Enrolment No./Seat No_______________

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III EXAMINATION – SUMMER 2025

Subject Code:2130002 **Date:11-06-2025**

Subject Name:Advance Engineering Mathematics

Time:02:30 PM TO 05:30 PM **Total Marks:70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Solve $\frac{dy}{dx}+(cotx)y=2cosx$	**03**
	(b)	Give Beta and Gamma function relationship and find $\beta(\frac{9}{2},\frac{7}{2})$	**04**
	(c)	Give the Statement of Convolution Theorem and find the Inverse Laplace transform of $\frac{s+2}{s^2(s+3)}$	**07**
Q.2	**(a)**	Check the Exactness of $(x^3+3xy^2)dx+(3x^2y+y^3)dy=0$	**03**
	(b)	Solve $\frac{dy}{dx}+\frac{2y}{x}=x^2y^2$	**04**
	(c)	Find the Fourier Series of $f(x)=\left\{\begin{matrix}-\pi & -\pi<x<0\\ x & 0<x<\pi\end{matrix}\right\}$	**07**
		OR	
	(c)	Solve the Initial –Value problem using Laplace transform $y''+3y'+2y=e^t$, y(0)=1, $y'(0)=0$	**07**
Q.3	**(a)**	Using the definition of Laplace transform prove that (1)$L(t^n)=\frac{n!}{s^{n+1}}$ (2)$L(e^{-at})=\frac{1}{s-a}$	**03**
	(b)	Form the partial differential equation of $z=f(\frac{x}{y})$	**04**
	(c)	Using Method of Variation of parameter solve $(D^2+4)y=tan2x$	**07**
		OR	
Q.3	**(a)**	Find $L(te^{4t}cos2t)$	**03**
	(b)	Using Partial differential equation eliminate the function f from the relation $f(xy+z^2$,x+y+z)=0	**04**
	(c)	Using Method of Undetermined coefficient solve $(D^2-2D)y=e^x(sinx)$	**07**
Q.4	**(a)**	Find the Fourier Sine series of $f(x)=2x\ in\ 0<x<1$	**03**
	(b)	If $L\big(f(t)\big)=\log\left(\frac{s+3}{s+1}\right)$ find $L\big(f(2t)\big)$ using change of scale property of Laplace transform.	**04**
	(c)	Solve $(x^2y-2xy^2)dx-(x^3-3x^2y)dy=0$	**07**

OR

Q.4 **(a)** Find the Fourier Cosine integral of $f(x) = \frac{\pi}{2} e^{-x}, x \geq 0$ **03**

(b) State First Shifting theorem of Laplace transform and using it find $L(e^{-3t}t^4)$ **04**

(c) Using Cauchy-Euler equation **07**

$$x^2 \frac{d^2y}{dx^2} - x\frac{dy}{dx} + y = \sin(logx)$$

Q.5 **(a)** Find the general solution to the partial differential equation **03**

$xp + yq = x - y$

(b) Solve $\frac{\partial^2 z}{\partial x^2} + 3\frac{\partial^2 z}{\partial x.\partial y} + 2\frac{\partial^2 z}{\partial y^2} = x + y$ **04**

(c) Discuss about ordinary point ,singular point and its types for the differential equation **07**

$x^3(x-1)y'' + 3(x-1)y' + 7xy = 0$

OR

Q.5 **(a)** Solve $p(1+q) = qz$ **03**

(b) Solve $\frac{\partial^3 z}{\partial x^3} - 2\frac{\partial^3 z}{\partial^2 x.\partial y} = 2e^{2x}$ **04**

(c) Find the Power Series solution of **07**

$(1+x^2)y'' + xy' - 9y = 0$

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Enrolment No./Seat No_______________

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III (NEW) EXAMINATION – SUMMER 2024

