B.E. / B.Tech. (Model Curriculum) Semester-I & II
BSC101 - Physics

P. Pages : 2

Time : Three Hours

6458

Max. Marks : 80

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Notes :
1. All questions carry equal marks.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Diagram and chemical equation should be given wherever necessary.
5. Illustrate your answers wherever necessary with the help of neat sketches.
6. Use of Non Programmable Electronic Calculator is allowed.

List of constants:

1) Plank's constant, $h = 6.634 \times 10^{-34}$ Js.

2) Free space permittivity, $\varepsilon_0 = 8.85 \times 10^{-12}$ F/m.

3) Mass of electron, $m_e = 9.1 \times 10^{-31}$ Kg.

4) Charge on electron, $e = 1.602 \times 10^{-19}$ C.

5) Velocity of light, $c = 3 \times 10^8$ m/s.

1.	a)	What is de-Broglie Hypothesis? Describe an experiment which support de-Broglie Hypothesis.	**6**
	b)	State Heisenberg's uncertainty principle and prove that electron do not exist inside the nucleus.	**6**
	c)	An electron and a 150 gm baseball are travelling at 220 m/sec, measured to an accuracy of 0.005%. Calculate uncertainty in the position of each.	**4**

OR

2.	a)	Write down a Schrodinger time independent wave equation for matter waves. Hence obtain the expression for energy of a particle in one dimensional potential well of infinite height.	**6**
	b)	Define phase velocity and group velocity and derive the relation between them.	**6**
	c)	An electron is confined to move between two rigid walls separated by 1 nm. Find the first two allowed energy states of the electron.	**4**

3.	a)	Draw energy level diagram for Ge.	**6**
	b)	Show that the probability of occupation of level ΔE above E_F is the same as the probability of non-occupation of level ΔE below E_F.	**6**
	c)	Determine the probability of an electron thermally excited into the conduction band in germanium at 27°C; if the band gap is 0.72 eV.	**4**

OR

4.	a)	Derive an expression for the barrier potential, V_0.	**6**
	b)	Draw energy band diagram for p-n-p transistor when biased in common base mode and in unbiased mode.	**6**

	c)	Calculate the conductivity of pure Si at room temperature, if carrier concentration is $1.6 \times 10^{16} / m^3$, electron mobility is $1500 \, cm^2 / V.sec$ and hole mobility is $500 \, cm^2 / V.sec$.	4
5.	a)	Derive an expression for energy stored in capacitor.	6
	b)	Derive an expression for induce surface charge density.	6
	c)	If a NaCl crystal subjected to an electric field of 1000 V/m and the resulting polarization is $4.3 \times 10^{-8} \, cm^2$, calculate the relative permittivity of NaCl.	4

OR

6.	a)	Explain electronic Polarization.	6
	b)	Derive Clausius-Mosotti equation.	6
	c)	The number of atoms in volume of one cubic meter of hydrogen gas is 9.8×10^{26}, the radius of hydrogen atom is 0.53 A°. Calculate the polarization and relative permittivity.	4
7.	a)	i) Write a short note on Thin Film	6
		ii) Anti reflection coating and its application	
	b)	Derive an expression for deflection of electron due to transvers electric field.	6
	c)	Newton's rings are observed in reflected light of wavelength 590 nm. The diameter of the 10th ring is 0.6 cm. Find the radius of curvature of lens.	4

OR

8.	a)	Draw the block diagram of a CRO. Explain the working of Trigger Circuit.	6
	b)	Explain the concept of Velocity Filter with neat labelled diagram.	6
	c)	In a Bainbridge mass spectrograph the electric field used is $8 \times 1014 \, V/m$, the magnetic field common to both places is $0.20 \, Wb/m^2$. If the ion source consists of singly ionized neon isotopes of atomic masses 20 & 22, Calculate linear separation of lined formed on photographic plate.	4
9.	a)	Explain the terms:	6
		i) Population inversion	
		ii) Metastable state	
		iii) Pumping	
	b)	Explain construction and working of Ruby laser with the help of energy level diagram.	6
	c)	White light has frequency range from $0.4 \times 10^{15} \, Hz$ to $0.7 \times 10^{15} \, Hz$ find the coherence time and coherence length.	4

OR

10.	a)	Draw structure of optical fiber and write function of each part.	6
	b)	Deduce the expression for acceptance angle of an optical fiber.	6
	c)	Calculate the numerical aperture and acceptance angle for an optical fiber whose core R.I. is 1.48 and cladding R.I. is 1.39.	4

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