TOTAL PAGES : 2

22PHU103N/22PHU103

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 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.	Questions	K Level	CO
1	1.	The parametric formula for the radius of curvature is ____ a) $\frac{(x'^2+y'^2)^{\frac{3}{2}}}{x'y''-x''y'}$ b) $\frac{(x'^2-y'^2)^{\frac{3}{2}}}{x'y''-x''y'}$ c) $\frac{(x'^2+y'^2)^{\frac{3}{2}}}{x'y''+x''y'}$ d) $\frac{(x'^2-y'^2)^{\frac{3}{2}}}{x'y''+x''y'}$	K1	CO1
	2.	The chord of curvature is parallel to y-axis then the length of the chord of curvature is --------- a) $2y_2(1+y_1^2)$ b) $2y_2(1-y_1^2)$ c) $\frac{2}{y_2}(1+y_1^2)$ d) $\frac{2}{y_2}(1-y_1^2)$	K2	CO1
2	3.	$\int \sin^{-1} x dx =$ ______ a) $x\sin^{-1}x-\sqrt{1-x^2}+c$ b) $x\sin^{-1}x+\sqrt{1-x^2}+c$ c) $x\sin^{-1}x-\sqrt{1+x^2}+c$ d) $x\sin^{-1}x+\sqrt{1+x^2}+c$	K1	CO2
	4.	$\int_0^{\frac{\pi}{2}} \sin^{10} x dx =$ ________ a) $\frac{53\pi}{512}$ b) $\frac{47\pi}{512}$ c) $\frac{61\pi}{512}$ d) $\frac{63\pi}{512}$	K2	CO2
3	5.	$\int_1^2 \int_x^{x\sqrt{3}} xydydx =$ ________ a) $\frac{15}{7}$ b) $\frac{15}{4}$ c) $\frac{15}{2}$ d) $\frac{15}{11}$	K1	CO3
	6.	Area bounded by the circles $r=2\sin\theta$ and $r=4\sin\theta$ is ________ sq.units a) 2π b) 3π c) 4π d) 5π	K2	CO3
4	7.	If $\bar{r}$ is a vector of constant magnitude then $\bar{r}\cdot\frac{d\bar{r}}{dt}=$ ___ a) 1 b) -1 c) 0 d) 3	K1	CO4
	8.	Angle between the surface $z=x^2+y^2-3$ and $x^2+y^2+z^2=9$ at (2,-1,2) is ______ a) $\frac{7}{3\sqrt{21}}$ b) $\frac{3}{7\sqrt{21}}$ c) $\frac{3}{8\sqrt{21}}$ d) $\frac{8}{3\sqrt{21}}$	K2	CO4
5	9.	If a vector function ***F*** is expressible as the gradient of a scalar point function ϕ then ***F*** is =______ a) conservative b) irrotational c) solenoidal d) divergent	K2	CO5
	10.	Which of the following theorem relates a surface integral to volume integral? a) Divergence b) Stoke's c) Green's d)Gauss's	K1	CO5

SECTION - B (35 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** Marks (5 × 7 = 35)

Module No.	Question No.	Questions	K Level	CO
1	11.a	Find the radius of curvature at the point θ on the curve $x=a(\theta+\sin\theta); y=a(1-\cos\theta)$	K2	CO1
		(OR)		

Cont...

	11.b	Show that the evolute of the cycloid is $x = a(\theta - \sin\theta); y = a(1-\cos\theta)$ is another cycloid.		
2	12.a	Evaluate $\int e^x(\sin x + \cos x)dx$	K3	CO2
		(OR)		
	12.b	Show that $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \log(\sin x + \cos x)\,dx = -\frac{\pi}{4}\log 2$		
3	13.a	Evaluate $\iint_A xydydx$ where A is the domain bounded by x-axis, ordinate $x = 2a$ and the curve $x^2 = 4ay$	K2	CO3
		(OR)		
	13.b	Find the centre of gravity of the plane semi-circle region $x^2 + y^2 = 4, x \geq 0$.		
4	14.a	If $\vec{r}$ is the position vector of the point $P(x,y,z)$. Then prove the following i) $div\vec{r} = 3$ ii) $curl\vec{r} = 0$ iii) $\nabla r^n = nr^{n-2}\vec{r}$ where $r = \|r\|$	K2	CO4
		(OR)		
	14.b	Prove that $grad(u \bullet v) = v \times curl u + u \times curl v + (v \bullet \nabla)u + (u \bullet \nabla)v$		
5	15.a	Find the common area between $y^2 = 4x$ and $x^2 = 4y$ by using Green's theorem..	K3	CO5
		(OR)		
	15.b	Evaluate $\iint_S \vec{A} \bullet \vec{n}ds$ where $\vec{A} = 4xz\vec{i} - y^2\vec{j} + yz\vec{k}$ where S is the surface of the cube bounded by $x = 0, x = 1, y = 0, y = 1, z = 0$ and $z = 1$.		

SECTION -C (30 Marks)

Answer **ANY THREE** questions

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

Module No.	Question No.	Questions	K Level	CO
1	16	Find the centre of curvature at any point (x, y) on the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ and show that the equation of the evaluate of the ellipse $(ax)^{\frac{2}{3}} + (by)^{\frac{2}{3}} = (a^2 - b^2)^{\frac{2}{3}}$	K3	CO1
2	17	If $I_{m,n} = \int_0^{\frac{\pi}{2}} \cos^m x \sin nx dx$ prove that $I_{m,n} = \frac{1}{m+n} + \frac{m}{m+n} I_{m-1,n-1}$. Hence deduce that $I_{m,m} = \frac{1}{2^{m+1}}\left[\frac{2}{1} + \frac{2^2}{2} + \frac{2^3}{3} + \ldots \frac{2^m}{m}\right]$	K3	CO2
3	18	Evaluate the following i) $\int_2^4 \int_0^x \int_0^{\sqrt{x+y}} zdzdydx$ ii) $\int_0^a \int_0^x \int_0^{x+y} e^{x+y+z}dzdydx$	K3	CO3
4	19	Determine $f(r)$ so that the vector $f(r)\vec{r}$ is both solenoidal and irrotational.	K3	CO4
5	20	Verify Gauss divergence theorem for $\vec{F} = (x^2 - yz)\vec{i} + (y^2 - xz)\vec{j} + (z - xy)^2\vec{k}$ taken over rectangular parallelepiped enclosed by $x = 0, x = a, y = 0, y = b, z = 0$ and $z = c$.	K3	CO5

Z-Z-Z END