TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2078 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEL, BEX, BEI, BCT, BAM, BIE, BAG, BAS	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

Subject: - Engineering Physics *(SH 402)*

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

1. Deduce the formula for the time period of compound pendulum and show that it is minimum when length of the pendulum is equal to radius of gyration.

   Or,

   Develop a differential equation of forced oscillations in LCR series circuit and find an expression for resonant frequency.
2. A string has linear density 525gm/m and tension 45N. When a sinusoidal wave of frequency 120Hz and amplitude 8.5mm is sent along the string, at what average rate does the wave transport energy.
3. What is meant by reverberation time. Derive the relation of sabine's formula. Also explain the growth and decay of sound in a hall.
4. What is chromatic aberration? Derive an expression for the condition of achromatism of two thin lenses in contract.
5. What do you mean by coherent sources? Derive necessary theory of interference due to wedge shape thin film.
6. The spacing of a atomic planes in a crystal is 3.1×10^{-10}. When a monochromatic beam of X-ray is incident on them at incident angle 82°30' second order image is produced, calculate the glancing angle for the 4^{th} order image.
7. A 200mm long glass tube is filled with a solution of sugar, containing 15 gram of sugar in 100ml of water. The plane of polarized light, passing through this solution, is rotated though 20° 30'. Find the specific rotation of sugar.
8. An optical fiber has numerical aperture 0.22 and refractive index change 0.012. What are the values of refractive index of core and cladding?
9. Define the term quadrupole. Derive the relation of the electric potential due to linear quadruple along its axial line.

   OR

   Derive an expression for electric field intensity due to the non-conducting spherically symmetric charge distribution of radius R at point (i) inside sphere (ii) outside sphere by using Gauss law. Also write down the significance of Gaussian surface.

10. Two similar balls of mass m and charge q are hanging from silk thread of length l. These two balls are repelled by angle 2θ, prove that the separation of the balls as $x = \left(\frac{q^2 l}{2\pi\varepsilon_o mg} \right)^{1/3}$, assuming θ is very small.

11. An electron with kinetic energy 2.5 KeV circles in a plane perpendicular to a uniform magnetic field. The radius of the orbit is 25cm. Calculate (i) the speed of the electron (ii) the flux density of magnetic field (iii) the number of revolutions per second.

12. What is the average time between collisions of free electrons in copper wire? Given, atomic weight = 63 gm/mol, denisty = 9gm/cm^3, resistivity = $1.7\times10^{-8}\Omega$m and Avogadro's no = 6.02×10^{23} mol^{-1}.

13. State and explain Biot and Savart's law. Derive an expression for magnetic field due to current carrying circular loop at axial line.

OR

Derive an expression for the growth and decay of current in LR circuit. Explain the meaning of inductive time constant.

14. A 10eV electron is circulating in a plane at right angles to a uniform field of magnetic induction of 1×10^{-4} Wb/m^2. Calculate its orbital radius, cyclotron frequency and period of revolution.

15. Sun light just outside the earth in atmosphere has an intensity of 1.4kW/m^2. Calculate the maximum electric and magnetic fields for sun light, assuming it to be a plane wave. Given c=2.99×10^8m/s.

16. Show that energy of an electron that is confined in the infinite potential well is quantized and sketch that energy level and wave function diagram for n=1, 2 and 3 for that well.

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