PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

NAAC Accredited-2022

'B^{++}' Grade (CGPA 2.96)

Name of the Faculty: Science & Technology

CHOICE BASED CREDIT SYSTEM

Syllabus: PHYSICS

Name of the Course: B.Sc. II (Sem.–III & IV)

(Syllabus to be implemented June 2023)

PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

B. Sc. Part – II
Core Subject: - Physics

(CBCS Semester Pattern) syllabus w.e.f. June 2023)

Programme Outcomes:

1. To understand the basic laws and explore the fundamental concepts of physics.
2. To understand the concepts and significance of the various physical phenomena.
3. To carry out experiments to understand the laws and concepts of physics.
4. To apply the theories learnt and the skills acquired to solve real time problems.
5. To acquire a wide range of problem solving skills, both analytical and technical and to apply them.
6. To enhance the student's academic abilities, personal qualities and transferable skills this will give them an opportunity to develop as responsible citizens.
7. To produce graduates who excel in the competencies and values required for leadership to serve a rapidly evolving global community.

Marks and Credits Distribution System

1. There will be four theory papers (Paper V and Paper VI for semester III and Paper VII and Paper VIII for semester IV) of 50 marks and 2 credits each. Annual practical examination will be of 100 marks and 4 credits. Total marks for physics as a core subject will be 300 [200 marks (8 credits) for theory and 100 marks (4 credits) for practical). Assessment system for both theory and practical will be of 80 % UA (University Assessment) and 20 % CA (College Assessment).

2. There shall be three periods per paper per week for theory and eight periods per week per practical batch of 16 (Sixteen) students each.

3. Duration of theory examination for each paper of 40 marks will be 2 hours each and that for the practical examination will be two days means 4 sessions of 3 hours each.

4. The theory examination of paper V and VI will be held at the end of semester III.

5. The theory examination of paper VII and VIII will be held at end of semester IV.

6. The practical examination of the both semester will be held at the end of semester IV. Every student will have to perform four experiments i.e. any one from each group.

7. Report of 20 % CA (5 Marks for internal examination and 5 Marks for assignment of each paper of every semester) of theory and practical (5 Marks for each group at the end of second term of B Sc Part II before commencement of University examination of fourth semester) has to submit by the College in the University office.

Titles of Physics as a core subject with their papers

Semester - III			
Paper No.	**Paper Name**	**Total marks**	**Scheme of marking**
V	General Physics and Sound	50	80% (UA) + 20% (CA)
VI	Electronic Devices and Applications	50	80% (UA) + 20% (CA)
Semester - IV			
VII	Geometrical, Physical and Fiber Optics	50	80% (UA) + 20% (CA)
VII	Modern Physics	50	80% (UA) + 20% (CA)
Practical			
At the end of Fourth Semester		100	80% (UA) + 20% (CA)

UA (University Assessment): Four groups each of 15 marks, 10 marks for Journal 10 marks for Educational tour/Industrial visit/Seminar or Conference attendance/Project report
CA (College Assessment): 20 Marks

Equivalent Subject for Old Syllabus

Sr. No.	Paper No.	Name of the OLD paper	Name of the NEW paper
1.	V	General Physics and Heat	General Physics and Sound
2.	VI	Electronics	Electronic Devices and Applications
3.	VII	Optics	Geometrical, Physical and Fiber Optics
4.	VIII	Modern Physics	Modern Physics

B.Sc. II

Semester III

General Physics and Sound

Core Paper	**Paper No.**	**Theory**	**Marks**	**Credit**
DSC 1C	V	30	50 (UA 40 + CA 10)	2

Course Objective:

1. To apply scientific and technical knowledge and skills of physics to other areas of a study.
2. To realize basic concepts, principles, laws and the theories related to various scientific phenomena.
3. To apply theories and solve problems faced in real life.

Course Outcomes:

After completion of the course the students

1. Understand vector analysis, differential operators and their physical significance.
2. Understand the concepts of precession, nutation and its applications.
3. Understand the concept of elasticity and its relevance.
4. Understand the concept of viscosity and different viscometer.
5. Illustrate concept of acoustics and its applications.
6. Develop problem solving skills and able to assess the results.

