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PRN:		Course Code :	ECE201R1

Second Year **B. Tech** End Semester Examination Summer 2023

Transforms & Vector Calculus

Day and Date: Monday, 12/6/23 Max Marks: **100**

Time : 2:00 pm - 5:00 pm Duration: **03** hrs

Instructions: All questions are compulsory.

			Marks	Bloom's Level	CO
Q.1	**Attempt the following**				
a)	Solve $(D^2-5D+6)y=\cos 3x$		08	L3	CO1
b)	Solve $\frac{d^2y}{dx^2}+\frac{dy}{dx}-2y=1+x-x^2$		08	L3	CO1
		OR			
b)	Solve $\frac{d^3y}{dx^3}-7\frac{dy}{dx}-6y=e^{2x}(x+1)$		08	L3	CO1
Q.2	**Attempt the following**				
a)	Find Laplace transform of $H'(t)$ where $H(t)=\begin{cases} t+1 & ;0\le t\le 2 \\ 3 & ;t>2 \end{cases}$		08	L2	CO2
b)	Find Laplace transform of $\int_0^\infty \left(\frac{\cos 6t-\cos 4t}{t}\right)dt$.		08	L3	CO2
		OR			
b)	Find $\overline{f}(s)$ for the following function. 1] $f(t)=t^2\cos at$ 2] $f(t)=t\sinh t$		08	L2	CO2
Q.3	**Attempt any two from the following**				
a)	Using Laplace transform method solve $\frac{dy}{dt}+3y(t)+2\int_0^t y(t)dt=t$, $y=0$ at $t=0$.		08	L3	CO2
b)	Find 1] $L^{-1}[\log(1+\frac{a}{s})]$ 2] $L^{-1}[\cot^{-1}(s+1)]$		08	L1	CO2
c)	Find $f(t)$ for the following function $\frac{s+29}{(s+4)(s^2+9)}$.		08	L2	CO2
Q.4	**Attempt any two from the following**				
a)	Find Fourier series for $f(x)=\lvert x\rvert, -\pi<x<\pi$ Hence deduce that $\frac{\pi^2}{8}=\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+\ldots$		08	L2	CO3
b)	Obtain half range sine series for $f(x)=lx-x^2$ on $(0,l)$.		08	L2	CO3
c)	Find Fourier series of $f(x)=\frac{\pi-x}{2}$ in $(0,2\pi)$.		08	L2	CO3

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Q.5 **Attempt any Two of the following**

a) Evaluate Fourier integral — 09 L4 CO4

i] $f(x)=\begin{cases}1; for|x|<1\\0; for|x|>1\end{cases}$ ii] $f(x)=\begin{cases}e^{kx}; forx<0\\e^{-kx}; forx>0\end{cases}$

b) Find Fourier sine integral of — 09 L2 CO4

1] $f(x)=\begin{cases}x; 0<x<1\\2-x; 1<x<2\\0; x>2\end{cases}$ 2] $f(x)=\begin{cases}\frac{\pi}{2}; for 0<x<\pi\\0; forx>\pi\end{cases}$

c) — 09 L2 CO4

1] Find Fourier sine transform of $f(x)=\begin{cases}1; 0\le x<1\\0; x\ge 1\end{cases}$

2] Find $f(x)$ if its Fourier sine transform is e^{-as}.

3] Find Fourier cosine transform of $f(x)$ if $f(x)=\begin{cases}1; 0\le x\le 1\\0; x>1\end{cases}$.

Q.6 **Attempt any Two of the following**

a) Find unit tangent vector to the curve — 09 L3 CO5

1] $x=2\sin 3t, y=2\cos 3t, z=8t$ At any time $t>0$.

2] $x=t, y=t^2, z=t^3$ at $t=1$.

b) Find the Directional Derivative of — 09 L3 CO5

1] $\phi=x^2y^2+y^2z^2+z^2x^2$ at $(1,1,-2)$ in the direction of tangent to the curve $x=e^{-t}, y=2\sin t+1, z=t-\cos t$ at $t=0$.

2] $\phi=xy^2+yz^2+zx^2$ Along the tangent to the curve $x=t, y=t^2, z=t^3$ at $p(1,1,1)$.

c) 1] Find the Divergence and curl of the vector — 09 CO5

$\overline{V}=xyzi+3x^2yj+(xz^2-y^2z)k$ At $(2,-1,1)$.

2] Show that the vector field by $\overline{f}=2xyz^3i+x^2z^3j+3x^2yz^2k$ is irrotational.

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