

**APPLIED PHYSICS NEW COURSE STRUCTURE ( Effective from June 2019)  
SEMESTER – 3**

Type of Course	Subject	Course code	Credits	Hours per week	External Exam marks	Exam duration	Internal Exam marks	Total Marks
Core – I Paper – I	Applied Physics	US03CAPH21(T)	4	4	70	3 hrs	30	100
		US03CAPH22(P)	2	4	50	2 hrs	----	50
Core – I Paper – II	Applied Physics	US03CAPH23(T)	4	4	70	3 hrs	30	100
		US03CAPH24(P)	2	4	50	2 hrs	----	50
Core – 2 Paper – I	Instrumentation	US03CINS21(T)	4	4	70	3 hrs	30	100
		US03CINS22(P)	2	4	50	2 hrs	----	50
Core – 2 Paper – II	Instrumentation	US03CINS23(T)	4	4	70	3 hrs	30	100
		US03CINS24(P)	2	4	50	2 hrs	----	50
Ability enhancement	English	US03AENG21(P)	2	4	35	2 hrs	15	50
Skill enhancement	XXX = ICT/STA/NCC/NSS	US03SXXX21(T)	2	2	35	2 hrs	15	50
			<b>28</b>	<b>38</b>	<b>550</b>	<b>26 hrs</b>	<b>150</b>	<b>700</b>

**SARDAR PATEL UNIVERSITY**  
**SYLLABUS FOR APPLIED PHYSICS**  
**SEMESTER – 3 : Core I – Paper I (Theory)**  
**APPLIED PHYSICS COURSE CODE : US03CAPH21 (4 Credit Course)**  
**COURSE TITLE : Optics and Remote Sensing**  
**(According to new course structure – Effective from June 2019)**

**Unit 1 : Cardinal points of an Optical Lens System and Lens Aberrations**

Introduction, Cardinal Points, Principal points and Principal planes, some remarkable features of Principal planes, focal points and focal planes, nodal points and nodal planes, construction of the image using cardinal points, Newton's formula, Gaussian formula, Cardinal points of a coaxial system of two thin lenses-object at infinity, focal length of the system, Introduction to Lens Aberrations, Spherical aberration, reducing spherical aberration, Coma, Astigmatism, Curvature of field, Distortion, Chromatic aberration-object at infinity and object at finite distance, objective and eyepiece, Huygens eyepiece, Ramsden eyepiece

**Unit 2 : Polarization of Light**

Introduction to polarization, unpolarized and polarized light, Natural light, types of polarization-plane, circularly and elliptically polarized light, partially polarized light, production of plane polarized light-polarization by reflection, Brewster's law, application of Brewster's law, polarization by refraction-pile of plates, polarization by scattering, polarization by selective absorption, polarization by double refraction, polaroid sheets, polarizer and analyzer, production and detection of linearly polarized light, Malus' Law, Anisotropic crystals, Calcite crystal, optic axis, principal section, principal plane, double refraction in calcite, Huygens' explanation, ordinary and extra-ordinary rays, positive and negative crystals, Nicol prism, retarders, Quarter wave plate, half wave plate, applications of polarized light, specific rotation, Laurent's half shade polarimeter.

**Unit 3 : Interference**

Introduction, phase difference and coherence between light waves, optical path and phase change, effect of optical path, superposition of waves, interference, theory of interference-analytical method, intensity distribution, techniques of obtaining interference, Fresnel Biprism-experimental arrangement, determination of wavelength of light, fringes with white light, lateral displacement of fringes, Lloyd's single mirror, determination of wavelength, interference in thin films, plane parallel film, interference due to reflected light, geometrical and optical path difference, conditions for maxima and minima, interference due to transmitted light, Haidinger fringes, Fizeau fringes, Newton's

rings, conditions for bright and dark rings, circular fringes, fringes of equal thickness, dark central spot, determination of wavelength of light

#### **Unit 4 : Basics of Remote Sensing**

Introduction to remote sensing, sun and atmosphere, concept of signatures, multi-spectral concept, remote sensing system, remote sensors, platforms, data product generation, data analysis-visual interpretation and digital techniques, end utilization, why observe earth from space?, Indian Remote sensing programme, the earth observation evolution-the paradigm shift, spy in the sky, Electromagnetic radiation, velocity of EM radiation, permittivity and permeability, polarization, coherent radiation, propagation of EM waves from one medium to other, Fresnel relation for reflection and transmission, some more wave properties of EM radiation-diffraction & Doppler effect, Attenuation-absorption & scattering, Thermal radiation, emissivity.

#### **Text Books :**

1. A Textbook of Optics by Dr. N. Subrahmanyam, Brij Lal and Dr. M. N. Avadhanulu, S. Chand & Company Ltd., New Delhi, 25<sup>th</sup> revised edition 2016.
2. Fundamentals of Remote Sensing by George Joseph, University Press Pvt. Ltd., Hyderabad.

