SEMESTER – I

UCPHA20 – Properties of Matter and Acoustics

Year: I **Sem:** I	**Course Code:** UCPHA20	**Title of the Course:** Properties of Matter and Acoustics	**Course Type:** Theory	**Course Category:** Core	**H/W** 6	**Credits** 5	**Marks** 100

Couse Objectives

1. To give introduction to different properties of matter namely elasticity, mass, viscosity and surface tension.
2. To make the students to understand the concept of bending, uniform bending and non-uniform bending of the beam.
3. To understand the concept of ultrasonics and its applications.

Course Outcomes (CO)

1. The properties of solids especially knowledge of elasticity help the students to identify the materials suitable for the construction of buildings, houses etc.
2. Learn the basics of properties of matter, how Young's modulus and rigidity modulus are defines and how they are evaluated for different shapes of practical relevance.
3. Properties of fluids especially knowledge of viscosity and surface tension help the students in their daily life and agriculture
4. Study the behaviour of the progressive wave
5. Learn the fundamentals of harmonic oscillator model, including free, damped and forced oscillators.

	PO					
CO	**1**	**2**	**3**	**4**	**5**	**6**
CO1	L	M	M	H	H	L
CO2	M	L	L	L	M	H
CO3	H	L	H	H	M	L
CO4	M	L	H	M	M	L
CO5	M	M	H	M	H	H

	PSO					
CO	**1**	**2**	**3**	**4**	**5**	**6**
CO1	H	M	H	M	L	H
CO2	M	H	H	M	H	L
CO3	L	M	H	M	L	H
CO4	M	M	M	H	H	M
CO5	H	H	M	L	M	H

(Low - L, Medium – M, High - H)

Course Syllabus

Unit I: Elasticity (12 hours)

1.1 Stress-Strain - Types- Hooke's law - Basic ideas of elastic moduli - Young's modulus-Rigidity Modulus- Bulk Modulus (K1, K2)
1.2 Behaviour of a wire under progressive tension - Work done in stretching and Twisting a wire (K3)
1.3 Twisting couple on a cylinder (K3)
1.4 Determination of Rigidity modulus and moment of inertia using torsional pendulum (with and without mass) (K3, K4)
1.5 Determination of q, n, σ by Searle's method (K3, K4)
1.6 Compound pendulum, moment of inertia - determination of radius of gyration using graph method. (K3, K4)

Unit II: Bending of Beams (12 hours)

2.1 Bending of beams - Expression for bending moment (K1, K3)
2.2 Cantilever- Determination of Young's Modulus by cantilever oscillations (K2, K4)
2.3 Non-uniform bending- Determination of Young's Modulus by Koenig's method (K2, K3,K4)
2.4 Uniform bending- Expression for Elevation (K2, K3, K4)
2.5 Experiment to determine young's modulus using pin and microscope (K3, K4)
2.6 Expression of Poisson's ratio- Relationship between the three moduli of elasticity (K3,K4)

Unit III: Surface Tension (15 hours)

3.1 Definition and dimension of surface tension, Excess of pressure, Problems and its relation between curvatures (K1, K2, K3, K4)
3.2 Jaeger's method and variation of surface tension with temperature - Drop weight method (K1, K2, K3, K4)
3.3 **Viscosity:** Viscosity definition, stream line flow, turbulent flow- Reynold's number, Searle's Viscometer, Meyer's formula for the rate of flow of a gas through a capillary tube. (K1, K2, K3, K4).
3.4 Poissuille's formula, Comparison of Viscosity using Oswald's Viscometer Stoke's formula, determination of co-efficient of viscosity (K3, K4)
3.5 **Osmosis:** Osmosis and osmotic pressure, Laws of osmotic pressure - Determination of osmotic pressure by Berkeley and Hartley method (K3, K4)
3.6 Osmosis and vapor pressure of a solution, Osmosis and boiling point of a solution (K3,K4)

Unit IV: Waves and Oscillations **(15 hours)**

4.1 Progressive wave – properties and characteristics of progressive wave (K1,K2)
4.2 Simple harmonic motion – Expression for free oscillations (K3)
4.3 Expression for Damped and Forced oscillations (K3, K4)
4.4 Expression for velocity of sound in a string - Determination of frequency of the vibratorin transverse and longitudinal mode using Melde's string (K2, K3, K4)
4.5 Determination of Specific gravity of solid and liquid by Melde's string (K3, K4)
4.6 Reverberation Time - Sabine's Formula (Derivation only) - Absorption coefficient Acoustic aspects of halls and auditorium (K2, K3)

