"Dissemination of Education for Knowledge, Science and Culture"
-Shikshanmaharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha's

Vivekanand College, Kolhapur

(An Empowered Autonomous Institute).

DEPARTMENT OF PHYSICS

UG Programme

Syllabus as per NEP-2020 (Phase 2.0)

Curriculum, Teaching and Evaluation Structure

for

B.Sc.-II Physics

Semester – III & IV

(Implemented from academic year 2025-26 onwards)

VIVEKANAND COLLEGE, KOLHAPUR

(An Empowered Autonomous Institute)

Department of Physics
B.Sc.

Program Outcomes (POs):

PO1: **Disciplinary Knowledge:** Graduates will gain in-depth understanding in their specific major or discipline, mastering the foundational principles and theories, as well as advanced concepts. Execute strong theoretical and practical understanding developed from the specific programme in the area of work.

PO2: **Problem-Solving Skills:** Graduates will learn to use their knowledge to identify, analyze, and solve problems related to their field of study.

PO3: **Analytical Skills:** Graduates will gain the ability to collect, analyze, interpret, and apply data in a variety of contexts. They might also learn to use specialized software or equipment.

PO4: **Research Skills and Scientific temper:** Depending on the field, graduates might learn how to design and conduct experiments or studies, analyze results, and draw conclusions. They might also learn to review and understand academic literature.

PO5: **Communication Skills:** Many programs emphasize the ability to communicate effectively, both orally and in writing. Graduates may learn to present complex information clearly and succinctly, write detailed reports, and collaborate effectively with others.

PO6: **Ethics and Professionalism**: Graduates may learn about the ethical and professional standards in their field, and how to apply them in real-world situations.

Program Specific Outcomes (PSOs):

PSO1: Understand basic mechanics and properties of matter.

PSO2: Students should understand mathematical concepts needed for understanding Physics.

PSO3: Students should understand fundamental basic theories of General Physics, Classical Mechanics, Quantum mechanics, Electricity and magnetism, Modern Physics, Space Science, Semiconductor Physics and able to apply this knowledge to analyze the variety of physics phenomenon.

PSO4: Students should learn laboratory skills; students should take measurements in Physics laboratory and analyze the measurements to draw valid conclusions.

VIVEKANAND COLLEGE, KOLHAPUR

(An Empowered Autonomous Institute)

Department of Physics

Departmental Teaching and Evaluation Scheme

UG Programme

Syllabus as per NEP-2020 (Phase 2.0)

B.Sc. II, Semester-III & IV

Sr. No.	Course Abbr.	Course code	Course Name	Teaching Scheme Hours/week		Examination Scheme and Marks				Course Credits
				TH	PR	ESE	CIE	PR	Marks	
Semester-III										
Major										
1	DSC-V	DSC03PHY31	Thermal Physics and Statistical Mechanics – I	2	-	40	10	-	50	2
2	DSC-VI	DSC03PHY32	Waves and Oscillations	2	-	40	10	-	50	2
3	DSC-PR-III	DSC03PHY39	DSC-Physics Lab-3	-	8	-	-	50	50	4
4	VSC-PR-I	VSC03PHY39	Lab Activities of Electronic devices	-	4	-	-	25	25	2
Minor										
5	MIN-V	MIN03PHY31	Fundamentals of Astronomy	2	-	40	10	-	50	2
6	MIN-VI	MIN03PHY32	Fundamentals of Astrophysics	2	-	40	10	-	50	2
7	MIN-PR-III	MIN03PHY39	MIN-Physics Lab-3	-	4	-	-	25	25	2
Open Elective										
8	OE-PR-III	2OEC03PHY39	Home Appliances Maintenance and Repairing	-	4	-	-	25	25	2
9	AEC-I		English	2	-	40	10	-	50	2
10	VEC-II		Environmental studies	-	-	50	-	-	-	2
Semester –III Total				**10**	**20**	**250**	**50**	**125**	**375**	**22**
Semester-IV										
Major										
1	DSC-VII	DSC03PHY41	Thermal Physics and Statistical Mechanics – II	2	-	40	10	-	50	2
2	DSC-VIII	DSC03PHY42	Optics	2	-	40	10	-	50	2
3	DSC-PR-IV	DSC03PHY49	DSC-Physics Lab-4	-	8	-	-	50	50	4
4	VSC-PR-II	VSC03PHY49	Lab Activities of Electronic devices	-	4	-	-	25	25	2
Minor										
5	MIN-VII	MIN03PHY41	Galaxy, cosmology and solar system	2	-	40	10	-	50	2
6	MIN-VIII	MIN03PHY42	Cosmic electrodynamics	2	-	40	10	-	50	2

7	MIN-PR-IV	MIN03PHY49	MIN-Physics Lab-4	-	4	-	-	25	25	2
Open Elective										
8	OE-PR-IV	2OEC03PHY49	Lab Activities of Physics Workshop Skills		4	-	-	25	25	2
9	AEC-II		English	2	-	40	10	-	50	2
10	VEC-III		Environmental studies	-	-	50	-	-	-	2
Semester –IV Total				**10**	**20**	**250**	**50**	**125**	**375**	**22**

B.Sc. II, Semester-III (DSC-V)

Thermal Physics and Statistical Mechanics -I
(DSC03PHY31)
(Credit: 2, 30 Hours)

Course Outcomes: After the completion of the course the student will be able to –

CO1	Demonstrate and understand the basic primary knowledge of Thermal Physics and Statistical Mechanics.
CO2	Get a proficiency in solving problems in Thermal Physics and Statistical Mechanics.
CO3	Understand the basic concepts of Kinetic Theory of Gases, Transport Phenomena, Thermometry, Thermodynamic Laws, Thermodynamic Process, Isothermal, Adiabatic Process, Entropy Etc.
CO4	Develop the critical skills in students to understand Thermal Physics, Statistical Mechanics etc.

