

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – MATHEMATICS

THIRD SEMESTER – NOVEMBER 2007

MT 3804 - CLASSICAL MECHANICS

AB 25

Date : 26/10/2007

Dept. No.

Max. : 100 Marks

Time : 9:00 - 12:00

Answer ALL the questions and each question carries 20 marks .

01.a.(i).State and prove the principle of Virtual Work

OR

(ii). Find the differential equation of motion for a bead sliding on a wire in the shape of a cycloid described by the equation $x = a (\theta - \sin \theta)$, $y = a (1 + \cos \theta)$,
 $0 \leq \theta \leq 2\pi$ [5]

b. (i).Derive the Lagrange's equation of motion and hence derive the equation of simple pendulum

OR

(ii). State Hamilton's principle and deduce Lagrange's equation from Hamilton's principle and find the equation of surface of revolution of a curve. [15]

02.a.(i) .Write down the Hamiltonian function for a spherical pendulum and deduce its equation of motion.

OR

(ii). Using the Hamilton function derive the equation of simple harmonic motion. [5]

b.(i). Formulate the Hamiltonian function H and give its physical significance and derive Hamilton's canonical equation of motion

OR

(ii). Define cyclic coordinates and derive the equation of motion using Routhian function. And hence deduce the equation of motion of a particle in the central force field. [15]

03.a.(i).Find the values of α and β so that the equation $Q = q^\alpha \cos \beta p$, $P = q^\alpha \sin \beta p$ represent a canonical transformation

OR

(ii). Establish a relation between Lagrange and Poisson bracket. [5]

b.(i). State and prove Hamilton's principle of least action

OR

(ii). Define Eulerian angles and discuss the motion of a top by
i.Lagrange's method
ii.Hamilton's method

04. a.(i) .State and prove Liouville's theorem .

OR

(ii). Find the transformation equation for ICT in terms of Poisson bracket. . [5]

b.(i).Derive Jacobi's identity.

OR

(ii).Derive the conservation theorem of angular momentum. [15]

05.a. (i).Discuss the motion of a particle moving in a plane under the action of central force using Hamilton Jacobi equation

OR

(ii).Classify the different types of periodic motion. [5]

b.(i).Derive the Hamilton – Jacobi equation for the Hamilton's principle function S . and deduce that $S = \int L dt + C$

OR

(ii).Discuss Kepler's problem using action angle variable. [15]
