16PH22

USN | | | | | | | | | | |

R. V. COLLEGE OF ENGINEERING

Autonomous Institution affiliated to VTU

II Semester B. E. Examinations Apr/May-17

Common to All Branches

ENGINEERING PHYSICS

Time: 03 Hours ***Maximum Marks: 100***

Instructions to candidates:

1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B. In Part B question number 2, 7 and 8 are compulsory. Answer any one full question from 3 and 4 &one full question from 5 and 6.

Physical constants : *Planck's constant* $= 6.625 \times 10^{-34} Js$

Boltzmanns constant$= 1.380662 \times 10^{-23} Jk^{-1}$

Velocity of light $= 3 \times 10^{8} ms^{-1}$

Mass of electron $= 9.11 \times 10^{-31} Kg$

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

Mass of proton/neutron $= 1.67 \times 10^{-27} Kg$

$\varepsilon_0 = 8.854 \times 10^{-12} F - m$

PART A

1	1.1	Name the interaction of radiation with matter relevant in the production of laser	01
	1.2	Find the wavelength of light given by GaAs laser. GaAs has a band gap of $104eV$.	01
	1.3	Write Heisenberg's uncertainty relation in terms of energy and time.	01
	1.4	List any two characteristics of matter waves.	01
	1.5	Write the relation for period of a simple harmonic motion in terms of force constant.	01
	1.6	Write the condition for critical damping.	01
	1.7	Find the Fermi velocity of electron in silver in an energy level at $5.5eV$.	01
	1.8	What is doping in semiconductors?	01
	1.9	Write the relation for coefficient of thermal conductivity in terms of rate of conduction and temperature gradient.	01
	1.10	Name the temperature dependent dielectric polarization.	01
	1.11	Draw the block diagram of point to point communication using optical fiber.	02
	1.12	Find the wavelength of electron accelerated by a potential difference of $1V$.	02
	1.13	Write the conditions for simple harmonic motion.	02
	1.14	Define mobility of charge carrier.	02
	1.15	Find the polarization produced in Nacl by an electric field of $600v/m$, if it has a dielectric constant of 6.	02

PART B

2	a	Explain the working of He-Ne laser with neat energy level diagram, specially mentioning the role of He atoms in the working.	07
	b	Derive the necessary condition for light propagation in an optical fiber. Explain how the light gathering power of the fiber can be improved.	06
	c	A continuous $12\,km$ long optical fiber link has a loss of $1.5\,dB/km$. Find the minimum optical power that must be launched into the fiber to maintain an optical power level of $0.3\,\mu W$ at receiving end.	03

3	a	Explain de-Broglie hypothesis. Describe the group velocity and phase velocity of matter waves and derive the dispersive relation between them.	08
	b	Build one dimensional time independent Schrodinger's wave equation.	05
	c	An electron is confines in a potential box of width $2A^0$. Find the minimum uncertainty in the momentum of electron assuming it is equal to its momentum and find the least energy value of that electron.	03
		OR	
4	a	Explain the principle and working of scanning electron microscope(SEM). Explain how resolution of SEM is increased in it.	07
	b	Describe a one dimensional quantum potential box of infinite height. Hence arrive at the energy eigen values and eigen functions of the particle in the box.	07
	c	Find the lowest energy of neutron confined to a nucleus of size $10^{-14}m$. Given the mass of neutron= $1.67 \times 10^{-27}kg$.	02
5	a	Construct the differential equation for an undamped physical system which executes simple harmonic motion. Explain the solution and the variation of kinetic energy and potential energy in one cycle.	0
	b	Apply the theory of forced oscillations to series LCR circuit and obtain an expression for current.	06
	c	If an iron ball of weight 89.00 N stretches a spring 10.00 cm. How many cycles per minute will this mass-spring system executes if allowed to oscillate? Represent the motion in terms of an equation when the amplitude is 15 cm.	04
		OR	
6	a	Explain simple harmonic motion and mention its characteristics. Deduce an expression for period of a torsional pendulum in terms of moment of inertia.	06
	b	Construct differential equation for a damped simple harmonically oscillating system. Explain how the sustained oscillation can be maintained in such systems.	06
	c	In a under damped motion of a body of mass 0.5 kg the time between two successive maxima is 0.35 and maximum amplitude decreases ½ its initial value after 10 cycles. Find the damping constant of the system.	04
7	a	Derive the expression for electron density in the conduction band of an intrinsic semiconductor. By analogy write the expression for hole density in the valence band.	07
	b	Mention the failures of classical free electron theory and write the assumptions of quantum free electron theory.	05
	c	Find the temperature at which we can expect a 10% probability that the electrons in silver have an energy which is 1% that of Fermi energy and above Fermi level. $E_F = 5.5eV$ for silver.	04
8	a	Explain how coefficient of thermal conductivity for a good conductors can be determined by Searle's method. Explain why this method cannot be used for the measurement of thermal conductivity of poor conductor. What is dielectric polarization and dielectric loss?	07
	b	Describe the polarization with frequency variation and also the dielectric absorption.	05
	c	Design a parallel plate capacitor using mica which will give a capacitance of $0.0252\mu F$. The mica sheets are available only in $2.5 \times 10^{-4}cm$ thickness. Dielectric constant of mica is 7 and dielectric strength is $4 \times 10^6 v/m$.	04