Code No. 7122 / CORE / N

FACULTY OF SCIENCE

M. Sc. I – Semester Examination, December 2018 / January 2019

Subject : Physics & Applied Electronics

Paper – I : Mathematical Physics

Time : 3 Hours **Max. Marks: 80**

Note : Answer all questions from Part–A and Part–B. Each question carries 4 marks in Part–A and 12 marks in Part – B.

PART – A (8 x 4 = 32 Marks)
(Short Answer Type)

1 Evaluate $\int_0^\infty x^6 e^{-2x} dx$ using Gamma functions.

2 Show that $P_n(-x) = (-1)^n P_n(x)$.

3 Show that $H_{2n}(0) = \frac{(-1)^n (2n)!}{n!}$.

4 Show that $L_n^1(x) = nL_{n-1}^1(x) - nL_{n-1}(x)$.

5 State and explain properties of Laplace transforms.

6 Find the Fourier transform of $f(x) = e^{-a|x|}$. where $a > 0$ and $-\infty < x < \infty$.

7 Determine the eigen value of the matrix $A = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$.

8 Define covariant and contravariant Tensors with suitable examples.

PART – B (4 x 12 = 48 Marks)
(Essay Answer Type)

9 (a) Solve the Bessel differential equation of zero order using infinite series solution method.

OR

(b) Prove the following recurrence relations

(n+1) $P_{n+1}(x) = (2n+1)xP_n(x) - nP_{n-1}(x)$ and $nP_n(x) = xP_n^1(x) - P_{n-1}^1(x)$

10 (a) Solve Laguerre's differential equation

$$x^2 \frac{d^2y}{dx^2} + (1-x)\frac{dy}{dx} + ny = 0$$

OR

(b) Show that $\int_{-\infty}^{+\infty} e^{-x^2} H_n(x) H_m(x) dx = 2^n \cdot n! \sqrt{\pi}$ if m = n.

11 (a) Find $L^{-1}\frac{1}{(s^2+a^2)^2}$ using convolution theorem.

OR

(b) State and prove the shifting and scale changing property of Fourier transforms.

12 (a) Verify Cayley – Hamilton theorem for the matrix $A = \begin{bmatrix} 3 & 2 \\ -1 & 4 \end{bmatrix}$.

OR

(b) Explain contraction of tensor, Quotient law, the rank of the tensor, symmetric and skew symmetric tensors.

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Code No. 7124 / CORE

FACULTY OF SCIENCE

M. Sc. I – Semester Examination, December 2018 / January 2019

Subject : Physics & Applied Electronics

Paper – II : Classical Mechanics

Time : 3 Hours **Max. Marks: 80**

Note : Answer all questions from Part–A and Part–B. Each question carries 4 marks in Part–A and 12 marks in Part – B.

PART – A (8 x 4 = 32 Marks)
(Short Answer Type)

1 Explain Galilean transforms.
2 What is Minkowski space? Explain briefly.
3 Explain about different types of constraints.
4 Set up Lagrangian for a simple pendulum.
5 Express Hamilton's equations in Poisson Bracket form.
6 Comment on cyclic coordinates.
7 Discuss on principal axis transformation.
8 What are normal modes? Explain it.

PART – B (4 x 12 = 48 Marks)
(Essay Answer Type)

9 (a) State and prove the principle of conservation of Linear momentum and Angular momentum.

OR

(b) What are space set of axes and body set of axes? Obtain Eulers equations of motion for a rigid body.

10 (a) Explain the importance of generalized coordinates. Obtain Lagrange's equation of motion for conservative systems.

OR

(b) State and explain Hamilton's principle. Using it find the Lagrange's equations of motion.

11 (a) Discuss about generating function. Using it express the Hamilton's equations from old set of coordinates to new set of coordinates.

OR

(b) Obtain Hamilton's equations. Apply it to the motion of a particle in a central force field.

12 (a) Analyze the vibrations of a linear tri atomic molecule.

OR

(b) Apply Lagrangian formulation for continuous systems.

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