

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

00207

**Term-End Examination**

**December, 2017**

**BET-021 : MATHEMATICS – II**

*Time : 2 hours*

*Maximum Marks : 70*

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

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

(a) Find the domain of definition of  
 $\log_e \frac{2+x}{2-x}$ .

(b) Evaluate :

$$\lim_{x \rightarrow 0} \frac{e^{px} - e^{-qx}}{x}$$

- (c) Show that the function  $\phi(x)$  defined below is continuous at  $x = 1$ .

$$\begin{aligned}\phi(x) &= x^2 + 1, \text{ when } x > 1 \\ &= 2, \text{ when } x = 1 \\ &= 2x, \text{ when } x < 1.\end{aligned}$$

- (d) Find the derivative of  $\tan^{-1} \sqrt{\frac{1 + \cos 2x}{1 - \cos 2x}}$ .

- (e) Find the equation of the normal at (3, 2) on the curve  $4x^2 + 9y^2 = 72$ .

- (f) Evaluate :

$$\int \frac{dx}{\sqrt{e^x - 1}}$$

- (g) Prove that  $\int_{-\pi}^{\pi} \frac{xe^{x^2}}{1 + x^2} dx = 0$ .

- (h) Evaluate :

$$\begin{vmatrix} 1 & \cos 60^\circ & \cos 30^\circ \\ \frac{1}{2} & \sin 30^\circ & \sin 60^\circ \\ 1 & 0 & 2 \end{vmatrix}$$

- (i) If  $x + \frac{1}{x} = 2 \cos \frac{\pi}{7}$ , show that

$$x^{-7} + \frac{1}{x^7} = -2.$$

- (j) Find the median of 3.1, 2.6, 5.0, 4.7, 2.4, 3.9, 5.1 and 3.6.

2. (a) If  $y = x \sqrt{\frac{x^2 + 4}{x^2 + 3}}$ , find  $\frac{dy}{dx}$ .

(b) Examine whether the following function is even or odd :

$$f(x) = \log_e (x + \sqrt{x^2 + 1}) \quad 2 \times 7 = 14$$

3. (a) Evaluate :

$$\lim_{x \rightarrow 0} \frac{\tan 2x - 2 \sin x}{x^3}$$

(b) The function  $f(x) = \frac{2x^2 - 8}{x - 2}$  is undefined

at  $x = 2$ . What value must be assigned to  $f(2)$ , if  $f(x)$  is to be continuous at  $x = 2$ ?  $2 \times 7 = 14$

4. (a) Integrate :

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

(b) Find the equation of the normal to the parabola  $y^2 = 3x$  which is perpendicular to the line  $y = 2x + 4$ .

$2 \times 7 = 14$

5. (a) Express  $\frac{1}{1 - \cos \theta + 2i \sin \theta}$  in the form of  $A + iB$ .

- (b) Draw a rough sketch of the curve  $\frac{x^2}{4} + \frac{y^2}{9} = 1$ ; and evaluate the area of the region under the curve and above the x-axis. 2×7=14

6. (a) Verify that  $B^T A^T = (AB)^T$  when

$$A = \begin{bmatrix} 1 & 1 & 2 \\ 2 & 1 & 0 \end{bmatrix}, B = \begin{bmatrix} 1 & 2 \\ 2 & 0 \\ -1 & 1 \end{bmatrix}.$$

(T denotes Transpose)

(b) Show that 
$$\begin{vmatrix} a & b-c & c-b \\ a-c & b & c-a \\ a-b & b-a & c \end{vmatrix}$$

$$= (a+b-c)(b+c-a)(c+a-b). \quad 2 \times 7 = 14$$

7. (a) Find the mean and the median for the following data :

| <i>Weight in kg</i> | <i>No. of Persons</i> |
|---------------------|-----------------------|
| 36 – 40             | 14                    |
| 41 – 45             | 26                    |
| 46 – 50             | 40                    |
| 51 – 55             | 53                    |
| 56 – 60             | 50                    |
| 61 – 65             | 37                    |
| 66 – 70             | 25                    |

- (b) Find the mean deviation of the following series :

| <i>X</i> | <i>Frequency</i> |
|----------|------------------|
| 10       | 3                |
| 11       | 12               |
| 12       | 18               |
| 13       | 12               |
| 14       | 3                |
| Total    | 48               |

$$2 \times 7 = 14$$