

S.E. ECS NEP June 2026.

04/06/26.

Time: 2 hour

SEM III

Marks: 60

Note: 1) Question 1 is compulsory.

2) Attempt any 3 questions from Question 2 to Question 6

3) Figures to the right indicate full marks.

- Q1 Attempt any five questions**
- A** If $A = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 3 & 0 \\ 1 & 4 & 2 \end{bmatrix}$ then find the eigen values of A^3 3
- B** Find Laplace transform of $e^{-2t} \sin 3t$ 3
- C** Find the Fourier coefficient a_n of $f(x) = x$ in $(0, 2\pi)$ 3
- D** Check whether the vectors $(-1, 3, 2)$ and $(4, 2, -1)$ are orthogonal. 3
- E** Find $L^{-1} \left[\frac{3}{s^2 - 4s + 12} \right]$ 3
- F** Reduce the following quadratic form through congruent transformation $x^2 + 2y^2 - 7z^2 - 4xy + 8xz$ 3
- Q2** 15
- A** Find Laplace transform of $t \sqrt{1 - \sin 2t}$ 4
- B** Find the Eigen values and Eigen vectors of the matrix 5
- $$A = \begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$$
- C** Reduce the following quadratic form to canonical form 6
- $$2x_1^2 + x_2^2 - 3x_3^2 - 8x_2x_3 - 4x_3x_1 + 12x_1x_2$$
- also find its rank, signature and class value.
- Q3** 15
- A** Verify Cauchy-Schwartz inequality for the vectors $u = (-4, 2, 1)$ and $v = (8, -4, -2)$ 4
- B** Check whether the following are subspaces 5
- i) $W = \{(a, 0, 0) / a \in R\}$ $v = R^3$
- ii) $W = \{(x, y) / x = y\}$ $v = R^2$
- C** Verify Cayley-Hamilton theorem for the matrix A and hence find A^{-1} 6
- where $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & -1 & 4 \\ 3 & 1 & -1 \end{bmatrix}$
- Q4** 15
- A** Evaluate $\int_0^\infty e^{-2t} \sin^2 t \, dt$, using Laplace transforms 4
- B** Find $L^{-1} \left[\frac{s+1}{(s+2)(s+3)(s+4)} \right]$ using partial fraction method 5
- C** Obtain half range cosine series for $f(x) = 2x - x^2$ in $(0, \pi)$ 6

- Q5 15
- A Obtain Fourier series expansion of $f(x) = a^2 - x^2$ in $(-a, a)$ 4
- B Prove that the matrix A is diagonalisable 5
- $$A = \begin{bmatrix} -9 & 4 & 4 \\ -8 & 3 & 4 \\ -16 & 8 & 7 \end{bmatrix}$$
- C Using Convolution theorem find $L^{-1} \left[\frac{s^2}{(s^2+1)(s^2+4)} \right]$ 6
- Q6 15
- A Find $L^{-1} \left\{ \log \left(\frac{\sqrt{s+1}}{s^2+2} \right) \right\}$ 4
- B Find the Fourier Series for $f(x) = \sqrt{1 - \cos x}$ in $0 \leq x \leq 2\pi$ 5
- C Construct an orthonormal basis for the subspace of R^3 by applying Gram-Schmidt process where $S = \{(1, 1, 1), (0, 1, 1), (0, 0, 1)\}$ 6
