

Total No. of Questions : 12]

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[3661]-12

F. E. Examination - 2009

APPLIED SCIENCE - I

(2003 Pattern)

Time : 3 Hours]

[Max. Marks : 100

Instructions :

- (1) Answer **any three** questions from section I and **any three** questions from section II.
- (2) Answers to the **two sections** should be written in **separate answer-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, electronic pocket calculator and steam tables is allowed.
- (6) Assume suitable data if necessary.

SECTION - I

- Q.1) (A) A thin film of uniform thickness is illuminated by monochromatic light. Obtain the conditions of darkness and brightness of the film as observed in reflected light. Why does an excessively thin film appear dark in reflected light ? [07]
- (B) State fundamental postulate of special theory of relativity. Derive the Einstein's Mass Energy relation. [06]
- (C) How far must the movable mirror of the Michelson's Interferometer be moved in order that 200 fringes of wavelength 6000\AA cross the field of view ? [04]

OR

- Q.2) (A) Explain the formation of Newtons Rings. Show that the diameter of n^{th} dark ring is directly proportional to square root of natural number. [07]
- (B) Write down Lorentz transformation equations. Derive Lorentz-Fitzgerald contraction equation. Discuss the result. [06]

- (C) A Beam of Sodium Light of Wavelength 5890×10^{-8} cm is incident on a thin film of magnesium fluoride of refractive index 1.38. Calculate the thickness of the film which will make it appear dark by reflection. [04]

Q.3) (A) Give the theory of plane diffraction grating. Obtain the condition for n^{th} order maxima and minima. [07]

(B) What are Ultrasonic Waves ? Explain any one application of Ultrasonic Waves. [06]

(C) A slit of variable width is illuminated by red light of wavelength 6500 \AA . At what width of the slit, the first minimum will fall at $\theta = 30^\circ$? [04]

OR

Q.4) (A) What is Magnetostriction effect ? Draw a neat diagram and explain the Magnetostriction Oscillator for the production of Ultrasonic Waves. [07]

(B) State Rayleigh's criterion of resolutions. Obtain expression for resolving power of grating. [06]

(C) The Bragg's angle corresponding to the first order reflection from the plane of the crystal is 30° , when X-rays of Wavelength 1.78 \AA are used. Calculate the interplanar spacing. [04]

Q.5) (A) Explain the phenomenon of double refraction on the basis of Huygens Wave theory of light. [06]

(B) What is nuclear fission ? Explain it on the basis of Bohr and Wheeler liquid drop model. [06]

(C) A polariser and an analyser are oriented, so that the amount of light transmitted is maximum. How can the analyser be oriented, so that the transmitted light is reduced to :

(1) 0.25

(2) 0.75

[04]

OR

- Q.6)** (A) With the help of neat labelled diagram explain principle, construction and working of Betatron. Obtain Betatron condition. [06]
- (B) What are retardation Plates ? Deduce the expression for thickness of QWP in terms of refractive indices. [06]
- (C) In a thermonuclear reaction 1.00×10^{-3} kg of hydrogen is converted into 0.993×10^{-3} kg helium. Calculate energy released in joule. [04]

SECTION - II

- Q.7)** (A) Classify solids on the basis of types of Bonding. Explain any one in detail. [07]
- (B) Calculate atomic packing factor for BCC and FCC Structures. [06]
- (C) Define the following :
- (1) Coordination Number
 - (2) Unit Cell
 - (3) Plane of Symmetry
 - (4) Isotropy
- [04]

OR

- Q.8)** (A) Explain the properties of talc and mica on the basis of their structures. Give the applications of talc and mica also. [07]
- (B) Why are Miller Indices of a lattice plane better than the Weiss Indices ? Draw (101) and (110) planes in a simple Unit Cubic Cell. [06]
- (C) Distinguish between Frenkel and Schottky defects in Ionic Crystals. [04]
- Q.9)** (A) What are secondary pollutants ? Explain the formation reactions and effects of any one secondary pollutant. [06]
- (B) Give the causes and disadvantages of Boiler Corrosion and Caustic Embrittlement. Explain the methods to minimise these. [06]
- (C) An exhausted zeolite bed was regenerated by passing 5 litres of 10% brine solution. The bed was exhausted on passing 1200 litres of hard water. Calculate the hardness of water. [05]

OR

- Q.10)** (A) Define BOD and COD. How are they determined for Waste Water Sample ? [06]
- (B) Explain the Electrodialysis Method for removal of ionic pollutants from water. [06]
- (C) Which are the air polluting emissions from I.C. Engines ? Explain the role of catalytic convertor for their control. [05]
- Q.11)** (A) Describe the techniques of solution and suspension polymerisation with the help of an example. [06]
- (B) Define Glass Transition Temperature. Discuss its importance and factors affecting it. [06]
- (C) Compare Natural and Vulcanised Rubber. [04]

OR

- Q.12)** (A) Give the preparation, properties and uses of **any two** of the following : [06]
- (1) Butyl Rubber
- (2) Polyvinyl Chloride
- (3) Polystyrene
- (B) Explain the cationic chain mechanism with the help of an example. [06]
- (C) What are Liquid Crystalline Polymers ? Give their properties and uses. [04]
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