KCG
COLLEGE OF TECHNOLOGY
Affiliated to Anna University
AUTONOMOUS

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023

First Semester

23PH111- ENGINEERING PHYSICS

(Common to: All Branches)

(Regulation 2023)

QUESTION BANK

(Applicable for Theory Courses)

UNIT 1-MECHANICS				
Q.No	**Part A- Questions**	**Marks**	**CO's**	**Bloom's Level**
1.	State Hooke's Law.	2	1	K1
2.	List the inference from stress-strain diagram?	2	1	K1
3.	What are the effects of hammering and annealing on elasticity of a material?	2	1	K1
4.	List any two factors affecting elastic modulus and tensile strength.	2	1	K1
5.	When a wire is bent back and forth, it becomes hot. Why?	2	1	K1
6.	Define elastic limit.	2	1	K1
7.	Define tensile strength.	2	1	K1
8.	Define yield point.	2	1	K1
9.	Explain neutral axis (or) how the various filaments of a beam are affected when the beam is loaded?	2	1	K1
10.	Explain bending moment of a beam.	2	1	K1
11.	Prove that the rotational kinetic energy is conserved in the torque free motion of a rigid body.	2	1	K1
12.	State the law of conservation of angular momentum.	2	1	K1
13.	Calculate the angular momentum of a disc whose rotational kinetic energy is 10kJ and moment of inertia about its axis of rotation is $4.5x10^{-4}$ kgm^2.	2	1	K3
14.	Two bodies of masses 6 kg and 10 kg have position along the x axis 5 m and 10 m respectively from the origin. Find the distance of the centre of mass from the origin and moment of inertia with respect to the axis of rotation through its centre of mass.	2	1	K3
15.	Calculate the moment of inertia of a solid cylinder of mass 200g and diameter is 10 cm with respect to its own axis.	2	1	K3
Q.No	**Part B- Questions**	**Marks**	**CO's**	**Bloom's Level**
1.	Explain the theory and obtain the Young's modulus using uniform bending method.	16	1	K3
2	State and prove Parallel and perpendicular axis theorem.	16	1	K3
3	Derive an expression for MI of a solid sphere about diameter and tangent.	16	1	K3
4	Derive an expression for MI of a thin circular disc. a. About an axis through its centre and perpendicular to its plane. b. About a diameter.	16	1	K3
5	Derive an expression for moment of inertia of a diatomic molecule and explain the rotational energy states of it.	16	1	K3
6	Derive an expression for moment of inertia of torsional pendulum.	16	1	K3
7	Explain stress-strain diagram for an elastic material.	8	1	K2
8	Explain the factors affecting elasticity	8	1	K2
9	Derive an equation for MI of a uniform rod. a. About an axis passing through its centre of mass.	16	1	K3

	b. About an axis passing through one end and perpendicular to its length			
10	Derive an equation for internal bending moment of a beam in terms of radius of curvature. Explain the theory and obtain the Young's modulus using nonuniform bending method.	16	1	K3

