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**HEF-1603010102010100** **Seat No.** ____________

# M. Sc. (Sem. I) (CBCS) Examination

**November/December – 2017**

## Physics : CT - 01

## (Mathematical Physics & Classical Mechanics)

Time : $2\frac{1}{2}$ Hours] [Total Marks : **70**

**Instructions :**

(1) Attempt all questions.

(2) All questions carry equal marks.

(3) Mathematical symbols have usual meanings.

1 Answer in brief any seven: 14

(a) Define differential and partial differential equations. 02

(b) What are the order and degree of differential equation? 02

(c) Calculate Wronskian for $y_1 = \sin x$, $y_2 = \cos x$ and $X = \sin x$. 02

(d) Find the Laplace transform for 1. 02

(e) Write the properties of Laplace transforms. 02

(f) What is cyclic coordinate? 02

(g) Prove for Poisson's bracket, $[X, X] = 0$. 02

(h) Consider a generating function $F_2 = q_i P_i$ and prove that it generates identity transformation. 02

(i) Define Hamilton's characteristic function. 02

(j) Why earth is oblate ellipsoid? 02

2 Answer any two of following questions : 14

(a) Find out the solution for homogeneous second order differential equation: y" + P(x) y' + Q(x) y = 0 using changing independent variable method. 07

(b) Using variation of parameters method, solve the equation: y" + P(x) y' + Q(x) y = X. 07

(c) What is Frobenius' method? Solve the equation: y" + xy' + y = 0 using Frobenius' method. 07

3 (a) What is the Laplace transform for coskt? 05

(b) What is the Fourier transform of F(x) = I–$x^2$ (for |x| < 1) and F(x) = 0 (for |x| > 1)? 05

(c) Find out the Laplace transform for F(t) = t. 04

OR

(a) Obtain the differential equation of orbit for both, potential as well as force. 05

(b) Prove: for elliptical orbit, the semi-major axis depends only on the energy. 05

(c) Prove: for Poisson's brackets, 04

$$[pi, H], H] = \ddot{p}_i$$

4 Answer any two of following questions: 14

(a) Define canonical transformation and derive the transformation equations for $F_1$ (q, Q, t) generating function only. 07

(b) Solve the following integral equation of orbit 07

$$\int dt = \int \frac{dr}{\left[\frac{2}{m}\left(E - V(r) - \frac{l^2}{2mr^2}\right)\right]^{1/2}}$$

Solution of this integral gives equation of which geometrical shape?

(c) Obtain (i) Hamilton-Jacobi equation and (ii) physical significance of Hamilton's principal function. 07

5 Answer any two of following questions : 14

(a) Write a note on Fourier sine and cosine transforms. 07

(b) Discuss the solution of boundary value problems using Fourier transforms. 07

(c) Write a note on Coriolis force. 07

(d) Write a note on Virial theorem. 07

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