TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Chaitra

Exam.	Regular / Back		
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. Define torsional pendulum. Derive an expression for its time period. Explain why the time period of the torsional pendulum remains unaffected even if the amplitude is large.

OR

What is a damped EM oscillations? Which factor in the circuit is responsible to produce such a motion? Derive a differential equation for this motion and write its solution. What will be the remedy of such motion to make it smooth?

2. A meter stick swings as a compound pendulum when suspended from one of its end. Calculate (a) period of the oscillations and (b) equivalent length of the simple pendulum that would have the same period.
3. Mention the conditions for good acoustics of a hall and derive an expression for reverberation time.
4. Why Newton's interference fringes are circular? Derive an expression for radius of the Newton's ring due to the transmitted light.

OR

Define dispersive and resolving power of a diffraction grating. Derive an expression for the resolving power of the grating having N slits.

5. A plane transmission grating having 5000 lines/cm is used to obtain a spectrum of light from a sodium lamp in the second order. Calculate the angular separation between the two sodium lines whose wavelengths are 589 nm and 589.6 nm.
6. Calculate the specific rotation if the plane of polarization is turned through 30.5° traversing 25 cm length of 10% sugar solution.
7. Define an optical fiber and mention its types. Explain the numerical aperture and acceptance angle for the optical fiber and derive the expression to establish a relationship between them.
8. Dispersive powers for crown and flint glass lenses are 0.015 and 0.030 respectively. How can you design an achromatic contact of the lenses of focal length 50 cm?
9. What is an electric Quadrupole? Derive an expression for the electric potential at any point on the axial line at a distance 'r' from the centre of a short Quadrupole. Also, show that the electric potential at that point is inversely proportional to r^3.

OR

Discuss the modification of Gauss law due to the presence of the dielectrics and derive a relation among displacement vector, polarization vector and the electric field.

10. A particle of charge $-q$ and mass m is placed midway between two equal positive charges q_0 of separation d. If the negative charge executes SHM between the positive charges, then derive an expression for the time period of the oscillations.

11. Calculate the mean free time and mean free path between the collisions for the free electrons in copper with number density of the electron 8.5×10^{28} m^{-3} and resistivity 1.7×10^{-8} ohm-m.($e = 1.6 \times 10^{-19}$ C, $m_e = 9.1 \times 10^{-31}$ kg and effective speed of the electron = 1.6×10^{6} m/s)

12. Define the cyclotron and cyclotron frequency. show that energy of a charged particle in a cyclotron is independent to the oscillating electric field.

OR

State Ampere's law in magnetism. Calculate the magnetic field outside and inside a current carrying long straight conductor.

13. An inductance of an inductor L connected to a battery of emf ε through a resistor of resistance R. Show that the p.d. across the inductor after time t is $V_L = \varepsilon e^{-(R/L)t}$. At what time the p.d. across the inductor is equal to the p.d. across the resistor such that $i = i_0/2$.

14. What is magnetic flux density at the center of a circular coil of radius 2 cm and with 20 turns carrying current of 10 A?

15. Write Maxwell equations in differential form. State and explain the pointing vector and theorem.

16. What is the physical significance of wave function? Derive the relation of Schrodinger wave equation in time dependent form.

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