INSTITUTE OF AERONAUTICALENGINEERING

(Autonomous)
Dundigal,Hyderabad-500043

FRESHMAN ENGINEERING

TUTORIAL QUESTION BANK

Course Name	:	**ENGINEERING PHYSICS**
Course Code	:	**AHS007**
Class	:	I B. Tech I Semester
Branch	:	Common for ECE/CSE/EEE/IT
Year	:	2016 – 2017
CourseCoordinator	:	Dr.Rizwana, Professor, Department of Freshman
Course Faculty	:	Dr. A Jayanth Kumar, Dr. Rizwana, Ms. S Charvani, Ms. K Sowmya, Mr. K Sai Baba, Dr. N RajeswaraRao, Mr. V S K Prasad Rao

OBJECTIVES

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner's learning process.

S No	QUESTION	Blooms taxonomy level	Course Outcomes
	UNIT – I **DIELECTRIC AND MAGNETIC PROPERTIES**		
Part - A(Short Answer Questions)			
1	**Explain** the terms: i Di-electric constant ii Electric polarization	Remember	1, 3
2	**Explain** the terms: i. Displacement vector ii. Electric susceptibility	Remember	1, 3
3	**Explain** the terms: i. Polarization vector ii. Polarizability	Remember	1, 3
4	**Explain** the terms: i. Electric dipole ii. Electric dipole moment	Remember	1, 3
5	**Define** the types of polarizations in dielectrics.	Remember	1, 3
6	**What** is meant by polarization mechanism in dielectrics?	Remember	1, 3
7	**What** is electronic polarization?	Remember	1, 3
8	**What** is ionic polarization?	Remember	1, 3
9	**What** is orientation polarization?	Remember	1, 3
10	**What** is internal field in dielectric material?	Understand	1, 3

11	**Write** an expression for internal field in dielectric material.	Remember	1, 3
12	**Explain** the terms: i. Magnetic induction ii. Magnetic susceptibility	Remember	1, 4
13	**Explain** the terms: i. Magnetic field intensity ii. Permeability	Remember	1, 4
14	**Explain** the terms: i. Relative permeability ii. Magnetic moment	Remember	1, 4
15	**Explain** Magnetization.	Remember	1, 4
16	**What** is Bohr magneton? Explain.	Analyze	1, 4
17	**Mention** the types of magnetic materials based on electron spins.	Analyze	1, 4
18	**What** is hysteresis loop?	Understand	1, 4
19	**Define** retentivity.	Understand	1, 4
20	**Define** coercivity.	Understand	1, 4
Part - B (Long Answer Questions)			
1	**What** is meant by polarization mechanism in dielectrics? Discuss different polarization mechanism in dielectrics.	Understand	1, 3
2	**What** is electronic polarization? Derive an expression for electronic polarizability in terms of the radius of the atom.	Analyze	1, 3
3	**What** is ionic polarization? Derive an expression for ionic polarizability.	Analyze	1, 3
4	**What** is local field in a dielectric material? Derive an expression for it by Lorentz method	Analyze	1, 3
5	**Explain** the origin of magnetic moment. Find the magnetic dipole moments due to orbital and spin motions of an electron.	Remember	1, 4
6	**What** are the characteristics of diamagnetic, paramagnetic and ferromagnetic substances? Explain their behavior with the help of examples.	Understand	1, 4
7	**Explain** domain theory of ferromagnetism.	Understand	1, 4
8	**Explain** the Hysteresis curve exhibited by Ferromagnetic material on the basis of domain theory	Understand	1, 4
Part - C (Analytical Questions)			
1	**Find** the electric susceptibility of a dielectric gas having dielectric constant of 1.000041.	Apply	2, 3
2	A parallel capacitor has an area of 100cm^2, a plate separation of 1 cm and is charged to a potential of 100 Volts. **Calculate** the capacitance of the capacitor and the change on the plates.	Apply	2, 3
3	The dielectric constant of He gas is 1.0000684. **Find** the electronic polarizability of He atoms if the gas contains 2.7 x 10^{25} atoms per m^3.	Apply	2, 3
4	A solid dielectric with density 3 x 10^{28} atoms / m^3 shows an electronic polarizability of 10^{-40} farad -m^{-2}. Assuming the internal electric field to be a Lorentz field, **calculate** the dielectric constant of the material.	Apply	2, 3
5	A parallel capacitor of area 650 mm^2 and a plate separation of 4 mm has a charge of 2x10^{-10} C on it. When a material of dielectric constant 3.5 is introduced between the plates, **what** is the resultant voltage across the capacitors.	Apply	2, 3
6	**Calculate** magnetization and magnetic flux density if magnetic field intensity 250amp/m and relative permeability is 15.	Apply	2, 4