Unit - I		
Sr. No.	***Name of the chapter***	***Contact hrs.***
	1. Vectors	6
1.1	Scalar and vector triple product	
1.2	Scalar and vector fields	
1.3	Del operator	
1.4	Divergence of a vector and their physical significance	
1.5	Curl of vector and their significance	
1.6	Problems	
	2. Precessional Motion	6
2.1	Precession	
2.2	Gyroscope	
2.3	Nutation	
2.4	Lanchester's rule	
2.5	Gyrostatic pendulum	
2.6	Motion of rolling disc	
2.7	Gyroscopic applications in brief	
2.8	Problems	
	3. Elasticity	6
3.1	Bending of a beam	
3.2	Bending moment	

3.3	Centrally loaded beam	
3.5	Y and η by Searle's method	
3.6	Problems	
Unit – II		
	4. Viscosity	6
4.1	Motion in a viscosity medium – Stroke's law	
4.2	Viscosity of liquid by rotating cylinder method	
4.3	Searle's viscometer	
4.4	Ostwald's viscometer	
4.5	Viscosity of gasses – Rankin's Method	
4.6	Problems	
	5. Sound	6
5.1	Acoustic transducers i) Pressure microphone ii) Moving coil loudspeaker	
5.2	Acoustics and its affecting factors	
5.3	Reverberation time and its optimum value	
5.4	Requirements of good Acoustics	
5.4	Sabine's formula	
5.5	Problems	

Reference Books:

Sr. No.	Name of the book	Author/s
1	Elements of matter	D.S. Mathur
2	Physics for degree students	C. L. Arora, P. S. Hemne.
3	Text book of properties of matter	N. S. Khare , S. K. Kumar
4	Text book of Sound	Brijlal and Subramanyam
5	Sound	Khanna and Bedi
6	Sound	Wood A. B
7	Mathematical Physics	Rajput & Gupta
8	Engineering Physics Part I	Selladurai PHI Learning Pvt. Ltd, New Delhi

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Semester III

Electronic Devices and Applications

Core Paper	**Paper No.**	**Theory**	**Marks**	**Credit**
DSC 1C	VI	30	50 (UA 40 + CA 10)	2

Course Objective:

1. The objective of this course is to introduce students to the basic knowledge of semiconductor devices and Digital Electronics, their practical applications.
2. This course mainly introduces basic electronic devices namely Transistor's amplifiers, Oscillators, Cathode Ray Oscilloscope, Field effect transistors (FETs) and Unijunction transistor (UJT).

Course Outcomes:

After completion of the course the students
1. Understand the basic theory and operation of semiconductor devices used for its circuit applications.
2. Understand the basic circuit concepts and responses.
3. Get hands-on on various electronic circuits and instruments.
4. Get expose to electronics technologies.

Unit - I		
Sr. No.	***Name of the chapter***	***Contact hrs.***
	1. Transistor amplifier	**7**
1.1	Transistor biasing: voltage divider bias	
1.2	Two stage R-C coupled transistor amplifier	
1.3	Frequency response curve of an amplifier	
1.4	Feedback	
1.5	Effect of positive and negative feedback on the frequency response curve	
1.6	Differential amplifier	
1.7	Modes of operation	
1.8	Common mode and differential mode signals	
1.9	Comparison between normal amplifier and differential amplifier	
1.10	Problems	
	2. Oscillator	**6**
2.1	Types of waveforms	
2.2	Oscillations from tank circuit	
2.3	Barkhausen criterion for sustained oscillations	
2.4	Concept of AF and RF oscillator	
2.5	Phase shift oscillator	
2.6	Colpitt's oscillator	
2.7	Hartley oscillator	
2.8	Crystal oscillator	
2.9	Problems	

	3. Unipolar Device	5
3.1	FET: Construction, operation, parameters and characteristics	
3.2	Application of FET as VVR	
3.3	UJT: Construction, operation and characteristics	
3.4	UJT as voltage sweep generator	
3.5	Problems	
	Unit – II	
	4. Digital Electronics	6
4.1	Binary number systems and operations	
4.2	De Morgan's theorems	
4.3	Half adder	
4.4	Full adder	
4.5	RS flip flop	
4.6	JK flip flop.	
4.7	Problems	
	5. Electronic Instruments	6
5.1	Principle, construction and working of CRT	
5.2	Block diagram of CRO	
5.3	Uses of CRO	
5.4	Digital multimeter (DMM) and its applications	
5.5	Regulated power supply – 1. Transistor series voltage regulator 2. IC voltage regulator	
5.6	Problems	

Reference Books:

Sr. No.	Name of the book	Author/s
1	Principles of electronics	V.K. Mehta
2	Electronics principles	Malvino
3	Op-Amps and linear integrated circuits	Ramakant Gayakwad
4	A Text book of Electrical Technology Vol. IV	B.L. Theraja, A.K. Theraja
5	Electronic Devices and Circuits, An introduction	Allen Mottershed
6	Basic Electronics & Linear Circuits	N.N Bhargava, D.C. Kulshreshta, S.C. Gupta.
7	Digital Principles and Applications	Malvino and Leach
8	Electronic Devices and Circuits	Jacob Milman & Chrstes S Halkias

B.Sc. II

Semester IV

Geometrical, Physical and Fiber Optics

Core Paper	Paper No.	Theory	Marks	Credit
DSC 2C	VII	30	50 (UA 40 + CA 10)	2

Course Objective:

