T.Y.B.SC. SEM – V (CBCS - 2016 Course) : SUMMER - 2019

SUBJECT : PHYSICS CLASSICAL MECHANICS

Day : Saturday
Date : 27/04/2019

Time : 11.00 A.M. To 02.00 P.M.
Max. Marks : 60

S-2019-0875

N. B. :

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.

Q. 1 Attempt **ANY TWO** of the following: **(12)**

a) Explain the effect of Coriolis force in nature.

b) Prove that $\vec{L} = \vec{R} \times \vec{P} + \vec{L'}$.

c) Derive an expression for acceleration of an Atwood machine by D'Alembert's principle.

Q. 2 Attempt **ANY TWO** of the following: **(12)**

a) Obtain the polar equation of the orbit in the form $\frac{l}{r} = 1 + e \cos \theta$.

b) Derive the equation for the motion of charged particle moving in constant magnetic field.

c) With the usual symbols obtain the equation:

$$\theta = \int \frac{L/r^2}{\left[2\mu\left(E - V - L^2/2\mu r^2\right)\right]^{1/2}} dr + \theta o.$$

Q. 3 Attempt **ANY TWO** of the following: **(12)**

a) By using D'Alembert's principle. Derive Langranges equations of motion.

b) If $\vec{i}$, $\vec{j}$ and $\vec{k}$ are the unit vector's along x, y and z axis, then show that in a fixed frame if $\vec{i}$, $\vec{j}$ and $\vec{k}$ rotate with angular velocity $\vec{w}$

$$\frac{d\vec{i}}{dt} = \vec{w} \times \vec{i} \; ; \; \frac{d\vec{j}}{dt} = \vec{w} \times \vec{j} \; ; \; \frac{d\vec{k}}{dt} = \vec{w} \times \vec{k}$$

c) If the disc is rolling down inclined plane without slipping then obtain an equation of motion by Lagrangian dynamics.

Q. 4 Attempt **ANY THREE** of the following: **(12)**

a) Explain the principle of virtual work.

b) A charged particle is moving with velocity $\vec{v} = \vec{i}\, v_x + \vec{j}\, v_y + \vec{k}\, v_z$. If $\vec{E}$ is electric field along x-axis and $\vec{B}$ is magnetic field along z-axis then derive the equation of motion of the particle.

c) A particle moves under action of a central force and the equation of its orbit is given by $r = C\cos\theta$ where, C is constant. Show that $F(r)\ \alpha\ \frac{1}{r^5}$.

d) A bead sliding on a uniformly rotating wire in a force free space. Show that $\ddot{r} = mw^2$.

P. T. O.

Q. 5 Attempt **ANY FOUR** of the following: **(12)**

a) Show that:

$$\frac{d\vec{r}'}{dt} = \frac{d\vec{r}}{dt} + \vec{w} \times \vec{r}.$$

b) Express the potential energy function V in the form $\vec{F} = -\vec{\nabla} V$, where F is conservative force.

c) Write a short note on Generalized co-ordinates.

d) The masses of Carbon and Oxygen atoms forming a diatomic molecule CO are $1.99 \times 10^{-26}\ kg$ and $2.66 \times 10^{-26}\ kg$ respectively. Determine the reduced mass of the hetero nuclear system.

e) Write a short note on constraints.

f) Calculate centripetal acceleration at co-latitudes 30^0 and 60^0 for earth's motion.

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