Enrollment No. _____

Shree Manibhai Virani and Smt. Navalben Virani Science College (Autonomous)

Affiliated to Saurashtra University, Rajkot

SEMESTER END EXAMINATION APRIL – 2017

M.Sc. Mathematics

16PMTDC03 – CLASSICAL MECHANICS -II

Duration of Exam – 3 hrs ***Semester – II*** ***Max. Marks – 70***

***Part A** (5x2= 10 marks)*

Answer **ALL** questions

1. State only the Hamilton's variational principle.
2. State only the Hamilton's canonical equations.
3. State the postulates of special theory relativity.
4. State only the transformation equations when the generating function is of the type $F_4(p, P, t)$.
5. State any two differences between Lagrangian and Hamiltonian procedures.

***Part B** (5x5= 25 marks)*

Answer **ALL** questions

6a. Derive Euler's equations of motion for a rigid body with one point fixed.

OR

6b. Derive Galilean transformation equations.

7a. Obtain the expressions for angular momentum for continuous rigid body and discrete rigid body.

OR

7b. Express the components of angular velocity ω of a rigid body along the space set of axes in terms of Euler angles.

8a. Explain in detail the phenomenon of time dilation and establish the relation $\Delta t' > \Delta t$ where notations are being usual.

OR

8b. Explain in detail the phenomenon of length contraction and establish the relation $l = l'$ where notations are being usual.

9a A body has the dimension $6i + 7j$ mt. in reference frame S. How this dimension will be represented in system S' when S' is moving with velocity 0.6 c along positive X-axis?

OR

9b A rod has proper length 1000 cm. is in a satellite which is moving with velocity 0.6c.What will be the length of the rod measured by an observer situated in the laboratory?

10a State all the four types of generating functions and derive the transformation equations if the generating function is $F_2(q, P, t)$.

OR

10b Define moment of inertia of a rigid body about some axis. Prove that the moment of inertia about a given axis is equal to the moment of inertia about a parallel axis through the C.M. plus the moment of inertia of the body as if concentrated at the C.M. with respect to the original axis.

***Part C* (5x7= 35 marks)**

Answer **ALL** questions

11a. Discuss in detail the principle of least action.

OR

11b. Discuss in detail the Routh's procedure.

12a. Derive the Lorentz transformation equations.

OR

12b. Establish the relation $E = mc^2$ where notations are being usual.

13a. Establish the relation $m = \dfrac{m_0}{\sqrt{1-\dfrac{u^2}{c^2}}}$ where notations are being usual.

OR .

13b. Derive Hamilton's canonical equations.

14a. Define Poisson bracket of two functions and establish the relation

i) $[u,v]+[v,u]=0$

ii) $[au+bv,w]=a[u,w]+b[v,w]$

OR

14b. Show that the transformations $Q = \log\left(1+q^{\frac{1}{2}}\cos p\right)$, $P = \dfrac{\cos p}{e^Q}$ are canonical and find the suitable generating function.

15a. Find the analytic solution of a torque free motion of a rigid body with one point fixed.

OR

15b. Hamilton's principal function for the problem of one dimensional simple harmonic oscillator.