Reg. No.															

Question Paper Code	13756

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2025

Second Semester

Electronics and Communication Engineering

(Common to Electrical and Electronics Engineering & Computer and Communication Engineering)

24BSPH201 - PHYSICS OF ELECTRONIC DEVICES

Regulations - 2024

Duration: 3 Hours Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	Quantum free electron theory assumes electrons are charged particles and obey …….. principle. (a) Pauli's Exclusion (b) Aufbau (c) Hund's (d) None of the above	1	K1	CO1
2.	The resistance of the conductor is inversely proportional to …….. (a) Length (b) area of cross-section (c) Temperature (d) resistivity	1	K1	CO1
3.	A direct Band gap semiconductor emits energy as…… (a) phonon (b) photon (c) positron (d) exciton	1	K1	CO2
4.	The Fermi level shifts ……. in intrinsic semiconductor with increase in temperature. (a) upward (b) downward (c) either upward or downward (d) neither upward nor downward	1	K2	CO2
5.	The relation between β and α is …….. (a) $\beta = 1 / (1 - \alpha)$ (b) $\beta = (1 - \alpha) / \alpha$ (c) $\beta = \alpha / (1 - \alpha)$ (d) $\beta = \alpha / (1 + \alpha)$	1	K1	CO3
6.	After peak point, the UJT operates in the _____ region (a) Cut-off (b) Saturation (c) Negative resistance (d) None of the above	1	K1	CO3
7.	Identify the expression for magnetic induction from the following. (a) $B = \mu_o(H+I)$ (b) $B = \mu_o(H \times I)$ (c) $B = \mu_o(H-I)$ (d) $B = \mu_o(H/I)$	1	K1	CO4
8.	When the electrical field is applied to the dielectric, the force acting on nucleus and electron cloud is ……. (a) Lorentz force (b) Coulomb force (c) Electric force (d) Magnetic force	1	K1	CO4
9.	Identify the key characteristic of the Franz-Keldysh effect? (a) A sharp, sudden increase in absorption at the bandgap. (b) A gradual increase in absorption below the bandgap. (c) A decrease in absorption below the bandgap. (d) A shift in the bandgap energy.	1	K2	CO5
10.	Which material system is often used to create quantum wells in optoelectronics? (a) GaAs/AlGaAs (b) Cu/Fe (c) Si/SiO_2 (d) Ag/Au	1	K1	CO6

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

11.	State Wiedemann Franz law.	2	K1	CO1
12.	Using Fermi function, evaluate the probability of an electron in a metal with $E-E_F = 0.01eV$ at 300 K.	2	K2	CO1
13.	What is negative temperature coefficient of resistance?	2	K1	CO2
14.	The following data are given for an intrinsic Ge at 280 K. Calculate the conductivity of the sample. ($n_i = 2.5 \times 10^{19} m^{-3}$, $\mu_e = 0.35\ m^2 V^{-1} S^{-1}$, $\mu_p = 0.19\ m^2 V^{-1} S^{-1}$).	2	K2	CO2
15.	Write the design of the base, emitter and collector of a BJT.	2	K1	CO3
16.	Differentiate a BJT and FET.	2	K2	CO3
17.	Draw hysteresis curve.	2	K2	CO4

18.	List the types of dielectric breakdown.		*2*	*K1*	*CO4*
19.	Mention the process of carrier recombination that takes place in materials.		*2*	*K1*	*CO5*
20.	Compare linear and nonlinear optical effects.		*2*	*K2*	*CO5*
21.	Define the Coulomb blockade effect.		*2*	*K1*	*CO6*
22.	Illustrate the confinement in quantum structures.		*2*	*K2*	*CO6*

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23.	a)	State the assumptions o f classical free electron theory model and apply it to derive the electrical conductivity of solids.	*11*	*K3*	*CO1*
		OR			
	b)	Use band theory of solids, derive an expression for the effective mass of an electron moving in energy bands.	*11*	*K3*	*CO1*
24.	a)	Obtain an expression for the carrier concentration of electrons in the conduction band of an n-type semiconductor with a neat energy band diagram.	*11*	*K3*	*CO2*
		OR			
	b)	Apply carrier transport semiconductor principles to explain the construction, working and V-I characteristics of a P-N Junction diode. Also discuss the advantages and applications of P-N Junction Diode.	*11*	*K3*	*CO2*
25.	a)	Demonstrate with a neat sketch, the construction, working, of an N-channel D-MOSFET.	*11*	*K2*	*CO3*
		OR			
	b)	Explain the semiconductor conduction principle to explain the construction, working operation and characteristics of SCR with a neat sketch.	*11*	*K2*	*CO3*
26.	a) (i)	Discuss the types of energy involved in the domain growth.	*6*	*K2*	*CO4*
	(ii)	Brief the cause for magnetism and classify materials.	*5*	*K2*	*CO4*
		OR			
	b) (i)	Brief the types of polarization in dielectrics.	*6*	*K2*	*CO4*
	(ii)	Deduce the Clausius- Mossoti equation applying internal field.	*5*	*K2*	*CO4*
27.	a)	Briefly discuss about emission of light from metals and semiconductors.	*11*	*K2*	*CO5*
		OR			
	b)	Explain construction and working of self electro-optic effect devices (SEED) with a neat diagram.	*11*	*K2*	*CO5*
28.	a)	Explain how the construction and working of single electron transistors.	*11*	*K3*	*CO6*
		OR			
	b)	Develop ways to tune the wavelength of light emitted from a quantum dot. And also utilize it for the construction and working of quantum dot lasers.	*11*	*K3*	*CO6*