(Please write your Exam Roll No.) *Exam Roll No.*

END TERM EXAMINATION

SECOND SEMESTER [B.TECH] JUNE 2025

Paper Code: BS-112	***Subject: Applied Mathematics-II***
Time: 3 Hours	***Maximum Marks:60***

Note: Attempt five questions in all including Q.No.1 which is compulsory. Select one question from each unit.

Q1 Attempt all questions **(5x4=20)**

a) Prove that $f(z) = \bar{z}$ *is nowhere analytic.*

b) Find the Principal value of $\log(-1-i)$

c) Find the Laplace transformation of $(1+t)e^{3t}$.

d) Taylor series expansion of $\frac{1}{z-2}$ in $|z| < 1$ is .....

UNIT-I

Q2 a) Find all the values of $(1+i)^i$. **(5)**

b) Varify that the function $u(x,y) = x(1+y)$ is harmonic. Find its corresponding analytic function. **(5)**

Q3 a) Evaluate the integral $\oint_C \tan z\, dz$ along the simple closed curve defined by $C : |z| = 5$. **(5)**

b) Find the Line integral $\int \frac{1}{z}$ along the straight line with the end points $z = 0$ and $z + 1 + i$. **(5)**

UNIT-II

Q4 a) Find the Bilinear transformation or Mobius transformation which maps $1, -i, -1$ of the z-plane onto the points $i, -1, i$ of the w-plane respectively. **(5)**

b) Discuss the type of singularities and find their residues for the function $(z) = \frac{1}{\sin z}$. **(5)**

Q5 a) Find and plot the Image of the vertical line $x = 1$ as well as horizontal line $y = 0$ under the function $f(z) = e^z$. **(5)**

b) Prove that the integral $\iint_{-\infty}^{\infty} \frac{x^2}{(x^2+1)(x^2+4)} dx = \frac{\pi}{3}$. **(5)**

UNIT-III

Q6 a) Using Laplace transformation solve the ordinary differential equation $y''(t) - 3y'(t) + 2\,y(t) = e^{3t},\ y(0) = 1, y'(0) = 0$. **(5)**

b) Find the inverse Laplace transformation of $F(s) = \frac{-11s+25}{s^2-6s+15}$. **(5)**

Q7 a) Determine the Fourier series of the function $f(x) = 1 - x^2$ in the interval $[-1,1]$. **(5)**

b) Find the Fourier transformation of $f(x) = \begin{cases} -1, & |x| < 1 \\ 0, & |x| > 1 \end{cases}$

Hence evaluate $\int_0^{\infty} \frac{\sin x}{x}$. **(5)**

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UNIT-IV

Q8 a) Find the temperature in a laterally insulated bar of length L whose ends are kept at temperature zero, assuming that initial temperature is $f(x) = \begin{cases} x, & 0 < x < \frac{L}{2} \\ L - x, & \frac{L}{2} < x < L \end{cases}$ **(5)**

b) A tightly stretched string with fixe end points $x = 0$ and $x = l$, is initially in a position given by $y = sin^3\left(\frac{\pi x}{l}\right)$. If it is released from rest from its position, find the displacement $y(x, t)$. **(5)**

Q9 a) Solve the Laplace equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$, subject to the conditions $u(0, y) = u(l, y) = u(x, 0) = 0$ and $u(x, a) = \sin\frac{n\pi x}{l}$. **(5)**

b) Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$, with boundary conditions $u(x, 0) = 3\sin(n\pi x), u(0, t) = 0$ and $u(1, t) = 0$, where $0 < x < 1, t > 0$. **(5)**

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