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

Term-End Examination

December, 2015

BET-021 : MATHEMATICS – II

Time : 2 hours   *Maximum Marks : 70*

Note : *Questions No. 1 is **compulsory**. Attempt any **four** questions out of the remaining questions. Use of calculator is permitted.*

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

   (a) If $A = \begin{bmatrix} 0 & 2 & 3 \\ 2 & 1 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 7 & 6 & 3 \\ 1 & 4 & 5 \end{bmatrix}$,

   find $2A + 3B$.

   (b) If $f(x - 2) = 2x^2 + 3x - 5$, prove that $f(-1) = 0$.

   (c) Show that

   $$\lim_{x \to -2} \sqrt{x^3 + 3x^2 - x + 3} = 3.$$

(d) If $y = \cos^{-1} \dfrac{1-x^2}{1+x^2}$, find dy/dx.

(e) Evaluate :

$$\int \sin 3x \sin 4x \, dx$$

(f) Find the semi-interquartile range of the daily wages (in ₹) of 7 persons given below :

12, 7, 15, 10, 19, 17, 25

(g) Evaluate :

$$\int_{0}^{1} (2x^3 + 3)^2 \, dx$$

(h) If $x = -1 + i\sqrt{2}$, find the value of

$$x^4 + 4x^3 + 4x^2 + 1.$$

(i) Find the equation of the tangent of the ellipse $4x^2 + 9y^2 = 72$ at $(3, 2)$.

(j) A particle moving in a straight line traverses a distance x in time t. If $t = \dfrac{1}{2}x^2 + x$, then find its velocity.

2. (a) If $A = \begin{bmatrix} 2 & 1 \\ 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -2 \\ -1 & 1 \end{bmatrix}$,

show that $(AB)^{-1} = B^{-1} \cdot A^{-1}$.

7

(b) Show that $\qquad$ 7

$$\begin{vmatrix} a^2+1 & ab & ac \\ ab & b^2+1 & bc \\ ac & bc & c^2+1 \end{vmatrix} = 1 + a^2 + b^2 + c^2.$$

3. (a) Evaluate : 4

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

(b) Verify Rolle's theorem for the function $f(x) = x(x-3)^2$ in the interval $[0, 3]$. 5

(c) If $f(x) = |x-2| + 1$, evaluate

$$\lim_{x \to 2+} \frac{f(x) - f(2)}{x-2} \text{ and } \lim_{x \to 2-} \frac{f(x) - f(2)}{x-2}.$$

What can you say about the existence of $f'(x)$ at $x = 2$? 5

4. (a) Find the derivative of $\tan^{-1}\left(\dfrac{\cos x}{1 + \sin x}\right)$. 4

(b) Find the equation of the tangent to the curve $\dfrac{x^2}{a^2} - \dfrac{y^2}{b^2} = 1$ at $(a \sec \theta, b \tan \theta)$. 5

(c)   A particle moves in a straight line and its velocity v at time t seconds is given by v = $(3t^2 - 4t + 5)$ cm/sec. Find the distance travelled by it during the first 3 seconds after the start.   5

5.   (a)   Evaluate :   7

$$\int \frac{x^2 + 5x + 2}{x + 2} \, dx$$

(b)   Evaluate :   7

$$\int_0^2 \frac{dx}{\sqrt{x+3} - \sqrt{x+1}}$$

6.   (a)   Find the mean and the standard deviation from the following :   7

Wages (₹)	No. of workers
120 – 200	10
200 – 210	12
210 – 220	18
220 – 230	20
230 – 240	25
240 – 250	18
250 – 260	16
260 – 270	5

(b) The following table gives the marks obtained by students in a class test : 7

Marks	No. of Students	Marks	No. of Students
32 – 36	10	48 – 52	51
36 – 40	37	52 – 56	35
40 – 44	65	56 – 60	18
44 – 48	80	60 – 64	4

Find the mean and median for the above data.

7. (a) If $x + iy = \sqrt{\dfrac{a + ib}{c + id}}$, prove that

$$(x^2 + y^2)^2 = \frac{a^2 + b^2}{c^2 + d^2} \, .$$ 7

(b) Find the area of the triangle bounded by the line $4y - 5x = 0$, the x-axis and the ordinate $x = 4$, by the method of integration. Verify your result by using the formula

Area of triangle $= \dfrac{1}{2} \times$ base $\times$ altitude. 7

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