The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Applied Physics	Academic Year	2022-23

B.E. (Civil, Mechanical, Electrical, Chemical, Metallurgy, Electronics, Irrigation and Water Management, Computer Science, Textile Technology, Textile Engineering and, Textile Processing): Regular Programme

Year	I	~~Core / Elective /~~ Foundation APH1101: Applied Physics I	Credits / Hours per week	04
Semester	I	Year of Introduction: 2007 Year of Syllabus Revision: 2022	Maximum Marks / Grade	100 (Theory) + 50 (Practical)
Mode of Transaction		Lectures/ Tutorials/Practical:: 03:01:03		

Course Outcome (CO) APH1101
CO1   Understand the basics of laws governing physical world
CO2   Application of physical laws in various engineering applications

Unit No.	Topic/Unit	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/Global (G) developmental needs	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
1	**Interference:** • Types of interference. Fresnel's biprism, White light fringes, Determination of the thickness of a thin sheet of transparent material. • Newton's rings, Determination of wave-length of sodium	08	13	1,2	CO1 CO2	PSOX			

						EMP, ENT, SD	N,R,G	ES, PE
	light using Newton's rings, Determination of refractive index of a liquid, Newton s rings with white light. • Non-reflecting films, Michelson interferometer, Types of fringes, Uses of Michelson's interferometer.							
2	**Diffraction:** • Introduction, Types of diffraction, Difference between interference and diffraction. Fraunhofer diffraction at a circular aperture, Plane diffraction grating, Formation of multiple spectra with grating, Maximum number of orders available with a grating. • Absent spectra with a diffraction grating, Effect of increase in the width of niled surface. • Determination of wavelength, dispersive power of grating. Meaning of resolving power, Rayleighs criterion of resolution. Resolving power of grating, prism, telescope and microscope.	07	12	1,2	CO1 CO2	PSOX		
3	**Maxwell's Equations and Electromagnetic Waves:** • Introduction to differential operators (Gradient, Divergence, Curl), Vector field, Irrotational vector field, rotational vector fields (curl), source and sinks of vector fields -divergence theorem. • Basic laws of electricity and magnetism- different forms. Lumped and distributed elements -oscillations, electromagnetic cavity oscillator. Charge conservation law —continuity equation, displacement current. • Maxwell's equations, electromagnetic waves in free space.	09	15	1,2	CO1 CO2	PSOX		
4	**LASER:** • Spontaneous and stimulated emission, Einstein's relation, conditions for lasing action,population inversion, pumping and active system, He-Ne laser, Uses of lasers.	06	10	1,2	CO1 CO2	PSOX		
5	**Oscillations:** • Simple Harmonic Motion – its expression and differential equation, Lissajous figures; • Damped oscillation – differential equation and its solution, critical damping, Logarithmic decrement, Analogy with electric circuits; Forced vibration – differential equation, • Amplitude and velocity resonance, Sharpness of resonance and Quality factor	08	13	1,2,3,4	CO1 CO2	PSOX		
6	**Sound Waves:** • Basics of Sound waves: Velocity, frequency, wavelength,	07	12	1,2,3,4	CO1 CO2	PSOX PSOX		

	intensity, loudness (expression), timber of sound, reflection of sound, echo; Reverberation, reverberation time, • Sabine's formula, remedies over reverberation; Absorption of sound, absorbent materials; Criteria for good acoustics of a building; • Ultrasonic: Production of ultrasonic waves, Detection of ultrasonics; Engineering applications of Ultrasonics (Non-destructive testing, Infrasound – Seismology (concept only))					PSOX			
7	**Waves and Particles:** • Equation of motion of matter waves, physical interpretation of wave function, • Operators. Eigen functions and Eigen values, momentum and energy operators, properties of wave functions • Solution of Schrodinger equation. Stationary state solutions. • The free particle, particle in a box, energy levels of a particle enclosed in one-dimensional potential box of infinite height. • The hydrogen atom (qualitative). Barrier Tunneling, STM, electron microscope.	08	13	2,3,4,5	CO1 CO2	PSOX PSOX			
8	**Semiconductor Devices and Nanotechnology:** • PN-junction diode and its application, rectifier: ripple factor, efficiency, filter. • Types of Solar Cells, p-n junction Solar Cells Characteristics, Efficiency. • Nano technology: Introductory Level: Length scales in physics, Nanostructures: 1D, 2D and 3D nanostructures (nanodots, thin films, nanowires, nanorods). • Applications of nanoparticles, quantum dots, nanowires and thin films for photonic devices (LED, solar cells).	07	12		CO1 CO2	PSOX			

