in the form of $A + iB$.

(h) Find the equation of the normal to the parabola $y^2 = 4(x - 1)$ at $(5, 4)$.

(i) A function f(x) is defined as follows :

$$f(x) = 2x + 1, \quad \text{when } x \leq 1$$
$$= 3 - x, \quad \text{when } x > 1$$

Examine whether $\lim_{x \to 1} f(x)$ exists or not ?

(j) The standard deviation calculated from a set of 32 observations is 5. If the sum of the observations is 80, what is the sum of the squares of these observations ?

2. (a) Find the inverse of $\begin{bmatrix} 2 & -1 & 4 \\ -3 & 0 & 1 \\ -1 & 1 & 2 \end{bmatrix}$.

(b) Show that

$$\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^2 & b^2 & c^2 \end{vmatrix} = -(a-b)(b-c)(a-c).$$

2×7=14

3. (a) A function f(x) is defined as follows :

$$f(x) = \frac{3}{2} - x, \quad \text{when } 0 < x < \frac{1}{2}$$
$$= \frac{1}{2}, \quad \text{when } x = \frac{1}{2}$$
$$= \frac{1}{2} - x, \quad \text{when } \frac{1}{2} < x < 1$$

Prove that f(x) is discontinuous at $x = \frac{1}{2}$.

(b) Show that the function $2x^3 + 3x^2 - 36x + 10$ has a maximum value at x = 3 and a minimum value at x = 2; Also find the maximum and the minimum values of the function.

(c) Evaluate :

$$\lim_{x \to 1} \frac{x^2 - 3x + 2}{x^2 - 4x + 3}$$

4+5+5=14

4. (a) If $y = \sqrt{3x} - \sqrt{\frac{3}{x}} + \frac{x+6}{6-x}$,

then find $\left[\frac{dy}{dx}\right]_{x=3}$.

(b) If $y = \frac{x-2}{x+2}$, show that $2x \cdot \frac{dy}{dx} = 1 - y^2$.

(c) If $f(x) = \sin 3x \sin 4x$, find $f''(x)$. Hence show that $f''\left(\frac{\pi}{2}\right) = 25$.

5+4+5=14

5. (a) Evaluate :

$$\int \sqrt{1 + \sin 2x}\, dx$$

(b) Evaluate :

$$\int_0^{\pi/2} \sqrt{1 + \sin x}\, dx$$

2×7=14

6. (a) Calculate the A.M. and median of the following data :

Weight (kgs)	*No. of Persons*
36 – 40	14
41 – 45	26
46 – 50	40
51 – 55	53
56 – 60	50
61 – 65	37
66 – 70	25

(b) Compute standard deviation and mean deviation about the mean of the following data :

Scores	f
4 – 5	4
6 – 7	10
8 – 9	20
10 – 11	15
12 – 13	8
14 – 15	3
Total	60

2×7=14

7. (a) A particle moving in a straight line is at a distance x cm from a fixed point in the straight line at time t seconds, where $x = 2t^3 - 12t + 11$.

Find the displacement, velocity and acceleration of the particle at the end of 2 seconds.

(b) Find the equation of the tangent to the curve $y = 2x^3 - 5x^2 + 6x - 7$ at (2, 1). *2×7=14*