INSTITUTE OF AERONAUTICALENGINEERING

(Autonomous)
Dundigal, Hyderabad-500043

MECHANICAL ENGINEERING

TUTORIAL QUESTION BANK

Course Title	WAVES AND OPTICS(Common for AE / ECE / ME)			
Course Code	AHSB04			
Programme	B.Tech			
Semester	I	AE | ECE | ME		
	II	CE | EEE		
Regulation	IARE - R18			
Course Structure	Lectures	Tutorials	Practical	Credits
	3	1	-	4
Course Coordinator	Mr. A Chandra Prakash, Assistant Professor			
Course Faculty	Dr. Rizwana, Professor Dr. Pratima, Associate Professor Dr. Y Veeraswamy, Associate Professor Dr. K Hari Prasad, Associate Professor Ms. S Charvani, Associate Professor Mr. K Saibaba, Assistant Professor Mr. T Srikanth, Assistant Professor Mr.VSK Prasad, Assistant Professor			

I. COURSE OBJECTIVES (COs):

The course should enable the students to:

I	Enrich knowledge in principals of quantum mechanics and semiconductors.
II	Correlate principles and applications of lasers and fiber optics.
III	Meliorate the knowledge of light and optics.
IV	Develop strong fundamentals of transverse, longitudinal waves and harmonic waves.

II. COURSE OUTCOMES (COs):

CO 1	Describe the concept of Quantum mechanics, different types of semiconductors, and variations of Fermi level in Extrinsic semiconductors.
CO 2	Understanding the concepts of laser light and its properties, communication in optical fibbers.
CO 3	Understand the different concepts of light, interference, diffraction, polarization concepts.
CO 4	Explore the concept of waves and its propagation in air and water.
CO 5	Understand about waves and its propagation.

III. COURSE LEARNING OUTCOMES(CLOs):

AHSB04.01	Recall the basic principles of physics and apply these concepts of physics in solving the real-time problems.
AHSB04.02	Acquireknowledge about fundamental in quantum mechanics.
AHSB04.03	Interpretation of dual nature of matter wave concept using Davisson & Germer's experiment.
AHSB04.04	Estimatethe energy of the particles using Schrödinger's wave equation and apply it to particle in potential box.
AHSB04.05	Recollect the conductivity mechanism involved in semiconductors and calculate carrier concentrations.
AHSB04.06	Understand the band structure of a solid and Classify materials as metals**,** insulators**,** or semiconductors, and sketch a schematic band diagram for each one.
AHSB04.07	Understand the basic principles involved in the production of Laser light and also real-time applications of lasers.
AHSB04.08	Recollect basic principle, construction, types and attenuation of optical fibers.
AHSB04.09	Understand the importance of optical fibers in real-time communication system.
AHSB04.10	Apply different laws of radiation to understand the phenomenon behind production of light.
AHSB04.11	Apply the phenomenon of interference in thin films using Newton's rings experiment.
AHSB04.12	Identify diffraction phenomenon due to slits.
AHSB04.13	Acquire knowledge of basic harmonic oscillators and discuss in detail different types of harmonic oscillators.
AHSB04.14	Describe the steady state motion of forced damped harmonic oscillator.
AHSB04.15	Acquire knowledge of reflection and transmission of waves at a boundary of media.

UNIT – I

QUANTUM MECHANICS

Part - A(Short Answer Questions)

