

S.E. ExtC C-Scheme May 2026

Time: 3 hour

Marks: 80

Note: 1) Question 1 is compulsory.

04/06/26

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

3) Figures to the right indicate full marks.

Q1	Attempt All questions	Marks
A	If $A = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 3 & 0 \\ 1 & 4 & 2 \end{bmatrix}$ then find the eigen values of A^2	5
B	Find Laplace transform of $f(t) = te^t \sin 2t$	5
C	Find the half range Sine Series for $f(x) = x^2$, where $x \in (-\pi, \pi)$	5
D	Determine the constant a, b, c, d if $f(z) = x^2 + 2axy + by^2 + i(cx^2 + 2dxy + y^2)$ is analytic.	5
Q2		
A	Using Green's theorem in a plane to evaluate the line integral $\oint_C (xy + y^2)dx + x^2dy$ Around the boundary of the region defined by $y=x^2$ and $y=x$	6
B	Find the Eigen values and Eigen vectors of the matrix $A = \begin{bmatrix} 2 & -1 & 1 \\ 1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$	6
C	Show that the function $v = e^x \sin y$ satisfies Laplace's equation, also find analytic function.	8
Q3		
A	Prove that $\vec{F} = (x^2 + xy^2)i + (y^2 + x^2y)j$ is irrotational.	6
B	Prove that the function $(x^3 - 3xy^2 + 3x) + i(3x^2y - y^3 + 3y)$ is analytic	6
C	Verify Cayley-Hamilton theorem for the matrix A and hence find A^{-1} and A^4 where $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$	8
Q4		
A	Using Stokes theorem to evaluate $\int_C \vec{F} \cdot d\vec{r}$ Where $\vec{F} = x^2i + xyj$ where C is the boundary of the rectangle $x=0, y=0, x=a, y=b$	6
B	Evaluate $\int_0^\infty \frac{e^{-2t} \cos 2t}{t} dt$, using Laplace transforms	6
C	Using Convolution theorem find $L^{-1} \left[\frac{s^2}{(s^2+9)(s^2+4)} \right]$	8

Q5

A Find $L \{ e^{-t} \sin 2t \cos 3t \}$ 6

B Prove that the vector field $\vec{F}$ on R^3 defined by 6

$\vec{F} = (y^2 \cos x + z^3) \hat{i} + (2y \sin x - 4) \hat{j} + (3xz^2 + 2) \hat{k}$
is conservative and find its scalar potential.

C Find the Fourier Series for $f(x) = \frac{3x^2 - 6x\pi + 2\pi^2}{12}$ in $0 \leq x \leq 2\pi$ 8

Q6

A Obtain Fourier series expansion of $f(x) = 9 - x^2$ in $(-3, 3)$ 6

B Prove that the matrix A is diagonalisable, find the transforming matrix and the diagonal matrix. 6

$$A = \begin{bmatrix} -9 & 4 & 4 \\ -8 & 3 & 4 \\ -16 & 8 & 7 \end{bmatrix}$$

C 4

i) Find $L^{-1} \left\{ \log \left(\frac{s+1}{s^2+2} \right) \right\}$

ii) Find $L^{-1} \left\{ \frac{1}{s^2+4s+5} \right\}$ 4
