Graphic Era HILL UNIVERSITY
Established by an Act of the State Legislature of Uttarakhand (Adhiniyam Sankhya 12 of 2011)
University under section 2(f) of UGC Act, 1956

Term Evaluation (Odd) Semester Examination September 2025

Roll no.....

Name of the Course: B.Tech. in Civil Engineering
Semester: III
Name of the Paper: Mathematics III
Paper Code: TMA 302
Time: 1.5 hour **Maximum Marks: 50**

Note:
(i) Answer all the questions by choosing any one of the sub-questions
(ii) Each question carries 10 marks.

Q1. (10 Marks)

a. Using Fourier sine integral show that $\int_0^\infty \frac{(1-cos\lambda\pi)}{\lambda} sin\lambda x \, d\lambda = \begin{cases} \frac{\pi}{2}, & if\ 0 < x < \pi \\ 0, & if\ x > \pi \end{cases}$ (CO1)

OR

b. Find the Fourier transform of $f(x) = \begin{cases} 1 - x^2, & if\ |x| \le 1 \\ 0, & if\ |x| > 1 \end{cases}$ and hence deduce that

$\int_0^\infty \frac{(xcosx - sinx)}{x^3} \cos\left(x/2\right) dx = -\frac{3}{16}\pi.$ (CO1)

Q2. (10 Marks)

a. Find the Fourier sine transform of $f(x) = \frac{e^{-ax}}{x}$ (CO1)

OR

b. Find the Fourier cosine transform of $f(x) = \frac{1}{1+x^2}$ (CO1)

Q3. (10 Marks)

a. If $\int_0^\infty f(x) cospx \, dx = \begin{cases} 1 - p, & 0 \le p \le 1 \\ 0, & p > 1 \end{cases}$ then prove that $\int_0^\infty \frac{sin^2 x}{x^2} dx = \frac{\pi}{2}$ (CO1)

OR

b. Find the Fourier Inverse transform for $\frac{1}{8 - 6ip - p^2}$ (CO1)

Q4. (10 Marks)

a. Prove that $u = x^2 - y^2 - 2xy - 2x + 3y$ is harmonic and find a function v such that $f(z) = u + iv$ is analytic. (CO2)

OR

b. If $u = x^2 - y^2$, find the corresponding analytic function $f(z) = u + iv$. (CO2)

Q5. (10 Marks)

a. Evaluate the following integral using the Cauchy integral formula

$\int_C \frac{4-3z}{z(z-1)(z-2)} dz, \quad C: |z| = \frac{3}{2}.$ (CO2)

OR

b. Find the value of the integral $\int_C \frac{z^2 - 2z}{(z+1)^2(z^2+4)} dz, \quad C: |z| = 10.$ (CO2)