Code No: R19BS1108 **R19** SET - 1

I B. Tech I Semester Regular Examinations, January - 2020
ENGINEERING PHYSICS
(Com. to CE, ME, Agri E)

Time: 3 hours Max. Marks: 75

Answer any five Questions one Question from Each Unit
All Questions Carry Equal Marks

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1. a) Set up the equation of motion for a forced vibration. Discuss the solution for the above equation and describe the phenomenon of resonance. (8M)

   b) Obtain an expression for Q factor for damped oscillations. (7M)

Or

2. a) State the basic laws of vectors and scalars. (8M)

   b) What is the difference between inertial and non-inertial frames of reference? Explain them with suitable examples. (7M)

3. a) What are the limitations of Sabine's formula? Discuss. (8M)

   b) Enumerate the features that an auditorium should have for good acoustics. (7M)

Or

4. a) What is non-destructive testing? Explain with principle how flaw in a solid can be detected by non-destructive method using ultrasonics. (8M)

   b) What are Ultrasonics? Discuss the method of magnetostriction method for the production of ultrasonics with a neat sketch. (7M)

5. a) Obtain the relation between different moduli of elasticity. (8M)

   b) Discuss stress-strain diagram. (7M)

Or

6. a) Show that Young's modulus 'Y', bulk modulus 'K' and rigidity modulus 'n' are related with 'σ' by the following relations given below (8M)

      i) $\frac{Y}{2n} = 1 + \sigma$

      ii) $\frac{Y}{3K} = 1 - 2\sigma$

   b) Write an essay about the elastic behavior of materials. (7M)

7. a) Describe the production of a pulsed red laser with a neat energy level diagram. (8M)

   b) Derive the relationship for Einstein's coefficients for spontaneous emission, stimulated emission and stimulated absorption. Discuss their physical significance. (7M)

Or
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8. a) Explain the principle of operation and use of a piezoelectric strain gauge sensor with a plot of electrical characteristics of a quartz crystal. (8M)

   b) Describe the principle of operation of a bimetallic strip. (7M)

9. a) Distinguish between hard and soft magnetic materials. (8M)

   b) Elucidate the atomic origin of permanent magnetism in magnetic materials. (7M)

Or

10. a) Define dielectric polarization. With the help of a graph discuss in detail the frequency dependence of different polarizations in dielectrics. (8M)

    b) The radius of the helium atom is about 0.55A.U. Calculate the (7M)
    (i) Polarizability and
    (ii) Relative permittivity of helium if the number of helium atoms in a volume of one meter cube is 2.7×10^{25}.

Code No: R19BS1108 **R19** SET - 2

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ENGINEERING PHYSICS
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Time: 3 hours Max. Marks: 75

Answer any five Questions one Question from Each Unit
All Questions Carry Equal Marks

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1. a) Derive an expression for average energy of a damped harmonic oscillator. (8M)

   b) The equation of forced oscillation is given by (7M)

   $2\left[\frac{d^2x}{dt^2}\right] + 3\left[\frac{dx}{dt}\right] + 16x = 30\sin 2t$. All quantities are expressed in CGS units. Find velocity, amplitude and maximum kinetic energy.

Or

2. a) Derive an expression for frequency of a simple harmonic oscillator and show that is independent of the amplitude of motion. (7M)

   b) A S.H.M is represented by the equation x = 0.12 cos (12t - π/6) where x is in meter and t in second. Find the frequency, time period and maximum velocity. (3M)

   c) What are conservative and non-conservative forces? Show that F= - gard V (5M)

3. a) State the acoustic requirements of a good auditorium. Explain how these requirements can be achieved. (8M)

   b) Derive expressions for growth and decay of sound energy inside a hall. (7M)

Or

4. a) Explain the principle of magnetostriction effect. (3M)

   b) With a neat circuit diagram describe the production of ultrasonics by piezoelectric oscillator method. (8M)

   c) Calculate the natural frequency of 40 mm length of pure iron rod with density 7.25×10^3 kg/m^3 and Young's modulus 115×10^9 N/m^2. (4M)

5. a) Describe with relevant theory the determination of Young's modulus of the material of a bar by uniform bending. (8M)

   b) Derive the relation $\vartheta = \frac{3K-2G}{6K+2G}$. (7M)

Or

6. a) What is a cantilever? (3M)

   b) Derive an expression to find the depression in a cantilever fixed at one end and loaded at the other end. (7M)

   c) Define stress and strain. Discuss the Stress – strain diagram. (5M)
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7. a) Explain construction and working of He-Ne laser with a neat energy level diagram. What is the role of He atoms in He-Ne laser? (8M)

   b) Write the differences between spontaneous and stimulated emissions. What is the necessity of population inversion in achieving lasing action? (7M)

Or

8. a) Write a short note on (8M)
   (i) Strain and Pressure sensors
   (ii) Pyroelectric detectors

   b) Explain the principle of operation and use of a bimetallic strip. (7M)

9. a) Define the terms magnetic susceptibility and relative permeability and further obtain a relation between them. (5M)

   b) What are ferromagnetic materials? Define hysteresis and explain it on the basis of domain theory. (10M)

Or

10. a) If at NTP the number of Argon atoms in one cubic metre is 2.7×10^{25} and the relative permittivity is 1.0024, then calculate the polarizability of Argon atom. (5M)

    b) Explain what is meant by local field in a dielectric and derive an expression for it for a cubic structure? (10M)

