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DKK-003-016206 Seat No. _____

M. Sc. (Maths) (Sem. II) (CBCS) Examination

April / May – 2015

EMT-2001 : Classical Mechanics - II

Faculty Code : 003

Subject Code : 016206

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

1 Choose the most appropriate alternative / alternatives : (any seven)

(1) The determinant of any proper orthogonal matrix related to a physical motion namely rotation must have value.

(A) 0 (B) 1

(C) -1 (D) none of these

(2) Which physical motion is related to the Eulerian angles.

(A) rotation with one point fixed

(B) translation

(C) magnification

(D) none of these

(3) Which of the following is/are true

(A) $F_1(q, Q, t)$ (B) $F_1(Q, Q, T)$

(C) $F_4(p, P, t)$ (D) $F_4(P, P, t)$

(4) The Routh's procedure combines

(A) Hamiltonian and Newtonian procedures

(B) Lagrangian and Hamiltonian procedures

(C) Lagrangian and Newtonian procedures

(D) none of these

(5) $[u,u]+[u,u]+.....+n$ times is equals to

(A) 1 (B) n

(C) 0 (D) none of these

(6) In Routh's procedure cyclic co-ordinates satisfy the

(A) Lagrangian equations

(B) Hamilton's equations

(C) Euler's equation

(D) Newtonian equations

(7) Which of the following is/are Hamilton's equation

(A) $\frac{d}{dt}\left(\frac{\partial L}{\partial q_L^0}\right)-\frac{\partial L}{\partial q_i}=0$ (B) $p_L^0=\frac{\partial H}{\partial q_i}$

(C) $q_L^0=\frac{\partial H}{\partial p_i}$ (D) $F=ma$

(8) The relation between H and L is stated as

(A) $H = p_i q_i^0 + L$ (B) $H = p_i q_i^0 + 2L$

(C) $H = p_i\, q_i^0 - L$ (D) $L = p_i\, q_i^0 + 3H$

(9) For F_2 type generating function

(A) $p_i = \frac{\partial F_2}{\partial q_i}$ (B) $Q_i = \frac{\partial F_2}{\partial p_i}$

(C) $Q_i = \frac{-\partial F_2}{\partial q_i}$ (D) $p_i = \frac{-\partial F_2}{\partial Q_i}$

(10) $[u,v]+[v,u]$ equals to

(A) 1 (B) -1

(C) 2 (D) none of these

2 Attempt any two :

(a) Discuss in detail the use of direction cosines to describe the orientation of any rigid body.

(b) What is Coriolis force ? Discuss any two effects of it.

(c) State and prove Euler's theorem for rigid bodies.

3 (a) Define Euler angles and derive the transformation matrix from space axis to body axis.

(b) State and prove Jacobi's identity for Poison brackets.

4 Attempt any two :

(a) Obtain analytic solution for the motion of a heavy symmetrical top.

(b) Discuss in detail the Routh's procedure.

(c) Derive Hamilton's canonical equations.

5 Attempt any two :

(a) Discuss in detail the principle of least action.

(b) Define Hamilton's principal function and show that it differs atmost from the indefinite time integral of Lagrangian only by a constant.

(c) Obtain Hamilton's principal function S for the problem of one dimensional Harmonic oscillator.