

Total No. of Questions : 12]

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[3761]-12

F. E. Examination - 2010

APPLIED SCIENCE - I

(2003 Course)

Time : 3 Hours]

[Max. Marks : 100

Instructions :

- (1) Answer **three** questions from section I and **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, Mollier charts, electronic pocket calculator and steam tables is allowed.
- (6) Assume suitable data, if necessary.

SECTION - I

Constants : $e = 1.6 \times 10^{-19} \text{C}$

$h = 6.63 \times 10^{-34} \text{ J-s.}$

$m_e = 9.1 \times 10^{-31} \text{ kg}$

$c = 3 \times 10^8 \text{ m/s.}$

- Q.1)** (A) A thin film of uniform thickness is illuminated by a monochromatic light. Derive the equation of path difference and conditions of maxima and minima in case of reflected light. [07]
- (B) Write down Lorentz Transformation Equations. Derive Lorentz Fitzgerald Contraction Equation. Discuss the result. [06]

- (C) A transparent film of refractive index 1.5 is introduced normally in the path of one of the interfering beams of Michelson's Interferometer, which is illuminated by light of wavelength 5000\AA . If 450 dark fringes sweep across the field, calculate the thickness of the film. [04]

OR

- Q.2) (A) Draw a neat, labelled diagram of experimental set up to obtain Newton's Rings in Laboratory.

Prove that in Newton's Rings diameters of dark rings in reflected system are proportional to square root of natural numbers. [07]

- (B) Deduce Einstein's Expression for Mass-Energy Equivalence. [06]

- (C) A wedge shaped air film having an angle of 40 seconds is illuminated by monochromatic light and fringes are observed vertically through a microscope. The distance measured between consecutive bright fringes is 0.12 cm. Calculate the wavelength of light used. [04]

- Q.3) (A) State and explain Rayleigh's criterion of resolution of two point objects.

Derive an expression for the resolving power of a telescope. [06]

- (B) What is Magnetostriction Effect ? Explain with neat diagram the magnetostriction oscillator for generating ultrasonic waves. [06]

- (C) In a grating spectrum, which spectral line in the fourth order will overlap with the third order line of $\lambda = 5416\text{\AA}$? [04]

OR

- Q.4) (A) Explain the Theory of Plane Diffraction Grating. Obtain the condition for the formation of principal maxima. [06]

- (B) Explain any three applications of Ultrasonic Waves. [06]

- (C) Light of Wavelength 6×10^{-5} cm falls on a screen at a distance of 100 cm from narrow slit. Find the width of the slit if the first minima lie 1.5 mm on either side of the central maxima. [04]

- Q.5)** (A) How do you analyse the given beam of light. [06]
(B) With the help of a neat labelled diagram explain the principle, construction and working of a Cyclotron. [06]
(C) Write down the Proton - Proton and Carbon Nitrogen Cycles for fusion reactions. [05]

OR

- Q.6)** (A) Explain the phenomenon of double refraction using Huygen's Wave Theory. [06]
(B) Define and explain Q Value of a Nuclear Reaction. Derive an expression for it. [06]
(C) State and explain Law of Malus. Two Nicols are oriented with their principal planes making an angle 60° . What percentage of the incident unpolarized light will pass through the system. [05]

SECTION - II

- Q.7)** (A) Define Unit Cell. How the planes in crystal designated by Miller's and Weiss Methods ? [07]
(B) Write a note on Bravis Lattice. [06]
(C) Describe the different types of defects in Crystals. [04]

OR

- Q.8)** (A) What is Liquid Crystal Phase ? State types of Liquid Crystals and applications of Liquid Crystals. [07]
(B) Define Atomic Packing Factor. Explain hexagonal close packing and face central cubic packing of atoms with suitable diagrams. [06]
(C) Differentiate between Crystalline Solids and Amorphous Solids. [04]

- Q.9)** (A) Define Scale and Sludge. What are the effects of scale and sludge in the boiler and give methods for the prevention from the same. [07]
(B) What is Water Pollution ? Give various methods for the Treatment of Industrial Waste Water. Explain any one in detail. [06]
(C) Write a note on Catalytic Converter. [04]

OR

- Q.10) (A)** What is Hardness of Water ? Describe Ion Exchange Method for Water Softening. [07]
- (B)** Define Air Pollution. What do you understand by Primary and Secondary Pollutants ? Explain their formation with suitable examples. [06]
- (C)** A zeolite bed gets exhausted on softening 1500 liter of a water sample. The exhausted bed requires 7 liter of 10% NaCl for regeneration, calculate Hardness of Water Sample. [04]

- Q.11) (A)** Give preparation, properties and applications of **any two** of the following : [06]
- (1)** Epoxy Resins
- (2)** Polystyrene
- (3)** PVC
- (B)** Define Polymer. Discuss the methods used to calculate the Molecular Weight of a Polymer. [06]
- (C)** Distinguish between LDPE and HDPE. [04]

OR

- Q.12) (A)** Define Vulcanization of Rubber. Explain the Vulcanization Process with suitable reaction and properties of Vulcanized Rubber. [06]
- (B)** Give preparation, properties and uses of **any two** of the following : [06]
- (1)** Polyethylene
- (2)** Phenol Formaldehyde
- (3)** Silicone Rubber
- (C)** Write a note on Biodegradable Polymers. [04]