First/Second Semester B.E. Degree Examination, December 2010 **Engineering Physics**

Tir	ne:	3 hrs. Max. Marks:100
N	3	 Answer any FIVE full questions, choosing at least two from each part. Answer all objective type questions only in OMR sheet page 5 of the answer booklet. Answer to objective type questions on sheets other than OMR will not be valued. Physical constants: Mass of the electron = m = 9.11 × 10³¹ kg, Charge of the electron = e = 1.6 × 10¹⁹ C, Velocity of light = c = 3 × 10⁸ m/s, Planck's constant = h = 6.626 × 10³⁴ J-S, Boltzmann constant = k = 1.38 × 10²³ J/K, Permittivity of free space = €₀ = 8.854 × 10¹² F/m, Avogadro number = NA = 6.022 × 10²⁶/K mole.
1	a.	Choose your answers for the following: i) In the black body radiation spectrum, with increasing temperature, the wavelength corresponding to maximum intensity shifts towards:
-	H	A) Longer wavelength side C) Initially longer, later shorter wavelength side The Davisson Germer experiment establishes B) Shorter wavelength side D) None of these
		A) Particle nature of X rays B) Dual nature of light C) Dual nature of particles D) Wave nature of particles iii) For a wave packet A) V _{gp} = V _{particle} B) V _{gp} = V _{phase} C) V _{gp} = G D) None of these
•		iv) For a photon and electron of equal wavelengths, their A) Energies are equal C) Both A and B D) Neither A nor B (04 Marks)
		Define phase velocity and group velocity. Derive an expression for the de Broglie wavelength from the concept of group velocity. An electron has a de Broglie wavelength 3 nm, and rest mass 0.511 eV. Determine its group velocity and kinetic energy. (06 Marks)
2	a.	Choose your answers for the following: i) The eigen functions associated with a system are A) Single valued and continuous B) Finite and continuous C) Finite, single valued and continuous D) Infinite, continuous and single valued
X		 ii) In the expression p = √2mE where p is the momentum, E represents A) Kinetic energy B) Total energy C) Potential energy D) Rest energy iii) For a particle moving in a potential well, the probability of finding it anywhere over the width of the well is A) 1.0 B) 0.0 C) 0.5 D) 1.5
	h	iv) For a free particle, the energy eigen values are A) Quantized—B) Continuous C) Zero D) None of these (04 Marks) Determine the energy eigen values and eigen functions for a particle in a one dimensional
		potential well of infinite height. (10 Marks) State Heisenberg's uncertainty principle. A spectral line of wavelength 546.1 nm has a width 10 ⁻⁵ nm. Estimate the minimum time spent by electrons in the excited state during transitions. (06 Marks)

3	a							
•		i) The unit (units) of electric field intensity, E, is (are) A) Volt/m B) N/Coulomb C) J/Coulomb D) Both A and						
		A) Volt/m B) N/Coulomb C) J/Coulomb D) Both A and ii) In a conductor, the resistivity, ρ, increases as						
3		A) Temperature decreases B) Temperature increases						
19		C) Does not depend on temperature D) None of these						
2		iii) The Fermi factor at E_{F_0} for $T > 0$ k is						
F		A) 0 B) 0.5 C) 1.0 D) 0.25	0					
	-	iv) The mobility μ of conduction electrons in a metal is given by	die die					
		A) $\frac{E}{V_d}$ B) $\frac{V_d}{E}$ C) $\frac{\sigma}{ne}$ D) Both B and C	(04 Marks)					
	b.	Derive an expression for the electrical conductivity, σ , in a metal.	(06 Marks)					
	c.	Discuss any two successes (or merits) of the quantum free electron theory of condu						
		The Fermi level for a metal is 3.1 eV, Calculate the energies for which the prob	(06 Marks)					
	d.		(04 Marks)					
		occupancy at 500 K are 5070 and 5070.	(4 - 1 - 1 - 1 - 1 - 1 - 1					
	50.	Cl. Cl. Cl. Cl.						
4	a.	Choose your answers for the following: i) The dipole moment of two charges +q and -q separated by a distance d is given	en by					
		-2/						
		A) +qd B) -qd C) $\frac{q^2}{d}$ D) $\frac{q^2}{d}$						
		ii) Temperature independent polarization mechanisms are	P .					
		A) Electronic and orientational B) Ionic and orientational						
		C) Electronic and space charge						
		D) Electronic and ionic						
		iii) Ferroelectric materials are						
		A) Magnetic						
		B) Dielectrics C) Magnetic materials which behave like dielectrics						
	•	D) Dielectric materials that behave like magnetic	8					
	đ	iv) In the B-H curve, the points X and Y represent respectively	3					
		A) Coercive field and remnant magnetiza	tion					
3 B	*	B) Remnant magnetization and coercive						
		C) Saturation density and coercive field	100 2136.000					
e 1		D) Remnant magnetization and susceptib	ility					
		Fig.Q4(a)(iv)						
	1.8		(04 Marks)					
	b.		(08 Marks)					
	c.		(04 Marks)					
ž	d.	A solid dielectric material has electronic polarisability equal to 7×10^{-40} Fm ² . If it						
		structure, calculate the relative permittivity of the material if it has 3×10^{28} atoms/m ³ .						

