



C20-C-CM-102

7017

BOARD DIPLOMA EXAMINATION, (C-20)

JUNE/JULY—2022

DCE – FIRST YEAR EXAMINATION

ENGINEERING MATHEMATICS – I

Time : 3 hours ]

[ Total Marks : 80

**PART—A**

3×10=30

- Instructions :** (1) Answer **all** questions.  
(2) Each question carries **three** marks.

1. If  $A = \{-2, -1, 0, 1, 2\}$  and  $f : A \rightarrow B$  is a function such that  $f(x) = x^2 + x + 1$ , then find the range of  $f$ .

2. Resolve  $\frac{x}{(x-1)(x-3)}$  into partial fractions.

3. If  $A = \begin{bmatrix} 2 & 3 & 1 \\ 6 & -1 & 5 \end{bmatrix}$ ,  $B = \begin{bmatrix} 1 & 2 & -1 \\ 0 & -1 & 3 \end{bmatrix}$  and  $A + B - X = 0$ , then find  $X$ .

4. If  $A + B = \frac{3\pi}{4}$ , then prove that  $(1 + \cot A)(1 + \cot B) = 2$ .

5. Prove that  $\frac{1 + \cos 2\theta}{\sin 2\theta} = \cot \theta$

6. Find the modulus of the complex number  $(3 + 4i)(2 - 3i)$ .
7. Find the distance between the parallel lines  $4x - 3y + 9 = 0$  and  $4x - 3y + 5 = 0$
8. Evaluate  $\lim_{x \rightarrow 0} \frac{\tan 9x}{\tan 4x}$
9. Find the derivative of  $\sqrt{x} - \sec x + \log x$  w.r.t.  $x$ .
10. Find the derivative of  $\sqrt{\tan 2x}$  w.r.t.  $x$ .

**PART—B**

8×5=40

- Instructions :** (1) Answer **all** questions.  
 (2) Each question carries **eight** marks.

11. (a) Show that 
$$\begin{vmatrix} a+b+2c & a & b \\ c & b+c+2a & b \\ c & a & c+a+2b \end{vmatrix} = 2(a+b+c)^3$$

**( OR )**

- (b) Solve the following system of equations using matrix inversion method :

$$x + y + z = 6, \quad x - y + z = 2, \quad 2x + y - z = 1$$

12. (a) If  $\cos x + \cos y = \frac{3}{5}$  and  $\cos x - \cos y = \frac{2}{7}$ , then show that

$$21 \tan\left(\frac{x-y}{2}\right) + 10 \cot\left(\frac{x+y}{2}\right) = 0$$

**( OR )**

- (b) Prove that  $\tan^{-1}\left(\frac{1}{7}\right) + \tan^{-1}\left(\frac{1}{13}\right) = \tan^{-1}\left(\frac{2}{9}\right)$

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13. (a) Solve  $2\sin^2\theta - \sin\theta - 1 = 0$

( OR )

(b) In any  $\Delta ABC$ , show that  $\cot\frac{A}{2} + \cot\frac{B}{2} + \cot\frac{C}{2} = \frac{s^2}{\Delta}$

14. (a) Find the equation of the circle with  $(-5, 1)$  and  $(3, -7)$  as the two end points of its diameter and also find its centre and radius.

( OR )

(b) Find the equation of the parabola whose focus is  $(1, -1)$  and directrix is  $x - 2y + 1 = 0$

15. (a) If  $x = a(\theta - \sin\theta)$  and  $y = a(1 - \cos\theta)$ , then find  $\frac{dy}{dx}$  at  $\frac{\pi}{2}$ .

( OR )

(b) If  $y = \tan^{-1}x$ , then find  $(1 + x^2)y_2 + 2xy_1 = 0$

**PART—C**

10×1=10

**Instructions :** (1) Answer the following question.

(2) Its carries **ten** marks.

16. Find the length of tangent, normal, sub-tangent and sub-normal at the point  $(2, 4)$  on the curve  $y = x^3 - 2x^2 + 4$  and also find the equations of tangent and normal.

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