

Total No. of Questions : 12]

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F. E. (2008 Course) Examination - 2008

APPLIED SCIENCE - I

Time : 3 Hours]

[Max. Marks : 100

**Instructions :**

- (1) Answer 3 questions from section I and 3 questions from section II.
- (2) Answers to the **two sections** should be written in **separate books**.
- (3) Black figures to the right indicate full marks.
- (4) Neat diagrams must be drawn wherever necessary.
- (5) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- (6) Assume suitable data, if necessary.

**SECTION - I**

- Q.1)** (A) What is Crystal Defect ? How does it arise ? Explain effect of point defect and line defect on properties of crystals. [06]
- (B) Explain in brief Organic Electrical Conductors : [06]
- (i) Conducting Polymers
  - (ii) Charge Transfer Compounds
- (C) State and explain Bragg's Law. [04]

**OR**

- Q.2)** (A) Explain basic structure, properties and applications of Fullerenes. [06]
- (B) For BCC iron compare (i) the interplaner spacing and (ii) diffraction angle for the (220) set of planes. The lattice parameter for Fe is 0.2866 (2.886 Å). Also assume that monochromatic light having a wavelength of 0.1790 nm (1.790 Å) is used, and order of reflection is 1 (one). [06]
- (C) Draw (110) and (111) plane in simple cubic unit cell. [04]

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- Q.3)** (A) What is meant by Precipitation Titration ? Explain Mohr's method for determination of  $\text{Cl}^-$  ions. [07]
- (B) Explain Titration curve for 0.1 N HCl and 0.1N NaOH. Which indicator can be used for this titration ? [06]
- (C) Balance following equations : [04]
- (i)  $\text{H}_2\text{O}_2 + \text{MnO}_4^- \rightarrow \text{O}_2 + \text{Mn}^{2+}$
- (ii)  $\text{PbS} + \text{H}_2\text{O}_2 \rightarrow \text{PbSO}_4$

**OR**

- Q.4)** (A) What is Iodometry ? Explain how the percentage of copper in brass can be determined by using iodometry ? [07]
- (B) Attempt following : [06]
- (i) How many milliliters of concentrated sulphuric acid, 94% (g/100g solution) of density  $1.831 \text{ g/cm}^3$  are required to prepare 1 litre of a 0.1 M solution ?
- (ii) One rupee silver coin weighing 2.75g was dissolved in acid and then diluted to 250 ml. with distilled water. 25 ml from this was titrated with 0.12M  $\text{NH}_4\text{CNS}$ . The end point was 16 ml. Calculate percentage of silver in the coin. (Given At. wt. of Ag = 107.88)

- (C) What is meant by Standard Solution ? How is it prepared ? [04]

- Q.5)** (A) Why vulcanisation of rubber is necessary ? Explain use of sulphur and benzoyl peroxide for this purpose. [07]
- (B) Give synthesis, properties and applications of : [06]
- (i) Polypropylene
- (ii) Polystyrene
- (C) Give classification of Polymers on the basis of their thermal behaviour. [04]

**OR**

- Q.6)** (A) Why recycling of plastics is necessary ? Explain recycling of any two plastics. [07]
- (B) Give reasons : [06]
- (i) Polymers take long time for dissolution.
- (ii) We consider average value for molecular weight of polymer.
- (C) Explain the factors which increase thermal stability of polymers with suitable example. [04]

## SECTION - II

- Q.7) (A) Explain the formation of Newton's Rings. Obtain an expression for the diameter of dark rings in reflected system. What will happen to the diameter of  $n^{\text{th}}$  dark ring if air film is replaced by water film ? Explain. [07]
- (B) (i) Explain how an electron beam can be made to bend either towards or away from the normal to an equipotential surface.
- (ii) Find the velocity of protons selected by a velocity selector using crossed electric and magnetic fields when electric field is 60kv/m and magnetic field is  $2000 \times 10^{-4}$  wb/m<sup>2</sup>. [04]
- (C) Explain the use of thin film as antireflection coating. [04]

OR

- Q.8) (A) (i) Draw a neat labelled diagram of Michelson's Interferometer and explain how it can be used to find the wavelength of monochromatic light. [04]
- (ii) A thin film illuminated by white light appears coloured when observed in reflected light. Explain why. [03]
- (B) Explain with a neat diagram the principle, construction and working of Bainbridge's Mass Spectrograph. [06]
- (C) A beam of monochromatic light of wavelength  $5.82 \times 10^{-7}$  m falls normally on a glass wedge of wedge angle of 20 seconds of an arc. If the refractive index of glass is 1.5, find the number of dark interference fringes per cm. of the wedge length. [04]
- Q.9) (A) (i) Give the theory of plane diffraction grating. Obtain the condition for the formation of  $n^{\text{th}}$  order maximum. [05]
- (ii) State the factors on which the resolving power of grating depends. [02]
- (B) (i) A grating has 6000 lines per cm. How many orders of light of wavelength 4500 Å can be seen ? [03]
- (ii) Discuss the use of ultrasonics for flaw detection. [03]
- (C) Explain what is Magnetostriction effect ? Draw a neat labelled diagram for the production of ultrasonics by Magnetostriction Oscillator. [04]

OR

- Q.10) (A)** (i) Obtain an expression for the resolving power of grating. [04]  
(ii) A quartz crystal in an ultrasonic interferometer produces stationary waves of frequency 1.5 MHz. If the distance between 6 consecutive nodes is 2.75 mm, find the velocity of ultrasonic waves. [03]

**(B)** Explain echo sounding technique and cavitation with one example each. [06]

**(C)** A single slit diffraction pattern is formed using white light. For what wavelength of light does the second minimum coincide with the third minimum for the wavelength  $4000 \text{ \AA}$  ? [04]

**Q.11) (A)** Explain giving diagram, the nature of refraction observed in case of a calcite crystal when

- (i) Optic axis parallel to the refracting surface and lying in the plane of incidence (normal incidence).  
(ii) Optic axis perpendicular to the refracting surface and lying in the plane of incidence (normal incidence). [06]

**(B)** Give the construction and working of betatron with neat diagram. Obtain the betatron condition. [06]

**(C)** A 20 cm. long tube containing 48 c.c. of sugar solution rotates the plane of polarisation by  $11^\circ$ . If the specific rotation of sugar is  $66^\circ$ , calculate the mass of sugar in the solution. [04]

**OR**

**Q.12) (A)** Describe the construction and working of Laurent's Half shade polarimeter and explain how it can be used for the determination of specific rotation of an optically active substance. [06]

**(B)** What do you mean by nuclear fusion ? Give an account of Proton - Proton Cycle as the cause of stellar energy. State the conditions required to initiate a self sustaining fusion reaction. [06]

**(C)** In a certain cyclotron, the maximum radius that the path of a deuteron may have before it is deflected out of the magnetic field is 20 cm.

(i) Calculate the velocity of deuteron at this radius

(ii) What is the energy of deuteron in MeV ?

Given :  $B = 1.5 \text{ wb/m}^2$

Mass of deuteron =  $3.34 \times 10^{-27} \text{ kg}$

Charge of Electron =  $1.6 \times 10^{-19} \text{ C}$

[04]