B.Sc. (CBCS Pattern) Sem-I

USPHT02 - Physics Paper-II (Gravitation, Oscillation and Properties of Matter)

P. Pages : 3 **GUG/W/22/11561**

Time : Three Hours * 3 7 3 6 * Max. Marks : 50

Either:

1. a) i) Define Gravitational Potential and Gravitational Field. **2**

ii) Derive an expression for the gravitational potential due to spherical shell **6**

a) At a point outside the spherical shell

b) At a point on the surface of shell

c) At a point inside the spherical shell.

iii) Calculate the Gravitational Potential and intensity of gravitational field of thin spherical shell of mass 10 kg and radius 0.1 m at a point 0.1 m. outside from the surface $(G = 6.673\times10^{-11}\,Nm^2/kg^2)$. **2**

OR

b) a) State Kepler's law of planetary motion. **2½**

b) Give basic idea of Global Positioning System (GPS). **2½**

c) Obtain an expression for gravitational self energy of a uniform solid sphere. Why it is negative. **2½**

d) Calculate the gravitational self energy of the Earth assuming its radius $6.37\times10^{6}\,m$ and mass to be $5.98\times10^{24}\,kg$. Given $G = 6.673\times10^{-11}\,Nm^2\,kg^{-2}$. **2½**

Either:

2. a) i) Define simple harmonic motion. **1**

ii) Derive the differential equation of linear S.H.M. and solve it to show $x = a\sin(\omega t + \phi)$. **6**

iii) A man stand on a platform with vibrates simple harmonically in vertical directions at a frequency of 5 hertz. Show that the mass losses contact with the platform when the displacement exceeds 10^{-2} meters. **3**

OR

b) a) Obtain an expression for the power dissipation in damped harmonic motion. **2½**

b) Define forced and damped harmonic oscillations. **2½**

c) State the conditions under which motion becomes dead beat, critically damped, damped oscillatory motion. **2½**

d) In an oscillatory circuit L = 0.5 H, C = 1.8 μF what is the maximum value of resistance to be connected so that the circuit may be produce oscillation. **2½**

Either:

3. a) i) Explain the term : Angle of shear and Angle of twist. **2**

ii) Derive an expression for the torque require to twist a cylinder of length 1 through an angle θ. **3**

iii) State and explain Hooks law. **2**

iv) Prove that $9/Y = 1/K + 3/\eta$. **3**

OR

b) a) State the Poisson's ratio. What are the limiting values of Poisson's ratio? **2½**

b) What is Torsional Pendulum? Deduce an expression for the time period of Torsional Pendulum. **2½**

c) Explain : (i) Elastic Limit (ii) Yield Point (iii) Elastic Fatigue with the help of stress – strain diagram. **2½**

d) A sphere of mass 0.8 Kg and radius 3 cm is suspended by a wire 1 m long of radius 0.5 m. If the time for one torsional of vibration 1.23 sec. Determine the modulus of rigidity of wire. **2½**

Either:

4. a) i) State and Prove Bernoulli's theorem for a liquid along a streamline. **5**

ii) What is turbulent flow and streamline flow. **2**

iii) Deduce an expression for the equation of continuity for incompressible. **3**

OR

b) a) Explain the concept of wetting. Under what conditions wetting is possible. **2½**

b) What is surface tension? Give its intermolecular interpretation. **2½**

c) Derive an expression for the excess pressure inside a soap bubble in air. **2½**

d) Calculate the excess pressure inside a soap bubble of radius 3×10^{-3}m S.T. of soap solution is 20×10^{-3}N/m. Calculate the surface energy. **2½**

5. Answer **any ten** questions from the following.

a) What is Gravitational self energy of a body? **1**

b) State Newton's law of Universal Gravitation. **1**

c) What is central force? **1**

d) Write the differential equation of S.H.M. **1**

e) What is meant by free harmonic oscillation? **1**

f) Define Quality factor. **1**

g) Define the term elasticity. **1**

h) Define Modulus of Rigidity. **1**

i) A wire 0.5 m long and 1 sq. mm. in cross section has Young's modulus $1.24\times10^{11}\text{N}/\text{m}^2$. How much work done in stretching it through 1 mm. **1**

j) What is meant by angle of contact? **1**

k) State Reynolds Number (K). **1**

l) Write the application of Bernoulli's theorem. **1**

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