MANIPAL ACADEMY of HIGHER EDUCATION
(Institution of Eminence Deemed to be University)

Reg.No.									

DEPARTMENT OF SCIENCES, I SEMESTER M.Sc. (PHYSICS)
END SEMESTER MAKE UP EXAMINATION, FEBRUARY 2023
CLASSICAL MECHANICS [PHY5152]

Time: 3 Hours   Date: 5/12/2023   Time: 9-12 PM   MAX. MARKS: 50

Note (i) Answer ALL questions.
(ii) Draw diagrams, and write equations wherever necessary

		Marks	CO	BL
1A	Show that a projectile motion in a resistive medium is described by $x = \frac{U}{k}\left(1 - e^{-kt}\right)$ and $y = -\frac{gt}{k} + \frac{kV+g}{k^2}\left(1 - e^{-kt}\right)$, where $x = U$, $y = V$ when $t = 0$, $k =$ resistive force per unit velocity per unit mass. Obtain an expression for its time of flight when the air resistance is small.	5	1	1,2
1B	Obtain expressions for velocity using polar coordinate system. Show the followings using spherical coordinates $\dot{\hat{e}}_r = \hat{e}_\theta\left(\dot{\theta}\right) + \hat{e}_\phi\left(\dot{\phi}\sin\theta\right)$	2+3	1	3
2A	What do you mean by 'central force field"? explain. In a conservative central force field show that the total energy of a system of two bodies is constant.	2+3	3	2
2B	With a neat diagram explain the concept of "scattering in a central force field" and obtain an expression for differential scattering cross section in terms of scattering angle φ.	5	2	1
3A	What do you mean by Coriolis force? Explain. Obtain an expression for deflection produced by Coriolis force on a freely falling particle.	2+3	3	2
3B	State D'Alembert's principle. Obtain Lagrange's Equations of motion for both conservative and non conservative forces using D'Alembert's principle.	2+3	4	2
4A	Obtain equations of motion for a bead sliding along an uniformly rotating wire in a force-free space using Lagrangian equation of motion by neglecting potential energy].	5	4	1, 3
4B	What do you mean by a rigid body? Obtain relations connecting the components of total angular momentum with the components of the angular velocity of a rigid body rotating about a fixed origin.	2+3	5	1
5A	Obtain equations of motion for a simple pendulum with moving support.	5	5	2
5B	Obtain Hamilton's canonical equations of motion. Show that $\Sigma q_i Q_i$ generates the exchange transformation in which position coordinates and momenta can be interchanged.	2+3	4	2

>>