CR-2531

M. Sc. (First Semester) Examination,

Nov.-Dec. 2018

PHYSICS

Paper : First

(Mathematical Physics)

Time Allowed : Three hours

Maximum Marks : 40

Note : Attempt questions of all two sections as directed

Section-A

(Short Answer Type Questions) 5x3=15

Note : Attempt all five questions. One question from each unit is compulsory. Each question carries 03 marks.

Unit-I

1. What do you understand by orthogonal and unitary matrics?

Or Discuss the diagonalisation of a matrix.

Unit-II

2. Write down the legendre differential equation and obtain

Or

Prove that

$$e^{n} \frac{d^{n}}{d\mu^{n}}\left(\mu^{n} e^{-\mu}\right)=L_{n}(\mu)$$

Unit-III

3. What are the use of Laplace transformation? Give suitable example for it.

Or

Defive the inverse LT by partial fractions.

Unit-IV

4. Define the fourier integral and transforms.

Or

Obtain the finite fourier cosine transform of x.

Unit-V

5. Prove that

$$P_{n}(-\mu)=(-1)^{n} P_{n}(\mu$$

Discuss the relation between the Fourier transform of the derivatives of a function.

Section-'B'

(Long Answer Type Questions) 5x5=25

Note : Attempt all five questions. One question from each unit is compulsory. Each question carries 05 marks.

Unit-I

6. Show that the set of vectors 1,72,12 given by

r_i = J – 2k

r_2 =i-j+k

$$1_3 = i+2j+k$$

is linear independent.

Or

Reduce the matrix A to its normal from, where

$$A = \begin{bmatrix} 0 & 1 & 2 & -2 \\ 4 & 0 & 2 & 6 \\ 2 & 1 & 3 & 1 \end{bmatrix}$$

Unit-II

7. Define and derive the series solution of Lagurre differential equation.

Or

(a) Prove that

$$\frac{d}{dx}\left\{x^{-n}J_n(x)\right\} = -x^{-n}J_{n+1}(x)$$

(b)

Show that

$$P_n(\mu) = \frac{1}{2^n \lfloor n}\left(\frac{d}{d\mu}\right)^n \left(\mu^2-1\right)^n$$

Unit-III

8. Find the Laplace transform of sin at and cos at.

Or

Explain the some properties of inverse Laplace transform.

Unit-IV

9. Obtain Fourier's series for the expansion of f(x)=xsin x in the interval $-\pi<x<\pi$. Hence deduce that

$$\frac{\pi}{4} = \frac{1}{2} + \frac{1}{1\cdot 3} - \frac{1}{3\cdot 5} + \frac{1}{5.7} -$$

Find the value of $\sum_{n=1}^{\alpha} \frac{1}{n^2}$ using fourier series.

Unit-V

10. Determine the following form as definite, semi-definite or indefinite

$2x_1^2 + 2x_2^2 + 3x_3^2 - 4x_2x_3 - 4x_3x_1 + 2x_1x_2$

Or

Prove that

$$\int_{-\infty}^{\infty} x e^{-x^2} H_n(x) H_m(x)\, dx = \sqrt{\pi}\left[2^{n-1} \underline{\lfloor n} \; S_{m,n-1} + 2^n \underline{\lfloor n+1} \; \delta_{n+1,\, m} \right]$$