End Semester (Back Paper) Examination 2024

Name of the course: B.Tech — *Semester: II*

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	(10×2=20 Marks)	
(a)	Solve: $\left(x^2+y^2\right)dx+2xydy=0$.	CO: 1
(b)	Solve: $\left(D^2-2D+1\right)y=x\sin x$.	
(c)	Solve by the method of variation of parameters: $\dfrac{d^2y}{dx^2}+y=\operatorname{cosec} x$.	
Q.2	(10×2=20 Marks)	
(a)	Evaluate $L\left[t^2e^{2t}\sin t\right]$.	CO: 2
(b)	Using convolution theorem prove that $L^{-1}\left\{\dfrac{s^2}{\left(s^2+a^2\right)\left(s^2+b^2\right)}\right\}=\dfrac{a\sin at-b\sin bt}{a^2-b^2}$	
(c)	Solve the differential equation using Laplace transform method. $\dfrac{d^2x}{dt^2}+9x=\cos 2t,\ \ x(0)=1,\ x\left(\dfrac{\pi}{2}\right)=-1$	
Q.3	(10×2=20 Marks)	
(a)	Expand the function $f(x)=x\sin x$, as a Fourier series in the interval $-\pi\le x\le\pi$.	CO: 3
(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 $f(x)=\begin{cases} x, & 0<x<\pi \\ -x, & -\pi<x<0 \end{cases}$	
Q.4	(10×2=20 Marks)	
(a)	Solve $\dfrac{\partial^2 z}{\partial x^2}-3\dfrac{\partial^2 z}{\partial x\partial y}+2\dfrac{\partial^2 z}{\partial y^2}=e^{2x-y}+e^{x+y}+\cos(x+2y)$	CO: 4
(b)	Solve $\dfrac{\partial u}{\partial x}=2\dfrac{\partial u}{\partial t}+u\quad ;\quad u(x,0)=6e^{-3x}$	
(c)	Find the temperature in a bar of length 2 whose ends kept at zero and lateral surface insulated if initial temperature is $\sin\dfrac{\pi x}{2}+3\sin\dfrac{5\pi x}{2}$.	
Q.5	(10×2=20 Marks)	
(a)	Prove that: $\int_{-1}^{1}P_m(x)P_n(x)dx=0$, if $m\neq n$	CO: 5
(b)	Prove that: $xJ_n'(x)=nJ_n(x)-xJ_{n+1}(x)$	
(c)	Prove that: $(2n+1)xP_n=(n+1)P_{n+1}+nP_{n-1}$	