U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

October 2024 Supplementary Examinations

Programme: B.E. **Semester: III**
Course Code & Branch: **Duration: 3 hrs.**
23MA3BSTFN (Common to all Branches except Civil Engg. & CS-Stream) / **Max Marks: 100**
22MA3BSTFN (Common to all Branches except CS-Stream)
Course: Transform Calculus, Fourier Series and Numerical Techniques

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - 1	***CO***	***PO***	**Marks**
1	a)	Find the Laplace transform of i) $f(t)=te^{2t}\sin(3t)$ ii) $f(t)=\frac{\sin(3t)}{t}$.	CO1	PO1	**06**
	b)	Express the function $f(t)=\begin{cases}\cos t & 0<t<\pi \\ \cos 2t & \pi<t<2\pi \\ \cos 3t & t>2\pi\end{cases}$ in terms of unit step function and hence find its Laplace transform.	CO1	PO1	**07**
	c)	Solve $y''+2y'-3y=\sin(t)$ with $y(0)=0=y'(0)$ by the method of Laplace transform.	CO1	PO1	**07**
		OR			
2	a)	Find the Laplace transform of $f(t)=t\int_0^t \frac{e^{-4t}\sin t}{t}dt$.	CO1	PO1	**06**
	b)	Show that the Laplace transform of the triangular wave function $f(x)=\begin{cases}a & 0\le t\le a \\ 2a-t & a\le t\le 2a\end{cases}$ of period $2a$ is $\frac{1}{s^2}\tanh\left(\frac{as}{2}\right)$.	CO1	PO1	**07**
	c)	Find the inverse Laplace transform of i) $F(s)=\frac{s+5}{s^2-6s+13}$ ii) $F(s)=\frac{(s+1)^2}{(s+2)^4}$.	CO1	PO1	**07**
		UNIT - 2			
3	a)	Obtain the complex form of the Fourier series for the periodic function $f(x)=e^{-x}$ in $-1\le x\le 1$.	CO1	PO1	**06**
	b)	Find the Fourier series of the periodic function $f(x)=x-x^2$ in the interval $(-\pi,\pi)$.	CO1	PO1	**07**

		c)	Determine the constant term and the first harmonic term of the Fourier series expansion of y from the given data	*CO1*	*PO1*	**07**

x	0	45	90	135	180	225	270	315
y	2	1.5	1	1.5	0	0.5	1	1.5

			UNIT - 3			
	4	a)	Find the Fourier transform of $f(x)=\begin{cases} a^2-x^2 & \text{for } \lvert x\rvert \le a \\ 0 & \text{for } \lvert x\rvert > a \end{cases}$.	*CO1*	*PO1*	**06**
		b)	Find the inverse Fourier sine transform of $\dfrac{e^{-as}}{s}$, $a>0$.	*CO1*	*PO1*	**07**
		c)	Obtain the Fourier cosine transform of e^{-ax}, $a>0$ and hence deduce the Fourier cosine transform of xe^{-ax} and also evaluate $\int_0^\infty \dfrac{\cos(\alpha x)}{a^2+\alpha^2}\,d\alpha$.	*CO1*	*PO1*	**07**
			UNIT - 4			
	5	a)	Derive Bendre-Schmidt formula for the solution of one-dimensional heat equation $\dfrac{\partial u}{\partial t}=c^2\dfrac{\partial^2 u}{\partial x^2}$.	*CO1*	*PO1*	**06**
		b)	Solve numerically the wave equation $u_{tt}=16u_{xx}$ subject to the boundary conditions $u(0,t)=0=u(5,t), t>0$ and the initial conditions $u_t(x,0)=0$, $u(x,0)=x^2(5-x)$ taking $h=1$, $k=0.25$ up to two time levels.	*CO1*	*PO1*	**07**
		c)	Solve the equation $\dfrac{\partial u}{\partial t}=\dfrac{\partial^2 u}{\partial x^2}$, $0<x<1$ at $t=0.001$ under the conditions $u(0,t)=0=u(1,t)$, $u(x,0)=f(x)$ where $f(x)=\begin{cases} 2x, & 0\le x\le 0.5 \\ 2(1-x), & 0.5\le x\le 1 \end{cases}$ by taking $h=0.1, k=0.001$.	*CO1*	*PO1*	**07**
			UNIT - 5			
	6	a)	Find the Z-transform of $\sin(3n+5)$.	*CO1*	*PO1*	**06**
		b)	Solve $y_{n+1}+2y_{2n+1}+y_n=n$ with $y_0=0=y_1$ by using Z-transform.	*CO1*	*PO1*	**07**
		c)	Find the path on which a particle in the absence of friction, will slide from one point to another in the shortest time under the action of gravity.	*CO1*	*PO1*	**07**
			OR			
	7	a)	Derive the Euler's equation in the form $\dfrac{\partial f}{\partial y}-\dfrac{d}{dx}\left(\dfrac{\partial f}{\partial y'}\right)=0$.	*CO1*	*PO1*	**06**
		b)	A heavy cable hangs freely under the gravity between two fixed points. Show that the shape of the cable is a Catenary.	*CO1*	*PO1*	**07**
		c)	Find the inverse Z-transform of $\dfrac{z^3-20z}{(z-2)^3(z-4)}$.	*CO1*	*PO1*	**07**

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