 LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

**M.Sc.** DEGREE EXAMINATION - **MATHEMATICS**

THIRD SEMESTER – **NOVEMBER 2012**

# MT 3812 - CLASSICAL MECHANICS

Date : 06/11/2012 Dept. No. Max. : 100 Marks

Time : 9:00 - 12:00

Answer ***ALL*** the questions:

01. a. i. The quantity exerted by the outside agent that causes the change of position is called ---------

ii. I get up in the morning and go to work – denotes --------------type of motion.

iii. I get up in the morning and go to work but evening I’m back at home – denotes --------------type

of motion.

iv. The generalized displacement is ----------------------------

v. Holo means ----------------in Greek.

**OR**

b. Derive the equation of motion of Atwood’s machine **[ 5 ]**

c. .i. State and prove the principle of Virtual Work and deduce D’Alembert’s principle

ii. An inextensible string of negligible mass hanging over a smooth peg at A connects another

mass m1on a frictionless inclined plane of angle θ to another mass m2 . Use D’Alembert’s

principle to prove that the mass will be in equilibrium if m2 = m1sinθ.

**OR**

d. Classify constraints and state the principles involved in choosing the generalised coordinates and

classify the constraints with reasons for any one of the following cases

i. A bead moving on a circular wire.

ii. A sphere rolling down a rough inclined plane without slipping.

iii. The molecules moving inside a gas container.  **[15]**

02. a. i. An ignorable coordinate is one which ----------------------

ii. In a conservative system, H = -------- + V

iii. In  variation , energy is ------------------------

iv. In - variation process, System point is speeded up or slowed down in order to make the total

travel time along every path ------------------

v. 

**OR**

b. Find the Routh’s function for the motion for the motion of a projectile. Hence deduce equation of

motion. [5]

c. State Hamilton’s principle and deduce Lagrange’s equation from Hamilton’s principle and hence

find the equation of motion of one dimension Harmonic oscillator.  **[7+8]**

**OR**

d. i. Derive the Hamiltonian function

ii. Derive Hamilton canonical equation of motion.

iii.Give the physical significance of Hamilton’s function **5+5+5]**

3.a. i.

ii. 

iii. The time taken by a light ray to travel between two points is ---------------.

iv. If the dynamical system have one degree freedom, then pdq – PdQ = ---------------

v. generates an -------------- transformation.

**OR**

b**.** Show that is a canonical transformation

**[5]**

c. State and prove Integral Invariant theorem of Poincare

.

**OR**

d. Discuss about the motion of a top

[7+8]

04.a. i. The solution of H (q1, q2 q3,…. qn , ) + = 0 is known as ----------------------

ii. In any dynamical system, the collection of points is called a-----------------

iii.  =

iv. If qi is cyclic, then pi a -----------------------

v. ****

**OR**

b. State and prove Liouvilli’s theorem. **[5]**

c. Derive the conservation theorem of angular momentum using Infinite decimal

contact transformation

**OR**

d.Derive the Hamilton – Jacobi equation for the Hamilton’s principle function S. and deduce that

 **[15+5]**

05.a.i. The Complete integral W of Hamilton –Jacobi equation is called -------

ii. Separation of variables in Hamilton Jacobi’s equation is possible only if ------------------

iii. For a conservative dynamical system in which the generalized coordinates are θ , φ cyclic, then

the solution is given by -------------

iv. Action integral denoted by A is defined to be -----------------

v. If Wk denotes characteristic function, then Jk = is known as ---------------

**OR**

b. Discuss the motion of a particle moving in a plane under the action of central

force using Hamilton - Jacobi equation. **[5]**

c. Derive the Hamilton – Jacobi equation for the Hamilton’s characteristic function

**OR**

d. Discuss Kepler’s problem using action angle variable.

[15]

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