Seat No	

F.Y.B.Tech. (Part-I) (Semester – I) (CBCS)

Examination, June– 2025

ENGINEERING MATHEMATICS - I

Sub. Code : 71810

Day and Date : Wednesday, 25/06/2025 **Total Marks :70**

Time : 10.30 a.m. to 1.00 p.m.

Instructions : 1) **Attempt any three questions from each section.**
2) **Figures to right indicates full marks.**
3) **Use of non-programmable calculator is allowed.**

Section-I

Q.1) a) Find the rank of matrix $\begin{bmatrix} 4 & -3 & 6 \\ 12 & -9 & 18 \\ 20 & -15 & 30 \end{bmatrix}$. **(6)**

b) Test for consistency and if possible Solve the equations: **(6)**

$$2x - y + 3z = 1, \quad 3x + 2y + z = 3, \quad x - 4y + 5z = -1$$

Q.2) a) Find Eigen values of the matrix : **(6)**

$$\begin{bmatrix} 3 & 10 & 5 \\ -2 & -3 & -4 \\ 3 & 5 & 7 \end{bmatrix}.$$

b) Find the Eigen values and Eigen vector of the smallest Eigen value of the matrix $\begin{bmatrix} 8 & -8 & -2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$. **(5)**

Q.3) a) Simplify $\frac{(\cos 5\theta - i\sin 5\theta)^2(\cos 7\theta + i\sin 7\theta)^{-3}}{(\cos 4\theta - i\sin 4\theta)^9(\cos\theta + i\sin\theta)^5}$. **(6)**

b) Using De Moivre's Theorem, Prove that **(5)**

$$\frac{\sin 5\theta}{\sin\theta} = 16\cos^4\theta - 12\cos^2\theta + 1.$$

Q.4) Attempt any Two **(6)**

a) Solve the following equations

$$x + y + 2z = 0, \quad x + 2y + 3z = 0$$
$$x + 3y + 4z = 0, \quad 3x + 4y + 7z = 0$$

b) Verify Cayley-Hamilton theorem for the matrix $\begin{bmatrix} 1 & 1 & 2 \\ 3 & 1 & 1 \\ 2 & 3 & 1 \end{bmatrix}$. **(6)**

c) Find all values of the $\left(\frac{1}{2} + i\frac{\sqrt{3}}{2}\right)^{\frac{3}{4}}$. **(6)**

Section-II

Q.5) a) Using Maclaurin's series prove that **(6)**

$$\log \text{ cox} = -\frac{x^2}{2} - \frac{x^4}{12} - \frac{x^6}{45} - - - - - - - - - - - - -$$

b) Expand in powers of $x^5 - x^4 + x^3 - x^2 - 1$ in powers of (x-1). **(6)**

Q.6) a) If $u = \log\left(\frac{x^2+y^2}{x \cdot y}\right)$, then prove that $\frac{\partial^2 u}{\partial x \partial y} = \frac{\partial^2 u}{\partial y \partial x}$. **(6)**

b) If $u = \frac{x+y}{1-xy}, v = \tan^{-1}(x) + \tan^{-1}(y)$, then find $\frac{\partial(u,v)}{\partial(x,y)}$. **(5)**

Q.7) a) Use Gauss elimination method to solve **(6)**

$2x + y + z = 10; \quad 3x + 2y + 3z = 18;$

$x + 4y + 9z = 16$

b) Apply Gauss-Jordan method to solve thee equations **(5)**

$x + y + z = 9, \; 2x - 3y + 4z = 13, \; 3x + 4y + 5z = 40.$

Q.8) Attempt any Two **(12)**

a) Evaluate $\lim_{x\to 1} \frac{x^x - x}{x - 1 - \log x}$

b) If $u = \tan^{-1}\left(\frac{x^3+y^3}{x-y}\right)$, prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \sin 2u$.

c) Use Jacobi's iteration method to solve

$20x + y - 2z = 17, \; 3x + 20y - z = -18, \; 2x - 3y + 20z = 25.$