7	**Find** relative permeability, if H=220amp/m and M=3300 amp/m.	Apply	2, 4
8	The magnetic susceptibility of aluminum is 2.3 x 10^{-5}. **Find** its permeability and relative permeability.	Apply	2, 4
9	If a magnetic field of strength 300 amp/meter produces a magnetization of 4200 A/m in a ferromagnetic material, **find** the relative permeability of the material.	Apply	2, 4
10	A para magnetic material has a magnetic field intensity of 10^4 A/m. If the susceptibility of the material at room temperature is 3.7 x 10^{-3}, **calculate** the magnetization and magnetic flux density in the material.	Apply	2, 4
	UNIT - II **LASERS**		
Part – A (Short Answer Questions)			
1	**Explain** the terms: i.Spontaneous emission ii. Stimulated emission	Remember	5
2	**Explain** the terms: i.Lasing action ii. Population inversion.	Remember	5
3	**Explain** the terms: i.Absorption ii. Pumping mechanism.	Remember	5
4	**Explain** metastable state.	Remember	5
5	**What** are Einstein coefficients?	Remember	5
6	**What** do you understand by population inversion? How it is achieved?	Understand	5
7	**Explain** the characteristics of laser beam.	Understand	5
8	**Explain** life time of an energy level.	Remember	5
9	**Explain** the basic principle for producing laser beam .	Remember	5
10	**Mention** applications of lasers in medical field.	Remember	5
11	**Write** the industrial applications of lasers.	Analyze	5
12	**Distinguish** between Ruby laser and He-Ne laser.	Analyze	5
13	**How** is light amplification achieved in a laser system?	Understand	5
14	**Explain** the need for cavity resonator in a laser.	Remember	5
15	**Write** various pumping mechanisms that are adopted in lasers.	Analyze	5
16	**Write** any four applications of laser.	Analyze	5
17	**Explain** the purpose of an active medium in a laser.	Remember	5
Part - B (Long Answer Questions)			
1	**What** are Einstein's coefficients of radiation? Derive relation between them.	Analyze	5
2	**Explain** the principle, construction and working of a Ruby laser with the help of a suitable diagram.	Understand	5
3	**Describe** the construction of He-Ne laser and discuss with relevant ELD, working of He-Ne laser.	Understand	5
4	**Explain** the principle, construction and working of a semi conductor laser with the help of a suitable diagram**.**	Understand	5
5	**Write** the applications of lasers in various fields.	Understand	5
Part - C (Analytical Questions)			
1	**Calculate** the wavelength of emitted radiation from a semiconductor diode laser, which has a band gap of 1.44eV.	Apply	2,5

