

(i) Printed Pages : 4

Roll No.

(ii) Questions : 9

Sub. Code :

2	6	1	0	5
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Exam. Code :

0	4	7	3
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M.Sc. Physics 2nd Semester

(2056)

MATHEMATICAL PHYSICS-II

Paper-PHY-8021

Time Allowed : Three Hours]

[Maximum Marks : 60

Note :— Attempt **Five** Questions in all, including Q. No. 9 (UNIT- V) which is compulsory and selecting **one** question from each Unit I- IV.

UNIT-I

1. (a) Define the terms:

6

(i) Topological group

(ii) Lie group

(iii) Structure constants of a Lie group.

(b) Show that if a group H of order h is a subgroup G of order g then g is an integral multiple of h.

6

2. (a) Show that groups of order 2 and 3 are always cyclic, but a group of order 4 may or may not be a cyclic group.

6

- (b) Discuss SU(2) group and O(3) symmetry group. Give its relevance in physics. 6

UNIT-II

3. (a) Obtain Fourier series expansion for the function, 6

$$f(x) = \begin{cases} 0 & -\pi \leq x \leq 0 \\ 1 & 0 < x \leq \pi \end{cases}$$

Verify the result by assuming the Fourier series in complex form.

- (b) Prove that if $g(\omega)$ is the Fourier Transform of $f(t)$, then Fourier Transform of $f(t)\cos at$ is given by: 3

$$\frac{1}{2}g(\omega - a) + \frac{1}{2}g(\omega + a).$$

- (c) The Fourier Transform of a convolution integral is given by the product of transforms of the convolving functions. 3

4. (a) Obtain Laplace transform of $f(t) = \sinh at \sin at$. 6

- (b) Show that for a periodic function $F(t)$ of period T so that $F(t+T) = F(t)$; $T > 0$, the Laplace transform is given by

$$L\{F(t)\} = \frac{1}{1 - e^{-sT}} \int_0^T e^{-st} F(t) dt \quad 6$$

UNIT-III

5. (a) Define metric tensor g_{ij} and show that it is symmetric. Describe its significance. 6
- (b) Construct Green's function for $\psi''(x) - \psi(x) = 0$ with the condition $\psi(x)$ is finite for all $x \in (-\infty, \infty)$. 6
6. (a) Show that $\frac{\partial A_p}{\partial x^q}$ is not a tensor even though A_p is a covariant tensor of rank 3. 6
- (b) Use Neumann series method to solve the integral equation
- $$F(x) = 1 - 2 \int_0^x x' F(x') dx' \quad 6$$

UNIT-IV

7. (a) Explain numerical integration using: 6
- (i) Simpson's rule
- (ii) Weddle's rule.
- (b) Explain Monte Carlo method and its applications. 6
8. (a) Calculate the mean and standard deviation of Poisson's distribution. 6
- (b) Explain the method of linear least square fitting. 6

UNIT-V

9. (a) State the two Schur's lemma's?
- (b) Define the term integral transform.
- (c) How do we classify an integral equation?
- (d) Write the covariant derivative of A_i^{rs} .
- (e) Find the Laplace transform of t^n .
- (f) What do you understand by the term simulation? $6 \times 2 = 12$