

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI – 600 086
(For candidates admitted during the academic year 2019-2020 & thereafter)
SUBJECT CODE : 19PH/PC/MP24
M.Sc. DEGREE EXAMINATION – APRIL 2023
BRANCH III - PHYSICS
SECOND SEMESTER

COURSE : MAJOR CORE

PAPER : MATHEMATICAL PHYSICS II

TIME : 3 HOURS

MAX. MARKS: 100

(10x3= 30)

SECTION A

I. ANSWER ALL QUESTIONS

1. State Convolution theorem.
2. Determine the sine transform of e^{ax}
3. Express Laplace equation in spherical coordinates.
4. Write the wave equation in three dimension.
5. Give the Hermite differential equation.
6. State Fuch's theorem.
7. Explain homomorphism?
8. What is a cyclic group?
9. Bring out the fallacy ,if any, in the following statement:" The mean of binomial distribution is 5 and standard deviation =3".
10. Find the probability that at most 5 defective fuses will be found in a box of 200 fuses if experience shows that 2% of fuses are defective.

SECTION B

(5x5= 25)

II. ANSWER ANY FIVE QUESTIONS

11. Determine the Fourier transform of the Gaussian distribution function

$$F(x)=N \exp(-\alpha x^2) \text{ where } N \text{ and } \alpha \text{ are constants.}$$

12. Solve the two-dimensional Laplace equation in cylindrical coordinates.

13. S.T. (i) $H_{2n}(0) = (-1)^n \frac{2n!}{n!}$ (ii) $H_{2n+1}(0) = 0$.

14. Show that the following matrices form a group under matrix multiplication and draw the group table

$$E = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}, A = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}, B = \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}, C = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$$

15. Show that if two symmetrical binomial distributions of degree n are so superposed that the n^{th} term of one coincides with $(n+1)^{\text{th}}$ term of the other, the distribution formed by adding superposed terms is a symmetrical binomial distribution of degree $(n+1)$.
16. Find the Laplace transform of the sawtooth wave function $f(t) = \frac{at}{T}$ $0 < t < T$ and $f(t+T) = f(t)$.
17. Find the Fourier transform of e^{-t}

SECTION – C

(3x15= 45)

III. ANSWER ANY THREE QUESTIONS

18. Using finite Fourier sine and cosine transforms evaluate $\int_0^{\infty} \frac{\cos nx \, dn}{a^2 + n^2}$ and $\int_0^{\infty} \frac{n \sin nx \, dn}{a^2 + n^2}$
19. Explain great orthogonality theorem.
20. Solve two dimensional heat flow equation.
21. Obtain the series solution of the Bessels equation
 $x^2(d^2y/dx^2) + x(dy/dx) + (x^2 - n^2)y = 0$
22. Define Poissons distribution and calculate the mean and standard deviation of poisons Distributions.
