*Sessional Examination 2024*
*B.SC 1$^{st}$ Semester*
*Subject: Physics*
*Paper: PHY101*
*Total Marks: 30*
*Time: 1 hr. 30 mins*

1. Evaluate the line integral $\int \vec{a} \cdot \overrightarrow{dr}$ where $\vec{a} = (x + y)\hat{\imath} + (y - x)\hat{\jmath}$ along each of the paths in the $x - y$ plane. (4)
   (a) The parabola $y^2 = x$ from (1,1) to (4,2).
   (b) The curve $x = 2u^2 + u + 1$, $y = 1 + u^2$ from (1,1) to (4,2)

2. Find the scale factors for spherical polar coordinates. (2)

3. Show that curl of a gradient is zero for any scalar field. (1)

3. If $\Phi(x, y, z) = 3x^2y - y^3x^2$ be any scalar function of $\Phi$. Find out (3)

   (a) Grad $\Phi$ at point (1,2,2)
   (b) Unit vector normal perpendicular to surface

4. Derive an expression for accelerations of pseudo forces arising due to rotating frame of reference. (3)

5. Prove that the angular momentum under central force is conservative in nature. (5)

6. Mention one effect of centrifugal force due to earth's rotation. (2)

7. Derive the expression for kinetic energy. (4)

Or

Define Centre of mass and find it for a rod of length L.

8. State the condition for conservative force. For given force, $\vec{F} = 3xyz\hat{\imath} + 4xy\hat{k}$ state what type force is this at point (0,1,1). (4)

9. State stable and unstable equilibrium condition. (2)

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