Suggested Reference Books:

1.	Engineering Physics: by R. K. Gaur and S. L. Gupta, Dhanpat Rai Publications (P) Ltd. 8th Edition.
2.	Modem Engineering Physics: by A. S. Vasudeva, S. Chand and Company Ltd.
3.	Engineering Physics by Dattu R. Joshi, McGraw Hill Education India
4.	Fundamentals of Physics: by D. Halliday, R Resnick and J. Walker, Asian Books Pvt. Ltd. 8th Edition
5.	Nanotechnology: Principles and Practices S.K. Kulkarni, (Capital Publishing Company)
6.	Nano science and Nanotechnology, K.K.Choudhury (Narosa)

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Applied Physics	Academic Year	2022-23

B.E. (Civil, Mechanical, Civil -Irrigation and Water Management): Regular Programme

Year	I	~~Core~~ / ~~Elective~~ / ~~Foundation~~ APH1XXX: Applied Physics	Credits / Hours per week	06 hrs/05 (credits) (04 credits for Lecture and Tutorial + 01 credit for Practical)
Semester	I	Year of Introduction: 2022 Year of Syllabus Revision: 2022	Maximum Marks / Grade	100 (Theory) + 50 (Practical)
Mode of Transaction		Lectures/ Tutorials/Practical:: 03:01:02		

Course Outcome (CO) APH1XXX

CO1   Understand the basics of laws governing physical world   CO3 Understanding the basics of sound and electro magnetic waves

CO2   understanding the basics of solar photo voltaic system   CO4 Application of physical laws in various engineering applications

Unit No.	Topic/Unit	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/Global (G) developmental needs	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
1	**Electromagnetic Waves:** • Basic laws and equations. Application for devices and instrumentation, Microscopes, Telescopes and camera,	09	23	1,2	CO1 CO3 CO4	PSO1 PSO2	Emp. Ent	L,N, R,G	ES

	Resolution and magnifications, Optical vibration and correction.								
2.	**LASER and Matter Waves:** • Fundamentals, Generation, Spontaneous and stimulated emission, conditions for lasing action, population inversion, Types and Engineering applications – Laser and electron beam machining and other instruments	08	21	1,2	CO1 CO4	PSO1 PSO2	Emp. Ent	L,N, R,G	ES
3.	**Sound Waves:** • Sound waves characteristic and properties, Velocity, frequency, wavelength, intensity, loudness (expression), timber, reflection, echo, reverberation. • Sabine's formula, remedies over reverberation; Absorption of sound, absorbent materials; Criteria for good acoustics of a building; • Ultrasonic: Production of ultrasonic waves, Detection of ultrasonics; Engineering applications of Ultrasonics (Non-destructive testing, Infrasound – Seismology (concept only))	09	23	1,2,3,4	CO1 CO3	PSO1 PSO 2	Emp. Ent	L,N, R,G	ES
4	**Solar cells** • Principle of working, conversion efficiency, Single, multi-junction solar cells, Photovoltaic system engineering, Thermo-photovoltaic generation in electricity, Concentration and storage of electrical energy, Photovoltaic – systems and applications	09	23	1,2,3,4	CO1 CO2	PSO1 PSO2	Emp, Ent	L,N, R,G,	ES
5.	**Introduction to physics of Buildings** • Heat transfer and air circulation in buildings, effects of thermal expansion	04	10	1,2,3,4	CO1 CO3 CO4	PSO1 PSO2	Emo, Ent	L,N, R,G,	ES

	Suggested Reference Books:
1.	Engineering Physics: by R. K. Gaur and S. L. Gupta, Dhanpat Rai Publications (P) Ltd. 8th Edition.
2.	Modem Engineering Physics: by A. S. Vasudeva, S. Chand and Company Ltd.
3.	Fundamentals of Physics: by D. Halliday, R Resnick and J. Walker, Asian Books Pvt. Ltd. 8th Edition
4.	Building Physics: Heat, Air and Moisture, 3rd edition, Hugo S. L, Hens, Wiley
5.	Stephen J. Fonash, " Solar Cell Device Physics", 2nd edition, Academic Press, 2003.

