

Total No. of Questions : 12]

[Total No. of Printed Pages : 4

[3661]-17

F. E. Examination - 2009

APPLIED SCIENCE - II

(2003 Course)

Time : 3 Hours]

[Max. Marks : 100

Instructions :

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

Constants :

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

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

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

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

SECTION - I

- Q.1) (A) State Heisenberg's Uncertainty Principle. Give one experiment to prove its validity. [06]
- (B) Using Schrodinger's wave equation, find energy and wave function of a particle in a rigid box. Show necessary waveforms. [07]
- (C) DeBroglie Wavelength of electrons in a monochromatic beam is 7.2×10^{-11} meters. Calculate the momentum and energy of electrons in the beam in electron volts. [04]

OR

- Q.2)** (A) Explain Davisson - Germer Experiment on electron diffraction and discuss the results. [07]
 (B) Derive Schrodinger time independent wave equation. [06]
 (C) Compute the lowest three permitted energy levels of an electron in an infinite potential well of width 1 \AA . [04]

- Q.3)** (A) State the important properties of lasers. Explain the operation of Solid State Ruby Laser with the help of a neat labelled diagram. [07]
 (B) (1) Explain the process of Holographic Recording. [03]
 (2) Explain Meissner effect. [03]
 (C) Explain in brief the type I and type II Superconductors. [04]

OR

- Q.4)** (A) Explain : [06]
 (1) Spontaneous Emission
 (2) Stimulated Emission
 (3) Population Inversion
 (B) (1) Define magnetic field intensity, susceptibility and permeability and show that $\mu_r = 1 + \chi$. [04]
 (2) Discuss applications of Ferrites. [04]
 (C) State any six applications of Laser. [03]

- Q.5)** (A) Explain the classification of solids into conductors, insulators and semiconductors on the basis of energy band theory. [06]
 (B) Explain with a neat diagram the principle, construction and working of a Bainbridge Mass Spectrograph. [06]
 (C) Calculate the conductivity of extrinsic silicon at room temperature if the donor impurity added is 1 in 10^8 silicon atoms.

Given : At room temperature,

$$n_i = 1.5 \times 10^{10} \text{ per cm}^3$$

$$\mu_e = 1,300 \text{ cm}^2/\text{volt} - \text{sec. and number of silicon atoms per unit volume} = 5 \times 10^{22}. \quad [04]$$

OR

- Q.6)** (A) Explain Hall effect. Obtain an expression for the Hall voltage. State applications of Hall effect. [06]
- (B) Develop a neat comparison between Optical Microscope and Electron Microscope. [06]
- (C) An electron starts at rest at the negative plate of a plane parallel capacitor across which is applied a direct voltage of 1,000 volts. The distance between the plates is 1 cm. How long will it take the electron to reach the positive plate ? Find its velocity at that instant. [04]

SECTION - II

- Q.7)** (A) Explain the method for determination of Calorific Value of a Highly Volatile Fuel. [07]
- (B) What is Knocking ? Explain how it is related with Octane Number and Cetane Number of a Fuel. [06]
- (C) A coal sample requires 20% excess air for complete combustion. Calculate weight of air for 100 kg coal if coal contains, C = 81%, H = 4%, N = 1.5%, S = 1.2%, O = 3%. [04]

OR

- Q.8)** (A) What is Proximate Analysis ? How it is carried out ? Give significance of percentage of the various components in a coal sample in this analysis. [07]
- (B) (1) Distinguish between low temperature carbonisation and high temperature carbonisation. [03]
- (2) Calculate GCV and NCV of a coal if 1.3 gm of coal is burnt in Bomb calorimeter, raises temperature of 2 litres of water in calorimeter by 4.65°C. Hydrogen percentage in coal is 2% and water equivalent is 690 gm. [03]
- (C) What is Rocket Propellant ? Give important characteristics of good propellant. [04]

- Q.9)** (A) Define Wet Corrosion. Explain Galvanic and Concentration Cell Corrosion with one example each. [07]
- (B) What is Secondary Battery ? Explain the construction, reactions and applications of Lead Acid Battery. [06]
- (C) Distinguish between Anodic Coatings and Cathodic Coatings. [04]

OR

- Q.10)** (A) What is Dry Corrosion ? Explain mechanism involved in it by using suitable example. [07]
- (B) Describe 'Anodic Protection' of metal for the Corrosion Control. [06]
- (C) Describe method of Electroplating of metal. [04]
- Q.11)** (A) Explain principle, instrumentation and working with the help of diagram for Atomic Absorption Spectroscopy. [06]
- (B) State the principle and technique involved in Thin Layer Chromatography. [06]
- (C) State the characteristics of Electromagnetic Radiation. [04]

OR

- Q.12)** (A) Explain experimental techniques of Column Chromatography. [06]
- (B) Give the principle and applications of Gas Chromatography. [06]
- (C) Calculate number of Vibrational Degrees of Freedom for following molecules. [04]
- (1) NH_3
- (2) H_2O
- (3) CO_2
- (4) C_6H_6