

**PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)**

**BSc DEGREE EXAMINATION MAY 2026
(Second Semester)**

Branch - MATHEMATICS

DIFFERENTIAL EQUATION & 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 order of the differential equation $(\frac{d^2y}{dx^2})^3 + (\frac{dy}{dx})^4 + 3y = 0$ is _____ (i) 6 (ii) 4 (iii) 2 (iv) 3	K1	CO1
	2	$W(e^x, xe^x) =$ _____ (i) e^{2x} (ii) e^{-2x} (iii) e^x (iv) e^{-x}	K2	CO1
2	3	If Ae^{3x} is the particular solution for $y'' - 4y = 2e^{3x}$, the value of A is _____ (i) 2/5 (ii) 5/2 (iii) 3/4 (iv) 4/3	K1	CO2
	4	If y_1, y_2 are two solutions of $F(y) = g(x)$ then $y_1 - y_2$ is a solution of (i) $F(y) = g(x)$ (ii) $F(y) = 0$ (iii) $F(y) = -g(x)$ (iv) $F(y) = 2g(x)$	K2	CO2
3	5	Which of the following matrices is singular? (i) $\begin{pmatrix} 1 & -2 \\ 4 & 3 \end{pmatrix}$ (ii) $\begin{pmatrix} 1 & 7 \\ 5 & 4 \end{pmatrix}$ (iii) $\begin{pmatrix} 6 & 4 \\ 3 & 2 \end{pmatrix}$ (iv) $\begin{pmatrix} 4 & -1 \\ 2 & 3 \end{pmatrix}$	K1	CO3
	6	The characteristic equation of the matrix $\begin{pmatrix} 1 & 0 & 3 \\ 2 & 1 & -1 \\ 1 & -1 & 1 \end{pmatrix}$ is _____ (i) $\lambda^3 - 3\lambda^2 - \lambda + 9 = 0$ (ii) $\lambda^3 + 3\lambda^2 + \lambda + 9 = 0$ (iii) $\lambda^3 - \lambda^2 - 3\lambda + 9 = 0$ (iv) $\lambda^3 - 3\lambda^2 + \lambda + 9 = 0$	K2	CO3
4	7	$L(\sinh a) =$ _____ (i) $\frac{a}{s^2 + a^2}$ (ii) $\frac{s}{s^2 + a^2}$ (iii) $\frac{a}{s^2 - a^2}$ (iv) $\frac{s}{s^2 - a^2}$	K1	CO4
	8	The value of the integral $\int_0^\infty e^{-t} \cos t dt =$ ____ (i) 1/2 (ii) -1/2 (iii) 2 (iv) -2	K2	CO4
5	9	The inverse Laplace transform of $\frac{1}{s}$ is (i) 1 (ii) 0 (iii) t (iv) t^2	K1	CO5
	10	If $L(f(t)) = F(s)$ then $L(tf(t)) =$ ____ (i) $sF(s)$ (ii) $F'(s)$ (iii) $-sF(s)$ (iv) $-F'(s)$	K2	CO5

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.	Show the principle of superposition for second order homogeneous differential equation.	K2	CO1
		(OR)		
	11.b.	Show that the functions e^{-3x} , $\sin 2x$, $\cos 2x$ are linearly independent		
2	12.a.	Write the general form of a particular solution of $y^3 + 9y' = x \sin x + x^2 e^{2x}$	K2	CO2
		(OR)		
	12.b.	Trace a general solution of the system $x' = y$; $y' = 2x + y$		
3	13.a.	Calculate the solution for the second order systems $X'' = AX$	K3	CO3
		(OR)		
	13.b.	Compute the inverse of $\begin{pmatrix} 4 & 2 & 1 \\ 3 & 6 & 2 \\ 2 & 3 & 7 \end{pmatrix}$		
4	14.a.	Compute $L^{-1}\left(\frac{1}{s^2(s-a)}\right)$	K3	CO4
		(OR)		
	14.b.	Compute the Laplace transform of $t^2 + \cos 2t \cos t + 3$		
5	15.a.	State and prove Convolution theorem	K4	CO5
		(OR)		
	15.b.	The Laplace transform of a casual signal $x(t)$ is $\frac{s+5}{s+3}$. Find the value of the signal $x(t)$ at $t = 1$		

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	Estimate the general solution of $y^{(4)} + 4y = 0$	K2	CO1
2	17	Express the particular solution of the system $x' = 4x - 3y$, $y' = 6x - 7y$	K2	CO2
3	18	Determine the eigen value and eigen vector of the matrix $\begin{pmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{pmatrix}$	K3	CO3
4	19	Compute the inverse Laplace transform of $\frac{1+2s}{(s+2)^2(s-1)^2}$	K3	CO4
5	20	Consider a mass on the spring with $m = 1$, $k = 1$ $x(0) = x'(0) = 0$. At each of the instants $t = 0, \pi, 2\pi, 3\pi, 4\pi, \dots, n\pi, \dots$ the mass is struck a hammer blow with a unit impulse. Calculate the resulting motion	K4	CO5