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

2261514

End Term Back Paper Examination January 2025

Name of the course: B.Tech | *Semester: I*

Name of the paper: Engineering Mathematics - II | *Paper Code: TMA -201*

Time: 3 hours | Maximum Marks: 100

Note:
(i) All questions are compulsory.
(ii) Answer any two sub questions among a, b and c in each main question.
(iii) Total marks in each main question are twenty.
(iv) Each sub part carries 10 marks.

Q.1 $(10\times 2 = 20$ Marks) CO: 1

a. Solve of $(1+x^2)dy - xy\,dx = 0$.

b. Test for exactness and solve the differential equation, $(y^2 - x^2)dx + 2xy\,dy = 0$

c. Solve by the method of variation of parameters: $\dfrac{d^2y}{dx^2} + y = \operatorname{cosec} x$.

Q.2 $(10\times 2 = 20$ Marks) CO: 2

a. Find the Laplace transform of $\dfrac{1-\cos t}{t}$.

b. Using convolution theorem prove that $L^{-1}\left\{\dfrac{s^2}{(s^2+a^2)(s^2+b^2)}\right\} = \dfrac{a\sin at - b\sin bt}{a^2-b^2}$

c. Find the Laplace transform of the periodic function $f(t) = e^t$ for $0 < t < 2\pi$.

Q.3 $(10\times 2 = 20$ Marks) CO: 3

a. Expand the function $f(x) = x^2$ as a Fourier series in the interval $-\pi \le x \le \pi$.

b. Find the Fourier series expansion of the periodic function of period 2π.
$f(x) = e^x, \quad 0 < x < 2\pi$

c. Obtain the Fourier series expansion of $f(x) = \begin{cases} x & 0 < x < \pi \\ -x, & -\pi < x < 0 \end{cases}$

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Q.4 (10×2=20 Marks) CO: 4

a. Solve $\frac{\partial^2 z}{\partial x^2}+\frac{\partial^2 z}{\partial x \partial y}-6\frac{\partial^2 z}{\partial y^2}=\cos(2x+y)$

b. Solve $\frac{\partial u}{\partial x}=2\frac{\partial u}{\partial t}+u$; $u(x,0)=6e^{-3x}$

c. Find the temperature in a bar of length 2 whose ends kept at zero and lateral surface insulated if initial temperature is $\sin\frac{\pi x}{2}+3\sin\frac{5\pi x}{2}$.

Q.5 (10×2=20 Marks) CO: 5

a. Prove that: $\int_{-1}^{1} P_m(x)P_n(x)\,dx=0$, if $m\neq n$

b. Prove that: $x.J_n'(x)=n.J_n(x)-x.J_{n-1}(x)$

c. Prove that: $(2n+1)xP_n=(n+1)P_{n+1}+nP_{n-1}$