S No	QUESTION	Blooms Taxonomy Level	Course Outcomes	Course Learning Outcomes (CLOs)
1	Discuss the de-Broglie's hypothesis of duality of material particles and arrive at the concept of matter waves.	Understand	CO 1	AHSB04.01 AHSB04.03
2	Write an expression for de-Broglie wave length in terms of momentum and kinetic energy.	Understand	CO 1	AHSB04.01 AHSB04.03
3	Light radiation exhibits both particle and wave nature. Explain this conception of light.	Understand	CO 1	AHSB04.01A HSB04.03
4	Explain the concept of Black body radiation.	Remember	CO 1	AHSB04.01 AHSB04.03
5	Explain the concept of Photoelectric effect.	Remember	CO 1	AHSB04.01 AHSB04.03
6	Explain the concept of Compton effect.	Understand	CO 1	AHSB04.01 AHSB04.03
7	Explain the physical significance of wave function which connects the particle nature and wave nature of matter wave.	Understand	CO 1	AHSB04.01 AHSB04.03
8	Describe behavior of matter waves by giving any two of its properties.	Understand	CO 1	AHSB04.01 AHSB04.03
9	Write expressions for wave function and energy of a particle in three dimensional square well box of infinite potential.	Understand	CO 1	AHSB04.01 AHSB04.03
10	Write expressions for eigen function and eigen values for a particle in one dimensional square well box of infinite potential.	Understand	CO 1	AHSB04.01 AHSB04.03
	Part - B (Long Answer Questions)			
1	Explain the concept of Black body radiation	Understand	CO 1	AHSB04.01 AHSB04.03
2	Describe the phenomena of Photoelectric effect with experimental arrangement	Understand	CO 1	AHSB04.01 AHSB04.03
3	What is Compton effect? Explain with neat diagram.	Understand	CO 1	AHSB04.01 AHSB04.03
4	Compare a particle with a wave and discuss about dual nature of radiation	Understand	CO 1	AHSB04.01 AHSB04.03
5	Explain Max – Born interpretation (Physical significance) of wave function	Understand	CO 1	AHSB04.01 AHSB04.04
6	Derive an expression for the wavelength associated with electron, accelerated by a potential	Understand	CO 1	AHSB04.01 AHSB04.04
7	Explain Plank's radiation law associated with block body radiation	Understand	CO 1	AHSB04.01 AHSB04.03
8	Discuss de-Broglie's concept of matter waves	Understand	CO 1	AHSB04.01 AHSB04.03
9	Matter waves are not electromagnetic waves but a new kind of waves. Justify this concept by discussing different properties of matter waves.	Understand	CO 1	AHSB04.01 AHSB04.03
10	Using Planck's and Einstein's theory of radiation, Show that the wavelength associated with an electron of mass *'m'* and kinetic energy *'E'* is given by $h/\sqrt{2\,m\,E}$.	Understand	CO 1	AHSB04.01 AHSB04.03
11	Describe Davisson Germer experiment with a neat diagram and explain how it established the proof for wave nature of electrons.	Understand	CO 1	AHSB04.01 AHSB04.03
12	Considering dual nature of electron, Derive Schrodinger's time independent wave equation for the motion of an electron.	Understand	CO 1	AHSB04.01 AHSB04.04
13	Assuming that a particle of mass *m* is confined in a field free region between impenetrable walls in infinite height at $x = 0$ and $x = a$, show that the permitted energy levels of a particle are given by $n^2 h^2 / 8 m a^2$.	Understand	CO 1	AHSB04.01 AHSB04.04
14	Discuss the results from the eigen values, eigen functions and probability density for a particle in a one dimensional potential box of infinite height. Also sketch the figures.	Understand	CO 1	AHSB04.01 AHSB04.04