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UNIT 2 - ELECTROMAGNETIC WAVES				
Q.No	Part A- Questions	Marks	CO's	Bloom's Level
1.	Give the Maxwell's equations in differential form.	2	2	K1
2.	Give the Maxwell's equations in integral form	2	2	K1
3.	List the Maxwell's equations for free space	2	2	K1
4.	List the Maxwell's equations for conducting medium	2	2	K1
5.	What are the characteristics of Maxwell's first equation?	2	2	K1
6.	What are the characteristics of Maxwell's second equation?	2	2	K1
7.	What are the characteristics of Maxwell's third equation ?	2	2	K1
8.	What are the characteristics of Maxwell's fourth equation?	2	2	K1
9.	Write down general electromagnetic wave equation in terms of electric field vector E for free space.	2	2	K1
10.	What is intrinsic or characteristic impedance of free space?	2	2	K1
11.	What is Poynting vector?	2	2	K1
12.	Give the properties of electromagnetic waves.	2	2	K1
13.	In a specific area of space, the magnetic field value is $1.2x10^{-2}$ T and the electric field value is $1.5x10^{6}$Vm-1. Find the total energy density of the electric and magnetic fields.	2	2	K3
14.	The electric field vector of a plane electromagnetic wave oscillates sinusoidal at a frequency $7.5x10^{10}$ Hz. Find the wavelength of this wave.	2	2	K3
15.	Electric field of plane electromagnetic wave is 450 NC^{-1}. Find the magnetic field in wave.	2	2	K3
Q.No	Part B- Questions	Marks	CO's	Bloom's Level
1.	Derive and explain Maxwell equations using Faraday's law and Gauss's law.	16	2	K3
2	Explain electromagnetic wave properties in detail.	16	2	K2
3	Derive the expression of electromagnetic wave equation from Maxwell's equation in matter.	8	2	K3
4	Derive and explain Maxwell equations using Ampere's law and Faraday's law.	16	2	K3
5	Prove that the energy content due to electric and magnetic field in electromagnetic waves are equal.	8	2	K2

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UNIT 3 - OPTICS AND LASERS				
Q.No	Part A- Questions	Marks	CO's	Bloom's Level
1.	Distinguish between ordinary light and Laser.	2	3	K2
2.	Distinguish between spontaneous and stimulated emission.	2	3	K2

3.	Write down the characteristics of laser.	2	3	K1
4.	What is population inversion?	2	3	K1
5.	Define meta-stable state.	2	3	K1
6.	Write down the methods used for pumping action.	2	3	K1
7.	What is the role of nitrogen and Helium in CO_2 laser?	2	3	K1
8.	What are the three important components of laser device?	2	3	K1
9.	What is optical resonator?	2	3	K1
10.	What is meant by active material or active medium in laser?	2	3	K1
11.	List out the conditions to be satisfied for total internal reflection.	2	3	K1
12.	List out the conditions for interference of light.	2	3	K1
13.	An atom is stimulated from the state of energy of $1x\ 10^{-34}$ J to an excited level of $7.625X10^{-34}$J. What is the frequency of the photon emitted?	2	3	K3
14.	Compute the numerical aperture and acceptance angle of an optical fiber from the following data n1=1.55, n2=1.5 and no=1.	2	3	K3
15.	A fiber cable has an acceptance angle 30^o and a core index of refraction of 1.4. Calculate the refractive index of the cladding.	2	3	K3
Q.No	Part B- Questions	Marks	CO's	Bloom's Level
1.	With a suitable diagram, outline the working of laser action in a Homojunction semiconductor laser.	16	3	K3
2	Illustrate the modes of vibration modes of CO_2 molecule. Describe the construction and working of CO_2 laser with energy level diagram. List out its characteristics, advantages and applications.	16	3	K3
3	Illustrate air wedge method with necessary theory to determine the thickness of a thin wire.	16	3	K3
4	Discuss various types of optical fibre in detail.	16	3	K2
5	Derive an expression for Numerical aperture and acceptance angle in optical fibres.	16	3	K3
6	Distinguish fibers based on refractive index profile and number of modes.	8	3	K2
7	Explain Stimulated emission and its existence using Einstein's theory.	8	3	K2
8	Explain different pumping mechanisms used in lasers with an example for each. Discuss the applications of laser in various fields.	16	3	K2

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UNIT 4 - QUANTUM MECHANICS				
Q.No	Part A- Questions	Marks	CO's	Bloom's Level
1.	Explain Compton effect.	2	4	K2
2.	What are matter waves or de-Broglie waves?	2	4	K1
3.	State the properties of matter waves.	2	4	K1
4.	Show that the phase velocity of matter waves is greater than the velocity of light.	2	4	K3
5.	What is Schrödinger wave equation?	2	4	K1
6.	Mention the physical significance of wave function.	2	4	K1