Unit 5: Ultrasonics **(15 hours)**

5.1 Introduction - characteristic properties of ultrasonic waves (K1,K2)
5.2 Stationary waves and resonance (Half wave length and quarter wave length resonance) Attenuation and Sources of ultra sound (K2,K3)
5.3 Piezoelectric method and Magnetostriction Method (K3,K4)
5.4 Low frequency/high intensity applications (Welding, Echo Sounder, sensor for temperature and pressure) (K3,K4)
5.5 High frequency/ low intensity applications (NDT, Holography) (K3,K4)
5.6 Different types of scans and its clinical Applications (Obstetrics, Examination of heart) SONAR (K3,K4)

Books for Study:

1. Murugeshan. R.S. - Properties of Matter, 1st Edition- Chand & Co.Pvt Ltd., NewDelhi, Reprint 2005.
2. D. S. Mathur - Elements of Properties of Matter, 1st Edition - Shyamala CharitableTrust, New Delhi, 2005.
3. Brijilal & Subramaniyam N. - Properties of Matter, 1st Edition - Vikas PublicationHouse, New Delhi, 2001.
4. Brijilal & Subramaniyam N – Textbook of Sound, 1st Edition - Vikas PublicationHouse, New Delhi, 2005.
5. M. N. Srinivasan - Textbook of Sound – Himalayan Publication, 1991.
6. Brijilal & Subramaniyam N - Waves and Oscillations - Vikas Publication House, New Delhi,1994.

Reference Books:

1. K. Halliday, R. Resnick and K.S. Krane and J. Walker - Fundamentals of Physics, 6th Edition - Wiley, N.Y., 2001.
2. R. P .Feymann, R.B., Leighton and M. Stands - The Feynmann Lectures on Physics, Vol 1,2 and 3-Narosa, New Delhi,1998,Vol.1,1st Edition, 1998, Vol 2. 2nd Edition, 1998, Vol.3.3rd Edition, 2001.
3. Arora C.L - Mechanics and Properties of Matter, 1st Edition - Chand & Co. Pvt. Ltd., New Delhi,1999.

SEMESTER – IV
UCPHE20 – Optics

Year: II Sem: IV	Course Code: UCPHE20	Title of the Course: OPTICS	Course Type: Theory	Course Category: Core	H/W 5	Credits 5	Marks 100

Course Objectives

1. Students understand the dual nature of light through the different branches of optics like Geometrical optics and Physical optics.
2. To teach them the aberration in lenses in optical instruments.
3. To teach the basic concepts and working of interference, diffraction and polarization.
4. To explain the students about important application of interference, diffraction and polarization.

Course Outcomes (CO)

1. To make the students understand different types of lenses and the aberrations in it
2. Learn about dispersion by thin prism and dispersion without deviation; deviation without dispersion of prism
3. Study about interference and various interferometers used for the applications like wavelength and resolution determination and refractive index of gases
4. Learn about the concept of diffraction. Its types Fresnel's and Fraunhofer diffraction experiments and applications
5. Study about polarization, its experiments Laurent's half shade polarimetry and applications

	PO					
CO	**1**	**2**	**3**	**4**	**5**	**6**
CO1	M	H	H	L	H	H
CO2	M	M	H	M	H	L
CO3	L	M	M	M	H	H
CO4	M	H	H	H	M	L
CO5	L	M	H	M	H	H

	PSO					
CO	**1**	**2**	**3**	**4**	**5**	**6**
CO1	H	M	H	L	H	H
CO2	M	H	H	M	L	H
CO3	H	L	H	H	M	L
CO4	M	H	H	L	M	H
CO5	H	M	L	M	H	M

(Low - L, Medium – M, High - H)

Course Syllabus

Unit I: Geometrical Optics (14 hours)

1.1 Lens and its types (K1)
1.2 Optic center of the lens - Principal foci and Principal points - Thick lens formula (K1,K2)
1.3 Power of thick lens - Defects in lenses - various defects and its minimizing method (K2, K3)
1.4 Method of minimizing spherical aberration - contact method and out of contact method – Chromatic aberration in lenses (K3)
1.5 Conditions for achromatic aberration of two thin lenses in contact and out of contact(K3 , K4)
1.6 Basic ideas of eyepiece - Ramsden's and Huygen's eyepiece and comparison(K4)

