End Semester Examination 2024

Name of the course: B.Tech
Name of the paper: Engineering Mathematics II
Time: 3 hours

Semester: II
Paper Code: TMA - 201
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	$(10\times2=20$ Marks)	
(a)	Solve $\left(y^4+2y\right)dx+\left(xy^3+2y^4-4x\right)dy=0.$.	CO: 1
(b)	Solve by method of variation of parameters: $\dfrac{d^2y}{dx^2}-y=\dfrac{2}{1+e^x}$.	
(c)	Solve $\dfrac{d^2y}{dx^2}+2\dfrac{dy}{dx}+y=x\cos x$.	
Q.2	$(10\times2=20$ Marks)	
(a)	Express the following function in terms of unit step function and hence evaluate the Laplace transform $f(t)=\begin{cases}t-1, & 1<t<2\\ 3-t, & 2<t<3\end{cases}$	CO: 2
(b)	Find the inverse Laplace transform of $\dfrac{2s^2+5s-4}{s^3+s^2-2s}$.	
(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	$(10\times2=20$ Marks)	
(a)	Find the partial differential equation by eliminating arbitrary constants $2z=\dfrac{x^2}{a^2}+\dfrac{y^2}{b^2}$	CO: 3
(b)	By using the Lagrange's method of multipliers find the general solution of $x\left(z^2-y^2\right)\dfrac{\partial z}{\partial x}+y\left(x^2-z^2\right)\dfrac{\partial z}{\partial y}=z\left(y^2-x^2\right)$	
(c)	By using Charpit's method solve the partial differential equation: $px+qy=pq$.	

Q.4	$(10\times2=20$ Marks)	
(a)	Solve the following equation by the method of separation of variables $\frac{\partial^2 u}{\partial x\partial t}=e^{-t}\cos x$ given that $u=0$ when $t=0$ and $\frac{\partial u}{\partial t}=0$ when $x=0$.	CO: 4
(b)	If a string of length l is initially at rest in equilibrium position and each of it's points is given the velocity $\left(\frac{\partial y}{\partial x}\right)_{t=0}=b\sin^3\frac{\pi x}{l}$ find the displacement $y(x,t)$.	
(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	$(10\times2=20$ Marks)	
(a)	Expand the function $f(x)=x\sin x$, as a Fourier series in the interval $-\pi\le x\le\pi$.	CO: 5
(b)	Find the Fourier sine and cosine transforms of $f(x)=e^{-ax}$.	
(c)	Obtain the Fourier series expansion of $f(x)=\begin{cases}x, & 0<x<\pi\\ -x, & -\pi<x<0\end{cases}$	