7.	Briefly explain the basis of normalization of wave function.	2	4	K2
8.	For a free particle moving within a 1D box the ground state energy cannot be zero. Why?	2	4	K3
9.	What is Compton wavelength?	2	4	K1
10.	What are Eigen values and Eigen functions?	2	4	K1
11.	What is a wave function?	2	4	K1
12.	Calculate the de-Broglie wavelength of a electron which has been accelerated by the application of 400 V potential.	2	4	K3
13.	Calculate the minimum energy that an electron can possess in an infinitely deep potential well of width 4 nm.	2	4	K3
14.	An electron is confined to a one-dimensional box of side 10^{-10} m. Find the first four eigen values of the electron.	2	4	K3
15.	Calculate the energy in eV of a photon of wavelength 1.2 A°.	2	4	K3
Q.No	Part B- Questions	Marks	CO's	Bloom's Level
1.	Derive Schrodinger's time independent and time dependent wave equation for matter waves.	16	4	K3
2	Solve Schrodinger's wave equation for a particle in a one-dimensional box and obtain the energy eigen values and eigen functions.	16	4	K3
3	What is Compton effect? Derive an expression for the change in wavelength due to Compton scattering by incident light with matter.	16	4	K3
4	Derive the energy eigen values and eigen functions of an electron enclosed in a 3-D cubical box.	16	4	K3
5	Derive a relationship for the change in the wavelength of a monochromatic x-ray in terms of the scattering angle due to inelastic scattering with electrons.	16	4	K3
6	Derive the energy eigen values and eigen functions of a particle trapped inside a two-dimensional box.	16	4	K3
7	Derive an expression for the energy levels and wave function for a particle trapped inside a one-dimensional infinite potential well.	16	4	K3

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UNIT 5 - APPLIED QUANTUM MECHANICS				
Q.No	Part A- Questions	Marks	CO's	Bloom's Level
1.	List out the characteristics of the particle executing simple harmonic motion in a simple harmonic oscillator.	2	5	K1
2.	What is meant by tunneling effect?	2	5	K1
3.	What is the principle used in scanning tunneling microscope?	2	5	K1
4.	What are the advantages and disadvantages of STM?	2	5	K1
5.	Give any two applications of STM.	2	5	K1
6.	What is the principle used in Resonant tunneling diode?	2	5	K1
7.	Explain peak current and valley current in resonant tunneling diode.	2	5	K2
8.	What are the advantages and disadvantages of resonant diode?	2	5	K1
9.	What are the applications of resonant tunneling diode?	2	5	K1
10.	State Bloch theorem.	2	5	K1
11.	What is an energy band?	2	5	K1

12.	**Explain the formation of valence band, conduction band and forbidden band gap.**	**2**	**5**	**K2**
13.	**What is a harmonic oscillator and give some examples.**	**2**	**5**	**K1**
14.	**Define barrier penetration.**	**2**	**5**	**K1**
15.	**What is quantum tunneling?**	**2**	**5**	**K1**
Q.No	**Part B- Questions**	**Marks**	**CO's**	**Bloom's Level**
1.	**Derive an expression for the energy values and eigen functions of a harmonic oscillator.**	**16**	**5**	**K3**
2	**Describe the principle, construction and working of a scanning tunneling microscope. List some of the merits and demerits of STM with applications.**	**16**	**5**	**K2**
3	**With necessary theory describes the quantum structure and V-I characteristics of a resonant tunneling diode along with its merits, demerits, and applications.**	**16**	**5**	**K2**
4	**Derive an expression for the eigen values for a particle in a finite potential well and show that they are quantized.**	**16**	**5**	**K3**
5	**Discuss Bloch theorem and prove the same for a particle in a periodic potential.**	**8**	**5**	**K3**
6	**Explain the behavior of an electron moving in a field of periodic potential using Kronig and Penny model.**	**8**	**5**	**K2**
7	**Discuss qualitatively how band theory of solids leads to the classification of solids into conductors, semiconductors, and insulators.**	**8**	**5**	**K2**

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