

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: IMSc
BRANCH: PHYSICS

SEMESTER : V
SESSION : MO/2024

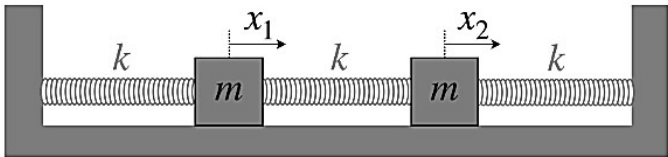
SUBJECT: PH203R1 CLASSICAL DYNAMICS

TIME: 3 Hours

FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

		CO	BL
Q.1(a)	State, with due explanations, the Newton's laws of motion.	[5]	1 2
Q.1(b)	A particle of charge +q enters a region having a constant magnetic field B in the y-direction, with a velocity $\mathbf{v} = v_{0x}\hat{x} + v_{0y}\hat{y}$. Find the subsequent trajectory of the particle.	[5]	1 3
Q.2(a)	Derive the Euler-Lagrange equations of motion using Hamilton's principle.	[5]	2 2
Q.2(b)	For the spring-mass system shown below, find the equations of motion using the system's Lagrangian.	[5]	2 3
			
Q.3(a)	Assuming that the kinetic and potential energies of a system are quadratic functions, derive the characteristic equation of the system.	[5]	3 2
Q.3(b)	Find out the T_{jk} and V_{jk} matrices for the coupled pendulum.	[5]	3 3
Q.4(a)	Derive the Lorentz transformation equations for an inertial frame moving with velocity v with respect to another, along the x-axis.	[5]	4 2
Q.4(b)	What is a light cone? Using the light cone, explain what you mean by spacelike, timelike and lightlike distances.	[2+3]	4 2
Q.5(a)	What is a covariant derivative? Show that the covariant derivative of the position vector r of a fluid element gives the velocity field u.	[2+3]	5 3
Q.5(b)	Derive the Poiseuille's formula for the flow rate of a viscous fluid through a pipe.	[5]	5 2