

M.Sc 1st Semester examination, 2017

Surprise Test:: Department of Mathematics,

Mugberia Gangadhar Mahavidyalaya

Paper MTM – 105 :: FULL MARKS – 20 :: Time : 40 Minutes

Answer any ten questions

2 × 10 = 20

1. State the fundamental postulates of special theory of relativity
2. Find the Euler's equation for the variational problem :: Minimize

$$I[y(x)] = \int_0^1 (2x - xy - y')y' dx.$$

3. Discuss about stability of the following system of dynamical equations

$$\frac{dx}{dt} = -x + y, \frac{dy}{dt} = 4x - y$$

4. Define holonomic constraints with examples.
5. What do you mean by generalized forces? Find an expression of it in terms of generalized coordinates
6. What is a canonical transformation? Prove that the transformation $Q = \frac{1}{p}, P = qp^2$ is canonical.
7. What is cyclic coordinates.
8. What is the advantage of Hamiltonian over Lagrangian?
9. State the Hamilton's Principal.
10. Show that the rate of change of angular momentum is equal to the applied torque for a system of particles
11. What do you mean by inertial and non inertial frames. Give examples these frames.
12. Find the expression of the kinetic energy when a rigid body is rotating about a fixed point.
13. What do mean by generalized coordinates and generalized momenta?
14. If the transformation equations between two sets of co-ordinates are

$P = 2(1 + \sqrt{q} \cos p)\sqrt{q} \sin p, Q = \log(1 + \sqrt{q} \cos p)$ then show that the transformation is canonical.

15. Show that the system $\ddot{x} + (2 + 3x^2)\dot{x} + x = 0$ is equivalent of the first order system

$\frac{dx}{dt} = y - x^3, \frac{dy}{dt} = -x + 2x^3 - 2y$. Using Liapunov function $v(x, y) = x^2 + y^2$, show that the origin in the (x, y) plane is asymptotically stable.