F.E. Sem II (Rev) CGS May-2014.
Sub:- Applied Physics

(REVISED COURSE) QP Code :**NP-17768**

(2 Hours) [Total Marks : 60

N. B. : (1) Question no. **1** is **compulsory**.
(2) **Figures** to **right** indicates marks.
(3) Attempt any **three** questions from Q. no. **2** to Q. no. **6**.
(4) Use necessary data wherever required.

1. Attempts any **five** :– **15**
   (a) Why the Newton's rings are circular and centre of interference pattern (reflected) is dark?
   (b) What is Rayleighi criteria of resolvation? What is resolving power of diffraction grating?
   (c) An optical glass fibre of refractive index 1.50 is to be clad with another glass to ensure internal reflection that will contain light travelling within 5° of the fibre axis. What maximum index of refraction is allowed for the cladding?
   (d) What is acronym of 'LASER'? How are they different than X-rays?
   (e) An electron is bound in one dimensional potential well of width 2A° that of infinite height. Find its energy value in the ground state.
   (f) Explain measurement of frequency of AC signal using CRO
   (g) What is the vortex state of a superconductor?

2. (a) With Newton's ring experiment explain how to determine the refractive index of Liquid. **8**
   In Newton's ring experiment, the diameter of 15^{th} dark ring was found to be 0.590 cm and that of 5^{th} dark ring was 0.336 cm. If the radius of curvature of planoconvex lens is 100 cm, calculate the wavelength of light.
   (b) Differentiate between S.I. fibre and GRIN fibre. Derive the expression for N.A. for step Index fibre. **7**

3. (a) What is holography? Explain its construction and reconstruction with neat diagram. **8**
   (b) Obtain the conditions for maxima and minima due to interference in a wedge shaped film observed in reflected light. Two optically plane glass strips of length 10 cm are placed one over the other. A thin foil of thickness 0.01 mm in instroduced between them at one end to form an air film. If the light used has wavelength 5900 A°. find the separation between consecutive bright fringes. **7**

4. (a) What is grating element? Derive condition for maximum diffraction at diffraction grating. **5**
   (b) What is Heisenberg's uncertainty principle? Show that electron can not exist in nucleus. **5**
   (c) What is superconductivity? Differentiate between Type-I and Type II superconductors. **5**

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5. (a) In plane transmission grating, the angle of diffraction for the second order principlal maxima for the wavelength 5×10^{-5} cm is 30°. Calculate the no. of lines/cm. on diffraction grating. 5

(b) Derive one dimensional time dependent schrodinger wave equation for matter wave. 5

(c) With neat diagram explain construction and working of Scanning Electron Microscope. 5

6. (a) Calculate the velocity and De Broglie wavelength of an α-particle of energy 1 KeV. Given Mass of α-particle $=6.68 \times 16^{-27}$ kg. 5

(b) With neat diagram explain construction and working of CRT. 5

(c) Explain the Physical Methods for synthesis of Nanoparticles. 5

Con. 5848-13. GX-10130

(REVISED)

(2 Hours) [Total Marks : 60

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

1. Attempt any **five** : -
   (a) Explain why an extensive thin film appears black in reflected light ? 3
   (b) How will you increase the resolving power of a diffraction grating ? 3
   (c) Calculate the numerical aparture of a fiber with core index n_1 = ~~1.01~~ 1.61 and cladding index n_2 = 1.55 3
   (d) What is the difference between spontaneous and stimulated emissions. 3
   (e) An electron is bound by a potential which closely approaches an infinite sqaure well of width 2.5×10^{-10}m. Calculate first lowest permissible energy for electron. 3
   (f) Write any two applications of CRO. 3
   (g) What is MAGLEV ? 3

2. (a) What do you understand by anti reflection coating ? Derive the conditions with proper diagram. 8
   (b) What is N.A. ? Consider a multimode step under fibre with $n_1 = 1.53$ and $n_2 = 1.50$ and λ = 1~~m~~ um. If the core radius = 50~~p~~ μm than calculate the ~~realised~~ normalized frequency of the fibre (V) and the number of guided mode. 7

3. (a) What is the difference between holography and photography ? Discuss the construction and reconstruction of image in holography with neat diagram 8
   (b) Derive the conditions for maxima and minima due to interference of light reflected from thin film of uniform thickness. 7

4. (a) What is the highest order spectrum which can be seen with monochromatic light of wavelength 6000 A^0 by means of a diffraction grating with 5000 lines / cm. 5
   (b) Explain the Hesenberg's uncertainity principle. 5
   (c) What are Type I and Type II superreconductors ? 5

5. (a) A plane grating just resolve two lines in the second order. Calculate the grating element if $d\lambda = 6A^0$, $\lambda = 6 \times 10^{-5cm}$ and the width of the ruled surface is 2cm. 5
   (b) Derive shrodingers time dependent wave equation. 5
   (c) Explain the working of SEM with a neat diagram. 5

6. (a) Find the energy of the neutron in units of electron volts where De-broglie wavelemgth is 1 $\mathring{A}$ 5
   mass of neutron = 1.674×10^{-27}kg
   planck's constant = 6.620×10^{-34} J.sees
   (b) Write a short note on electrostatic forcussing. 5
   (c) What are carbon tubes and what are their properties. 5

F.E sem II (Rev) CGS may 17/5/13
Sub — Applied Physics - 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**
