P P SAVANI UNIVERSITY

Third Semester of B. Tech. Examination

December 2022

SESH2031 Differential Methods for Chemical Engineers

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	3
	a. 1 **b.** 2 **c.** 3 **d.** 4			
(ii)	The root of the PDE $(2D^2 + 5DD' + 2D'^2)z = 0$ is _____.		2	5
	a. $\left(2, -\frac{1}{2}\right)$ **b.** $\left(-2, \frac{1}{2}\right)$ **c.** $\left(2, \frac{1}{2}\right)$ **d.** $\left(-2, -\frac{1}{2}\right)$			
(iii)	The two functions $\sin 2x$ and $\cos 2x$ are _____ solutions.		1	4
	a. independent **b.** dependent **c.** linear **d.** non-linear			
Q - 2 (a)	Solve $2xyy' = y^2 - x^2$.	**[05]**	1	3/5
Q - 2 (b)	Solve $\frac{y^2z}{x}p + xzq = y^2$.	**[05]**	2	3/5
	OR			
Q - 2 (a)	Solve $(x^2 + y^2 + 1)dx - 2xydy = 0$.	**[05]**	1	3/5
Q - 2 (b)	Solve $x^2(y - z)p + y^2(z - x)q = z^2(x - y)$.	**[05]**	2	3/5
Q - 3	Find the Laplace transform of $\frac{1-e^{-t}}{t}$.	**[05]**	3	4
	OR			
Q - 3	Solve $(D^3 - 3D^2D' + 4D'^3)z = e^{x+2y}$.	**[05]**	2	3/5
Q - 4	**Attempt any one:**	**[10]**		
(i)	Solve $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 12y = e^{6x}$.		1	3/5
(ii)	Find the Laplace transform of $e^{-3t}(2\cos 5t - 3\sin 5t)$.		3	4

SECTION – II

			CO	BTL
Q - 1	**Choose correct answer for any two:**	**[05]**		
(i)	Z -transform of the 2^n is _____.		3	3
	a. $\frac{1}{z+2}$ **b.** $\frac{z}{z+2}$ **c.** $\frac{1}{z-2}$ **d.** $\frac{z}{z-2}$			
(ii)	Which of the following is not periodic functions?		4	1/2
	a. x **b.** e^x **c.** $\ln x$ **d.** All			
(iii)	Which of the following is odd function.		4	1/2
	a. $\cos x$ **b.** $\tan x$ **c.** x^2 **d.** None			
Q - 2 (a)	Find the Z-transform of $(n + 1)^2$.	**[05]**	3	4
Q - 2 (b)	Find the Fourier series of $f(x) = e^{-x}$ in the interval $0 < x < 2\pi$.	**[05]**	4	5
	OR			
Q - 2 (a)	Find the inverse Z-transform of $\frac{7z-11z^2}{(z-1)(z-2)(z+3)}$.	**[05]**	3	3/5
Q - 2 (b)	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]**	4	3/5

Q - 3	Express the function $f(x) = \begin{cases} 1 & 0 \le x < \pi \\ 0 & x > \pi \end{cases}$ as a Fourier sine integral and hence, evaluate $\int_0^\infty \frac{1-\cos \pi\omega}{\omega} \sin \omega x d\omega$.	**[05]**	**4**	**5/6**
	OR			
Q - 3	Find the Fourier series solution to the differential equation $y'' + 2y = 3x$ with the boundary conditions $y(0) = y(1) = 0$.	**[05]**	**4**	**3/4**
Q - 4	**Attempt any one:**	**[10]**		
(i)	Using the Z-transform, solve $y_{n+2} + 6y_{n+1} + 9y_n = 2^n$ with $y_0 = y_1 = 0$.		**3**	**3/5**
(ii)	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**	**5/6**

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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