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First Semester B.E. Degree Examination, Dec.2017/Jan.2018
Engineering Physics

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing one full question from each module.

2. Physical constants : Velocity of light, $c = 3 \times 10^8$ m/s

Planck's constant, $h = 6.63 \times 10^{-34}$ JS

Mass of electron, $m_e = 9.1 \times 10^{-31}$ kg

Charge of electron, $e = 1.6 \times 10^{-19}$ C

Boltzmann constant = 1.38×10^{-23} JK⁻¹

Avagadro number = 6.02×10^{23} /mol

Module-1

- 1 a. Write the assumptions of Planck's law of radiation. Deduce Wein's law and Rayleigh-Jeans law from Planck's law of radiation. (07 Marks)
- b. Set up time independent one dimensional Schrodinger wave equation. (06 Marks)
- c. What is Compton effect? Explain its physical significance. (03 Marks)
- d. An electron is bound in an one dimensional potential well of width 1 \AA , but if infinite wall height. Find its energy values in the ground state, and also in the first excited states. (04 Marks)

OR

- 2 a. State Heisenberg's uncertainty principle. Show that electrons cannot exist inside the nucleus. (07 Marks)
- b. State de Broglie hypothesis and show that group velocity is equal to particle velocity. (06 Marks)
- c. Briefly explain three properties of wave function. (03 Marks)
- d. Compute the de Broglie wavelength for an electron moving with one tenth part of the velocity of light. (04 Marks)

Module-2

- 3 a. Explain Fermi energy and Fermi factor. Explain the variation of Fermi factor with temperature. (07 Marks)
- b. Derive the expression for electrical conductivity of an intrinsic semiconductor. (05 Marks)
- c. Write a note on Meglave vehicles. (04 Marks)
- d. The electron concentration in a semiconductor is $5 \times 10^{17} \text{ m}^{-3}$. Calculate the conductivity of the material if the drift velocity of electron is 350 ms^{-1} in an electric field of 1000 Vm^{-1} . (04 Marks)

OR

- 4 a. Discuss the merits of quantum free electron theory. (06 Marks)
- b. What is superconductivity? Explain Type-I and Type-II superconductors. (06 Marks)
- c. What is (i) mean collision time, (ii) drift velocity, (iii) Meissner effect? (04 Marks)
- d. Calculate the Fermi velocity and the mean free path for the conduction electrons in silver, given that its Fermi energy is 5.5 eV and the relaxation time for electrons is $3.83 \times 10^{-14} \text{ S}$. (04 Marks)

Module-3

- 5 a. Define angle of acceptance and numerical aperture. Obtain an expression for the numerical aperture of an optical fiber. (07 Marks)
- b. What is holography? Explain the principle of construction of hologram with suitable ray diagram. (05 Marks)
- c. Explain the processes of spontaneous emission and stimulated emission. (04 Marks)
- d. A medium in thermal equilibrium at temperature 300 K has two energy levels with a wavelength separation of $1 \mu\text{m}$. Find the ratio of population densities of the upper and lower levels. (04 Marks)

OR

- 6 a. Describe the construction of CO_2 laser and explain its working with the help of energy level diagram. (06 Marks)
- b. Discuss the three types of optical fibers with suitable diagrams. (06 Marks)
- c. Mention four applications of LASER. (04 Marks)
- d. The angle of acceptance of an optical fiber is 30° when kept in air. Find the angle of acceptance when it is in a medium of refractive index 1.33. (04 Marks)

Module-4

- 7 a. Explain in brief the seven crystal systems with neat diagrams. (07 Marks)
- b. Explain the crystal structure of diamond with neat sketch and calculate its atomic packing factor. (06 Marks)
- c. Define unit cell, primitive cell and Bravais lattice. (03 Marks)
- d. Calculate the glancing angle for incidence of x-rays of wavelength 0.58 \AA on the plane (132) of NaCl which results in second order diffraction maxima taking the lattice constant as 3.81 \AA . (04 Marks)

OR

- 8 a. What are Miller indices? Derive an expression for interplanar distance in terms of Miller indices. (07 Marks)
- b. Define coordination number and packing factor. Calculate the packing factor for SCC and FCC structure. (06 Marks)
- c. Derive Bragg's law. (04 Marks)
- d. Draw the following planes in a cubic unit cell: i) (1 1 1) ii) (1 0 1) iii) (0 $\bar{1}$ 1). (03 Marks)

Module-5

- 9 a. Describe the construction and working of Reddy's shock tube. (06 Marks)
- b. Discuss the variation of density of energy states for 3D, 2D, 1D and 0D structures. (06 Marks)
- c. Describe sol gel method of producing nano particles. (05 Marks)
- d. Mention any three applications of nano particles. (03 Marks)