#### **Reference Books :**

1. Basics of Remote Sensing and GIS by Dr. S. Kumar, University Science Press
2. Remote sensing and GIS by Basudeb Bhatta, Oxford University Press, New Delhi

**SARDAR PATEL UNIVERSITY**  
**SYLLABUS FOR APPLIED PHYSICS**  
**SEMESTER – 3 : Core I – Paper II (Theory)**  
**APPLIED PHYSICS COURSE CODE : US03CAPH22 (4 Credit Course)**  
**COURSE TITLE : Digital Electronics & Optoelectronic Devices**  
**(According to new course structure – Effective from June 2019)**

**UNIT 1: Number systems, Logic Gates and Logic Families**

Number systems: The decimal number system, the binary number system, addition, subtraction and multiplication of binary systems, representation of signed numbers and binary arithmetic in computers, the octal number system, the hexadecimal number system, addition of octal and hexadecimal numbers, 1's complement arithmetic, 2's complement arithmetic, Conversion of number systems, Logic Gates: The AND gate, the OR gate, the NOT gate, the universal gates, the XOR-XNOR gates. Logic Families: Digital IC specification terminology, logic families- transistor-transistor logic (TTL), integrated injection logic (IIL/h), emitter-coupled logic (ECL).

**UNIT 2: Boolean Algebra and Flip-Flops**

Boolean Algebra: Logic operations, axioms and laws of Boolean algebra, reducing Boolean expressions, Boolean functions and their representation. Karnaugh Maps: two, three and four variable K-maps, Flip-Flops: Classification of sequential circuits, latches and flip-flops (5-R, D, J-K, T), operating characteristics and applications of flip-flops.

**UNIT 3: Combinational Logic Design**

Adders, half adders, full adders, subtractors, half subtractors, full subtractors, Binary parallel adder, 4-bit parallel subtractor, binary adder-subtractor, parity bit generator/checkers, Comparators: 1 bit, 2 bit and 4 bit comparator, Encoder: Octal to binary encoder, Decimal to BCD Encoder, Decoder: 3 line to 8 line decoder, BCD to Decimal Decoder, 2 line to 4 line decoder, Applications of decoder, Multiplexer: 2 input 4 input multiplexer, Demultiplexer: 1 line to 4 line, 1 line to 8 line multiplexer.

**UNIT 4: Optoelectronic Devices**

Introduction, light units, Light Emitting Diodes: operation, construction, characteristics and parameters, seven segment displays, LED seven segment display, Liquid Crystal Cells: LCD seven segment displays, Photoconductive cells: construction, characteristics,

parameters and applications, photodiodes and solar cells, Optocouplers: Operation, construction, specification and applications, photomultiplier tube: Operation, characteristics, circuit diagram and voltage divider and applications, Laser diode: operation, characteristics and parameters

**Text book:**

1. Fundamentals of Digital Circuits (2<sup>nd</sup> Ed.) by A. Anand Kumar (PHI Learning Private Limited, New Delhi)
2. Electronic Devices and Circuits by David A. Bell, Fifth edition, Oxford University Press, New Delhi

**Reference book:**

1. Digital Logic and Computer Design by M. Morris Mano (Pearson Publication)
2. Basic Electronics -Solid State by B. L. Theraja, (S. Chand Publications).

**SARDAR PATEL UNIVERSITY**  
**SYLLABUS FOR APPLIED PHYSICS**  
**SEMESTER – 3 : Core I – Paper I (Practicals)**  
**APPLIED PHYSICS COURSE CODE : US03CAPH2 (2 Credit 4 hours)**  
**COURSE TITLE : APPLIED PHYSICS PRACTICALS**  
**(According to new course structure – Effective from June 2019)**

1. Determination of energy band gap ' $E_g$ ' of a semiconductor diode.
2. Verification of Malus' law
3. Determination of specific rotation of sugar by Laurent's half shade Polarimeter.
4. Verification of Stefan's fourth power law.
5. Calibration of magnetic fields by Hall probe method.
6. ' $\lambda$ ' by Cylindrical Obstacle
7. Determination of ' $\lambda$ ' using Biprism
8. Newton's Rings Experiment
9. Dissociation energy determination of  $I_2$

**Reference Books :**

1. A Laboratory Manual of Physics for Undergraduates by D P Khandelwal
2. University Practical physics by D C Tayal-Himalayan publishing house.
3. Advanced Practical Physics by Worsnop & Flint.
4. Instructions manual-Kit developed for doing experiments in Physics (At BSc. and M.Sc. Physics levels) by R Srinivasan and K R S Priolkar-Indian Academy of Science, Bangalore.
5. B.Sc. Practical Physics by C. L. Arora, S. Chand & Company Ltd. New Delhi.

1. Use of multimeter
2. Use of CRO
3. Logic gate using discrete component
4. Reduction of Boolean expression
5. Logic gates using ICs
6. Flip-flops (RS, Clocked RS, D, JK Flip – flops)
7. Half and Full Adder
8. Half and Full subtracter
9. Study of resonance in an LCR circuit
10. Study of SMPS

Practical - 2

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3. Advanced Practical Physics by Worsnop & Flint.
4. Instructions manual-Kit developed for doing experiments in Physics (At BSc. and M.Sc. Physics levels) by R Srinivasan and K R S Priolkar-Indian Academy of Science, Bangalore.
5. B.Sc. Practical Physics by C. L. Arora, S. Chand & Company Ltd. New Delhi