P P SAVANI UNIVERSITY

Third Semester of B. Tech. Examination

December 2022

SESH2011 Differential Equations

23.11.2022, Wednesday **Time: 10:00 a.m. To 12:30 p.m.** **Maximum Marks: 60**

Instructions:

1. The question paper comprises of two sections.
2. Section I and II must be attempted in separate answer sheets.
3. Make suitable assumptions and draw neat figures wherever required.
4. Use of scientific calculator is allowed.

SECTION – I

			CO	BTL
Q - 1	**Choose correct answer for any two:**	**[05]**		
(i)	Degree of the differential equation $y = z\frac{dy}{dx} + \frac{x}{\frac{dy}{dx}}$ is _____.		1	1/2
	a. 1 **b.** 2 **c.** 3 **d.** 4			
(ii)	The necessary condition for the differential equation to be an exact differential equation is _____.		2	1
	a. $\frac{\partial N}{\partial y} \neq \frac{\partial M}{\partial x}$ **b.** $\frac{\partial N}{\partial x} = \frac{\partial M}{\partial x}$ **c.** $\frac{\partial M}{\partial x} = \frac{\partial N}{\partial y}$ **d.** $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$			
(iii)	The root of the PDE $(2D^2 + 5DD' + 2D'^2)z = 0$ is _____.		2	2
	a. $\left(2, -\frac{1}{2}\right)$ **b.** $\left(-2, \frac{1}{2}\right)$ **c.** $\left(2, \frac{1}{2}\right)$ **d.** $\left(-2, -\frac{1}{2}\right)$			
Q - 2 (a)	Solve $x^2(y-z)p + y^2(z-x)q = z^2(x-y)$.	**[05]**	2	5
Q - 2 (b)	Solve $(x^2 + y^2 + 1)dx - 2xydy = 0$.	**[05]**	1	4/5
	OR			
Q - 2 (a)	Solve $\frac{y^2z}{x}p + xzq = y^2$.	**[05]**	2	5
Q - 2 (b)	Solve $2xyy' = y^2 - x^2$.	**[05]**	1	4/5
Q - 3	Solve $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 2(x+y)u$.	**[05]**	2	5
	OR			
Q - 3	Solve $z = px + qy - 2\sqrt{pq}$.	**[05]**	2	3/5
Q - 4	**Attempt any one:**	**[10]**		
(i)	Find the orthogonal trajectory of $r = a(1 - \cos\theta)$.		1	4
(ii)	Solve $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 12y = e^{6x}$.		1	5

SECTION – II

Q - 1	**Choose correct answer for any two:**	**[05]**		
(i)	Which of the following is not periodic functions?		5	1/2
	a. x **b.** e^x **c.** $\ln x$ **d.** All			
(ii)	Which of the following is odd function.		5	1/2
	a. $\cos x$ **b.** $\tan x$ **c.** x^2 **d.** None			
(iii)	$L\{\cosh a\,t\} =$_____.		4	1
	a. $\frac{s}{s^2+a^2}$ **b.** $\frac{a}{s^2-a^2}$ **c.** $\frac{a}{s^2+a^2}$ **d.** $\frac{s}{s^2-a^2}$			
Q - 2 (a)	Find the Fourier series of $f(x) = \begin{cases} \pi x & 0 \le x \le 1 \\ \pi(2-x) & 1 \le x \le 2 \end{cases}$.	**[05]**	5	4
Q - 2 (b)	Find the Laplace transform of $\frac{1-e^{-t}}{t}$.	**[05]**	4	5
	OR			
Q - 2 (a)	Find the Fourier series of $f(x) = e^{-x}$ in the interval $0 < x < 2\pi$.	**[05]**	5	5

Q - 2 (b)	Find the Laplace transform of $\int_0^t e^{-t}\,dt$.	**[05]**	**4**	**5**
Q - 3	Find the Fourier cosine and Fourier sine transforms of $f(x) = \begin{cases} k & 0 < x < a \\ 0 & x > a \end{cases}$	**[05]**	**4**	**4/5**
	OR			
Q - 3	Find the half-range cosine series $f(x) = \sin x$ in the interval $(0, \pi)$.	**[05]**	**4**	**5**
Q - 4	**Attempt any one:**	**[10]**		
(i)	Using Fourier integral representation, show that $\int_0^\infty \frac{\cos\omega x + \omega \sin\omega x}{1+\omega^2} d\omega = \begin{cases} 0 & x < 0 \\ \frac{\pi}{2} & x = 0 \\ \pi e^{-x} & x > 0 \end{cases}$		**4**	**4/5**
(ii)	Find the Laplace transform of $f(t) = \begin{cases} 4; & 0 \le t < 1 \\ 3; & t \ge 1 \end{cases}$		**4**	**5**

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CO : Course Outcome Number BTL : Blooms Taxonomy Level

Level of Bloom's Revised Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create