OR

- 10 a. Describe the principle, construction and working of a scanning electron microscope. (08 Marks)
- b. Define: i) Mach number ii) Subsonic waves (04 Marks)
- iii) Supersonic waves iv) Ultrasonic waves. (04 Marks)
- c. Explain pyrolysis method of obtaining carbon nanotubes. (04 Marks)
- d. The distance between the two pressure sensors in a shock tube is 100 mm. The time taken by a shock wave to travel this distance is 100 microsecond. If the velocity of sound under the same conditions is 340 ms^{-1} , find the Mach number of the shock wave. (04 Marks)

USN

I H M I 7 M E O I S

First Semester B.E. Degree Examination, Dec.2017/Jan.2018
Engineering Chemistry

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

- 1 a. What are reference electrodes? Describe the construction and working of Calomel electrode, mention the uses. (07 Marks)
- b. Define Battery. Explain construction, working and uses of Ni-metal Hydride battery. (07 Marks)
- c. What are fuel cells? Explain the construction and working of Methanol oxygen cell. (06 Marks)

OR

- 2 a. Define single Electrode Potential? Derive Nernst equation for single electrode. (07 Marks)
- b. What are concentration cells? The cell potential of Ag concentration cell, $\frac{\text{Ag}_{(s)}}{\text{AgNO}_3} (0.001\text{M}) \parallel (\text{AgNO}_3(\text{XM}) / \text{Ag}_{(s)})$ is 0.0659 V at 25°C. Write the cell reactions and calculate the value of X. (07 Marks)
- c. Write a note on: (i) Capacity (ii) Cycle life (iii) Voltage (06 Marks)

Module-2

- 3 a. Define corrosion. Explain electrochemical theory of corrosion by taking Iron as an example. (07 Marks)
- b. What is Anodizing? Explain anodizing of aluminium, mention uses. (07 Marks)
- c. Define Electroless plating. What are the differences between electro plating and electroless plating? (06 Marks)

OR

- 4 a. What is differential aeration corrosion? Explain pitting corrosion with anode and cathode reactions. (07 Marks)
- b. Define metal finishing? Explain electroplating of Nickel by Watt's bath, mention the uses. (07 Marks)
- c. What is cathodic protection? Explain the sacrificial anode method and impressed current method. (06 Marks)

Module-3

- 5 a. Define GCV and NCV? How calorific value of a solid/liquid fuel is determined using bomb calorimeter. (07 Marks)
- b. Define octane and cetane number? What is the objective of reforming of petrol and discuss the various methods of reforming. (07 Marks)
- c. What are solar cells? Describe the method of purification of silicon by zone refining. (06 Marks)

OR

- 6 a. A coal sample containing 92% C, 7% H₂ and 3% Ash is subjected to combustion in a bomb calorimeter. Calculate the Gross and Net calorific values. Given that mass of coal sample is 0.85×10^{-3} kg, mass of water in copper calorimeter is 2 kg, water equivalent of calorimeter is 0.75 kg, rise in temperature of water is 2.5°C, latent heat of steam is 2454 kJ/kg and specific heat of water is 4.187 kJ/kg/°C. (07 Marks)
- b. Describe the production of solar grade Si by union carbide process. (07 Marks)
- c. Explain the construction and working of a PV cell. (06 Marks)

Module-4

- 7 a. What are polymers? Illustrate the mechanism of addition polymerization by taking vinyl chloride as an example. (07 Marks)
- b. Describe the manufacture of, (i) PMMA (ii) Kevlar. Mention the uses. (07 Marks)
- c. Define addition and condensation polymerization process with one example each. (06 Marks)

OR

- 8 a. Define Glass Transition Temperature. Explain any three factors affecting T_g. (07 Marks)
- b. What are Elastomers? Give the synthesis and applications of, (i) Silicone rubber (ii) Epoxy resin. (07 Marks)
- c. A polymer sample containing 50, 100 and 150 molecules having molar mass 2000 g/mol, 2500 g/mol and 3000 g/mol respectively. Calculate the number average and weight average molecular mass of polymer. (06 Marks)

Module-5

- 9 a. What is Boiler Feed Water? Explain the differences between scale and sludge formation in boiler. (07 Marks)
- b. What is desalination? Explain the desalination of sea water by electrodialysis. (07 Marks)
- c. What are nano materials? Explain the synthesis of nano material by Sol.gel method. (06 Marks)

OR

- 10 a. Define COD and BOD. In COD test 25.5 cm³ and 12.5 cm³ of 0.05 N FAS solution are required for blank and sample titration respectively. The volume of the test sample used is 26 cm³. Calculate the COD of the sample solution. (08 Marks)
- b. Describe the synthesis of nano materials by chemical vapor condensation process. (06 Marks)
- c. Write a note on CNT and Dendrimers. (06 Marks)
