TOTAL PAGES: 2
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PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION DECEMBER 2025
(Second Semester)

Branch- **MATHEMATICS**

DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS

Time: Three Hours — Maximum: 75 Marks

SECTION-A (10 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** marks (10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	The general solution of a first-order differential equation contains: a) One arbitrary constant b) Two arbitrary constants c) No constant d) Depends on the order of equation	K1	CO1
	2	If $\frac{dy}{dx}+y=e^x$, then its integrating factor is a) $e^{x/2}$ b) e^{-x} c) e^x d) 1	K2	CO1
2	3	The equation $y''+5y'+6y=0$ is (a) Homogeneous (b) Non-homogeneous (c) First-order linear (d) Non-linear	K1	CO1
	4	The roots of the auxiliary equation $r^2-5r+6=0$ are a) -2,-3 b) 2,3 c) 5,6 d)-5,-6	K2	CO1
3	5	The method of elimination is most useful when: (a) The system is nonlinear (b) The system has constant coefficients (c) The system is homogeneous (d) All of the above	K1	CO1
	6	*A* system of differential equations *means:* (a) Only one equation in one variable (b) Two or more differential equations involving two or more unknown functions (c) An algebraic system (d) None of these	K2	CO1
4	7	The Laplace transform of f(t)=1 is a) 1/s+1 b) $\frac{1}{s^2}$ c) 1 d) 1/s	K1	CO1
	8	The first shifting theorem states:$L\{e^{at}f(t)\}=$ a) F(s-a) b) F(s+a) c) $e^{-as}F(s)$ d)$e^{as}F(s)$	K2	CO1
5	9	For a piecewise continuous function, the Laplace transform is: (a) Undefined (b) Exists if $f(t)$ is of exponential order (c) Always zero (d) Equal to Fourier transform	K1	CO1
	10	The Laplace transform of the unit impulse function $\delta(t)$ is a) 1/s b) 0 c)1 d) s	K2	CO1

Cont...

SECTION - B (35 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	Solve the differential equation $(6xy - y^3)dx + (4y + 3x^2 - 3xy^2)dy = 0$.	K2	CO2
		(OR)		
	11.b.	Solve the initial value problem $x^2 \frac{dy}{dx} + xy = \sin x, y(1) = y_0$.		
2	12.a.	Verify that the functions $y_1(x) = e^x$ and $y_2(x) = xe^x$ are solutions of the differential equations $y'' - 2y' + y = 0$ and then find a solution satisfying the initial conditions $y(0) = 3, y'(0) = 1$.	K2	CO3
		(OR)		
	12.b.	Find the particular solution of $y'' - 4y' + 5y = 0$ for which $y(0) = 1, y'(0) = 5$.		
3	13.a.	To find a general solution of the system $x' = y;\ y' = 2x + y$.	K3	CO2
		(OR)		
	13.b.	Find a general solution of the system $(D - 4)x + 3y = 0;\ -6x + (D + 7)y = 0$.		
4	14.a.	Determine $L[3e^{2t} + 2sin^2 3t]$.	K3	CO3
		(OR)		
	14.b.	Find $L[e^{at}]$.		
5	15.a.	Find $L^{-1}[tan^{-1}\left(\frac{1}{s}\right)]$.	K3	CO3
		(OR)		
	15.b.	Find $L[(\sin ht)/t]$.		

SECTION -C (30 Marks)

Answer **ANY THREE** questions

ALL questions carry **EQUAL** Marks (3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	Solve the initial value problem $\frac{dy}{dx} - y = \frac{11}{8}e^{-x/3}, y(0) = -1$.	K3	CO3
2	17	Solve the initial value problem $y''' + 3y'' - 10y' = 0$, $y(0) = 7, y'(0) = 0, y''(0) = 70$,	K3	CO4
3	18	Find the particular solution of the system $x' = 4x - 3y;\ y' = 6x - 7y$ That satisfies the initial conditions $x(0) = 2, y(0) = -1$.	K4	CO4
4	19	Solve the initial value problem $x'' - x' - 6x = 0, x(0) = 2, x'(0) = -1$.	K4	CO5
5	20	A mass $m = 1$ is attached to a spring with constant $k = 4$; there is no dashpot. The mass is released from rest with $x(0) = 3$.At the instant $t = 2\pi$ the mass is struck with a hammer, providing an impulse $p = 8$. Determine the motion of the mass.	K4	C52

Z-Z-Z END