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QUESTION BANK (DESCRIPTIVE)

Subject with Code :ENGINEERING PHYSICS(19HS0848)

Course & Branch: I-B.Tech – I Sem -CE&Agri.Engg. **Regulation:**R19

UNIT – I

Motion of Particles

1. a) Define vector and scalar quantities and give two examples. (4M)
   b) Define gradient of a scalar field and give its physical significance. (8M)
2. a) Write a note on gradient of a scalar field. (6M)
   b) Show that F = - grad V. (6M)
3. a) Explain the divergence of a vector field and give its physical significance. (6M)
   b) If *r* is the position vector of a point, then show that a) div *r* = 3 and b) grad (*r*.A) = A. (6M)
4. a) Define dot product of two vectors and write their properties. (8M)
   b) Two vectors are given by $A=4j-7k$ and $B=5i+3j$, find their dot product. (4M)
5. a) Define curl of a vector and write its physical significance. (6M)
   b) If $A = 2xi+2yj+3zk$, find *curl A*. (3M)
   c) If r is the position vector of a point, prove that *curl r = 0* (3M).
6. a) State and explain Newton's laws of motion. (4M)
   b) Derive Newton's first law and third law from second law of motion. (8M)
7. a) Explain inertial and non-inertial frames of reference. (4M)
   b) Obtain an expression for velocity of a body moving in a rotating frame of reference with constant angular velocity. (8M)
8. a) Define gravitational field and gravitational potential. (4M)
   b) Explain the motion of rocket. (8M)
9. a) Describe the motion of rocket with a neat diagram. (8M)
   b) A rocket starts from rest with an initial mass M_0 and its mass at burnt out is M. Find the ratio of (M_0/M) if the speed of rocket is twice the exhaust speed. (4M)
10. a) State and explain Kepler's laws of planetary motion. (8M)
    b) If the Earth be one half of its present distance from the sun, what will be the number of days in a year? (4M)

Unit-II
Physics of Solids

1. a) Define the following
   i) Elasticity ii) isotropic materials iii) rigid body iv) Plasticity v) Hooke's law (5M)
   b) What is stress? Explain different types of stresses. (7M)
2. a) What is Hooke's law? Explain. (4M)
   b) Describe the behavior of a wire under an increasing load. (8M)
3. a) Define a) Young's modulus b) Bulk modulus c) Rigidity modulus d) Poisson's ratio (4M)
   b) Derive the relation between different elastic moduli. (8M)
4. a) Mention different types of supports. (8M)
   b) Calculate Poisson's ratio for silver.
   Given its Young's modulus $=7.25 \times 10^{10}$ N/m^{2}and bulk modulus = 11×10^{10} N/m^2. (4M)
5. a) Classify different types of beams. (8M)
   b) Obtain an expression for the internal energy due to strain. (4M)
6. a) Define strain. Explain the types of strain. (8M)
   b) A wire of 3.0 m long and 0.625 sq.cm in cross section is found to stretch by 0.3 cm under a tension of 1200 kg. What is Young's modulus of the material of the wire? (4M)
7. a) Define Young's modulus and bulk modulus. (4M)
   b) Obtain the relation between the Young's modulus and bulk modulus. (8M)
8. a) Define Young's modulus and rigidity modulus. (4M)
   b) Obtain the relation between rigidity modulus and Young's modulus. (8M)
9. a) Define shear strain. Explain how shear strain is related to modulus of rigidity. (8M)
   b) The Young's modulus for steel is $Y=2 \times 10^{11}$N/m^2 and its rigidity modulus $\eta=8 \times 10^{10}$N/m^2. Estimate the Poisson's ratio and its bulk modulus. (4M)
10. a) Deduce an expression for energy stored per unit volume in stretched wire. (7M)
    b) Estimate the work done in stretching a wire of cross section 1.25 mm^2 and length 1.9 m through 0.14 mm. The Young's modulus of wire is 45 $\times 10^9$ N/m^2. (5M)

Unit-III

Acoustics and Ultrasonics

1. a) Define reverberation and reverberation time. (2M)
   b) Illustrate the basic requirements for an acoustically good hall. (6M)
   c) Explain the remedies that must be followed for the construction of an acoustically good hall. (4M)