	Part - C (Analytical Questions)			
1	Calculate the velocity and kinetic energy of an electron having wavelength of 0.21nm.	Understand	CO 1	AHSB04.02 AHSB04.03
2	Calculate the de Broglie wavelength associated with a proton moving with a velocity of 1/10 of velocity of light. (mass ofproton = 1.674 x 10^{-27} kg).	Understand	CO 1	AHSB04.02 AHSB04.03
3	Calculate the wavelength of an electron raised to a potential 15kV.	Understand	CO 1	AHSB04.02 AHSB04.03
4	Calculate de-Broglie wavelength of neutron. (Given kinetic energy of the neutron is 0.025eV mass of neutron =1.674 x 10^{-27} kg).	Understand	CO 1	AHSB04.02 AHSB04.03
5	Calculate the wavelength of an electron, if the kinetic energy of the electron is 0.025 eV.	Understand	CO 1	AHSB04.02 AHSB04.03
6	Find the wavelength associated with an electron rose to a potential 1600V.	Understand	CO 1	AHSB04.02 AHSB04.04
7	Calculate the energies that can be possessed by a particle of mass 8.50 x10^{-31}kg which is placed in an infinite potential box of width 10^{-9}m.	Understand	CO 1	AHSB04.02 AHSB04.04
8	Find the lowest energy of an electron confined in a square box of side 0.1nm.	Understand	CO 1	AHSB04.02 AHSB04.04
	UNIT – II			
	INTRODUCTION TO SOLIDS AND SEMICONDUCTORS			
	Part – A (Short Answer Questions)			
1	Define Bloch theorem.	Understand	CO 2	AHSB04.05
2	Define a metallic solid and draw its band diagram to explain its electronic behavior.	Understand	CO 2	AHSB04.05
3	On the basis of band theory how the crystalline solids are classified into conductors, semiconductors and insulators.	Understand	CO 2	AHSB04.05
4	Define a semiconductor and draw its band diagram to explain its electronic behavior.	Understand	CO 2	AHSB04.05
5	Define an insulator and draw its band diagram to explain its electronic behavior.	Remember	CO 2	AHSB04.05
6	Write the classification of semiconductors based on variation of conductivity in terms of temperature and doping.	Understand	CO 2	AHSB04.05
7	What do you understand by an intrinsic semiconductor? Give an example.	Remember	CO 2	AHSB04.05
8	Write the expressions for carrier concentration of electrons and holes in intrinsic semiconductors in n-type and p-type semiconductors.	Remember	CO 2	AHSB04.05
9	Write an expression for carrier concentration of electrons in p-type semiconductor.	Understand	CO 2	AHSB04.06 AHSB04.14
10	What is an expression for carrier concentration of holes in n-type semiconductor?	Understand	CO 2	AHSB04.06
11	Give the statement of Hall effect using a proper diagram representing current, magnetic field and Hall voltage.	Understand	CO 2	AHSB04.06
	Part - B (Long Answer Questions)			
1	What is Bloch's theorem? Explain in detail the motion of electron in a periodic potential.	Understand	CO 2	AHSB04.05
2	Using Kronig-Penny model show that the energy spectrum of an electron contains a number of allowed energy bands separated by forbidden bands.	Understand	CO 2	AHSB04.05
3	Explain the origin of energy band formation in solids	Understand	CO 2	AHSB04.06
4	Distinguish between intrinsic and extrinsic semiconductors. Indicate on an energy level diagram, the conduction and valence bands, donor and acceptor levels for intrinsic and extrinsic semiconductors.	Understand	CO 2	AHSB04.06
5	Deduce the mathematical expression for intrinsic carrier concentration and hence show that the Fermi level lies at the middle for an intrinsic semiconductor.	Remember	CO 2	AHSB04.05
6	Obtain an expression for carrier concentration of n- type semiconductor.	Understand	CO 2	AHSB04.05
7	Obtain an expression for carrier concentration of p- type semiconductor.	Understand	CO 2	AHSB04.05

