May - June
2010

Total No. of Questions : 12] [Total No. of Printed Pages : 4

[3761]-107

F. E. (Semester - II) Examination - 2010

APPLIED SCIENCE - II

(June 2008 Pattern)

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 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 stream tables is allowed.

(6) Assume suitable data, if necessary.

Constants : $h = 6.63 \times 10^{-34}$ J.s.
$c = 3 \times 10^{8}$ m/s.
$m_e = 9.1 \times 10^{-31}$ kg
$m_p = 1.67 \times 10^{-27}$ kg
$e = 1.6 \times 10^{-19}$ C

SECTION - I

Q.1) (A) Write a note on Proximate Analysis of Coal. **[07]**

(B) What is Rocket Propellant ? Explain different types of Propellants used in Rocket. **[06]**

(C) Observations in the Boy's gas calorimeter experiment on a gaseous fuel are given below, find the G.C.V. and N.C.V. of the Fuel.

Volume of Gas burnt (STP) = 0.08 m^3

Mass of Cooling Water used = 29.5 kg

Rise in temperature of circulating water = 9.1°C

Mass of steam condensed = 0.04 kg **[04]**

OR

Q.2) (A) Describe how the calorific value of a solid fuel is determined using Bomb calorimeter. **[07]**

(B) A sample of coal requires 20% excess air for complete combustion. Calculate weight of air for 250 gm of the coal, if its composition is C = 81%, H = 4%, N = 1.5%, S = 1.2%, O = 3%, ash = 9.3%. **[06]**

(C) Write the Chemical Reactions for :

(1) Production of Hydrogen gas by steam reforming of hydrocarbons.

(2) Production of Biodiesel. **[04]**

Q.3) (A) Explain the factors affecting the Corrosion. **[07]**

(B) Explain electrochemical corrosion in acidic and basic medium. **[06]**

(C) Explain cathodic protection of metals. **[04]**

OR

Q.4) (A) Define corrosion. Explain Atmospheric corrosion by Oxygen for Sodium, Aluminium and Silver. **[07]**

(B) Explain corrosion of Zinc coated steel and Tin coated steel. Which is more protective ? Why ? **[06]**

(C) Describe electroplating of metals. **[04]**

Q.5) (A) What is alkalinity of water ? State the types of alkalinities. How alkalinity in a water sample is determined ? **[06]**

(B) Explain :

(1) Supercooled water and metastable equilibrium in water system.

(2) Triple Point in Water System. **[06]**

(C) Find the number of phases and number of components in the following :

(1) Solution of Sodium Chloride in Water

(2) Mixture of N_2 and O_2 Gases **[04]**

OR

Q.6) (A) What is meant by 'Scale' in Boiler ? How is it formed ? Give any one internal treatment method along with reactions, for treatment of scales. **[06]**

(B) Draw and explain phase diagram for Sulphur System. **[06]**

(C) Explain Zeolite Process of softening of water. **[04]**

SECTION - II

Q.7) (A) Explain the concept of group velocity and wave velocity. Show that group velocity is equal to the velocity of particle. **[06]**

(B) Deduce Schroedinger's time independent wave equation. **[07]**

(C) Calculate de-Broglie wavelength of 10 keV Protons in eV. **[04]**

OR

Q.8) (A) Obtain an expression for energy and wave function of a particle trapped in rigid box. **[07]**

(B) State and explain Heisenberg's uncertainty principle. Illustrate the same with electron diffraction at a single slit. **[06]**

(C) Calculate first two energy eigen values of an electron trapped in an infinite potential well of length $1A^{o}$. **[04]**

Q.9) (A) (1) Explain the terms - Optical pumping and Resonant cavity.

(2) With the help of energy band diagram explain construction and working of Semiconductor Laser. **[07]**

(B) State and explain : **[06]**

(1) Meissner Effect and

(2) Isotope Effect

(C) With the help of neat energy level diagram explain the technique used to achieve population inversion in He-Ne Laser. **[04]**

OR

Q.10)(A) Explain Type-I and Type-II Superconductors. **[06]**

(B) With the help of neat diagram explain construction and working of Ruby Laser. Also comment on 'Ruby Laser is pulsed Laser'. **[07]**

(C) Explain BCS Theory of Superconductivity. **[04]**

Q.11)(A) Explain classification of Solids into conductors, semiconductors and insulators on the basis of energy band theory. **[06]**

(B) Explain synthesis of metal nanoparticles by colloidal route. **[06]**

(C) Draw energy band diagram for P-N junction diode in forward and reverse biased Condition. **[04]**

OR

Q.12)(A) Explain optical properties and electrical properties of nanoparticles. **[06]**

(B) What is Hall Effect ? Obtain an expression for the Hall Voltage and Hall coefficient. State applications of Hall Effect. **[06]**

(C) Calculate the band gap energy in Germanium. Give that it is transparent to radiation of wavelength greater than 17760 A^{o}. **[04]**
