LAST MOMENT TUITIONS

# Applied Physics 2

# May 19

**Total marks: 80**
**Total time: 3 Hours**

**INSTRUCTIONS**
**(1) Question 1 is compulsory.**
**(2) Attempt any three from the remaining questions.**
**(3) Draw neat diagrams wherever necessary**.

**Q1.a)** Explain the formation of colors in thin film when it is exposed to white light. (3M)
**b)** Write the formula for dispersive power of the grating. Explain how it can be increased. (3M)
**c)** A bare core optical fiber with no cladding is kept in air medium and has fractional index difference of 1.2%. Calculate acceptance angle of the fiber. (3M)
**d)** Differentiate between holography and photography. (3M)
**e)** Using cylindrical co-ordinate system, calculate volume of the cylinder of radius r and height h. (3M)
**f)** An electron is accelerated through a potential difference of 18 kV in a cathode ray tube. Calculate kinetic energy and speed of the electron. (3M)
**g)** Explain top down and bottom up approaches to prepare nanomaterials. (3M)

**Q2 a)** What is anti-reflection coating? State the conditions for refractive index and thickness of the film in order to act as anti-reflection coating? White light is sent vertically downward onto a horizontal thin film that is sandwiched between the materials. The indices of the refraction are 1.8 for top material, 1.65 for thin film and 1.50 for the bottom material. The film thicknesses is 5 x 10-7 m. Which are the visible wavelengths (400 – 700 nm) those results in fully constructive interference at an observer above the film? (8M)
**b)** Give the advantages of optical fiber cables on conventional electric cables. Calculate core radius required for an optical fiber to act as a single mode fiber if its core refractive index is 1.46 and cladding refractive index is 1.455 and operating wavelength is 1300 nm. (7M)

**Q3 a)** Explain Fraunhofer's double slit diffraction experiment and obtain expression for resultant intensity of light on the screen and derive the formula for missing orders in the double slit diffraction pattern. (8M)
**b)** With energy level diagram explain the construction and working of He-Ne Laser . (7M)

**Q4 a)** Calculate divergence of the vector $\vec{F} = x\,2yi - (z\,3 - 3x)j + 4y\,2\vec{k}$ . (5M)
**b)** Draw the block diagram of cathode ray oscilloscope (CRO) and explain the importance of time base circuit. (5M)
**c)** Interference fringes are produced by monochromatic light falling normally on a wedge-shaped film of refractive index 1.4. The angle of wedge is 20 seconds of an arc and the distance between successive bright fringes is 0.25 cm. Calculate wavelength of the light used. (5M)

**Q5 a)** Write Maxwell's equations in differential form and give their physical significance. (5M)

**b)** The ground state and excited state of the laser is separated by 1.8 eV. Calculate the ratio of number of atoms in the excited state to the ground state and wavelength of the radiation emitted at 27°C. (5M)

**c)** Explain construction and working of atomic force microscope (AFM). (5M)

**Q6 a)** Explain sputtering method for synthesis of nano materials. (5M)

**b)** Explain experimental arrangement of Newton's rings experiment and show that diameters of dark rings are proportional to square root of natural numbers. (5M)

**c)** An electron enters in a uniform magnetic field B=0.23 x 10-2 Wb/m2 at 45°angle to B. Determine radius and pitch of the helical path. Assume electron speed to be 3 x 107m/sec. (5M)