

PSG COLLEGE OF ARTS & SCIENCE  
(AUTONOMOUS)

BSc EGREE EXAMINATION DECEMBER 2024  
(Second Semester)

Branch - PHYSICS

MATHEMATICS – II FOR PHYSICS

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 equation _____ is called the characteristic equation of the matrix A. (a) $\phi(\lambda) = 0$ (b) $\phi(\lambda) \neq 0$ (c) $\phi(\lambda) > 0$ (d) $\phi(\lambda) < 0$	K1	CO1
	2	The characteristic equation of the matrix A is _____ (a) $ A + \lambda I  = 0$ (b) $ A - \lambda I  = 0$ (c) $ A - \lambda I  > 0$ (d) $ A - \lambda I  < 0$	K2	CO1
2	3	A solution containing as many arbitrary constants as there are independent variables is called a _____. (a) complete integral (b) particular integral (c) singular integral (d) general integral	K1	CO2
	4	A solution obtained by giving particular values to the arbitrary constants in a complete integral is called a _____. (a) complete integral (b) particular integral (c) singular integral (d) general integral	K2	CO2
3	5	Pick the correct answer. $L(\sin 2t)$ is (a) $\frac{2}{s^2 + 4}$ (b) $\frac{s}{s^2 + 4}$ (c) $\frac{2}{s^2 - 4}$ (d) $\frac{s}{s^2 - 4}$	K1	CO3
	6	$L^{-1}\left[\frac{1}{s}\right] =$ _____. (a) 1 (b) 0 (c) 1/s (d) s	K2	CO3
4	7	If $f(x) =$ _____ then $f(x)$ is said to be even function (a) $f(x)$ (b) $-f(-x)$ (c) $f(-x)$ (d) $f(x^2)$	K1	CO4
	8	The Fourier series expansion of an even function contains (a) sine terms only (b) cosine terms only (c) both sine and cosine terms (d) neither sine nor cosine terms.	K2	CO4
5	9	If $f(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} F(s)e^{-ixs} ds$ is (a) Fourier transform (b) Fourier integral theorem (c) Fourier cosine transform (d) Fourier sine transform	K1	CO5
	10	$F(s)$ is a complex function if $f(t)$ is a _____ function. (a) real even (b) real (c) real odd (d) real even	K2	CO5

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.	Find the eigen values of the matrix $\begin{pmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{pmatrix}$	K3	CO1
	(OR)			
	11.b.	Calculate $A^4$ when $A = \begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}$ .		
2	12.a.	Solve $p^2 + q^2 = npq$	K3	CO2
	(OR)			
	12.b.	Solve $p(1 + q^2) = q(z - 1)$		
3	13.a.	Find $L(\sin^3 2t)$	K3	CO3
	(OR)			
	13.b.	Find $L^{-1}\left[\frac{1}{s(s+1)(s+2)}\right]$ .		
4	14.a.	Express $f(x) = \frac{1}{2}(\pi - x)$ as a Fourier series with period $2\pi$ , to be valid in the interval 0 to $2\pi$ .	K3	CO4
	(OR)			
	14.b.	Express $f(x) = x$ ( $-\pi < x < \pi$ ) as a Fourier series with period $2\pi$ .		
5	15.a.	Find $F_c\{e^{-ax}\}$ and $F_s\{e^{-ax}\}$ .	K3	CO5
	(OR)			
	15.b.	Find the Fourier cosine transform for $F(x)$ if $f(x) = \begin{cases} 1 & \text{when }  x  < 1 \\ 0 & \text{when }  x  > 1 \end{cases}$		

**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	Diagonalise the matrix $\begin{bmatrix} 2 & -2 & 3 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{bmatrix}$	K3	CO1
2	17	Solve $(y^2 + z^2)p - xyq = -xz$	K3	CO2
3	18	Solve the equation $\frac{d^2y}{dt^2} + 2\frac{dy}{dt} - 3y = \sin t$ given that $y = \frac{dy}{dt} = 0$ when $t = 0$ .	K3	CO3
4	19	Show that $x^2 = \frac{\pi^2}{3} + 4\sum_{n=1}^{\infty} (-1)^n \frac{\cos nx}{n^2}$ in the interval $(-\pi \leq x \leq \pi)$ . Deduce that (i) $\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \dots = \frac{\pi^2}{12}$ (ii) $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \dots = \frac{\pi^2}{6}$ (iii) $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots = \frac{\pi^2}{8}$	K3	CO4
5	20	Find $F_c\{e^{-a^2x^2}\}$ and $F_s\{xe^{-a^2x^2}\}$ and show that $e^{x^2/2}$ is self reciprocal under Fourier cosine transform and $Xe^{-\frac{x^2}{2}}$ is self reciprocal under Fourier sine transform.	K3	CO5