

**Examination Control Division**

2074 Ashwin

Exam.	Back		
Level	BE	Full Marks	80
Programme	BEL, BEX, BAME, BCT, BIE, B.Agric.	Pass Marks	32
Year / Part	1 / 1	Time	3 hrs.

**Subject: - Engineering Physics (SH402)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ All questions carry equal marks.
- ✓ Assume suitable data if necessary.

1. Define centers of suspension and oscillation of a compound pendulum and show that they are interchangeable. What length of the pendulum has its minimum time period?

**OR**

Define SHM. Derive the expression for energy of SHM. Show that the KE and PE of simple harmonically oscillating object changes with time however the total energy is invariant.

2. What is LC oscillation? Derive the differential equation of free oscillation and compare its solution with mass spring system.
3. What is piezoelectric effect? Describe the construction of a piezoelectric oscillator for the production of ultrasonic waves.
4. Explain how interference fringes are formed by a thin wedge shaped film examining by normally reflected light. Derive a relation for the fringe width on such system of interference fringes.

**OR**

What is double refraction? Explain how would you use the phenomenon to produce linear polarized light and circularly polarized light.

5. A diffraction grating used at normal incidence gives a line (540 nm) in a certain order superposed on the violet line (405 nm) of the next higher order. How many lines per cm are there in the grating if the angle of diffraction is  $30^\circ$ ?
6. In Ramsden's eyepiece a coaxial lens system is used. There are two lenses in air and are of equal focal length of separated by a distance  $2f/3$ . Find positions of the cardinal points.
7. Discuss the physical significance of numerical aperture (NA). How does it depend on refractive index of core and cladding?
8. Calculate the thickness of doubly refracting plate capable of producing a path differences of  $\frac{\lambda}{4}$  between extraordinary and ordinary rays of wavelength 5890 Å. (Use  $\mu_o = 1.53$ ; and  $\mu_e = 1.54$ )
9. What is an electric dipole and dipole moment? Show that electric field for a short dipole drops inversely to cube of the distance at any point from the dipole on an axial line.

**OR**

What is an electric quadrupole? Calculate potential for points on the axis of the quadrupole.

10. Two point charges  $6\mu\text{C}$  and  $-24\mu\text{C}$  are 18 cm apart in air. Locate the positions of zero potential on the line joining the charges.
11. Two capacitors having capacitance  $25\mu\text{F}$  and  $5\mu\text{F}$  are connected in parallel and charged with a 100V power supply. Calculate the total energy stored in the two capacitors.
12. What is superconductor? Explain critical magnetic field. Describe the characteristics of superconductor.

**OR**

Explain Biot-Savart law. Show that a current carrying circular coil behaves as a magnetic dipole for a large distance.

13. Explain meaning of self induction. Calculate inductance for a solenoid and Toroid.
14. Deuterons in a cyclotron describe a circle of radius 0.32 m just before emerging from dees. The frequency of the applied emf's 10 MHz. Find the flux density of the magnetic field and the energy of deuterons emerging out of the cyclotron. (mass of deuterons =  $3.32 \times 10^{-27}$  kg.)
15. What are Maxwell's equations? Using Maxwell equations derive electromagnetic (em) wave equation in dielectric medium. Prove that em wave travels with velocity less than velocity of light in such medium.
16. A non relativistic particle is moving three times as fast as an electron. The ratio of the de-Broglie wavelength of the particle to that of the electron is  $1.813 \times 10^{-4}$ . Calculate the mass of the particle.

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