Indian Institute of Science Education and Research Kolkata

Department of Physical Sciences

PH1101 :: Mechanics I

Mid-semester Examination (Autumn 2024)

Marks: 20. Duration: 90 minutes

1. Compute the following limit: [2]

$$\lim_{x \to \pi} \frac{\cos\left(\frac{x}{2}\right)}{x - \pi} \quad .$$

2. Using the definition of derivative, compute $\frac{d}{dx}\left(e^{3x}\right)$. [3]

3. Draw two curves $f_1(x) = \sin(2x)$ and $f_2(x) = \cos(2x)$ in the domain $[0, \frac{\pi}{4}]$. Shade the region between these two curves in the given domain and then find the area of the shaded region. [2+3]

4. Find the locations and the corresponding values of the finite maxima and minima of the potential function $U(x) = x^4 - x^2$. [5]

5. An observer at a sea beach near the Earth's equator finds that the Sun takes about 2 min and 20 seconds to fully disappear below the horizon during the sunset. Estimate the radius of the Sun, in the unit of radius of the Earth r_E, if the distance to the Sun is 23450 r_E. [5]