8	Explain the dependence of Fermi level on carrier-concentration and temperature	Understand	CO 2	AHSB04.06
9	Discuss in detail Hall effect and obtain an expression for Hall coefficient. Mention the uses of Hall effect.	Understand	CO 2	AHSB04.06
10	Give the graphical representation of Kronig-Penny model. Explain the conclusions drawn from the graph.	Understand	CO 2	AHSB04.06
11	With neat energy band diagrams, explain the classification of materials.	Understand	CO 2	AHSB04.06
12	Derive an expression for the electron concentration in the conduction band of an intrinsic semiconductor.	Understand	CO 2	AHSB04.06
13	Derive an expression for the hole concentration in the valence band of an intrinsic semiconductor.	Understand	CO 2	AHSB04.06
14	What is an intrinsic semiconductor? Explain why an instrinsic semiconductor behaves as an insulator at 0K. Give 2D representations of the crystal of Silicon at T = 0K and T > 0K.	Understand	CO 2	AHSB04.06
15	What is an extrinsic semiconductor? Distinguish between n-type and p-type semiconductors.	Remember	CO 2	AHSB04.05
	Part - C (Analytical Questions)			
1	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].	Understand		AHSB04.02 AHSB04.06
2	What temperature would the E_F be shifted by 15% from middle of forbidden gap (E_g)? Given E_g =1.2ev, effective mass of holes is 5 times that of electrons.	Understand	CO 2	AHSB04.02 AHSB04.06
3	Calculate intrinsic carrier concentration for Ge at 27^0C. Given Eg in Germanium is 0.7eV.	Understand	CO 2	AHSB04.02 AHSB04.06
4	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 metalis6.55 x 10^{28}electrons/m^3.	Understand	CO 2	AHSB04.02 AHSB04.06
5	Find carrier concentration, if the R_H of a specimen is 3.66 x 10^{-4} m^3c^{-1}.	Understand	CO 2	AHSB04.02 AHSB04.06
6	Calculate the density of charge carriers of semiconductor, given the Hall efficient is -6.85 × 10^{-5} m^3/Coulomb.	Understand	CO 2	AHSB04.02 AHSB04.06
	UNIT-III			
	LASERS AND FIBER OPTICS			
	Part - A (Short Answer Questions)			
1	Define spontaneous and stimulated emission processes involved during de-excitation of atoms.	Understand	CO 3	AHSB04.07
2	Explain the phenomenon of lasing action required for the production of laser light.	Understand	CO 3	AHSB04.07
3	Explain the different characteristics of laser ?	Remember	CO 3	AHSB04.07
4	What are the different types of lasers ?	Understand	CO 3	AHSB04.07
5	Mention any three applications of laser beams in different fields.	Understand	CO 3	AHSB04.07
6	Write the expression for Acceptance angle and Numerical aperture of an optical fiber.	Understand	CO 3	AHSB04.08
7	Draw a neat sketch of refractive index profile of step index optical fiber.	Remember	CO 3	AHSB04.08
8	What is the principle behind propagation of light signal through an optical fiber?	Remember	CO 3	AHSB04.07
9	Write the expressions for Snell's law and critical angle associated with an optical fiber.	Understand	CO 3	AHSB04.07 AHSB04.14

