

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION DECEMBER 2024
(Fifth Semester)

Branch – PHYSICS

MATHEMATICAL PHYSICS

Time: Three Hours

Maximum: 50 Marks

SECTION-A (5 Marks)

Answer ALL questions

ALL questions carry EQUAL marks

(5 x 1 = 5)

- 1 Which of the following theorem convert line integral to surface integral?
(i) Gauss divergence and Stokes theorem (ii) Stokes theorem only
(iii) Green's theorem only (iv) Stokes and Green's theorem only
- 2 Divergence of the curl of a twice differentiable continues vector function is _____.
(i) Unity (ii) Infinity (iii) Zero (iv) A unit vector
- 3 The Caley-Hamilton theorem deals only with _____ matrices.
(i) Unitary (ii) Inverse (iii) Square (iv) Orthogonal
- 4 Laplace transform if $\sin(at)u(t)$ is?
(i) s/a^2+s^2 (ii) a/a^2+s^2 (iii) s^2/a^2+s^2 (iv) a^2/a^2+s^2
- 5 Which of the following theorems can be applied in the function of Cauchy's Integral Theorem?
(i) Green's (ii) Stoke's
(iii) Gauss Divergence (iv) Taylor's

SECTION - B (15 Marks)

Answer ALL Questions

ALL Questions Carry EQUAL Marks

(5 x 3 = 15)

- 6 a Explain Stokes Theorem.
OR
b Define Kronecker delta symbol and List the properties of Kronecker delta.
- 7 a Interpret Gradient in orthogonal Curvilinear coordinates.
OR
b Write the differential operators Gradient, Divergence and Curl of spherical coordinates.
- 8 a Find the Eigen values and normalized eigen vectors of the matrix .

1	0	0
0	1	1
0	1	1

OR

- b Diagonalise the following matrices?

4/3	$\sqrt{2}/3$
$\sqrt{2}/3$	5/3

$\cos \theta$	$-\sin \theta$	0
$\sin \theta$	$\cos \theta$	0
0	0	1

- 9 a. Find the sine transform of e^{-ax}/x .
OR
b. State any two properties of Laplace Transforms.

Cont...

- 10 a. What is an analytical function. Derive necessary and sufficient conditions for a function to be analytic.

OR

- b. State and Prove Cauchy's integral theorem.

$$\int_c f(z) dz = 0$$

SECTION -C (30 Marks)Answer **ALL** questions**ALL** questions carry **EQUAL** Marks

(5 x 6 = 30)

- 11 a State and Prove Gauss Divergence theorem.

OR

- b Introduce the two expressions of christoffel's 3-index symbols and Derive the relation between first and second kind.

- 12 a Derive an equation for div V in orthogonal curvilinear coordinates.

OR

- b Write the differential operators Gradient, Divergence and Curl of cylindrical coordinates.

- 13 a.(i) Show that the Eigen values of a matrix are invariant under similarity transformation.

(ii) Show that the following matrices are Orthogonal

[A] =	cos θ	-sin θ	0
	sin θ	cos θ	0
	0	0	1

[B] =	cos θ	0	sin θ
	0	1	0
	-sin θ	0	cos θ

OR

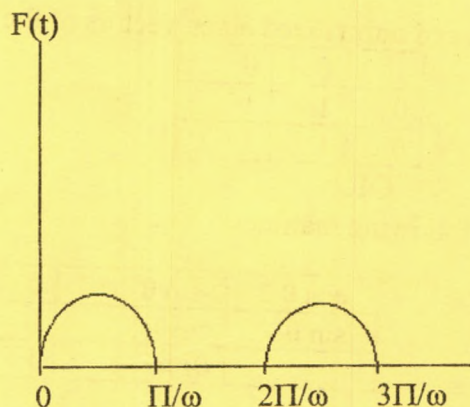
- b Find the characteristic equation of the following matrix and verify the Cayley-Hamilton theorem.

1	2	3
2	-1	4
3	1	1

- 14 a Represent the equations of finite fourier sine and cosine transform

OR

- b Obtain the laplace transform of half wave rectifier function as shown in the figure



- 15 a State and prove the cauchy's riemann equations for a function of a complex variable to be analytic.

OR

- b. State and Prove Cauchy's integral formula. $f(z_0) = \frac{1}{2\pi i} \int_c \frac{f(z) dz}{(z-z_0)}$

Z-Z-Z END