2. a) Explain reverberation and reverberation time. (4M)
   b) Derive Sabine's formula for reverberation time. (8M)
3. a) Define: a) absorption coefficient b) Open window unit c) Sabine. (3M)
   b) Explain the determination of absorption coefficient of a sample using Sabine's formula. (6M)
   c) Reverberation time of an acoustically good hall must be optimum. Justify. (3M)
4. a) Explain reverberation and reverberation time. (4M)
   b) Illustrate the basic requirements for an acoustically good hall. (4M)
   c) A hall of volume 2 m^3 with an absorption of 4 Sabine. Calculate its reverberation time. (4M)
5. a) Describe the factors affecting the acoustics of buildings. (6M)
   b) Outline the remedies that must be followed for an acoustically good hall. (6M)
6. a) What are ultrasonics? Mention their wavelength. (4M)
   b) Outline the properties of ultrasonic waves. (4M)
   c) Write any four applications of ultrasonics. (4M)
7. a) Describe the piezoelectric effect. (4M)
   b) Explain the production of ultrasonics by piezoelectric method. (8M)
8. a) Describe any one method of production of ultrasonics. (8M)
   b) Calculate the capacitance to produce ultrasonic waves of 10^6 Hz with an inductance of 1 henry. (4M)
9. a) Give any four methods for the detection of ultrasonics. (4M)
   b) Write the applications of ultrasonics. (8M)
10. a) Explain the properties of ultrasonics. (4M)
    b) Write any four methods for the detection of ultrasonics. (4M)
    b) A piezo electric crystal has a thickness of 0.002 m. If the velocity of sound wave in crystal is 5750 m/s, calculate the fundamental frequency of the crystal. (4M)

Unit –IV

Harmonic Oscillators

1. a) Define simple harmonic motion. Give three examples. (4M)
   b) Derive the equation of motion of simple harmonic oscillator and find its solution. (8M)
2. a) What is a simple harmonic oscillator? Derive the equation of motion of simple harmonic oscillator. (8M)
   b) A particle executes SHM with a period of 0.002 sec and amplitude of 10 cm. Find its acceleration when it is 4 cm away from its mean position and also obtain its maximum velocity. (4M)
3. a) Define simple harmonic motion and simple harmonic oscillator. Give examples. (4M)

b) Write the properties of simple harmonic motion. (4M)

c) A particle executing S.H.M is represented by $x=10\sin(4\pi t+\pi/3)$ m. Find the frequency and the displacement after a time of 1 second. (4M)

4. a) Define damped harmonic motion. Give examples. (4M)

b) Derive and solve differential equation of damped harmonic oscillator. (8M)

5. a) Distinguish between damped and forced oscillations. (4M)

b) Solve the differential equation of damped harmonic oscillator. (8M)

6. a) Explain logarithmic decrement, relaxation time and quality factor of an oscillator. (9M)

b) The amplitude of a second pendulum falls to one half of its initial value in 150 seconds. Calculate the Q factor. (3M)

7. a) Explain different types of damped oscillations with suitable examples. (8M)

b) A point performs damped oscillations according to the law $x=a_o e^{-bt} \sin \omega t$. Find the amplitude of oscillation and velocity of the particle at the moment t=0. (4M)

8. a) What are damped oscillations? Solve the differential equation of a damped harmonic oscillator. (8M)

b) Discuss the case of under damped motion. (4M)

9. a) What are forced oscillations? Give examples. (4M)

b) Distinguish between damped and forced oscillations. (4M)

c) Explain the phenomenon of resonance with suitable examples. (4M)

10. a) Distinguish between damped and forced oscillations with suitable examples. (4M)

b) Explain the phenomenon of resonance and write the applications of resonance in various fields. (4M)

c) The frequency of a tuning fork is 300Hz. If its quality factor Q is 5×10^4, find the time After which its energy becomes (1/10) of its initial value. (4M)

Unit-V

(Physics of Nanomaterials)

1. a) Define Nano science and nanotechnology. (2M)

b) Explain the basic principles of nanomaterials. (8M)

2. a) Describe the classification of nanomaterials with suitable examples. (4M)

b) Nanomaterials behave differently in their properties than the bulk materials. Justify. (8M)

3. a) What are nanomaterials? Explain their classification. (3M)

b) Explain in detail the quantum confinement effect and how it affects the optical and magnetic properties of nanomaterials. (5M)

c) Write any two applications of nanomaterials in detail. (4M)

4. a) What are nanomaterials? Explain the basic principles of nanomaterials. (8M)
   b) Outline the properties of nanomaterials that are affected due to increased surface area to volume ratio. (4M)
5. a) Explain the synthesis of nanomaterials by ball milling method. (8M)
   b) Discuss the advantages of nanomaterials. (4M)
6. a) Describe the sol-gel method of synthesis of nanomaterials. (8M)
   b) Explain how the physical and optical properties changes when a material is brought down to Nano scale. (4M)
7. a) Describe any one method of fabrication of nanomaterials. (8M)
   b) Write any four applications of nanomaterials. (4M)
8. a) Discuss the advantages of nanomaterials in science and technology. (2M)
   b) Write a note on the properties of nanomaterials. (6M)
   c) Explain how nanomaterials are used in the field of medicine and sensor technology. (4M)
9. a) Explain the principle of Scanning Electron Microscopy (SEM). (8M)
   b) Write any two applications of SEM. (4M)
10. a) What is Scanning Electron Microscope? Discuss in detail the construction and working of SEM. (8M)
    b) Explain the strengths and limitations of SEM. (4M)