

Total No. of Questions : 12]

[Total No. of Printed Pages : 4

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F. E. Examination - 2010

APPLIED SCIENCE - II

(2003 Course)

Time : 3 Hours]

[Max Marks : 100

**Instructions :**

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

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**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) Explain De-Broglie's Concept of Matter Waves. Derive an Expression for the De-Broglie Wavelength in terms of Energy. [06]
- (B) Derive Expressions for Energy and Wave Function of a Particle in a Rigid Box. [07]
- (C) An electron is bound by a potential box of infinite height having a width  $2.5\text{\AA}$ . Calculate the minimum uncertainty in its velocity. [04]

**OR**

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- Q.2)** (A) Derive Schrodinger's Time independent wave equation. [06]  
 (B) State Heisenberg's Uncertainty Principle. Illustrate the same with the help of Electron Diffraction Experiment at a Single Slit. [06]  
 (C) Write short note on Physical Significance of  $\psi$ . [05]
- Q.3)** (A) Explain construction and working of He-Ne Gas Laser with neat labelled diagram. [06]  
 (B) What is Holography ? Write a note on Holography Recording. [04]  
 (C) State and explain : [07]  
 (1) Meissner Effect  
 (2) Critical Fields  
 (3) Zero Resistance

OR

- Q.4)** (A) (1) Explain the Process of Stimulated Emission and Population Inversion. [04]  
 (2) Explain special properties of Laser. [04]  
 (B) What are Ferrites ? Discuss their properties and uses. [06]  
 (C) Discuss applications of Superconductors. [03]
- Q.5)** (A) Show that the Fermi-Level lies exactly at the centre of the energy gap in an Intrinsic Semiconductor. [06]  
 (B) Obtain an expression for the displacement produced when an electric field acts perpendicular to the motion of an electron. [06]  
 (C) Draw energy band diagrams of P-N Junction Diode under Forward Bias and Reverse Bias Conditions. [04]

OR

- Q.6)** (A) Derive an Expression for Conductivity in an Intrinsic and Extrinsic Semiconductors. [06]
- (B) Give the principle, construction and working of an Electron Microscope. [06]
- (C) Electrons accelerated by a potential of 250V enter the electric field at an angle of incidence  $50^\circ$  and get refracted through an angle of  $30^\circ$ . Find the potential difference between the two regions. [04]

## SECTION - II

- Q.7)** (A) What is Proximate Analysis ? Explain the method of analysis of each of these constituents along with the significance ? [07]
- (B) Give composition, boiling range and uses of fractions obtained in distillation of crude oil. [06]
- (C) 0.72 gm of a fuel containing 80% carbon when burnt in a bomb calorimeter, increased the temperature of water from  $27.3^\circ\text{C}$  to  $29.1^\circ\text{C}$ . If the calorimeter contains 250 gm of water and its water equivalent is 150 gm. Calculate HCV in kJ/kg. [04]

OR

- Q.8)** (A) What is meant by Natural Gas ? Give composition, properties and applications of LPG and CNG. [07]
- (B) What is Biodiesel ? Explain the process to get it from animal oil. State advantages of it over conventional diesel. [06]
- (C) A producer gas has the following percentage composition by volume  $\text{CH}_4 = 3.5\%$ ,  $\text{CO} = 25\%$ ,  $\text{H}_2 = 10\%$ ,  $\text{CO}_2 = 10.8\%$ ,  $\text{N}_2 = 50.7\%$ . Calculate theoretical air required per  $\text{m}^3$  of the gas. [04]
- Q.9)** (A) What is Dry Corrosion ? Discuss the role of nature of oxide film formed in oxidation corrosion of metal. State and explain Pilling Bedworth Rule. [07]
- (B) How are Metals Coated by Hot Dipping Technique ? Give the applications of Galvanising and Tinning. [06]
- (C) Distinguish between Cathodic Protection and Anodic Protection. [04]

OR

- Q.10)** (A) What is Wet Corrosion ? Discuss the mechanism of Wet Corrosion. [07]
- (B) Explain Corrosion in Zn Coated Iron and Tin Coated Iron, which is more protective ? And Why ? [06]
- (C) What happens when ? [04]
- (1) Impurity is present in metal.
  - (2) Iron Rod is buried in moist soil.
  - (3) Zn Rod is dipped in  $\text{CuSO}_4$  Solution.
  - (4) A Metal under water drop.
- Q.11)** (A) Give instrumentation involved in UV Visible Spectroscopy. [06]
- (B) State the principle and technique involved in Paper Chromatography. [06]
- (C) Define the terms : [04]
- (1) Wavelength
  - (2) Frequency
  - (3) Wavenumber
  - (4) Energy
- OR
- Q.12)** (A) Describe principle and experimental setup of Column Chromatography. [06]
- (B) Give applications of IR Spectroscopy. [06]
- (C) Define the terms : [04]
- (1)  $R_f$
  - (2)  $R_x$
  - (3) Chromatogram
  - (4) Elution