2	A semiconductor diode laser has a wavelength of 1.55μm. **Find** its band gap in eV.	Apply	2,5
3	**Find** the relative population of the two states in a ruby laser that produces a light beam of wavelength 6943A^{o} at 300K.	Apply	2,5
4	**Find** the relative population of the two states in a laser that produces a light beam of wavelength 1.06 μm at 300K.	Apply	2,5
	UNIT-III **NANOMATERIAL**		
Part - A (Short Answer Questions)			
1	**Discuss** origin of nanotechnology.	Remember	6
2	**What** are nanomaterials? Explain.	Remember	6
3	**Write** about nanoscale.	Remember	6
4	**Why** nanomaterials exhibit different properties? Explain.	Remember	6
5	**Explain** quantum confinement effect on nanoparticles.	Remember	6
6	**Write** the important applications of nanomaterials in bio fields.	Remember	6
7	**Describe** any three processes by which nanomaterials are fabricated.	Remember	7
8	**Describe** the important applications of nanotechnology.	Remember	6
9	**Write** the applications of nanomaterials in industry.	Analyze	6
10	**Discuss** how TEM can be used to characterize nanoparticles.	Understand	7
11	**Give** three methods of fabrication of nanomaterials.	Analyze	7
12	**What** are the advantages of TEM?	Analyze	6
Part – B (Long Answer Questions)			
1	**Discuss** in detail the basic principle of nanomaterials.	Understand	6
2	**Discuss** optical, physical and chemical properties of nanomaterials.	Analyze	6
3	**Discuss** electrical, magnetic and mechanical properties of nanomaterials.	Analyze	6
4	**Explain** top-down fabrication method using chemical vapour deposition technique.	Remember	7
5	**Describe** the process of sol-gel and precipitation in the fabrication of nanostructures.	Remember	7
6	**Explain** Transmission Electron Microscopy characterization technique of nanomaterials.	Remember	6
7	**Explain** how X-ray diffraction can be used to characterize nanoparticles.	Remember	6
8	**Describe** any one method of preparation of nanomaterial.	Analyze	7
9	**List** out the applications of nanomaterials in various fields.	Analyze	6
Part - C (Analytical Questions)			
1	**Calculate** the surface area to its volume ratio of a spherical particle of diameter 8 mm.	Apply	2,6
2	If the radius of a sphere is made one-third, **how** its surface area to volume ratio changes.	Apply	2,6
3	If the dimension of a cube is doubled, **how** its surface area to volume ratio varies.	Apply	2,6
	UNIT-IV **QUANTUM MECHANICS**		
Part – A (Short Answer Questions)			

1	**What** are matter waves?	Understand	1, 8
2	**Write** an expression for de-Broglie wave length in terms of momentum and kinetic energy.	Apply	1, 8
3	**What** is dual nature of light?	Remember	1, 8
4	**State** Heisenberg's Uncertainty principle.	Remember	1, 8
5	**Show** that $\lambda = 12.26/\sqrt{V}$ A°.	Analyze	1, 8
6	**Explain** the physical significance of wave function.	Remember	1, 9
7	**Write** expressions for wave function and energy of a particle in one dimensional potential box.	Remember	1, 9
8	**What** is de-Broglie hypothesis?	Remember	1, 8
9	**Write** any two properties of matter waves.	Understand	1, 8
10	**What** is degeneracy?	Understand	1, 9
11	**What** are degenerate energy levels?	Understand	1, 9
12	**Write** expressions for wave function and energy of a particle in three dimensional potential box.	Remember	1, 9
Part – B (Long Answer Questions)			
1	**Explain** the concept of dual nature of the light.	Understand	8
2	**Explain** the properties of matter waves.	Understand	8
3	**Derive** an expression for de-Broglie wave length.	Analyze	8
4	**Describe** the experimental verification of matter waves using Davisson-Germer experiment.	Understand	8
5	**Derive** Schrodinger's wave equation for the motion of an electron.	Analyze	9
6	**Show** that the energies of a particle in a potential box are quantized.	Understand	9
7	**Show** that the wavelength associated with an electron of mass 'm' and kinetic energy 'E' is given by $\lambda = h / \sqrt{2mE}$	Apply	8
8	**Describe** an experiment to establish the wave nature of electrons.	Understand	8
9	**Discuss** extension of potential well concept to three dimensions.	Analyze	9
10	**Derive** expressions for wave function and energy of a particle in one dimensional potential box.	Analyze	9
Part - C (Analytical Questions)			
1	**Calculate** the velocity and kinetic energy of an electron having wavelength of 0.21nm.	Apply	2, 8
2	**Calculate** the de Broglie wavelength associated with a proton moving with a velocity of $1/10$ of velocity of light. (mass of proton $=1.674 \times 10^{-27}$ kg)	Apply	2, 8
3	**Calculate** the wavelength of an electron raised to a potential 15kV.	Apply	2, 8
4	**Calculate** its de-Broglie wavelength. (Given kinetic energy of the neutron is 0.025eV mass of neutron $=1.674 \times 10^{-27}$ kg)	Apply	2, 8
5	**Calculate** the energies that can be possessed by a particle of mass 8.50×10^{-31}kg which is placed in an infinite potential box of width 10^{-9}cm.	Apply	2, 9
6	**Calculate** the velocity and kinetic energy of an electron having wavelength of 0.21 nm.	Apply	2, 8
7	**Find** the lowest energy of an electron confined in a square box of side 0.1nm.	Apply	2, 9