10	Discuss different types of attenuation in optical fibers that occur during propagation of light signals.	Understand	CO 3	AHSB04.07 AHSB04.14
	Part – B (Long Answer Questions)			
1	What are the characteristics of lasers, and explain the phenomenon of lasing action required for the production of laser light.	Understand	CO 3	AHSB04.07
2	What do you understand by absorption and pumping mechanism related to excitation of atoms from lower to higher energy states?	Understand	CO 3	AHSB04.07
3	Explain the construction of a Ruby laser in detail, with the help of a neat suitable diagram.	Understand	CO 3	AHSB04.06
4	Describe the construction of He-Ne gaseous laser in detail, with the help of a neat diagram.	Understand	CO 3	AHSB04.07
5	Discuss the importance of lasers in various fields like industry, medicine, science, etc., by giving their applications.	Understand	CO 3	AHSB04.07
6	Explain the following terms:i. Spontaneous emission ii. Stimulated emission iii. Pumping mechanism iv.Population inversion	Understand	CO 3	AHSB04.07
7	What is an optical fiber? Explain its construction and principle with a neat diagram.	Understand	CO 3	AHSB04.07
8	Derive an expression for angle of acceptance of an optical fiber in terms of refractive indices of core and cladding	Understand	CO 3	AHSB04.07
9	Define Numerical aperture. Derive an expression for numerical aperture of an optical fiber.	Understand	CO 3	AHSB04.06
10	Explain in detail, different types of optical fibers based on refractive index profile of core medium.	Understand	CO 3	AHSB04.06
11	Draw the block diagram of fiber optic communication system and explain the functions of each block in the system.	Understand	CO 3	AHSB04.06
12	Explain the advantages of optical fibers in communication.	Understand	CO 3	AHSB04.06
13	Explain in detail, different types of optical fibers based on mode propagation	Understand	CO 3	AHSB04.06
14	Explain about different types attenuations in optical fibers	Understand	CO 3	AHSB04.06
	Part - C (Analytical Questions)			
1	Calculate the wavelength of emitted radiation from a semiconductor diode laser, which has a band gap of 1.44eV.	Understand	CO 3	AHSB04.02 AHSB04.07
2	A semiconductor diode laser has a wavelength of 1.55μm. Find its band gap in eV.	Understand	CO 3	AHSB04.02 AHSB04.07
3	Calculate the wavelength of emitted radiation from a semiconductor diode laser, which has a band gap of 1.68eV.	Understand	CO 3	AHSB04.02 AHSB04.07
4	A semiconductor diode laser has a wavelength of 1.42μm. Find its band gap in eV.	Understand	CO 3	AHSB04.02 AHSB04.07
5	Calculate the refractive indices of core &cladding of an optical fiber with a numerical aperture of 0.33 and their fractional differences of refractive indices being 0.02.	Understand	CO 3	AHSB04.02 AHSB04.07
6	A step index fiber has a numerical aperture of 0.16 and core refractive index of 1.45.Calculate the acceptance angle of the fiber and refractive index of the cladding.	Understand	CO 3	AHSB04.02 AHSB04.07
7	The refractive indices of core and cladding materials of a step index fiber are 1.48 and 1.45 respectively. Calculate i) Numerical aperture ii) Acceptance angle.	Understand	CO 3	AHSB04.02 AHSB04.07
8	An optical fiber has a numerical aperture of 0.02 and a cladding refractive index of 1.59. Find the acceptance angle for the fiber in water which has a refractive index of 1.33.	Understand	CO 3	AHSB04.02 AHSB04.07
9	Calculate the fractional index change for a given optical fiber if the refractive indices of the core and the cladding are 1.563 and 1.498 respectively.	Understand	CO 3	AHSB04.02 AHSB04.07

UNIT-IV				
LIGHT AND OPTICS				
Part – A (Short Answer Questions)				
1	State principle of superposition of waves in case of two or more waves travelling simultaneously in a medium.	Understand	CO 4	AHSB04.01 AHSB04.09
2	What is meant by interference of light? Also define constructive and destructive interference	Remember	CO 4	AHSB04.01 AHSB04.09
3	Monochromatic light from a narrow slit falls on two parallel slits and the interference fringes are obtained on a screen. Sketch this Young's double slit experiment.	Understand	CO 4	AHSB04.01 AHSB04.09
4	What are coherent sources that are used for the phenomenon of interference?	Remember	CO 4	AHSB04.01 AHSB04.09
5	Write the condition for constructive and destructive interference in terms of path difference and phase difference	Understand	CO 4	AHSB04.01 AHSB04.09
6	Define fringe width. Write the expression of fringe width.	Understand	CO 4	AHSB04.01 AHSB04.09
7	What do you understand by diffraction of light? Draw a neat diagram showing diffraction phenomenon.	Understand	CO 4	AHSB04.01 AHSB04.09
8	Distinguish between Fraunhofer and Fresnel's classes of diffraction	Remember	CO 4	AHSB04.01 AHSB04.09
9	Compare the important phenomena's of interference and diffraction exhibited by light.	Understand	CO 4	AHSB04.01 AHSB04.09
10	What is plane transmission grating? Discuss its construction	Remember	CO 4	AHSB04.01 AHSB04.10
Part – B (Long Answer Questions)				
1	Give the analytical treatment of interference of light and hence obtain the condition for maximum and minimum intensity by using Young's double slit experiment.	Understand	CO 4	AHSB04.09
2	Derive an expression for fringe width in interference pattern and show that fringe width of both bright and dark fringes is equal.	Understand	CO 4	AHSB04.09
3	Describe and explain the formation of Newton's rings in reflected light and derive the condition for dark and bright fringes.	Understand	CO 4	CAHS008.13
4	Give the theory of Fraunhofer diffraction due to a single slit and hence obtain the condition for maxima and minima. Using this obtain intensity distribution curve.	Understand	CO 4	CAHSB04.10
5	Discuss the theory of Fraunhofer diffraction due to N slits and derive the conditions for principal maxima and minima.	Understand	CO 4	CAHSB04.10
6	Explain the theory of Fraunhofer diffraction due to circular aperture and determine the radius of Airy's disc.	Understand	CO 4	CAHSB04.10
7	Explain the construction and working of Michelson interferometer with a neat diagram	Understand	CO 4	CAHSB04.10
8	State principle of superposition of waves in case of two or more waves travelling simultaneously in a medium.	Understand	CO 4	CAHSB04.09
9	Monochromatic light from a narrow slit falls on two parallel slits and the interference fringes are obtained on a screen. Sketch this Young's double slit experiment.	Understand	CO 4	CAHSB04.09
10	Compare the important phenomena's of interference and diffraction exhibited by light. What is plane transmission grating? Discuss its construction	Understand	CO 4	CAHSB04.10
11	Explain the theory of Fraunhofer diffraction due to diffraction grating? Discuss its construction.	Understand	CO 4	CAHSB04.10
Part - C (Analytical Questions)				
1	Two slits separated by a distance of 0.2 mm are illuminated by a monochromatic light of wavelength 550 nm. Calculate the fringe width on a screen at distance of 1 m from the slits.	Understand	CO 4	AHSB04.02 AHSB04.09