Unit II: Dispersion (14 hours)

2.1 Dispersion - Prism - Explanation of VIBGYOR- application (K1)
2.2 Dispersion produced by a thin prism - angular dispersion (K1, K2)
2.3 Dispersive power of a prism - resolving power of a prism (K2, K3)
2.4 Combination of prisms to produce - dispersion without deviation and deviation without dispersion (K3)
2.5 Achromatic prism - Direct vision spectroscope-constant deviation spectrometer (K3,K4)
2.6 Determination of refractive index of the material of small angled prism (K4)

Unit III: Interference (14 hours)

3.1 Interference - condition for interference - theory of interference in reflected system (K1, K2)
3.2 Interference in thin films- Thin films - air wedge - Determination of diameter of a thin wire by air wedge method - test for optical flatness (K2, K3)
3.3 Newton's rings- Determination of refractive index of a liquid (K4)
3.4 Michelson's interferometer - theory - application - determination of wavelength and resolution of spectral lines (K4)
3.5 Refractive index of gases - Jamin's and Rayleigh's interferometer - Fabry - Perot interferometer (K3, K4)
3.6 Holography – Principle - construction and reconstruction –application(K1, K3, K4)

Unit IV: Diffraction **(14 hours)**

4.1 **Diffraction:** Fresnel's Diffraction (K1)

4.2 Fresnel's ideas of wave fronts - Fresnel's explanation of rectilinear propagation of light - half period zones (K1, K2, K3)

4.3 Comparison of half period one and convex lens - Diffraction at a circular aperture, straight edge (K2, K3)

4.4 **Fraunhofer diffraction:** Fraunhofer diffraction at single slits and double slits - theory of plane diffraction grating - determination of wavelength using grating (K3, K4)

4.5 Dispersive power of a grating - absent spectra - overlapping spectra - resolving power of a grating (K2, K3)

4.6 Difference between prism and grating - difference between Fresnel andFraunhofer diffraction(K3, K4)

Unit V: Polarization **(14 hours)**

5.1 Polarisation - Double refraction by Huygens explanation of double refraction in uniaxial crystals (K1, K2)

5.2 Nicol prism as a polarizer and analyser (K3, K4)

5.3 Quarter and half wave plates - production and detection of a plane- circularly and elliptically polarized light (K4)

5.4 Optical activity - Fresnel's explanation - experimental verification(K3)

5.5 Specific rotatory power - determination of specific rotatory power by Laurent's half shade polarimeter (K3)

5.6 Kerr effect and Faraday Effect -LCDs (K3, K4)

Books for Study:

1. Subramanyam, Brijlal – A Text of Optics – S.Chand & Co. Ltd., 2006.
2. Murugesan R – Optics and Spectroscopy - S.Chand & Co. Ltd., 2005.

Reference Books:

1. Khanna D.R, Gulati H.R. - Optics - S.Chand and Co. Ltd., Reprint 2002.
2. Raj M.G. - Fundamentals of Optics – Anmol Publications Ltd., New Delhi, 1996.
3. C.L.Arora – Optics, 1st Edition - S.Chand and Co. Ltd., New Delhi, 1999.
4. Eugene Hecht - Optics, 4th Reprint – Pearson Education Publication, 2004.

SEMESTER – V

UEPHA20 – Elective IA: Digital Electronics and Communication

Year: III **Sem:** V	**Course Code:** UEPHA20	**Title of the Course:** Elective IA: Digital Electronics and Communication	**Course Type:** Theory	**Course Category:** Core	**H/W** 5	**Credits** 5	**Marks** 100

Course Objectives

1. To analyze logic processes and implement logical operations using logic circuits.
2. To understand the design and operation of arithmetic circuits, logic families, flip flop and counters.
3. To analyze different parameters of analog communication techniques.
4. To introduce students the concept and theory of signals and systems needed in electronics and telecommunication fields

Course Outcomes (CO)

The learners will be able to

1. Learn the fundamental operation of logic circuit.
2. Express the basic design and operation of arithmetic circuits.
3. Convert different type of codes and number systems which are used in digital communication system.
4. To introduce students to the basic idea of signal, modulation and demodulation techniques of analog communication.
5. To understand the concept, working principle, block diagram and key applications of AM and FM transmitting & receiving system.

