LIB

17th May 13

Applied Physics

FE Sem II (Rev)

AP-II.

AGJ 1st half (b+) 40

Con. 6890-13. **(REVISED COURSE)** **GS–5454**

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

N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **three** questions from Q. **2** to Q.**6**.
(3) **Figures** to the **right** indicate **full** marks.
(4) Assume **suitable** data wherever **necessary**.

1. Attempt any **five** :–

(a) A glass material A with which an optical fibre is made has a refractive index of 1·55. This material is clad with another material whose refractive index is 1·51. The light in the fibre is launched from air. Calculate the numerical aperture of the fibre. **3**

(b) Suppose that in the experiment on Newton's Rings, first light of red colour is used and then blue light, which set of rings would have larger diameter ? Justify your answer with proper expression. **3**

(c) What is a population inversion state ? Explain its significance in the operation of laser ? **3**

(d) In a plane transmission grating, the angle of diffraction for second order principal maximum for the wavelength 5×10^{-5} cm is 30°. Calculate the number of lines /cm of the grating surface. **3**

(e) An electron is bound in an one dimensional potential well of width of 2Å, but of infinite height. Find its energy values in the first excited state. **3**

(f) Explain the measurement of frequency of AC signal using CRO. **3**

(g) Define superconductivity and explain critical magnetic field and critical temperature of a superconductor. **3**

2. (a) With the help of a proper diagram and necessary expression, explain how Newton's ring experiment is useful to determine the radius of curvature of a plano convex lens. In a Newton ring's experiment the diameter of 5^{th} ring was 0·336 cm and the diameter of 15^{th} ring is 0·590 cm. Find the radius of curvature of plano-convex lens if the wavelength of light used is 5890 Å. **8**

(b) What is dispersion in optical fibres ? Mention any three dispersion you have studied and explain any one in detail. **7**

Compute the maximum radius allowed for a fibre having core refractive index 1·47 and a cladding refractive index 1·46. The fibre is to support only one mode at a wavelength of 1300m.

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3. (a) With a neat energy level diagram describe the construction and working of He-Ne laser. What are its merits and demerits. 8

   (b) A plane wave of monochromatic light falls normally on a uniformly thin film of oil, which covers a glass plate. The wavelength of the source can be varied continuously. Complete destructive interference of reflected light is observed for 5000Å and 7000Å and for no other wavelengths in between. Find the thickness of the oil layer. Given that refractive index of oil is 1·3 and glass is 1·5. 7

4. (a) Monochromatic light of wavelength 6560Å falls normally on a grating 2 cm wide. The first order spectrum is produced at an angle of 16° 17' from the normal. Calculate total no. of lines on the grating. 5

   (b) An electron has a speed of 400m/s. with uncertainty of 0·01%. Find the accuracy in its position. 5

   (c) Distinguish between Type I and Type II superconductors. 5

5. (a) Derive the condition for absent spectra in grating. 5

   (b) Show that the energy of an electron in the box varies as the square of natural numbers. 5

   (c) What are different techniques to synthesize nanomaterial ? Explain one of them in detail. 5

6. (a) A bullet of mass 40 gms and an electron both travel at velocity of 1100 m/s. What wavelengths can be associated with them ? Why the wave nature of bullet is not revealed through diffraction effect. 5

   (b) Derive Bethe's law for electron refraction. 5

   (c) Draw the schematic diagram of SEM and explain its construction and working. 5