Subject Code:2130002 **Date:11-07-2024**

Subject Name: Advance Engineering Mathematics

Time:10:30 AM TO 01:30 PM **Total Marks:70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	Solve $9yy' + 4x = 0$.	3
	(b)	Solve the initial value problem $y' - (1 + 3x^{-1})y = x + 2; y(1) = e - 1$.	4
	(c)	Find the Fourier series of the function $f(x) = x^2; -\pi < x < \pi$.	7
Q.2	**(a)**	Find the general solution of $y'' + 3y' + 2y = 0$.	3
	(b)	Solve $y''' - 3y'' + 3y' - y = 4e^t$.	4
	(c)	Using the method of variation of parameters find the general solution of $(D^2 - 2D + 1)y = 3x^{\frac{3}{2}}e^x$.	7
		OR	
	(c)	Using the method of undermined coefficients, find a particular solution of $y'' - 4y' - 12y = 8x^2$.	7
Q.3	**(a)**	Obtain the Fourier series for the function $f(x)$ given by $f(x) = \begin{cases} 1 + \left(\frac{2x}{\pi}\right); -\pi \le x \le 0 \\ 1 - \left(\frac{2x}{\pi}\right); 0 \le x \le \pi \end{cases}$. Hence, deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \cdots = \frac{\pi^2}{8}$.	7
	(b)	A function $f(x)$ is defined by $f(x) = \begin{cases} 1; -1 \le x \le 1 \\ 0; otherwise \end{cases}$ Find the Fourier integral representation of $f(x)$. Hence, evaluate (a) $\int_0^\infty \frac{sin\lambda cosx\lambda}{\lambda} d\lambda$. (b) $\int_0^\infty \frac{sin\lambda}{\lambda} d\lambda$.	7
		OR	
	(a)	Find a cosine series of period 2π to represent $f(x) = sinx$ in $0 < x < \pi$. Also, graph the corresponding periodic continuation of $f(x)$. Hence deduce that $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \cdots . = \frac{\pi}{4}$	7
	(b)	Determine the series solution for the differential equation $y'' + y = 0$ about $x_0 = 0$.	7
Q.4	**(a)**	Find the Laplace transform of $t^3 + e^{-3t} + t^{\frac{3}{2}}$.	3
	(b)	Find the Laplace transform of $cosh(kt)coskt$	4

	(c)	Find the inverse Laplace transform of $\frac{2s+3}{(s+2)(s+1)^2}$	**7**
		OR	
	(a)	Define (i) Gamma function and Beta function (ii) Write the relation between Beta and Gamma function.	**3**
	(b)	Find the Laplace transform of unit step function $f(t) = \begin{cases} 0; 0 \le t < k \\ 1; \quad t \ge k \end{cases}$	**4**
	(c)	Solve the IVP using the Laplace transform: $y'' + 4y = 0; y(0) = 1, y'(0) = 6.$	**7**
Q.5	**(a)**	Form the partial differential equation by eliminating the arbitrary constants for $az + b = a^2x + y$.	**3**
	(b)	Solve $(y + z)p - (x + z)q = x - y$.	**4**
	(c)	Using the method of separation of variables, solve $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$.	**7**
		OR	
	(a)	Find the complete integral of $z = px + qy + pq$.	**3**
	(b)	Solve $\left(D^2 + 10DD' + 25D'^2\right)z = e^{3x+2y}$.	**4**
	(c)	The base of semi-infinite strip of metal plate is 30cm and is kept at 100°C. The two long edges are at zero temperature. Find the temperature at any point 15cm away from the base and situated midway between the long edges.	**7**

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GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III(NEW) EXAMINATION – SUMMER 2023

Subject Code:2130002 **Date:21-07-2023**

Subject Name:Advance Engineering Mathematics

Time:02:30 PM TO 05:30 PM **Total Marks:70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

Q.1	**(a)**	(i) Solve $3e^x \tan y\, dx + \left(1+e^x\right)\sec^2 y\, dy = 0$.	**03**
		(ii) Solve $\dfrac{dy}{dx} + \dfrac{4x}{x^2+1} = \dfrac{1}{\left(x^2+1\right)^3}$.	**04**
	(b)	Find the Fourier series expansion of $f(x) = x^2\ ; -2 \le x \le 2$.	**07**
Q.2	**(a)**	(i) Define Signum function and Triangular wave function.	**03**
		(ii) Solve $y'' + 4y = 8x^2$.	**04**
	(b)	Find the power series solution of $\left(x^2+1\right)\dfrac{d^2y}{dx^2} + 2x\dfrac{dy}{dx} + xy = 0$.	**07**
		OR	
	(b)	Find the Fourier series of $f(x) = \begin{cases} x^2 & ;\ x \in (0,\pi) \\ 0 & ;\ x \in (\pi, 2\pi) \end{cases}$	**07**
Q.3	**(a)**	(i) Find $L\left(t^2 \cos at\right)$.	**03**
		(ii) Find general solution of $y'' + 9y = \sec 3x$ by method of variation of parameters.	**04**
	(b)	Using convolution theorem, find $L^{-1}\left(\dfrac{1}{\left(s^2+a^2\right)^2}\right)$.	**07**
		OR	
Q.3	**(a)**	(i) Find $L^{-1}\left\{\dfrac{1}{\left(s+\sqrt{2}\right)\left(s-\sqrt{3}\right)}\right\}$.	**03**
		(ii) Solve $\left(D^2 - 2D + 1\right)y = x e^x \sin x$.	**04**
	(b)	Solve the equation $y'' - 3y' + 2y = 4t + e^{3t}$, when $y(0) = 1$ and $y'(0) = -1$	**07**
Q.4	**(a)**	(i) Find $L\left\{\int_0^t e^{-u}\cos u\, du\right\}$.	**03**
		(ii) Find Fourier sine series of $f(x) = \pi - x,\quad 0 < x < \pi$.	**04**
	(b)	Find the solution of $y'' + 4y = 2\sin 3x$ by the method of undetermined coefficients.	**07**

