



C-14- C/CM-102

4015

BOARD DIPLOMA EXAMINATION, (C-14)

OCT/NOV—2015

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.  
(3) Answers should be brief and straight to the point and shall not exceed *five* simple sentences.

1. Resolve  $\frac{7x - 6}{(x - 1)(x - 2)}$  into partial fractions.

2. If

$$A = \begin{pmatrix} 2 & 3 & 1 \\ 0 & 1 & 5 \end{pmatrix} \text{ and } B = \begin{pmatrix} 1 & 2 & 6 \\ 0 & 1 & 3 \end{pmatrix}, \text{ find } 2A-3B.$$

3. If

$$A = \begin{pmatrix} 1 & 4 & 7 \\ 2 & 5 & 8 \\ 3 & 6 & 9 \end{pmatrix} \text{ and } B = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 0 \end{pmatrix}, \text{ find } A^T - B^T.$$

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4. Prove that

$$\frac{\cos 11^\circ \sin 11^\circ}{\cos 11^\circ \sin 11^\circ} \tan 56^\circ$$

5. Prove that

$$\frac{\sin 2}{1 - \cos 2} \tan$$

6. Express  $\frac{2}{3} - \frac{3i}{4i}$  in the form of  $a + ib$ .

7. Find the distance between parallel lines  $2x + 3y - 5 = 0$  and  $2x + 3y - 9 = 0$ .

8. Find the equation of the circle with  $(2, 3)$  and  $(6, 9)$  as the end points of a diameter.

9. Evaluate :

$$\sum_{n=1}^n \frac{1 + 2 + 3 + \dots + n}{n^2}$$

10. Find  $\frac{dy}{dx}$ , if  $y = x \sin x$ .

### PART—B

10×5=50

**Instructions :** (1) Answer *any five* questions.

(2) Each question carries **ten** marks.

(3) Answers should be comprehensive and the criterion for valuation is the content but not the length of the answer.

11. (a) If

$$A = \begin{pmatrix} 1 & 2 & 1 \\ 3 & 0 & 2 \\ 4 & 5 & 0 \end{pmatrix} \text{ and } B = \begin{pmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 0 & 1 & 3 \end{pmatrix},$$

verify that  $(AB)^T = B^T A^T$ .

(b) Solve the system of equations  $x + 2y + 3z = 6$ ,  $2x + 4y + z = 7$  and  $3x + 2y + 9z = 14$  by using Cramer's rule.

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12. (a) If  $A + B + C = 180^\circ$ , then prove that

$$\sin 2A + \sin 2B + \sin 2C = 4 \cos A \cos B \sin C.$$

(b) If

$$\tan^{-1}(x) + \tan^{-1}(y) + \tan^{-1}(z) = \frac{\pi}{2},$$

show that  $XY + YZ + ZX = 1$ .

13. (a) Solve :

$$2 \cos^2 \theta + 3 \cos \theta - 1 = 0$$

(b) In a triangle  $ABC$ , prove that  $2bc \cos A = a^2 - b^2 - c^2$ .

14. (a) Find the equation of the parabola whose focus is at  $(1, -1)$  and directrix is the line  $3x - 4y - 5 = 0$ .

(b) Find the lengths of the major and minor axes, length of latus rectum, eccentricity and foci of the ellipse

$$\frac{x^2}{25} + \frac{y^2}{16} = 1$$

15. (a) Find  $\frac{dy}{dx}$ , if  $y = x^x$ .

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

16. (a) If

$$u = \log(x + y + z), \text{ prove that } x \frac{u}{x} + y \frac{u}{y} + z \frac{u}{z} = 1.$$

(b) If

$$u(x, y) = x^2 + xy + y^2, \text{ find } \frac{\partial^2 u}{\partial x^2} \text{ and } \frac{\partial^2 u}{\partial y^2}$$

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17. (a) Find the equations of tangent and normal to the curve  $y = x^2 - 2x + 1$  at  $(1, 2)$ .

(b) The side of an equilateral triangle is increasing at a rate of  $2 \text{ cm/sec}$ . Find the rate of increase of its area given its side is  $25 \text{ cm}$ .

- \* **18.** (a) The sum of two numbers is 24. Find the numbers so that the sum of their squares is a minimum.
- (b) If the radius of a spherical balloon is increased by 0.1%, find the approximate percentage increase in its volume.

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