Tutorials will be based on above topics.

Bloom's Taxonomy Levels: 1. Remember   2. Understand   3. Application   4.Analysis   5.Evaluation   6. Creation

Programme Name: FSBE-1 (Civil/IWM/Mechanical)

Programme Specific Outcome (PSO)

PSO1   Learn basics of applied engineering physics to understand and solve various problems related to basic physics

PSO2   Basic understanding and application of the electromagnetic theory, modern optics, laser, crystal physics, optics and their applications in optical instrumentation

PSO3   Learn about various properties of materials

PSO4   Hands-on practice of basics and advanced experiments intended for industrial and research applications

Syllabus of Courses

![MSU Baroda logo]	**The Maharaja Sayajirao University of Baroda** **Faculty Technology and Engineering** **Department of Applied Physics**	**Academic Year**	**2022-23**

FSBE-1 (Civil/IWM/Mechanical)

Year	**I**	**Core / ~~Elective / Foundation~~** **APH1XXXL: Applied Physics Laboratory Practical**	**Credits / Hours per week**	**02hrs (Credit 1)**
Semester	**I**	Year of Introduction: ~~2007~~ Year of Syllabus Revision~~: 2016~~	**Maximum Marks / Grade**	**50**
Mode of Transaction		Laboratory Experiments, Discussion and viva		

Course Outcome (CO) APH1101L
- CO1 Understanding the optical instruments
- CO2 Understanding the physical properties through experiments
- CO3 Methods to determine physical properties
- CO4 Understanding of advances in instrumentation

No.	Experiment	Hours	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R) /Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
1	**Microscope:** - To determine the average separation between consecutive wires of a given grid using travelling Microscope	02	1,2	CO1, CO2	PSO1, PSO2	SD	G	PE

2	**Telescope:** - To determine the resolving power of given Telescope using Raleigh Criteria of Resolution	02	2	CO1 CO2	PSO1, PSO2			
3	**Frequency of AC Mains:** To determine the frequency of A. C. Mains	02	2,3	CO3 CO4	PSO1, PSO2			
4	**Sound Waves:** To determine the velocity of sound wave in air using resonance tube	02	3,4	CO4	PSO1, PSO3			
5	**Ultrasonic Waves:** To determine the frequency of Ultrasonic waves and find out the velocity of Ultrasonic wave in air by using the interference theory of longitudinal wave.	02	2,3	CO1 CO2	PSO1, PSO4			
6	**Solar Cell:** Study of I-V characteristics and determine the various parameters of given solar cell	02	2,3	CO4	PSO1, PSO3			
7	**Laser Parameters:** To determine the full angular divergence of the given gas laser	02	3,4	CO4	PSO1, PSO3			
8	**Wavelength of Laser:** To determine the wavelength of the given laser source using diffraction	02	3,4	CO4	PSO1, PSO3			
9.	**Temperature Sensor:** To study the nature of different temperature (NTC/PTC/Pt-100)	02	4,5	CO1	PSO1, PSO3			
10.	**Young's Modulus:** To determine the Young's Modulus of a given object	02	4,6	CO1	PSO1, PSO3			
	References							
1.	Engineering Physics, R.K.Gaur and S.L.Gupta Dhanpatrai Paublication Ltd. 8th Edition							
2.	Fundamentals of Physics, D.Haliday, R.Resnik aand J.Walker Asisan Books Pvt Ltd, 8th Edition							
3.	Practical Physics, C.L.Arora S.Chand Publications							