Code No: R19BS1108 **R19** SET - 3

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Time: 3 hours Max. Marks: 75

Answer any five Questions one Question from Each Unit
All Questions Carry Equal Marks

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1. a) What is amplitude resonance? Derive the condition for amplitude resonance in case of forced oscillations. (8M)

   b) The equation of damped harmonic motion is given by $2\left[\frac{d^2x}{dt^2}\right] + 12\left[\frac{dx}{dt}\right] + 50x = 0$. Find frequency of damped oscillations. (4M)

   c) A particle performing S.H.M has velocity 8 cm/sec and 10 cm/sec, when it is at a distance 5 cm and 4 cm respectively from mean position. What is its amplitude? (3M)

Or

2. a) Deduce the equation of motion of a damped harmonic oscillator. Discuss the case when it is under damped motion. (8M)

   b) Define frame of reference and describe the inertial and non-inertial frames of references with the help of necessary diagrams. (7M)

3. a) Explain how sound absorption coefficient of a material is determined. (8M)

   b) Elucidate clearly what causes reverberation and how it can be minimized. (7M)

Or

4. a) Explain piezoelectric method. (3M)

   b) With the help of a neat labeled circuit diagram explain the production of ultrasonic waves using a piezoelectric oscillator. (8M)

   c) Calculate the frequency of ultrasonic waves produced by a 5.5 $x10^{-3}$ m thick quartz plate whose Young's modulus is 8 x 10^{10} N/m^2 and density is 2.65 x 10^3 kg/m^3. (4M)

5. a) Define stress and strain. Explain different types of moduli with necessary expressions. (8M)

   b) Derive the relation $\vartheta = \frac{Y}{2G} - 1$. (7M)

Or

6. a) What is uniform bending? (3M)

   b) Derive an expression for depression for a rectangular beam loaded in such a way that the bending is uniform. (7M)

   c) Describe an experimental method used to find the Young's modulus of a rectangular bar loaded in uniform bending. (5M)
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7. a) Discuss different types of possible transitions between two atomic energy states. (9M)

   b) Explain applications of lasers in various fields. (6M)

Or

8. Discuss qualitatively any two sensors with their applications. (15M)

9. a) Classify magnetic materials on the basis of permanent magnetic dipole moment and list out the properties of each. (10M)

   b) A paramagnetic material of magnetic susceptibility 2.5 x 10^{-3} is placed in a magnetic field of intensity 10^4 A/m. Calculate (i) the relative permeability of the material (ii) magnetization and (iii) magnetic flux density (5M)

Or

10. a) What is meant by dielectric polarization? Discuss the different types of polarizations in dielectric materials. (10M)

    b) Derive the Clausius-Mossoti relation for a dielectric and mention its significance. (5M)

Code No: R19BS1108 **R19** SET - 4

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Time: 3 hours Max. Marks: 75

Answer any five Questions one Question from Each Unit
All Questions Carry Equal Marks

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1. a) Set up the differential equation of forced oscillations. Explain the terms involved in it. Write the general solution of the differential equation. (8M)

   b) The equation of forced oscillation of a mechanical system is $2\left[\frac{d^2x}{dt^2}\right] + 3\left[\frac{dx}{dt}\right] + 1256x = 50\sin 2t$ all quantities are in S. I units. Calculate (7M)

   (i) Velocity at resonance (ii) Quality factor (iii) Band width

Or

2. a) Derive the equation of motion for a simple harmonic oscillator and obtain its solution. (8M)

   b) A simple pendulum of length 100 cm has energy equal to 0.3 J when its amplitude is 2 cm. What will be its energy if its (3M)
   (a) length is increased to 150 cm (b) amplitude is increased to 3 cm?

   c) Explain the difference between conservative and non-conservative forces with suitable examples. (4M)

3. a) Derive Sabine's formula for reverberation time. (8M)

   b) Explain various requirements of a good auditorium. (7M)

Or

4. a) Describe in detail pulse-echo testing technique. (8M)

   b) What are the advantages and limitations of ultrasonic testing? (7M)

5. a) Explain the terms: (8M)
   (i) Young's modulus and
   (ii) Shear modulus

   b) Derive the relation $Y = \frac{9GK}{3K+G}$. (7M)

Or

6. a) What do you mean by non-uniform bending? (3M)

   b) Derive an expression for Young's modulus of a bar of length 'l' m width'd' m and breadth, 'b' m bent non-uniformly. (7M)

   c) Explain how the depression and hence Young's modulus of a rectangular beam is determined using non-uniform bending. (5M)
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7. a) Explain the concepts of stimulated absorption, stimulated emission and spontaneous emission with suitable diagrams. (8M)
   b) Derive the relationship between Einstein's coefficients and write their physical significance. (7M)

Or

8. a) Write short note on following sensors (8M)
   (i) Piezoelectric
   (ii) Magnetostrictive
   b) Discuss the principle and working of a bimetallic strip. (7M)

9. a) How can you classify magnetic materials on the basis of magnetic susceptibility? Describe the properties of each material and illustrate the variation of their magnetic susceptibility with temperature. (10M)
   b) Define magnetic dipole moment associated with a current loop. Calculate the magnetic moment associated with an electron moving in a circular orbit of radius 0.51**Å** with a frequency of 6.8×10^{14} revolutions per second. (5M)

Or

10. a) Describe electronic polarization and show that electronic polarizabilty depends on the volume of the atom. (10M)
   b) Define the terms dielectric susceptibility and relative permittivity and further obtain a relation between them. (5M)