Third Year B.Sc. Examination
April – 2016
Physics : Paper – 301
(Classical Mechanics, Quantum Mechanics, Mathematical Physics)

Paper code → 8937

Time : 2 Hours] **[Total Marks : 75**

1 (a) Write principle of virtual work. Derive Lagrangian equation for non conservative system. 10

(b) Explain Rayleigh's dissipation function and obtain Lagrangian function when frictional force is present. 05

(c) Shortest distance between any two points is a straight line when geodesic is a straight line. 04

OR

1 (a) Show that Newtonian, Lagrangian and Hamilton formulations are equivalent. 10

(b) Explain series L-C-R circuit and obtain Lagrangian function. 05

(c) Define ignorable coordinate. Prove that corresponding momentum is constant. 04

2 (a) Derive Euler's equation of motion. 08

(b) Discuss shortest time period problem. 07

(c) Define different types of constraints. 04

OR

2 (a) Explain Lagrangian undetermined multiplier with illustration. 08

(b) Write Hamilton's principle . 03

(c) State and prove fundamental postulates of Quantum mechanics. 08

3 (a) Define angular momentum. Obtain $\hat{L}_x$ component in spherical polar coordinate system. 10

(b) Show that the equation of motion is $x^{\bullet} = \frac{\hat{p}}{m}$, where p is linear momentum operator. 04

(c) $[\hat{r}_i , \hat{p}_j] = i\hbar\delta_{ij}$ prove. 05

OR

3 (a) Write dimensionless Schrodinger equation. Discuss Eigen value, Eigen function, Asymptotic behavior and recursion relation. 12

(b) If $\hat{H} = \frac{1}{2} m \dot{x}^2 + V(x)$ then prove $i\hbar \dot{x} = [\hat{x}, \hat{H}]$ 04

(c) Eigen value of self ad joint operator is real, prove it. 03

4 (a) Derive Helmholtz equation in spherical polar coordinate system. 12

(b) Find out types of singularity for given examples.

(1) $2xy'' + (4x + 1)y' + (2x + 1) = 0$ 02

(2) $xy'' + (1 + 2x)y' + (1 + x)y = 0$ 02

(3) $(1 + x)y'' + xy' - y = 0$ 02

OR

4 (a) Explain series solution method with an illustration. 06

(b) Derive Laplacian equation for Cartesian coordinate system. 06

(c) Derive scale factors for spherical polar coordinate system and write Laplacian operator for spherical polar coordinate system. 06

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