Roll No. | | | | | | | | | | | | |  Total No. of Pages : 02

Total No. of Questions : 11

M.Sc (Physics) PIT (2015 to 2017) (Sem.-2)

# MATHEMATICAL PHYSICS - II

Subject Code : PHS-421

Paper ID : [51113]

Time : 3 Hrs. Max. Marks : 70

**INSTRUCTIONS TO CANDIDATES :**

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains SEVEN questions carrying FIVE marks each and students have to attempt any SIX questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

## SECTION-A

**1. Answer briefly :**

a. Define a group, subgroup and a class.

b. What is Beta function? Prove that it is symmetric.

c. What are the properties of delta function?

d. Discuss in which problem of Physics, the spherical Bessel's function can be applied. Also state its physical significance.

e. Show that $P_n(1)=1$, where n=0,1,2,3....

f. Show that $J_{1/2}(x) = \sqrt{\frac{2}{\pi}} \sin x$.

g. Give the physical significance of associated Legendre polynomial?

h. Find the Laplace transform of (i) $t^n e^{at}$ and (ii) $t \cos at$.

i. State and explain the Dirichlet's conditions of Fourier series.

j. Find the inverse Laplace transform of $\frac{e^{-1/s}}{s}$

## SECTION-B

2. Explain reducible and irreducible representations and mention their main features.

3. Write a short note of special unitary group SU(2).

4. Derive the relation between Beta and Gamma functions.

5. Find Fourier transform of Gaussian distribution function $f(x)=Ne^{-\alpha x2}$, where N and a are constants.

6. Find the Fourier transform of $e^{-|t|}$.

7. For the Bessel's functions of first kind, prove that

$$xJ'_n(x) = nJ_n(x) - xJ_{n+1}(x)$$

8. Find Fourier series of the function $e_x$ in the interval $-\pi<x<\pi$.

## SECTION-C

9. Define isomorphism between two groups. Prove that every finite group of order n is isomorphic to a permutation group of n symbols.

10. if $\Gamma z = \int_0^\infty e^{-t}t^{z-1}\,dt$, evaluate $\int_0^{\pi/2} cos^{m-1}x\, sin^{n-1}x\, dx$ in terms of Gamma functions.

11. Show that Rodrigue's formula for Legendre's polynomial is given by :

$$P_n(x) = \frac{1}{2_n n!}\frac{d^n}{dx^n}(x^2-1)^n$$