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Reg. No. : .....

**Code No. : 20654 E**      **Sub. Code : EEMA 11**

B.Sc. (CBCS) DEGREE EXAMINATION,  
NOVEMBER 2023.

First Semester

Mathematics

Elective – ALGEBRA AND DIFFERENTIAL EQUATIONS

(For those who joined in July 2023 onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. One of the roots of the reciprocal equation  $6x^6 - 25x^5 + 31x^4 - 31x^2 + 25x - 6 = 0$  is
- (a) 4 (b) -2  
(c) -1 (d) 0
2. The equation whose roots are 10 times those of the equation  $x^3 + 3x - 5 = 0$  is \_\_\_\_\_.
- (a)  $x^3 + 3x - 50 = 0$  (b)  $x^3 + 30x - 50 = 0$   
(c)  $x^3 + 30x - 500 = 0$  (d)  $x^3 + 300x - 5000 = 0$

3. If the equation  $2x^3 - 3x^2 + 2x - 3 = 0$  has one root  $i$ , then its real root is \_\_\_\_\_.
- (a)  $\frac{2}{3}$  (b)  $-\frac{2}{3}$   
(c)  $\frac{3}{2}$  (d) 1
4. One root of  $x^4 - 3x + 1 = 0$  lies between \_\_\_\_\_.
- (a) 2 and 3 (b) 2 and 2.5  
(c) 2.5 and 3 (d) 1 and 2
5. Horner's method can be used to get the \_\_\_\_\_ roots of the equation  $f(x) = 0$ .
- (a) rational (b) integers  
(c) positive integers (d) irrational
6. The characteristic equation of the matrix  $A = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$  is \_\_\_\_\_.
- (a)  $x^2 + 2x + 1 = 0$  (b)  $x^2 - 2x + 1 = 0$   
(c)  $x^2 + 2x - 1 = 0$  (d)  $x^2 - 2x - 1 = 0$
7. The general solution of the differential equation  $y - P(x+1) = P$  is \_\_\_\_\_.
- (a)  $y = P(x+2)$  (b)  $y = cx$   
(c)  $y = cx + 2c$  (d)  $y = c(x+1)$

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8. The value of  $L(\cosh at)$  is \_\_\_\_\_.

- (a)  $\frac{s}{s^2 + a^2}$  (b)  $\frac{a}{s^2 + a^2}$   
 (c)  $\frac{s}{s^2 - a^2}$  (d)  $\frac{a}{s^2 - a^2}$

9. The value of  $L^T\left(\frac{1}{s^2}\right)$  is \_\_\_\_\_.

- (a)  $t$  (b)  $2t^2$   
 (c)  $\frac{t^2}{2}$  (d)  $\frac{2}{t^2}$

10. The solution of  $2p + 3q = 1$  is \_\_\_\_\_.

- (a)  $\phi(2x - 3y, y + 3z) = 0$   
 (b)  $\phi(2x - 3y, y - 3z) = 0$   
 (c)  $\phi(3x - 2y, y - 3z) = 0$   
 (d)  $\phi(3x - 2y, 3y - z) = 0$

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

11. (a) Solve the equation  $x^4 - 5x^3 + 4x^2 + 8x - 8 = 0$  if one of whose roots is  $1 - \sqrt{5}$ .

Or

(b) Form the equation with rational coefficients one of whose roots is  $\sqrt{2} + \sqrt{3}$ .

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12. (a) Diminish the roots of the equation  $x^3 + x^2 + x - 100 = 0$  by 4.

Or

(b) Find by Newton's method the root of the equation  $x^3 - 3x + 1 = 0$  which lies between 1 and 2.

13. (a) Find the inverse of the matrix

$$A = \begin{pmatrix} 2 & 2 & 0 \\ 2 & 1 & 1 \\ -7 & 2 & -3 \end{pmatrix} \text{ using Cayley-Hamilton}$$

theorem.

Or

(b) Calculate  $A^4$  when  $A = \begin{pmatrix} 1 & 3 \\ 2 & 4 \end{pmatrix}$ .

14. (a) Solve :  $P^3 - 6P^2 + 11P - 6 = 0$ .

Or

(b) Solve :  $y = p \sin p + \cos p$ .

15. (a) Find  $L(e^{-ax} \cos bx)$ .

Or

(b) Find  $L^T\left(\frac{1}{(s+3)^2 + 25}\right)$ .

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[P.T.O.]





PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

16. (a) Solve the equation

$$8x^4 - 90x^3 + 315x^2 - 405x + 162 = 0 \quad \text{given that the roots are in geometric progression.}$$

Or

- (b) Solve :  $6x^6 - 5x^5 - 44x^4 + 44x^2 + 5x - 6 = 0$ .

17. (a) Find the positive root of  $x^3 - x - 3 = 0$  by Horner's method correct to two places of decimals.

Or

- (b) Find by Newton's method correct to 3 places of decimals the root between 0 and 1 of the equation  $3x - \cos x - 1 = 0$ .

18. (a) Find the eigen values and eigen vectors of

$$\text{the matrix } A = \begin{pmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{pmatrix}.$$

Or

- (b) Find the inverse of the matrix  $\begin{pmatrix} 3 & 3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{pmatrix}$

using Cayley-Hamilton theorem.

19. (a) Solve :  $3x - y + \log p = 0$ .

Or

- (b) Solve :  $p \cot x + q \cot y = \cot z$ .

20. (a) Find  $L(t^2 + \cos 2 + \cos t + \sin^2 2t)$ .

Or

- (b) Find  $L^T \left[ \log \left( \frac{s+a}{s+b} \right) \right]$ .

