End Semester (Back Paper old syllabus) 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	$(10\times2=20$ Marks)	
(a)	Solve: $\frac{dy}{dx}=\frac{\sqrt{1-y^2}}{\sqrt{1-x^2}}$.	CO: 1
(b)	Test for exactness and solve the differential equation $\left(e^y+1\right)\cos x\,dx+e^y\sin x\,dy=0$.	
(c)	Solve by the method of variation of parameters: $\frac{d^2y}{dx^2}+y=\sec x$.	
Q.2	$(10\times2=20$ Marks)	
(a)	Evaluate $L\left[t^2e^{2t}\sin t\right]$.	CO: 2
(b)	Using convolution theorem prove that $L^{-1}\left\{\frac{s^2}{\left(s^2+a^2\right)\left(s^2+b^2\right)}\right\}=\frac{a\sin at-b\sin bt}{a^2-b^2}$	
(c)	Solve the differential equation using Laplace transform method. $\frac{d^2x}{dt^2}+9x=\cos 2t,\quad x(0)=1,\ x\left(\frac{\pi}{2}\right)=-1$	
Q.3	$(10\times2=20$ Marks)	
(a)	Expand the function $f(x)=x^2$ 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	$(10\times2=20$ Marks)	
(a)	Solve $\frac{\partial^2z}{\partial x^2}+\frac{\partial^2z}{\partial x\partial y}-6\frac{\partial^2z}{\partial y^2}=\cos(2x+y)$	CO: 4
(b)	Solve $\frac{\partial u}{\partial x}=2\frac{\partial u}{\partial t}+u\quad;\qquad u(x,0)=6e^{-3x}$	
(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	$(10\times2=20$ Marks)	
(a)	Prove that: $\int_{-1}^{1}P_m(x)P_n(x)dx=0,\text{if } m\ne n$	CO: 5
(b)	Prove that: $x.J_n'(x)=n.J_n(x)-x.J_{n+1}(x)$	
(c)	Prove that: $(2n+1)xP_n=(n+1)P_{n+1}+nP_{n-1}$	