8	**Find** the wavelength associated with an electron rose to a potential 1600 V.	Apply	2, 8
UNIT-V SEMICONDUCTOR PHYSICS			
Part - A (Short Answer Questions)			
1	**Classify** semiconductors.	Remember	10
2	**Explain** intrinsic semiconductor	Remember	10
3	**What** is carrier concentration?	Understand	10
4	**Define** energy gap.	Remember	11
5	**Write** a short note on p-type semiconductor.	Understand	10
6	**Write** a short note on n-type semiconductor.	Understand	10
7	**What** is Hall effect?	Understand	11
8	**What** are the applications of Hall effect?	Apply	11
9	**Explain** extrinsic semiconductor	Remember	10
10	**Write** expressions for carrier concentration of electrons and holes in intrinsic semiconductors.	Understand	10
11	**Write** an expression for carrier concentration of electrons in p-type semiconductor.	Understand	10
12	**Write** an expression for carrier concentration of holes in n-type semiconductor.	Understand	10
13	**Where** does the Fermi level exists in case of p-type and n-type semiconductors at T=0K.	Remember	10
Part - B (Long Answer Questions)			
1	**Distinguish** intrinsic and extrinsic semiconductors.	Understand	10
2	**Derive** an expression for intrinsic carrier concentration.	Apply	10
3	**Derive** an expression for carrier concentration of p-type semiconductors.	Understand	10
4	**Derive** an expression for carrier concentration of n-.type semiconductors.	Understand	10
5	**Write** notes on direct band gap and indirect band gap semiconductors.	Understand	11
6	**Explain** Hall effect and its importance.	Remember	11
7	**Derive** the expression for energy gap.	Analyze	11
8	**Explain** the variation of Fermi level with temperature in the case of p-type and n-type semiconductor.	Remember	10
9	**Derive** an expression for density of electrons in intrinsic semiconductor.	Analyze	10
10	**Derive** an expression for density of holes in intrinsic semiconductor.	Analyze	10
Part - C (Analytical Questions)			
1	**Calculate** the density of charge carriers of semiconductor, given the Hall efficient is $-6.85 \times 10^{-5}\ m^3$/Coulomb.	Apply	2,11
2	**Find** carrier concentration of an intrinsic semiconductor of band gap 0.78eV at 300K. [Given that the effective mass of electron=effective mass of hole = rest mass of electron.]	Apply	2,10
3	**What** temperature would the E_F be shifted by 15% from middle of forbidden gap (E_g). Given E_g=1.2ev. Given effective mass of holes is 5 times that of electrons	Apply	2, 10

4	**Calculate** intrinsic carrier concentration for Ge at 27^0C. [for Ge atomic weight =72.6,Density=5400kg/m^3 Band gap Eg=0.7eV]	Apply	2, 10
5	**Calculate** Hall voltage developed across the width of the slab of a metallic slab carrying a current of 30A is subjected to a magnetic field of 1.75T. The magnetic field is perpendicular to the plane of the slab and to the current. The thickness of the slab is 0.35cm. The concentration of free electrons in the metal is 6.55 x 10^{28}electrons/m^3.	Apply	2, 11
6	**Find** carrier concentration, if the R_H of a specimen is 3.66 x 10^{-4} m^3c^{-1}.	Apply	2,11

Prepared By: Dr.A Jayanth Kumar, Professor
Dr.Rizwana, Associate Professor
Ms S Charvani, Associate Professor
Ms K Sowmya, Assistant Professor
Mr K Saibaba, Assistant Professor
Mr N RajeswaraRao, Assistant Professor
Mr V S K Prasad, Assistant Professor

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