PRN:		Course Code :	UAM 301

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

Transform Calculus, Fourier Series and Numerical Techniques

Day and Date: wednesday, 29/11/2023 Max Marks: **100**

Time : 10.30 am to 1.30 pm Duration: **03** hrs

Instructions: 1) All questions are compulsory.
2) Assume suitable data wherever necessary.
4) Non-programmable calculator is allowed.

		Marks	Bloom's Level	CO
Q.1	**Attempt the following**			
a)	Find the positive root of the following equations by Newton's Raphson method i) $2\sin x = x$ (with $x_0 = 2$), ii) $x\sin x + \cos x = 0$ (with $x_0 = \pi$).	08	L2	CO1
b)	Carry out four iterations of the Bisection method to find the root of the equation $(2x+1)^2 = 4\cos(\pi x)$ in the interval $\left(\frac{1}{4}, \frac{1}{3}\right)$.	08	L2	CO1
	OR			
b)	Find the real root of the equation $xe^{-x/2} = 1$ in the interval (0, 2) using the secant method, correct to four decimal places.	08	L3	CO1
Q.2	**Attempt the following**			
a)	Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 0.2$ from the following table	08	L2	CO2

x	0.0	0.3	0.6	0.9	1.2	1.5	1.8
y	-1	-0.6289	-0.1264	0,6371	1.9856	4.4375	8.7056

b)	Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 1.15$ from the following table	08	L2	CO2

x	1.00	1.05	1.10	1.15	1.20	1.25	1.30
y	1.0000	1.0247	1.0488	1.0723	1.0954	1.1180	1.1401

OR

b)	Find $f'(4)$ and $f'(3)$ from the following table	08	L3	CO2

x	1	2	4	8	10
y	0	1	5	21	27

Q.3	**Attempt any two from the following**			
a)	Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by using i) Simpson's one-third rule taking $h = \frac{1}{4}$, ii) Simpson's three-eighth rule taking $h = \frac{1}{6}$.	08	L2	CO2
b)	Use Romberg's method to compute $\int_0^1 \frac{dx}{1+x^2}$, correct to four decimal	08	L2	CO2

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places.(Take $h=0.5, 0.25$ and 0.125)

c)	Evaluate $\int_4^{5.2} \log_e(x)\,dx$ using Weddle's rule by taking $n=6$.	08	L2	CO2
Q.4	**Attempt any two from the following**			
a)	Use definition of Laplace Transform to find i) $L\{e^{at}\}$, ii) $L\{\sinh(at)\}$.	08	L1	CO3
b)	Find $L\{F(t)\}$, where $F(t)=\begin{cases}\cos\left(t-\frac{2\pi}{3}\right) & ;t>\frac{2\pi}{3},\\ 0 & ;t<\frac{2\pi}{3}.\end{cases}$	08	L1	CO3
c)	Find $L\left\{\int_0^t \frac{\sin x}{x}\,dx\right\}$.	08	L2	CO3
Q.5	**Attempt any Two of the following**			
a)	Find $L^{-1}\left\{\frac{(s-1)^2}{s(s+1)(s-3)}\right\}$.	09	L2	CO3
b)	Find $L^{-1}\left\{\frac{1}{(s+a)(s+b)}\right\}$ by convolution theorem.	09	L4	CO3
c)	Solve the following equation by using Laplace transform $\frac{d^2y}{dt^2}+\frac{dy}{dt}=2$ with $y(0)=3$ and $y'(0)=1$.	09	L4	CO3
Q.6	**Attempt any Two of the following**			
a)	Find a Fourier series to represent $f(x)=x^2$ in $(0,2\pi)$ and hence deduce that $\frac{\pi^2}{12}=\frac{1}{1^2}-\frac{1}{2^2}+\frac{1}{3^2}-\frac{1}{4^2}+\cdots$.	09	L2	CO4
b)	Obtain Fourier expansion for $f(x)=a^2-x^2$ in $(-a,a)$.	09	L3	CO4
c)	Obtain half range cosine series for $f(x)=x-x^2$; in $0\le x\le 1$.	09	L1	CO4

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