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 :

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

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

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

$c = 3 \times 10^{8}$ 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 A°. **[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,

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

$\mu_e = 1{,}300$ cm^2/volt – sec. and number of silicon atoms per unit volume $= 5 \times 10^{22}$. **[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 votls. 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 Propellent ? Give important characteristics of good propellent. [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
