

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)
BSc DEGREE EXAMINATION DECEMBER 2024
(Second Semester)

Branch - **ELECTRONICS**

MATHEMATICS - II

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	A function $f(x)$ is said to be even if _____ (a) $f(x) = 0$ (b) $f(x) = 1$ (c) $f(-x) = f(x)$ (d) $f(-x) = -f(x)$	K1	CO1
	2	$a_0 =$ _____ in the half – range cosine series in $(0, \pi)$ (a) $\frac{2}{\pi} \int_0^\pi f(x) dx$ (b) $\frac{1}{\pi} \int_0^\pi f(x) dx$ (c) $\frac{2}{\pi} \int_0^\pi f(x) \cos nx dx$ (d) $\frac{1}{\pi} \int_0^\pi f(x) \cos nx dx$	K2	CO1
2	3	The differential equation of all spheres whose center lie on the x – axis is _____ (a) $x + yp = 0$ (b) $y + zq = 0$ (c) $yp + z = 0$ (d) $x + zq = 0$	K1	CO2
	4	The solution of $\frac{\partial z}{\partial y} = \sin x$ is (a) $\cos x + f(x)$ (b) $-\cos y + f(x)$ (c) $-\cos x + f(y)$ (d) $\cos y + f(x)$	K2	CO2
3	5	$L[e^{-7t}] =$ _____ (a) $\frac{1}{s-7}$ (b) $\frac{1}{s+7}$ (c) $\frac{1}{s^2+49}$ (d) $\frac{1}{s^2-49}$	K1	CO3
	6	$L^{-1}\left[\frac{1}{s^2}\right] =$ _____ (a) t (b) $\frac{1}{t}$ (c) t^2 (d) $\frac{1}{t^2}$	K2	CO3
4	7	If $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$, then $\nabla \cdot \vec{r}$ is _____ (a) 0 (b) 1 (c) 2 (d) 3	K1	CO4
	8	If A is a constant vector, then $\text{div } \vec{A} =$ _____ (a) 0 (b) 1 (c) 2 (d) 3	K2	CO4
5	9	Which of the following is not an application of Green's theorem (a) Solving two-dimensional flow integrals (b) Area surveying (c) Volume of plane figures (d) Centroid of plane figures	K1	CO5
	10	If C is a closed curve, then $\int_C \vec{F} \cdot d\vec{r} =$ _____ (a) $\frac{1}{r}$ (b) $2r$ (c) 0 (d) r^2	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 that the Fourier series for $f(x) = x$, $-\pi < x < \pi$ is given by $f(x) = 2 \sum_{n=1}^{\infty} (-1)^{n+1} \frac{\sin nx}{n}$	K2	CO1

Cont...

1	(OR)		K2	CO1
	11.b.	Expand $f(x) = \cos x, 0 < x < \pi$ in a Fourier sine series		
2	12.a.	Find the PDE by eliminating the arbitrary constants a, b and c from $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$	K3	CO2
	(OR)			
	12.b.	Form the PDE by eliminating f, from $f(xy + z^2, x + y + z) = 0$		
3	13.a.	Find $L(\sin 8t \cos 4t + \cos^3 4t + 5)$	K3	CO3
	(OR)			
	13.b.	Find $L^{-1}\left[\frac{s-3}{s^2+4s+13}\right]$		
4	14.a.	Find the directional derivative of $\phi = x^2yz + 4xz^2$ at (1, 1, 1) in the direction of $\vec{i} + \vec{j} - \vec{k}$.	K4	CO4
	(OR)			
	14.b.	Show that $2xy\vec{i} + (x^2 + 2yz)\vec{j} + (y^2 + 1)\vec{k}$ is irrotational.		
5	15.a.	Find the work done by the force $\vec{F} = (2xy + z^3)\vec{i} + x^2\vec{j} + 3xz^2\vec{k}$ when it moves a particle from (1, -2, 1) to (3, 1, 4) along any path.	K5	CO5
	(OR)			
	15.b.	Use divergence theorem, evaluate $\iint_S \nabla r^2 \cdot \hat{n} \, ds$.		

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	Expand $f(x) = (\pi - x)^2$ as a Fourier series of periodic 2π in the interval $0 < x < 2\pi$. Hence deduce the sum of the series $1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$	K3	CO1
2	17	Solve $z = px + qy + \sqrt{1 + p^2 + q^2}$.	K5	CO2
3	18	Find (i) $L[t \cos^3 t]$. (ii) the Laplace transform of the periodic function $f(t) = \begin{cases} t & \text{for } 0 < t < 1 \\ 2 - t & \text{for } 1 < t < 2 \end{cases}$ and $f(t + 2) = f(t)$.	K3	CO3
4	19	Prove that $\text{curl curl } \vec{F} = \text{grad div } \vec{F} - \text{Laplacian } \vec{F}$.	K3	CO4
5	20	Verify Green's theorem in the XY plane for $\int_C ((xy + y^2) dx + x^2 dy)$, where C is the closed curve of the region bounded by $y = x$ and $y = x^2$.	K5	CO5