CO	**PO**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	M	H	M	H	L	M
CO2	M	L	H	M	M	L
CO3	L	M	H	M	M	H
CO4	L	M	H	M	L	L
CO5	H	M	H	M	L	H

CO	PSO					
	1	2	3	4	5	6
CO1	M	H	M	H	M	L
CO2	H	M	H	M	M	H
CO3	M	L	M	H	M	M
CO4	H	M	H	H	L	M
CO5	H	M	H	L	H	M

(Low - L, Medium – M, High - H)

Course Syllabus

Unit I: Boolean algebra and Logic gates (12 hours)

1.1 Decimal and binary systems -Decimal to binary and binary to decimal conversion (K1,K2)
1.2 Boolean operations, logic expressions, rules and laws of Boolean algebra (K4)
1.3 DeMorgan's theorems -Simplification ofBoolean expressions using Boolean algebra Techniques (K1, K2,K4)
1.4 Fundamental products-Sum of products - Karnaugh map- pair, quads and octet (K3)
1.5 AND gate - OR gate - NOT gate - NAND gate - NOR gate (K2, K4)
1.6 EX – OR and EX – NOR gates – NAND and NOR as universal gates (K2, K4)

Unit II: Arithmetic Circuits and Logic Families (12 hours)

2.1 Introduction of Arithmetic circuits (K1)
2.2 Adders- Half Adder - Full Adder (K2,K3)
2.3 Subtractor - Half Subtractor (K2,K3)
2.4 Parallel binary adders- BCD adder (K3,K4)
2.5 Multiplexers and De-Multiplexers with suitable example (K3, K4)
2.6 Digital logic family- RTL NOR gate-DTL NAND gate- TTL NAND gate - Characteristics of TTL family(K3, K4)

Unit III: Flip Flop and Counters, D/A Conversion & A/D Conversion (13 hours)

3.1 RS flip flop -clock pulses- clocked RS flip flop- Preset and clear, JK flip flop- Race around condition- JK Master slave flip flop- D flip flop- T flip flop(K2,K3)
3.2 Asynchronous counter-3 bit binary counter - Mod 7 counter (K2, K3)
3.3 Operation of synchronous counters- mod8 parallel counter (K3, K4)
3.4 Combination counter-Decade counter (K3, K4)
3.5 Binary weight- Resistance divider method – Binary ladder method (K3,K4).
3.6 Simultaneous equation (K4)

Unit IV: Modulation and Demodulation (12 hours)

4.1 Modulation- Amplitude modulation- Mathematical analysis of AM wave (K1,K3,K4)
4.2 Modulation index (modulation factor) - Power in AM wave (K1, K2)
4.3 Frequency modulation - expression for frequency modulated wave(K1, K3)

4.4 Demodulation -Ratio Detector (K1, K2, K4)
4.5 Block diagram of AM transmitting system- AM receiver: Principle of Superhetrodyne receiver (K3,K4)
4.6 Block diagram of FM transmitting & receiving system (K3, K4)

Unit V: Propagation of Radio Waves and Radar (13 hours)

5.1 Antenna- Dipole and Folded type Antennas-array of antennas (K1,K2)
5.2 Propagation of Radio waves -Propagation of ground waves- Space wave propagation- Skywave propagation (K3,K4).
5.3 Skip distance and maximum usable frequency and Fading (K1,K2)
5.4 The ionosphere- Effect of ionosphere on propagation of radio waves - Eccles Larmor theory (K3,K4)
5.5 Principle, working and applications of Radar (K1,K2,K3,K4)
5.6 Range equation for radar and Duplexer (K3, K4)

Book for Sudy:

1. Malvino and Leech – Digital Principles and Applications, 5th Edition – Tata McGraw Hill, 2002.
2. A.Subramanyam - Applied Electronics –National Publishing Company, 2006.
3. R.Murugeshan Kiruthiga Sivaprasath - Modern Physics – S.Chand, 2007.

Books for Reference:

1. Mano Morris – Digital Logic and Computer Designs, 23rd Edition – Prentice Hall Publication, 2000.
2. R.S. Sedha – A Textbook of Electronics – S.Chand Publication, 2001.
3. Gupta & Kumar - Handbook of Electronics – PragatiPrakasan Publication, 2002..
4. T.L.Floyd – Digital Fundamentals, 3rd Edition – Universal Book Stall, New Delhi, 2002.
5. V.K.Puri – Digital Electronics, 5th Reprint – Tata McGraw Hill Publication, 2003.