

*M.B. D.*

- N.B.** (1) Question No. 1 is **compulsory** from **Section I**.  
 (2) Attempt any **two** questions from Question Nos. 2 to 5.  
 (3) Attempt **both** the sections in **separate** answer-books.  
 (4) Assume **suitable** data and symbols if **required**.  
 (5) **Figures** to the **right** indicate **full marks**.

**SECTION I**

1. Attempt any **four** :— *Applied Sciences II (Revised), May 07, Pg. 1* 5
- (a) Explain in short —  
 What will be the Newton's Rings pattern like, if the  
 (i) white light replaces monochromatic light ?  
 (ii) when planoconvex lens of larger Radii of curvature (R) is used ?  
 (iii) when a transparent liquid ( $\mu$ ) is placed between planoconvex lens ( $\mu_1$ ) and the glass plate ( $\mu_2$ ) such that  $\mu_1 < \mu < \mu_2$ . 5
- (b) Calculate the energy released in KWh by 700 gm  $U^{235}$  undergoing fission.  $Q = 200$  MeV per fission. Avagadro's No.  $N = 6.025 \times 10^{23}$ /gm mole. 5
- (c) What is the difference between step index and graded index fibre ? 5
- (d) What is (i) stimulated emission, (ii) population inversion and (iii) pumping method in lasers ? 5
- (e) A slit of width 'a' is illuminated by white light. For what value of 'a' will the 1st minimum for red light fall at an angle of  $30^\circ$  ? Wavelength of red light is  $6500 \text{ \AA}$ . 5
- (f) In comparing the wavelengths of two monochromatic X-ray lines, it is found that line A gives a 1st order Bragg reflection maximum at a glancing angle of  $30^\circ$  to the smooth face of a crystal. Line B of known wavelength of  $0.97 \text{ \AA}$  gives a 3rd order reflection maximum at a glancing angle of  $60^\circ$  with the same face of the same crystal. Find the wavelength of the line A. 5
2. (a) What are characteristic X-rays of an element ? How can they be used to determine the atomic no. of an element ? Examine the formation of  $L_\beta$  X-rays. 8
- (b) Derive the expression for Numerical Aperture of fibre optic cable. What is acceptance angle ? The numerical aperture of an optical fibre is 0.5 and core refractive index is 1.54. Find R.I. of the cladding. 7
3. (a) Obtain the condition for maxima and minima of the light reflected from a thin transparent film of uniform thickness. Why is the visibility of the fringe much higher in the reflected system than in the transparent system ? 8
- (b) Explain the construction and working of He-Ne Laser with neat energy level diagram. 7
4. (a) Discuss the phenomenon of Fraunhofer's diffraction at single slit and obtain the condition for 1st minimum. A plane transmission grating having 3000 lines per cm give an angle of diffraction of a spectral line of  $30^\circ$  in 3rd order. Find the wavelength of the given line. 8
- (b) The bombardment of  ${}_3\text{Li}^7$  at rest by proton produces two alpha particles per reaction. If the energy of each  $\alpha$  particle per reaction is 10 MeV, then write the reaction and calculate the energy of the bombarding proton. Give that : 7
- Mass of Li = 7.018232 a.m.u.  
 Mass of particle = 4.003874 a.m.u.  
 Mass of proton = 1.008143 a.m.u.  
 1 a.m.u. = 931 MeV.
5. Write short note on any **three** :— 15
- (a) Nuclear Reactor (d) Mosley's Law  
 (b) G. M. Counter (e) Bragg's Spectrometer.  
 (c) Holography

SECTION II

- N.B.** (1) Question No. 6 is compulsory.  
 (2) Attempt any two questions from remaining three.

6. Attempt any five from the following :— 20
- (a) What is cracking ? Why catalytic cracking is superior than thermal cracking ?
  - (b) What is meant by octane number ? Explain the role of antiknocking agents.
  - (c) 1.56 gm of the coal was Kjeldahlized and  $\text{NH}_3$  gas thus evolved was absorbed in 50.0 ml of 0.1 N  $\text{H}_2\text{SO}_4$ . After absorption the excess (residual) acid required 6.25 ml of 0.1 N NaOH for exact neutralization. 2.60 gm of the coal sample in a qualitative analysis gave 0.1755 gm of  $\text{BaSO}_4$ . Calculate the percentage of N and S in the coal sample.
  - (d) Distinguish between Galvanizing and Tinning.
  - (e) Explain the pitting corrosion with relevant equation.
  - (f) What are alloys ? What are the purposes of making alloy ?
  - (g) Explain the scope and importance of biotechnology in medicine.
7. (a) Describe the refining of petroleum with various fractions obtained. 5
- (b) Write short note on :— 2
- (i) Cathodic protection
  - (ii) Stainless steel.
- (c) What are plain carbon steel ? How are they classified on the basis of their carbon content ? 2
8. (a) Write composition, properties and uses of the following :— 6
- (i) German Silver
  - (ii) Duralumin.
- (b) Calculate the volume of air required for complete combustion of 1 m<sup>3</sup> of gaseous fuel which possess by volume :— 5
- $\text{CH}_4 = 35\%$ ,  $\text{C}_2\text{H}_4 = 5\%$ ,  $\text{CO} = 15\%$ ,  $\text{H}_2 = 40\%$ ,  $\text{N}_2 = 1\%$ , Water Vapour = 4%.
- (c) Explain the following factors influencing the rate of corrosion :— 4
- (i) Relative area of cathode and anode
  - (ii) pH of medium.
9. (a) What are the main constituents of paint ? Write their functions. 4
- (b) Describe the manufacture of biogas with its composition and important uses. 7
- (c) A sample of coal contains C = 70%, O = 20%, H = 8%, S = 0.5%, N = 0.5%, Ash = 1.0%. 4
- Calculate the gross and net calorific value by Dulong and Petits formula.