

Total No. of Questions : 12]

[Total No. of Printed Pages : 4

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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 steam 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

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- 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 $1\text{\AA}$. [04]
- Q.9) (A)** (1) Explain the terms - Optical pumping and Resonant cavity. [07]
- (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 $17760 \text{ \AA}$. [04]