

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 2026
(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	Sum of the eigen values of a matrix A is equal to (i) A (ii) Trace of A (iii) 0 (iv) 1	K1	CO1
	2	The eigenvalues of a symmetric matrix are (i) complex (ii) real (iii) imaginary (iv) non-negative	K2	CO1
2	3	A solution containing as many arbitrary constants as there are independent variables is called _____ integral. (i) particular (ii) single (iii) complete (iv) double	K1	CO2
	4	The overall integral of the PDE $z = pq$ will be (i) $Z = x + y + a$ (ii) $Z = x - y + a$ (iii) $Z = xy$ (iv) $Z = (x + a)(y + b)$	K2	CO2
3	5	If $L\{f(t)\} = F(s)$, then $L\{e^{at}f(t)\} = \underline{\hspace{2cm}}$. (i) $F(s + a)$ (ii) $F(s - a)$ (iii) $F'(s)$ (iv) $-F'(s)$	K1	CO3
	6	$L^{-1}\left\{\frac{3}{s^2+9}\right\} = \underline{\hspace{2cm}}$. (i) $\cos 3t$ (ii) $\cosh 3t$ (iii) $\sin 3t$ (iv) $\sinh 3t$	K2	CO3
4	7	If $f(x)$ is an odd function, then $\int_{-a}^a f(x) dx =$ (i) $2 \int_0^a f(x) dx$ (ii) 0 (iii) $\int_0^a f(x) dx$ (iv) $\int_{-a}^0 f(x) dx$	K1	CO4
	8	If $f(x)$ is an even function, then the formula for finding the Fourier coefficient a_n is (i) $a_n = \int_0^\pi f(x) \cos nx dx$ (ii) $a_n = \frac{2}{\pi} \int_0^\pi f(x) \cos nx dx$ (iii) $a_n = \frac{1}{\pi} \int_0^\pi f(x) \cos nx dx$ (iv) $a_n = \frac{1}{\pi} \int_{-\pi}^\pi f(x) \cos nx dx$	K2	CO4
5	9	If $F(s)$ is the Fourier Transform of $f(x)$, then $F[f(ax)]$ is (i) $sF\left(\frac{s}{a}\right)$ (ii) $F\left(\frac{s}{a}\right)$ (iii) $\frac{s}{a}F\left(\frac{s}{a}\right)$ (iv) $aF\left(\frac{s}{a}\right)$	K1	CO5
	10	If $F(s)$ is the Fourier Transform of $f(x)$, then $F[f(x - a)]$ is (i) $e^{as}F(s)$ (ii) $e^{ias}F(s)$ (iii) $e^{-as}F(s)$ (iv) $e^{-ias}F(s)$	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.	Determine the eigen values and eigen vectors of the matrix $\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$.	K3	CO1
		(OR)		

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	11.b.	Calculate A^4 by using Cayley Hamilton Theorem, when $A = \begin{bmatrix} 5 & 3 \\ 1 & 3 \end{bmatrix}$.		
2	12.a.	Eliminate the arbitrary function f and ϕ from the relation $z = f(x + y) + \phi(x - y)$.	K3	CO2
	(OR)			
	12.b.	Solve: $\frac{\partial^2 z}{\partial x \partial y} = \sin y + x$.		
3	13.a.	i) Find $L\{t^2 e^{-3t}\}$. (ii) Find $L\{\frac{\sin at}{t}\}$.	K3	CO3
	(OR)			
	13.b.	i) Find $L^{-1}\left\{\frac{s}{(s+3)^2+4}\right\}$. ii) Find $L^{-1}\left\{\frac{1}{s(s^2+a^2)}\right\}$.		
4	14.a.	Express $f(x) = x, (-\pi < x < \pi)$ as a Fourier Series with period 2π .	K3	CO4
	(OR)			
	14.b.	Find a Fourier Sine Series for $f(x) = \begin{cases} x, & 0 < x < \frac{\pi}{2} \\ 0, & \frac{\pi}{2} < x < \pi \end{cases}$		
5	15.a.	Prove that $F(f(ax)) = \frac{1}{ a } F\left(\frac{s}{a}\right)$.	K3	CO5
	(OR)			
	15.b.	Find the Fourier cosine transform for $f(x)$ if $f(x) = \begin{cases} 1 & \text{when } x < 1 \\ 0 & \text{when } x > 1 \end{cases}$. Deduce that $\int_0^\infty \frac{\sin t}{t} dt = \frac{\pi}{2}$.		

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	Determine the characteristic equation of the matrix and hence find the inverse $\begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$.	K3	CO1
2	17	Eliminating the arbitrary function from the equation $F(xy + z^2, x + y + z) = 0$.	K3	CO2
3	18	Solve the differential equation $\frac{d^2 y}{dt^2} - 10 \frac{dy}{dt} + 24y = 24t$ 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 $-\pi \leq x \leq \pi$ and hence deduce that $\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \dots = \frac{\pi^2}{12}$.	K3	CO4
5	20	Find the Fourier cosine transform of $e^{-ax}, a > 0$.	K3	CO5