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Code No. 0135 / CORE

FACULTY OF SCIENCE

M. Sc. I – Semester Examination, January / February 2020

Subject : Physics
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 Show that $\int_0^\infty \frac{e^{-st}}{\sqrt{t}}\ dt = \sqrt{\pi/s}$.

2 Evaluate $\int_0^{\pi/2} \sqrt[3]{Tan\theta}\ \ d\theta$.

3 Show that $H_n'(x) = 2nH_{n-1}(x)$.

4 Prove that recurrence relation $L_n'(x) = nL_{n-1}'(x) - nL_{n-1}(x)$.

5 State and prove the first shifting theorem in Laplace transforms.

6 Find the Laplace transform of $\frac{sint}{t}$.

7 Define covariant and contravariant tensors and write down their transformations rule for rank 2.

8 State the properties of the determinants of a matrix.

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

9 (a) Show that $(n+1)p_{n+1}(x) = (2n+1)xP_n(x) - nP_{n-1}(x)\ \ and\ P_n(-x) = (-1)^n P_n(x)$.

OR

(b) Show that $J_o(x) + 2\sum_{n=1}^{\infty} J_{2n}(x) = 1$.

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

OR

(b) State and prove the Rodrique's formula for Laguerre polynomial.

11 (a) Verify the Perseval's identify for the Fourier transform of

$$f(x) = 1 \quad for\ |x| < a$$
$$= 0 \quad for\ |x| > a$$

and show that $\int_0^\infty \frac{sin^2 u}{u^2}\ \ du = \pi/2$

OR

(b) Find the inverse Laplace transform of $\frac{1}{(s^2-1)}$ using convolution theorem.

12 (a) State Caley-Hamilton theorem. Verify Caley-Hermilton theorem for matrix

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

OR

(b) Find the eigen values of eigen vectors of the matrix

A= $\begin{bmatrix} 5 & 7 & -5 \\ 0 & 4 & -1 \\ 2 & 8 & -3 \end{bmatrix}$

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Code No. 0137 / CORE

FACULTY OF SCIENCE

M. Sc. I – Semester Examination, January/February 2020

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 the Euler's angles with a neat diagram.
2 Explain the momentum four vector.
3 What are constraints? Illustrate with examples.
4 Write a note on generalized coordinates.
5 Explain briefly the principle of least action.
6 What are cyclic coordinates? Explain.
7 Explain the importance of Eigen value equation.
8 What is principal axis transformation?

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

9 (a) Explain Euler angles. Derive Euler's equations of motion for a rigid body.

OR

(b) Briefly explain Minkowski space. Derive Lorentz transformation in four space.

10 (a) State D'Alembert's principle Derive Lagrange's equations of motion from D'Alembert's principle.

OR

(b) State Hamilton's principle. Derive Lagrange's equations from Hamilton's principle.

11 (a) Define Lagrange and Poisson brackets. Find a relation between them.

OR

(b) Discuss Hamilton – Jacobi theory. Discuss its importance.

12 (a) Define normal coordinates. Obtain normal coordinates for a system of linear tri-atomic molecule.

OR

(b) Explain the difference between the Lagrangian and Hamiltonian formulations. Briefly discuss the conservation theorem.

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