(04 Marks)

PART - B

5	a.	Choose your answers for the following:						
		i)	The life time of an A) Nano seconds	n electron in a metast B) Micro second			lli seconds	
	Ē	ii)	,	chanism for pumping	g in a diode laser i	s		
			A) Forward bias	B) Optical		lischarge D) No		
٠,		iii)	7.72	er pulse is 10 ⁻¹⁰ J. If	the power of the	laser is 8 mW, the	e duration of	
			the pulse is A) 125 ns	B) 0.125 ns	C) 12.5 ns	D) 1.25 ns	1.0	
		iv)		r the ratio of the parti			N #	
	e:		A) 1:10	B) 10:1	C) 1:100	D) 100:1	(04 Marks)	
	b.			construction and v		niconductor laser		
		adva	ntages and two app	lications of the same	: 1	10-30 TE 46 - 4-	(12 Marks)	
	c.	the o	ratio of population	of two energy states t is the wavelength o	in a laser is 1.055	$9 \times 10^{\circ}$. If the term	(04 Marks)	
		me s	ystem is 37 C, wha	t is the wavelength o	i the faser:	2 A	(041Marks)	
			.e.	NOT CAR WAY G				
6	a.	4.70	ose your answers fo					
		i)	Type – I supercon		C) Ferromagne	etic D) Antifer	Tomagnetic	
		ii)		B) Paramagnetic ctor, stronger the mag	,		Tomagnetic	
		11)					ture	
		A) Higher is the critical temperature C) Critical temperature remains same B) Lower is the critical temperature D) None of these						
		iii)		odes supported by an	The state of the s			
		134 Sa A & 1.00	A) 1600	The second secon	C) 800	D) 3200		
		iv)		perture of an optic	al fiber is 0.309	. Its angle of a	cceptance is	
			approximately	T) 150	C) 10.50	D) 17 60		
	i.	ъ.	A) 18°	B).17°	C) 18.5°	D) 17.5°	(04 Marks)	
				ray propagation thro		er.	(06 Marks) (06 Marks)	
•	c. d.			n, working and applic wer 200 mW loses		r after traveling a		
	u.			ation coefficient of the		anior davoring a	(04 Marks)	
*		5000			1	9		
ੂੰ ਵ		~ !						
7	a.	Choose your answers for the following: i) The inter atomic distance for the NaCl lattice is						
		i)	i ne inter atomic c	iistance for the NaCl	lattice is	77 - 0	•	
			A) 5.63 Å	B) 2.81 Å	C) 11.26 Å	D) 1.41 Å		
		ii)		tice points/unit cell in				
			A) 4	B) 6	C) 2	D) 8		
		iii) According to Bragg's law which of the following triplets corresponds to the first						
			orders of reflectio	n? 4° B) 12°, 24.57°,	29 60 (1) 150 20	2 40 420 10 140	200 420	
	,	iv)	- Printfild - Marianana and Thin - 12 - 10 and 12 - 12	ectrometer, if the dete				
		14)	rotated by	edometer, if the det	color rolates by 0	, the orystal table	would have	
			A) 3°	B) 12°	C) 2°	D) 9°	(04 Marks)	

	b. Arrive at an expression for the inter planar spacing for a family of Bravais plandices (h, k, l).						vais planes	lanes with miller (06 Marks)	
	c.	Determine the coordination number, number of lattice points per unit cell and atomic packing factor for the FCC lattice. (or face centred cubic lattice) (06 Marks)							
	d.			nes in the unit cube	and the second s		·)	(04 Marks)	
8	a.	Choose your answers for the following: i) Reduction of 3-d bulk material in all the three directions results in							
			d firen	B) 1 d wire	C) Quantum) Quantum	particle	
	БŤ	A) L		lling, the dimension B) L	C) L ²	D D	is 0) L ⁻²	CA.	
		iii) Whic							
		A) Ultrasound method C) Testing by chemical interaction iv) Ultrasonic waves in solids are		B) Dynamic testing D) Magnetic methods					
	İ	A) L	ongitudinal		B) Transver D) None of			(04 Marks)	
b. Write short notes on: i) Carbon nano tube ii) Self organization on the nano so							nano scale	ale (08 Marks)	
	c. Discuss the principle and working of the ultrasonic method of nondestructive to							ing. (08 Marks)	
				* * *	* *				
	(47) 47) 47) 47) 47) 47) 47) 47) 47) 47)								