E&TC - II

PRN:		Course Code :	UEC301

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

Transforms & Vector Calculus

Day and Date: Tuesday, 28/11/2023 Max Marks: **100**

Time : 1-30 am to 1-30 PM Duration: **03** hrs

Instructions: i)All questions are compulsory.
ii) Non Programmable calculator is allowed .

		Marks	Bloom's Level	CO
Q.1	**Attempt the following**			
a)	Solve $\frac{d^2y}{dx^2}+6\frac{dy}{dx}+9y=e^{-3x}\frac{1}{1+x^2}$.	08	L3	CO1
b)	Solve $x^2\frac{d^2y}{dx^2}-3x\frac{dy}{dx}+4y=2x^2$.	08	L3	CO1
	OR			
b)	Solve $(x+2)^2\frac{d^2y}{dx^2}-(x+2)\frac{dy}{dx}+y=3x+4$.	08	L3	CO1
Q.2	**Attempt the following**			
a)	Find the Laplace transform of i) $4t^2+\sin 3t+e^{2t}$, ii) $t^2\sin 3t$	08	L2	CO2
b)	Find the Laplace transform of $e^{-4t}\int_0^t u\sin 3u\ du$.	08	L3	CO2
	OR			
b)	Find the Laplace transform of $f(t)=K\frac{t}{T}$ for $0<t<T$ and $f(t)=f(t+T)$.	08	L2	CO2
Q.3	**Attempt any two from the following**			
a)	Find the inverse Laplace transform $\frac{2s^2-4}{(s+1)(s-2)(s-3)}$.	08	L3	CO2
b)	Find the inverse Laplace transform by using convolution theorem $\frac{1}{s\left(s^2+a^2\right)}$.	08	L3	CO2
c)	Solve by using Laplace transform $\frac{d^2y}{dt^2}+4\frac{dy}{dt}=-8t$ at $y(0)=0$, $y'(0)=0$.	08	L3	CO2

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Q.4 **Attempt any two from the following**

a)	Find a Fourier series to represent $f(x)=\left(\frac{\pi-x}{2}\right)$ in the interval $0\le x\le 2\pi$.	08	L3	CO3
b)	Find a Fourier series to represent $f(x)=2-\frac{x^2}{2}$ in the interval $(0,2)$.	08	L2	CO3
c)	Expand $f(x)=\begin{cases} kx & ; \ 0\le x\le \frac{l}{2} \\ 0 & ; \ \frac{l}{2}<x<l \end{cases}$ into half range cosine series.	08	L2	CO3

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

a)	Find the Fourier transform of $f(x)=\begin{cases} 1 & ; \ \lvert x\rvert\le a \\ 0 & ; \ \lvert x\rvert>a \end{cases}$.	09	L3	CO4
b)	Find the Fourier sine and cosine transform of $f(x)=2e^{-5x}+5e^{-2x}$.	09	L2	CO4
c)	Find finite Fourier sine and cosine transform of $f(x)=x^2;\ 0\le x\le 4$.	09	L2	CO4

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

a)	i) Find the directional derivative of $\phi(x,y,z)=xy^2+yz^3$ at the point $(2,-1,1)$ in the direction of the vector $i+2j+2k$, ii) Find the angle between the surface $xy=z^2$ at $(1,4,2)$ and $2x^2+3y+3z^3=4$ at $(1,-1,2)$.	09	L3	CO5
b)	If $\phi(x,y,z)=x^3+y^3+z^3-3xyz$ Find i) $\bar{r}\cdot\nabla\phi$, ii) div $\bar{F}$, iii) Curl $\bar{F}$, where $\bar{F}=\nabla\phi$.	09	L3	CO5
c)	If $\bar{a}$ is a constant vector and $\bar{r}=xi+yj+zk$ Prove that i) $\nabla(\bar{a}\cdot\bar{r})=\bar{a}$ ii) $div(\bar{a}\times\bar{r})=0$ iii) $curl(\bar{a}\times\bar{r})=2\bar{a}$	09	L2	CO5

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