(OLD COURSE)

(2 Hours)   [Total Marks : 75

N.B. : (1) Question No. 1 is **compulsory.**
        (2) Attempt any **four** questions from the **remaining.**
        (3) Mention **suitable** examples wherever **necessary.**
        (4) Draw structure wherever applicable.

1. Attempt any **five** of the following :-   15
    (a) Differentiate between spontaneous emission and stimulated emission.
    (b) Explain why thin film interference pattern for wedge film is parallel where as for Newton's ring it is circular ?
    (c) Explain de-broglie's hypothesis ?
    (d) What spectres would be absent when width of opacity is double than that of the transparency in a grating ?
    (e) Describe Pirani gauge.
    (f) Differentiate between soft and hard magnetic material.
    (g) What is the wave length of neutron, whose energy is 0.025 ev and mass 1.676×10^{-27} kg ?

2. (a) Describe the origin of color on Parallel thin film, with the derivation of constructive and destructive conditions.   8
    (b) Consider an air core toriod with 500 turns, cross-section 6 cm^2, mean radius 15 cm, coil current 4 amp. Now calculate m.m.f. (NIo), reluctance (R), M. flux (ψ), M-flux density (B) and M-field intensity (H).   7

3. (a) By using Time Dependent Schrödiger equation, prove that energy levels of particle in one dimensional box of infinite height are quantized, where as for free particle is continuous.   8
    (b) A plane wave of monochromatic light falls normally on a uniform thin film of oil which covers a glass plate. Wave length of source when change continuously then complete destructive interference taken place only for wave length 5000 A° and 7000 A°. Find the thickness of oil layer when R.I. of oil is 1.3 and that of glass is 1.5.   7

4. (a) Describe He-Ne laser with suitable energy level diagram by maintioning how metastable state, pumping and population inversion taken place.   5
    (b) The position and momentum of 1 kev electon are simultaneously measured. If its position is located within 10 nm, then what is the momentum of the particle and what is the uncertainty in its momentum ? Given that mass of electron = 9.1×10^{-31} kg, charge of electron = 1.6×10^{-19} c and h = 6.63×10^{-34} J.S.   5
    (c) Light incident on a grating with 6000 lines per cm. Find angular separation in 2nd order of two sodium lines of wave length 5890 A° and 5896 A°.   5

[TURN OVER

5. (a) Differentiate between step index fiber and graded index fiber and derive the expression   **5**
         for N.A. for both.
    (b) Find de-broglie's wave length of a circket ball having speed 150 km/hr with mass   **5**
         450 gm and electron having speed 10^5 m/sec.
    (c) Define resolving power of a grating. Calculate maximum order possible for a grating   **5**
         with 15,000 lines / inch, with wave length 5893 A°.

6. (a) Prove that diameter of dark ring in Newton's ring is proportional to the square   **5**
         root of natural number and explain why centre of Newton's ring is dark ?
    (b) For a step index fiber core R.I. is 1.48, cladding R.I. is 1.38, core radius 50 μm,   **5**
         wave length of light propagated 1 μm. Now calculate N.A., normalized frequency
         (V) and no. of guided modes (Ms).
    (c) Compare diagram para and ferromagnetie materials interms of dipole moment and   **5**
         susceptibility.

7. Write short notes on any **three**.   **15**
    (a) Rotary pump
    (b) SEM
    (c) Antireflection.
    (d) Holography.