(2 Hours) **[Total Marks : 60**

1) Question no.1 is compulsory
2) Attempt any three questions from Q.2. TO Q. 6
3) Use suitable data wherever required.
4) Figures to the right indicate full marks.

1. Attempt any five of the following **15**
   a) Why does an excessively thin film appear to be perfectly dark when illuminated by white light.
   b) In a plane transmission grating the angle of diffraction for the first order principal maximum is 20^0 for a wavelength of $6500A^0$. Calculate the number of lines in one cm of the grating surface.
   c) Explain the term V-number of an optical fibre .
   d) Differentiate between Spontaneous Emission & Stimulated Emission
   e) Show that divergence of the curl of a vector is zero.
   f) An electron is accelerated through a potential difference of 18 Kv in a colour Cathode ray tube.Calculate the kinetic energy & the speed of the electron.
   g) What will happen when a liquid is introduced between the plano convex lens and glass plate in Newton's rings experiment.

2. (a) What do you mean by thin film? Obtain the conditions for the maxima and minima of the light reflected from a thin transparent film of uniform thickness **8**
   (b) Explain Step index and Graded index fibres. A Step Index fibre has a core diameter of $2.9*10^{-6}$ m , the refractive indices of core & claddings are 1.52 &1.5189 resply . If the light of wavelength 1.3 μm is transmitted through the fibre determine the normalized frequency & number of modes supported by the fibre. **7**

3. (a) With neat energy level diagram describe the construction and working of Nd-Yag laser **8**
   (b) What is grating element. The visible spectrum ranges from 4000 A^0 to 5000 A^0 . Find the angular breadth of the first order visible spectrum produced by a plane grating having 6000 lines/cm when light is incident normally on the grating **7**

4. (a) Explain with neat diagram, construction and working of SEM. **5**

   (b) Explain spherical co-ordinate system? State the transformation relation between Cartesian and Spherical coordinates **5**

   (c) What is Holography? Distinguish between holography and ordinary photography? **5**

5. (a) Show that diameter of Newton's dark ring is directly proportional to square root of natural number? **5**

   (b) What are the different techniques to synthesise nanomaterial & explain one of them in detail. **5**

   (c) In a Newton's rings experiment the diameter of n^{th} and $(n+12)^{th}$ rings are 4.3mm and 6.8mm respectively . Radius of curvature of plano-convex lens is 1m. Find the wavelength of light. **5**

6. (a) Explain the physical significance of divergence and curl of a vector field? **5**

   (b) State Bethe's law and explain electrostatic focusing of electron beam? **5**

   (c) Two glass plates enclose a wedge –shaped air film touching at one edge are separated by wire of 0.03mm diameter at distance 15 cm from the edge. Monochromatic light of Wavelength $\lambda=6000A^{o}$ from a broad source falls normally on the film .Calculate the fringe width. **5**