1. To apply skills of geometrical, physical and fiber optics to other areas of a study.

2. To apply theories and solve problems faced in real life.

3. To perform the experiments as a) Goniometer for equivalent focal length b) Diffraction at single slit c) Resolving power of grating d) Optical activity by polarimeter

Course Outcomes:

After completion of the course the students

1. Understand the cardinal points of lens system
2. Understand the phenomenon of interference of light. Michelson's interferometer and F-P interferometer and its applications
3. Understand phenomenon of diffraction of light and use of zone plate
4. Understand concept of resolving power and find R.P of prism and grating
5. Understand polarization, optically active substance and its use in polarimeter
6. Understand of optical fiber and its use in communication system

Unit - I		
Sr. No.	***Name of the chapter***	***Contact hrs.***
	1. Cardinal points	**6**
1.1	Lagrange's equation	
1.2	Cardinal points of optical system	
1.3	Graphical construction of image using cardinal points & Newton's formula	
1.4	Relation between focal lengths for any optical system	
1.5	Relations between lateral, axial and angular magnifications	
1.6	Combination of two thin lenses separated by finite distance	
1.7	Problems	
	2. Interference of light	**5**
2.1	Michelson's interferometer	
2.2	Applications of Michelson's interferometer to measure i) wavelength of light ii) Difference in wavelengths and iii) Refractive index of thin film	
2.3	Fabry Perot interferometer	
2.4	Superiority of F.P. interferometer over Michelson's interferometer	
2.5	Problems	

	3. ***Diffraction of light & resolving power***	7
3.1	Fresnel's half period zones	
3.2	Explanation of rectilinear propagation of light	
3.3	Zone plate	
3.4	Fresnel's diffraction at straight edge	
3.5	Geometrical and spectral resolution	
3.6	Distinction between magnification and resolution	
3.7	Modified Rayleigh's criterion	
3.8	R.P. of plane diffraction grating	
3.9	R. P. of prism	
3.10	Problems	
	Unit - II	
	4. ***Polarization***	7
4.1	Concept of polarization	
4.2	Double refraction	
4.3	Huygen's explanation of double refraction through uni-axial crystals	
4.4	Nicol's prism and optical rotation	
4.5	Optical Activity and Specific Rotation	
4.6	Laws of rotation and plane of polarization	
4.7	Polaroid and their use to polarization	
4.8	Polarimeter experiment	
4.9	Problems	
	5. ***Optical Fibers***	5
5.1	Structure of fibers	
5.2	Types of optical fiber	
5.3	Numerical aperture	
5.4	Step index fiber and graded index fiber	
5.5	Fiber optic communication system	
5.6	Advantages of optical fiber	
5.7	Problems	

Reference Books:

Sr. No.	Name of the book	Author/s
1	Optics and Spectroscopy	R. Murigation
2	Text book of optics (new edition)	Brijlal and Subramanyam
3	Optics (Second edition)	Ajay Ghatak
4	Geometrical and Physical optics	D. S. Mathur
5	Fundamental of optics	Jenkins and white
6	Optics and Atomic physics	Satya Prakash
7	Engineering Physics	S. Selladurai
8	Optical Communication	Jain, Mathur

B.Sc. II

Semester IV

Modern Physics

Core Paper	**Paper No.**	**Theory**	**Marks**	**Credit**
DSC 2C	VIII	30	50 (UA 40 + CA 10)	2

Course Objective:

1) To provide an understanding of physical concepts and theories of modern physics.
2) To provide an advance description of nature through new theories different from classical description.
3) To introduce the special theory of relativity, wave-particle duality and atomic physics.
4) To introduce production of X-rays and their applications.

Course Outcomes:

After completion of the course the students
1) Understanding of modern theories and evolution of physics from classical to its modern era.
2) Understand the intuitive ideas of the relativity.
3) Understand the nature of light in the form wave-particle duality.
4) Describe crystal structure with X-ray diffraction.

Unit - I		
Sr. No.	***Name of the chapter***	***Contact hrs.***
	1. The Special Theory of Relativity	8
1.1	Introduction	
1.2	Inertial and Non-Inertial frame of reference	
1.3	Galilean transformation	
1.4	Ether hypothesis	
1.5	Michelson-Morley experiment	
1.6	Einstein's postulates of special relativity	
1.7	Lorentz transformation	
1.8	Variation of length with velocity	
1.9	Variation of time with velocity	
1.10	Variation of mass with velocity	
1.11	Twin paradox	
1.12	Mass energy relation	
1.13	Problems	
	2. Matter Waves	6
2.1	De-Broglie's hypothesis of matter waves	
2.2	De-Broglie's wavelength - in terms of momentum, temperature and P.D./K.E.	
2.3	Particle velocity, group velocity, phase velocity and their inter-relationship	