OR

Q.4 **(a)** (i) Find $L^{-1}\left[\log\left(\frac{s+a}{s+b}\right)\right]$. **03**

(ii) Solve $\frac{dy}{dx}+\frac{y}{x}=x^3y^3$. **04**

(b) Find the series solution using Frobenious method for $xy''+y'-y=0$. **07**

Q.5 **(a)** (i) Derive partial differential equation by eliminating a and b from $z=(x-a)^2+(y-b)^2$. **03**

(ii) Solve $pz-qz=z^2+(x+y)^2$. **04**

(b) Solve $\left(D^2+DD'-6D'^2\right)z=y\cos x$. **07**

OR

Q.5 **(a)** (i) Solve $p+q^2=1$. **03**

(ii) Using Charpit's method solve $z=pq$. **04**

(b) Solve $\frac{\partial u}{\partial x}+2\frac{\partial u}{\partial y}=0$ by separation of variable method. **07**

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Seat No.: ________ Enrolment No.___________

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– III (NEW) EXAMINATION – SUMMER 2022

Subject Code:2130002 Date:08-07-2022

Subject Name:Advance Engineering Mathematics

Time:02:30 PM TO 05:30 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Solve the differential equation $ye^x\,dx + \left(2y + e^x\right)dy = 0$.	**03**
	(b)	Find the Laplace Transform of $(t+1)^2 e^t$	**04**
	(c)	Find the Fourier series expansion of the periodic function $f(x) = x - x^2$ in the interval $-\pi \le x \le \pi$.	**07**
Q.2	**(a)**	Find $L^{-1}\left\{\dfrac{3s+4}{s^2+9}\right\}$	**03**
	(b)	Solve $y'' - 2y' + y = 10e^x$	**04**
	(c)	Find the Fourier series of the periodic function with a period 2 of $f(x) = \begin{cases} \pi \;, & 0 \le x \le 1 \\ \pi(2-x)\;, & 1 \le x \le 2 \end{cases}$	**07**
		OR	
	(c)	Find the power series solution of the equation $\left(x^2+1\right)y'' + xy' - xy = 0$ about $x = 0$.	**07**
Q.3	**(a)**	Define Bata function, Gamma function and write the relation between Beta and Gamma function.	**03**
	(b)	Use convolution theorem to find the inverse Laplace Transform of $\dfrac{1}{(s+1)\left(s^2+1\right)}$.	**04**
	(c)	Solve the differential equation using method of variation of parameters: $y'' + 9y = \tan 3x$.	**07**
		OR	
Q.3	**(a)**	Define (1) Rectangle function; (2) Saw tooth wave function .	**03**
	(b)	Find the half range sine series of $f(x) = x^2$ in the interval $(0, \pi)$.	**04**
	(c)	Solve the initial value problem using Laplace Transform $y'' + y' = t^2 + 2t$, $y(0) = 4$, $y'(0) = -2$	**07**

Q.4	**(a)**	Find the Laplace Transform of $\int_0^t e^{-2t}\, t^3\, dt$.	**03**
	(b)	Solve the differential equation $\frac{dy}{dx}+\frac{2y}{x}=y^2x^2$.	**04**
	(c)	Find the Fourier Integral representation of the function $f(x)=\begin{cases}1-x^2\ , & \lvert x\rvert\le 1\\ 0\ , & \lvert x\rvert>1\end{cases}$	**07**

