000191

PRN:		Course Code :	UEC301

Second Year **B. Tech** End Semester Examination Winter 2024

Transform and Vector Calculus

Day and Date: Fri 22 NOV 2024 Max Marks: **100**

Time : 10:30AM To 01:30PM Duration: **03** hrs

Instructions:1) All questions are compulsory.
2) Use of non-programmable calculator is allowed.

		Marks	Bloom's Level	CO
Q.1	**Attempt the following**			
a)	Solve $\frac{d^3y}{dx^3} - y = (e^x + 1)^2$	08	L3	CO1
b)	Solve $(D^4 + 10D^2 + 9)y = 96\sin 2x \cos x$	08	L3	CO1
	OR			
b)	Solve $(D^2 - 4D + 3)y = \left(x^2 e^x\right)^2$	08	L3	CO1
Q.2	**Attempt the following**			
a)	Find the Laplace transform of following functions *i)* $\sin^3 t$ *ii)* $e^{-2t}\cosh t$	08	L4	CO2
b)	Find the Laplace transform of $\frac{d}{dt}\left(\frac{\sin^2 t}{t}\right)$	08	L3	CO2
	OR			
b)	Find the Laplace transform of $\int_0^t u^3 \cosh 3u\, du$	08	L4	CO2
Q.3	**Attempt any two from the following**			
a)	Find inverse Laplace transform of following functions i) $\frac{s+2}{s^2-4s+13}$ ii) $\frac{2s^2-1}{(s^2+1)(s^2+4)}$	08	L3	CO3
b)	Find inverse Laplace transform of $\frac{s}{\left(s^2+a^2\right)^2}$ using convolution theorem.	08	L3	CO3
c)	Find inverse Laplace transform of following functions i) $\cot^{-1}[s+1]$ ii) $\frac{1}{s^2(s-1)}$	08	L3	CO3

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

a)	Find the Fourier series of function $f(x)=\begin{cases}-x & ;-\pi<x<0\\ 0 & ;0<x<\pi\end{cases}$	08	L2	CO4
b)	Find the Fourier series of function $f(x)=x$; on $[-1,1]$	08	L2	CO4
c)	Find the half range sine series for $f(x)=\begin{cases}x & ;0<x<\pi/2\\ \pi-x & ;\pi/2<x<\pi\end{cases}$	08	L2	CO4

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

a)	Find the Fourier sine transform of $f(x)=\frac{e^{-ax}}{x}$ and hence, evaluate $\int_0^\infty \tan^{-1}\left(\frac{x}{a}\right)\sin x dx$	09	L3	CO5
b)	Find the Fourier Transform of function $f(x)=e^{-\lvert x\rvert}$.	09	L3	CO5
c)	Find the Fourier Sine & Cosine Transform of function for $f(x)=\begin{cases}1; & 0\le x<1\\ 0; & x\ge 1\end{cases}$	09	L3	CO5

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

a)	Find the directional derivative of $\phi=x^2y^2+y^2z^2+x^2z^2$ at $(1,1,-2)$ in the direction of $x=e^{-t},, y=2\sin t+1, z=t-\cos t$ at $t=0$.	09	L3	CO6
b)	Find angle between the surfaces $xy=z^2$ at $(1,4,2)$ and $2x^2+3y+3z^3=4$ at $(1,-1,2)$.	09	L3	CO6
c)	Find the divergence and curl of the vector $\overline{f}=(y+z)i+(x+z)j+(x+y)k$ at the point $(1,0,2)$. Also prove that the vector $\overline{r}=2xyz^3i+x^2z^3j+3x^2yz^2k$ is irrotational.	09	L3	CO6

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