2.4	Properties of matter waves	
2.5	Bohr's quantum condition on the basis of matter wave hypothesis	
2.6	Heisenberg's uncertainty principle	
2.7	Problems	
	3. Vector atom model	8
3.1	Space quantization	
3.2	Spin hypothesis	
3.3	Stern-Gerlach experiment	
3.4	Quantum number associated with vector atom model	
3.5	Pauli's exclusion principle	
3.6	Spin orbital coupling	
3.7	Hund's rule	
3.8	Total angular momentum	
3.9	L-S coupling	
3.10	j-j coupling	
3.11	Zeeman effect	
3.12	Normal and anomalous Zeeman effect	
3.13	Problems	
	Unit - II	
	4. Compton effect	3
4.1	Compton Effect	
4.2	Expression for change in wavelength for scattered photon	
4.3	Experimental verification of Compton effect	
4.4	Problems	
	5. X-rays	5
5.1	X-ray production by Coolidge tube : principal, construction and working	
5.2	Properties and characteristics of X-rays	
5.3	Continuous and Characteristic X-rays spectrum	
5.4	Bragg's Law	
5.5	Applications of X-rays in various fields	
5.6	Problems	

Reference Books:

Sr. No.	Name of the book	Author/s
1	Introduction to special relativity	Robert Resnik
2	Special relativity for beginners: A textbook for undergraduates	Jürgen Freund
3	Modern Physics 13th edition	R. Murugeshan and K. Sivaprasath
4	Elements of Modern Physics	S. H. Patil
5	Modern Physics (For B.E., B.Tech., B.Sc. and A.M.I.E students)	B. L.Theraja
6	Modern Physics 3rd edition	R. Serway, C. Moses and C. Moyer
7	Atomic Physics [Modern Physics] (For M.Sc. and B.Sc. Students)	S. N. Ghoshal

B.Sc. II (Physics)

Practical

Core Paper	Marks	Credit
DSC 2C	100 (80 UA+ 20 CA)	4

Course Outcomes:

After completion of the course the students

1) Understands the methods of experimental physics.

2) Emphasis on different laboratory techniques specially the importance of accuracy of measurements.

3) Providing a hands-on learning experience in measuring the basic concepts, properties of matter, heat , optics, electricity. electronics and modern physics.

List of Experiments

Group I (General Physics, Heat and Sound)

Sr. No.	Name of the experiments
1	Young's Modulus (Y) by bending of the centrally loaded beam
2	Y or η of the material of wire by Searle's method
3	Young's modulus (Y) by Vibration of a bar
4	Kater's Pendulum
5	Surface tension by Quinke's method
6	Viscosity of liquid by Searle's method
7	Surface Tension of liquid by capillary rise method
8	Thermal conductivity by Lees's method
9	Velocity of sound in air by Kundt's tube
10	Velocity of sound in air by resonating bottle

Group II (Electronics)

Sr. No.	Name of the experiments
1	Transistor series voltage regulator
2	Voltage divider bias
3	Use of C.R.O. for measurement of unknown AC voltage, DC voltage and frequency
4	Characteristics of FET
5	Coplitt's Oscillator
6	Phase shift Oscillator
7	DeMorgan's Theorems
8	Two Stage RC Coupled Amplifier
9	Construction of half adder and full adder using gates
10	UJT as voltage sweep generator

Group III (Optics)

Sr. No.	Name of the experiments
1	Biprism: To determine the wavelength of monochromatic light
2	Goniometer : equivalent focal length of thin lenses
3	Goniometer : cardinal points
4	Determination of Cauchy's constants
5	Double refracting prism

6	Optical activity of sugar solution (Polarimeter)
7	Diffraction at single slit
8	Resolving power of grating
9	Diffraction due to straight edge
10	Wedge shaped film: Measurement of thickness
	Group IV (Electricity, Magnetism and Modern Physics)
Sr. No.	**Name of the experiments**
1	Constants of B.G.
2	Comparison of Capacities by De Sauty's bridge
3	Mutual Inductance of coils
4	Low resistance by Carry Foster method
5	High resistance by nearly equal deflection method
6	Solar cell characteristics to determine fill factor and efficiency
7	Impedance of LCR circuit
8	Sharpness of series resonance circuit
9	Study of characteristics of G-M tube and determination of its operating voltage, Plateau length and slopes.
10	Verification of inverse square law for gamma rays

Note:

- At least eight experiments from each group are required to certify the journal.
- 10 Marks for certified journal
- 10 Marks should not be given in case of lost certificate.
- 10 Marks for educational trip / industrial visit/ seminar or conference attendance/ project report.
- Such students may appear the University practical examination of 80 marks.