2	Two coherent sources of monochromatic light of wavelength 6000 A^o produce an interference pattern on a screen kept at distance of 1 m from them. The distance between two consecutive bright fringes on the screen is 0.5 mm. Find the distance between the two coherent sources	Understand	CO 4	AHSB04.02 AHSB04.09
3	In a Newton's rings experiment, the diameter of 15^{th} ring was found to be 0.59 cm and that of 5^{th} ring is 0.336 cm. If the radius of curvature of lens is 100 cm, find the wavelength of the light.	Understand	CO 4	AHSB04.02 AHSB04.09
4	Newton's rings are observed in the reflected light of wavelength 5900A^o. The diameter of tenth dark ring is 0.5 cm. Find the radius of curvature of the lens used.	Understand	CO 4	AHSB04.02 AHSB04.09
5	Find the highest order that can be seen with a grating having 15000 lines per inch. The wavelength of light used is 600 nm.	Understand	CO 4	AHSB04.02 AHSB04.09
6	How many orders will be visible if the wavelength of light is 5000 Ao and the number of lines per inch on the grating is 2620?	Understand	CO 4	AHSB04.02 AHSB04.09
7	A grating has 6000 lines per cm. Find the angular separation between two wavelengths 500 nm and 510 nm in the 3^{rd} order.	Understand	CO 4	AHSB04.02 AHSB04.09
	UNIT - V			
	HARMONIC OSCILLATIONS AND WAVES IN ONE DIMENSION			
	Part - A (Short Answer Questions)			
1	Define amplitude of a body executing simple harmonic motion.	Remember	CO 5	AHSB04.11
2	Define time period of a body executing simple harmonic motion	Understand	CO 5	AHSB04.11
3	Define phase of a body executing simple harmonic motion	Understand	CO 5	AHSB04.11
4	Distinguish between free and forced oscillation.	Understand	CO 5	AHSB04.11
5	Explain the phenomena involved in stationary wave	Remember	CO 5	AHSB04.11
6	Explain the phenomena involved in a progressive wave	Remember	CO 5	AHSB04.11
7	Compare a longitudinal wave with a transverse wave.	Understand	CO 5	AHSB04.11
8	What are the laws of a stretched string.	Remember	CO 5	AHSB04.11
9	What is a longitudinal wave? Write the wave equation of longitudinal wave.	Remember	CO 5	AHSB04.12
10	What is a transverse wave? Write the wave equation of transverse wave.	Remember	CO 5	AHSB04.12
	Part - B (Long Answer Questions)			
1	Derive the equation of a motion of a Simple mechanical harmonic oscillator.	Understand	CO 5	AHSB04.11
2	What is an electrical harmonic oscillator? Obtain the expression for the frequency of oscillation.	Understand	CO 5	AHSB04.11
3	Solve the differential equation of a damped harmonic oscillator. Investigate the conditions of light, heavy and critical damping.	Understand	CO 5	AHSB04.11
4	Discuss the oscillations and amplitude variation with respect to forcing frequency in case of forced damped oscillator.	Understand	CO 5	AHSB04.11
5	What is a transverse wave? Derive the wave equation of transverse wave.	Understand	CO 5	AHSB04.11
6	Derive an expression for the reflection and transmission amplitudes, when a transverse wave is travelling X-Direction in a string.	Understand	CO 5	AHSB04.11
7	What is a longitudinal wave? Derive the wave equation of longitudinal wave.	Understand	CO 5	AHSB04.12
8	Derive the plane acoustic wave equation and show that velocity of sound wave is $v = \sqrt{\frac{\gamma P}{\rho_o}}$	Understand	CO 5	AHSB04.12
9	What is simple harmonic motion? What the Characteristics of simple harmonic motion?	Remember	CO 5	AHSB04.11
10	Find the velocity of transverse wave propagation along a stretched string and obtain the frequencies of vibration for a string length	Understand	CO 5	AHSB04.12
11	Explain the terms: (i) Periodic motion (ii) Oscillatory motion (iii) Damped and undamped oscillations (iv) Forced oscillations			
12	Discuss the various types of waves. Describe the propagation mechanism of transverse and longitudinal waves	Understand	CO 5	AHSB04.12
13	Derive the relation between displacement and frequency of a particle executing simple harmonic motion	Remember	CO 5	AHSB04.11

