PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION DECEMBER 2025
(First Semester)

Branch – **PHYSICS**

MATHEMATICS – I 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	Parametric formula for Radius of Curvature_____. a) $\rho = \frac{(1-y_1^2)^{3/2}}{y_2}$ b) $\rho = \frac{(x'^2+y'^2)^{3/2}}{x'y''-y'x''}$ c) $\rho = \frac{(x'^2-y'^2)^{3/2}}{x'y''+y'x''}$ d) $\rho = \frac{(1+y_2^2)^{3/2}}{y_1}$	K1	CO1
	2	The locus of the centre of curvature is called: (a) Evolute (b) Envelope (c) Involute (d) Tangent	K2	CO1
2	3	$\int e^x cosx\, dx$ is evaluated, using: (a) Direct formula (b) Substitution (c) Integration by parts (d) Partial fractions	K1	CO1
	4	Bernoulli's formula is used in: (a) Successive differentiation (b) Successive integration by parts (c) Partial fractions (d) Taylor expansion	K2	CO2
3	5	The area of a circle of radius 'a' using a double integral in polar coordinates is: (a) πa (b) πa^2 (c) $2\pi a$ (d) $2a$	K1	CO1
	6	The value of $\Gamma(1/2)$ is: (a) 1 (b) $\sqrt{\pi}$ (c) π (d) $1/\sqrt{\pi}$	K2	CO2
4	7	The directional derivative of a scalar function ϕ in the direction of a unit vector $\hat{n}$ is: (a) $\nabla \cdot \phi\hat{n}$ (b) $\nabla\phi.\hat{n}$ (c) $\phi.\hat{n}$ (d) $\nabla \times \phi$	K1	CO1
	8	Curl of a gradient of any scalar function is always: (a) Scalar (b) Zero vector (c) Gradient (d) Divergence	K2	CO2
5	9	Stoke's theorem relates: (a) Surface integral of curl to line integral over boundary (b) Line integral to volume integral (c) Divergence to area integral (d) None of these	K1	CO1
	10	Line integral $\int_c \vec{F} \cdot d\vec{r}$ depends on path when: (a) $\nabla \times \vec{F} \neq 0$ (b) $\nabla \times \vec{F} = 0$ (c) $\nabla.\vec{F} = 0$ (d) $\vec{F}$ is conservative	K2	CO2

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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 radius of curvature at the point $\left(\frac{a}{4}, \frac{a}{4}\right)$ to the curve $\sqrt{x}+\sqrt{y}=\sqrt{a}$.	K2	CO2
		(OR)		
	11.b.	Find the envelope of the family of the curves $(x-a)^2+y^2=4a$ where a is a parameter.		
2	12.a.	Obtain the reduction formula for $\int cos^n x\, dx$	K2	CO2
		(OR)		
	12.b.	Evaluate $x^2 tan^{-1} x$, by using integration by parts.		
3	13.a.	Find the area between the parabola $x^2=4y$ and the straight line $x-2y+4=0$.	K3	CO3
		(OR)		
	13.b.	Show that $\Gamma(n+1)=n\Gamma(n)$.		
4	14.a.	If $\phi(x,y,z)=3x^2+2y-3z$, find $\nabla\phi$ and the directional derivative at (1,1,1) in the direction of $2\vec{\imath}+2\vec{\jmath}-\vec{k}$.	K3	CO3
		(OR)		
	14.b.	If $\vec{F}=(x+y+1)\vec{\imath}+\vec{\jmath}-(x+y)\vec{k}$, Prove that $\vec{F}\cdot curl\vec{F}=0$.		
5	15.a.	If $\vec{F}=x^2\vec{\imath}+y^2\vec{\jmath}$, evaluate $\int \vec{F}.d\vec{r}$ from (0,0) to (1,1) along the line $y=x$.	K4	CO4
		(OR)		
	15.b.	Evaluate $\iint \vec{F}\cdot\hat{n}\, ds$ where $\vec{F}=18z\,\vec{\imath}-12\,\vec{\jmath}+3y\vec{k}$, as S is part of the plane $2x+3y+6z=12$ which is in the first octant.		

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	Find the radius of curvature at the point θ on the curve $x=(\theta+sin\theta), y=a(1-cos\theta)$.	K2	CO2
2	17	Derive an expression for $\int sin^m x cos^n x dx$ when both m and n are odd integers.	K2	CO2
3	18	Express $\int_0^1 x^m (1-x^n)^p\, dx$ in terms of Gamma functions.	K3	CO3
4	19	Find a and b such that the surfaces $ax^2-byz=(a+2)x$ and $4x^2y+z^3=4$ cut orthogonally at $(1,-1,2)$.	K3	CO3
5	20	Verify Greens theorem in a plane for the integral $\int_C\{(x-2y)dx+x\,dy\}$, taken around the circle $x^2+y^2=1$.	K4	CO4

Z-Z-Z END