OR

Q.4	**(a)**	Find the inverse Laplace Transform of $\frac{e^{-\pi s}}{s^2-2s+2}$.	**03**
	(b)	Solve $(mz-ny)\,p+(nx-lz)\,q=ly-mx$.	**04**
	(c)	Solve $x^2y''+5xy'+3y=\frac{\log x}{x^2}$	**07**
Q.5	**(a)**	Form a differential equation for the equation $z=(x-2)^2+(y-3)^2$.	**03**
	(b)	Find the Laplace Transform of $f(t)=\begin{cases}t^2\ , & 0<t<1\\ 4t\ , & t>1\end{cases}$	**04**
	(c)	Solve the equation $u_x=2u_t+u$ given $u(x,0)=4e^{-4x}$, by the method of separation of variables.	**07**

OR

Q.5	**(a)**	Solve $p^2+q^2=x+y$	**03**
	(b)	Solve $\frac{\partial^2 z}{\partial x^2}+z=0$, given that when $x=0$, $z=e^y$ and $\frac{\partial z}{\partial x}=1$.	**04**
	(c)	Solve $\left(D^2+DD'-6D'^2\right)z=\sin(2x+y)$.	**07**

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Seat No.: ________ Enrolment No.___________

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– III EXAMINATION – SUMMER 2020

Subject Code: 2130002 **Date:26/10/2020**

Subject Name: Advanced Engineerng Mathematics

Time: 02:30 PM TO 05:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

			MARKS
Q.1	**(a)**	Solve $\frac{dy}{dx} = e^{x-y} + x^2 e^{-y}$.	03
	(b)	Solve $\frac{dy}{dx} + 2xy = 2e^{-x^2}$.	04
	(c)	State convolution theorem and use it to find $L^{-1}\left[\frac{1}{(s^2+a)^2}\right]$.	07
Q.2	**(a)**	Solve $y'' - 3y' + 2y = e^x$.	03
	(b)	Find Fourier series for $f(x) = x^2;\ -\pi \le x \le \pi$.	04
	(c)	Find a power series solution of $y'' + y = 0$ near the ordinary point x=0.	07
		OR	
	(c)	Find Fourier series in the interval $(0, 2\pi)$ if $f(x) = \begin{cases} -\pi & 0 < x < \pi \\ x - \pi & \pi < x < 2\pi \end{cases}$ and hence show that $\sum_{n=1}^{\infty} \frac{1}{(2n+1)^2} = \frac{\pi^2}{8}$.	07
Q.3	**(a)**	Find $L^{-1}\left[\frac{e^{-3s}}{s^2}\right]$.	03
	(b)	Solve $y'' - 4y' - 12y = \sin x$ by method of undetermined coefficient.	04
	(c)	Solve $y'' + y = \sec x$ by using method of variation of parameters.	07
		OR	
Q.3	**(a)**	Solve $\frac{d^3y}{dx^3} - 3\frac{dy}{dx} + 2y = 0$.	03
	(b)	Solve $(D^2 - D - 2)y = \sin 2x$.	04
	(c)	Solve by Charpit's method $p = (z + qy)^2$.	07
Q.4	**(a)**	Find $L[e^{-t}\sin^2 t]$.	03
	(b)	Find $L^{-1}\left[\frac{3}{s^2+6s+18}\right]$.	04
	(c)	Solve $y'' - y' - 2y = 0$; with $y(0) = 1,\ y'(0) = 0$ by using Laplace	07

transform.

OR

Q.4	**(a)**	Solve $\left(x^4+y^4\right)dx - xy^3 dy = 0$.	**03**
	(b)	Find cosine series for $f(x)=e^x$ in $0<x<L$.	**04**
	(c)	Find Fourier series for $f(x)=3x\left(\pi^2-x^2\right)$ in $-\pi<x<\pi$.	**07**
Q.5	**(a)**	Solve $pq=1$.	**03**
	(b)	Solve $p^2-x=q^2-y$.	**04**
	(c)	Find a series solution of $y''+xy'+y=0$ near the ordinary point x=0.	**07**

OR

Q.5	**(a)**	Solve $\dfrac{\partial^2 z}{\partial x \partial y}=\sin x \sin y$ given that $\dfrac{\partial z}{\partial y}=-2\sin y$ when $x=0$ and $z=0$ when y is an odd multiple of $\pi/2$.	**03**
	(b)	Solve $r-2s+t=\sin(2x+3y)$.	**04**
	(c)	Solve $\left(p^2+q^2\right)x=pz$.	**07**

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