	Part - C (Analytical Questions)			
1	A particle executes a S.H.M of period 10 seconds and amplitude of 1.5 meter. Calculate its maximum acceleration and velocity.	Understand	CO 5	AHSB04.02 AHSB04.11
2	A body executing S.H.M has its velocity 16cm/s when passing through its centre mean position. If it goes 1 cm either side of mean position, calculate its time period.	Understand	CO 5	AHSB04.02 AHSB04.11
3	A body of mass 5 gms is subjected to an elastic force of 40 dyne/cm, and a frictional force of 5 dyne-sec/cm. If it is displaced through 2 cm and then released. Find whether the resulting motion is oscillatory or not? Also find the time period if it is oscillatory.	Understand	CO 5	AHSB04.02 AHSB04.11
4	A 0.5 kg mass suspended from a linear spring of force constant 1000 N/m and a damping coefficient 0.05 Ns/m. An external force $F = F_0 \sin(pt)$ is applied, where F_0 = 25N and p is twice the natural frequency of the system, then calculate (i) Amplitude of resulting motion. (ii) Phase shift of displacement with request to driving force.	Understand	CO 5	AHSB04.02 AHSB04.12
5	Calculate the speed of transverse waves in a wire of 1 mm^2 cross sectionunder the tension produced by by 0.1 kgwt (specific gravity of material of wire = 9.81 gm/cm^3 and g = 9.81m/sec^2).	Understand	CO 5	AHSB04.02 AHSB04.12
6	A copper wire of radius 10^{-3} m has a wavelength of 1m. It is fixed at both ends and is subjected to a tension of 10^4 N. Calculate the fundamental frequency and the frequencies of the first two overtones. (Density of copper = 8.92 x 10^{-3} kg/m^3).	Understand	CO 5	AHSB04.02 AHSB04.12
7	A wire 50cm long and of mass 6.5 x 10^{-1} kg is stretched so that it makes 80 vibrations per second. Find the stretched force in kgwt.	Understand	CO 5	AHSB04.02 AHSB04.12
8	A metal rod 150cm long is fixed at the centre. When it vibrates longitudinally, the frequency is found to be 1200. Calculate the Young's modulus of the material of the rod. Its density is 8 g/cm^3.	Understand	CO 5	AHSB04.02 AHSB04.12

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