QP Code: RF23MSC017 | Reg. No | | | | | | | | | | | AY - 23

GIET UNIVERSITY, GUNUPUR – 765022

M. Sc. (First Semester) Regular Examinations, February – 2024

22PHPC102 - Classical Mechanics

(Physics)

Time: 3 hrs | Maximum: 70 Marks

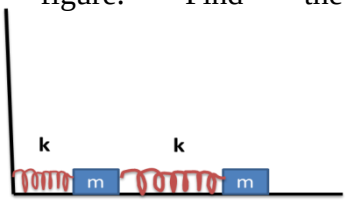
(The figures in the right hand margin indicate marks.)

PART – A **(2 x 10 = 20 Marks)**

Q.1. Answer ***ALL*** questions	CO #	Blooms Level
a. $L=\frac{1}{2}(m\dot{r}^2+r^2\dot{\theta}^2+r^2\sin^2\theta\dot{\phi}^2)$. Find generalised momenta.	CO1	K2
b. Find the generating function F(p,Q) if $P=2q^{1/2}\sin p(1+q^{1/2}\cos p)$ & $Q=\log(1+q^{1/2}\cos p)$	CO1	K1
c. Find $\lfloor J_x, J_y \rfloor$	CO2	K3
d. $H(q,p)=\frac{\alpha p^2 q^4}{2}+\frac{\beta}{q^2}$, Find the corresponding Lagrangian.	CO2	K2
e. The transformation $Q=q^{\alpha}\cos(\beta p), P=q^{\alpha}\sin(\beta p)$ is canonical for what values of α and β.	CO2	K1
f. $L=\frac{1}{2}m(1+4a^2x^2)\dot{x}^2-mgax^2$, Find Lagrange's equation of motions.	CO3	K2
g. Check whether the transformation is canonical or not Q=ptanq, P = log(sinp)	CO3	K2
h. Find the canonical transformation q, P from the generating function F1(q, Q, t)=1/2(mw^2cotQ).	CO3	K3
i. A particle of mass m moves in 1D potential $V(x)=\frac{\alpha}{3}x^3+\frac{\beta}{4}x^4$, find frequency of small oscillation.	CO4	K3
j. A particle of unit mass moves along the x-axis under the influence of a potential $V(x) = x(x-2)^2$. Find the time period of oscillation of the particle.	CO4	K2

PART – B **(10 x 5 = 50 Marks)**

Answer ***ANY FIVE*** questions	Marks	CO #	Blooms Level
2. Set up Lagrangian and obtain the Lagrange's equation for a simple pendulum. Deduce the formula for its time period.	10	CO2	K2
3. What is Hamilton's principle? Derive Lagrange's equation of motion from D'Almbert's principle.	10	CO1	K2

4.	Define Euler's angles and obtain an expression for the complete transformation matrix.	10	CO1	K2
5.	Show that the Poisson and Lagrange bracket is invariant under canonical transformation.	10	CO2	K2
6.	Discuss the vibration of linear triatomic molecule.	10	CO4	K2
7.	Outline Hamiltonian-Jacobi theory and apply it to solve the problem of Harmonic oscillator.	10	CO3	K3
8.a	A system of two coupled oscillators is shown in figure. Find the expressions for the normal mode of freuencies. 	7	CO4	K3
b.	$V(x) = ax^2 + \frac{b}{x^2}$, find angular frequency.	3	CO4	K2