Unit	Syllabus	Hours
Unit 1	**Kinetic Theory of Gases and Thermometry** **Kinetic Theory of Gases:** Kinetic model of an ideal gas, Mean free path and its expression, RMS velocity, Most probable velocity, Derivation of Maxwell's law of distribution of velocities and its experimental verification, Transport Phenomena: transport of momentum (viscosity), Transport of thermal energy (conduction), Transport of mass (diffusion), Law of equipartition of energy (qualitative) and its applications to specific heat of monoatomic and diatomic gases. **Thermometry:** Concept of heat and temperature, Temperature scales, Principle of thermometry, Mercury thermometer, Platinum resistance thermometer, Thermocouple (Principle, construction and theory), Thermoelectric thermometer.	15
Unit 2	**Laws of Thermodynamics and Entropy** Thermodynamic system, Thermodynamic variables, Thermodynamic state, equation of state, Thermodynamic equilibrium, Zeroth Law of thermodynamics, Internal energy, First law of thermodynamics, Conversion of heat into work, Specific heats C_P & C_V, Applications of First Law thermodynamics (Isothermal process, Adiabatic process, Isochoric, Isobaric), Relation between C_P & C_V, Workdone during isothermal and adiabatic processes, Reversible & irreversible processes, Second law of thermodynamics, Carnot's ideal heat engine, Carnot's cycle (Working & efficiency), Carnot's theorem. **Entropy**: Concept & significance, change in entropy, Entropy changes in reversible & irreversible processes, Third law of thermodynamics, Entropy change in conduction of heat, Diffusion of gases, Physical significance of entropy, Un-attainability of absolute zero, Zero point energy, Application of thermodynamics.	15

Reference Books:

1. Heat and Thermodynamics – Brij Lal and N. Subramanyam, S. Chand and Co. Ltd., 2002
2. Theory and Experiments on Thermal Physics – P. K. Chakrabarti, New Central Book Agency (P) Ltd., 2013
3. Thermodynamics And Statistical Physics - Sharma, J. M., Himalaya Publishing House, 2005
4. Text book of heat- J. B. Rajam, S. Chand and company Ltd., 1967
5. Thermal Physics: with Kinetic Theory, Thermodynamics and Statistical Mechanics - S.C. Garg, R.M. Bansal, C.K. Ghosh, Mc Graw Hill, 2017
6. Fundamentals of Statistical and Thermal Physics, Reif Frederick, New York, McGraw-Hill, 1965.

B.Sc. II, Semester-III (DSC-VI)

Waves and Oscillations
(DSC03PHY32)
(Credit: 2, 30 Hours)

Course Outcomes: After the completion of the course the student will be able to -

CO1	Demonstrate and understand the basic primary knowledge of waves and oscillations.
CO2	Get a proficiency in solving problems in waves and oscillations.
CO3	Understand the basic concepts of harmonic oscillations, oscillations of different frequencies, Lissajous figures, coupled oscillations, ultrasonic waves their applications, acoustic of building and reverberations
CO4	Develop the critical skill in students to understand waves and oscillations.

Unit	Syllabus	Hours
Unit 1	**Superposition of Harmonic Oscillations:** Linearity and superposition principle, Composition of two simple harmonic motions, Superposition of two collinear harmonic oscillations- for oscillations having equal frequencies (Analytical and geometrical methods) and oscillations having different frequencies (Beats), Superposition of two perpendicular harmonic oscillations - for oscillations having equal frequencies (Graphical and analytical methods) and oscillations having different frequencies (Lissajous figures), Uses of Lissajous figures. **Coupled Oscillations:** Normal modes of vibration, Normal coordinates, Frequency of oscillatory systems, Energy transfer in coupled oscillatory system.	15
Unit 2	**Waves Motion and Ultrasonic waves:** Waves Motion: Plane waves, Spherical waves, Transverse waves on a string, Travelling and standing waves on a string, Normal modes of a string, Group velocity and phase velocity. Ultrasonic waves: Piezo-electric effect, Production of ultrasonic waves by Piezo-electric generator, Detection of ultrasonic waves, Properties of ultrasonic waves, Applications of ultrasonic waves. **Sound and Acoustics of buildings:** Sound: Transducers and their characteristics, Types of microphones, Moving coil loudspeaker, Intensity and loudness of sound, Decibels, Intensity levels, Musical notes, Musical scale. Acoustics of buildings: Reverberation and reverberation time, Absorption coefficient, Concept of perfect absorber, Optimum reverberation, Sabine's formula for measurement of reverberation time, Acoustic aspects of halls and auditoria.	15

Reference Books:

1) Elements of properties of matter - D. S. Mathur, S. Chand & Co. Pvt. Ltd., New Delhi, Reprint, 2016
2) A textbook of sound – N Subrahmanyam, Brijlal, Vikas Publishing House Pvt. Ltd., New Delhi., 1985
3) Waves and Oscillations - N. Subrahmanyam, Brij Lal, Vikas Publishing House Pvt. Ltd., New Delhi, 2nd Revised Edition, 2012
4) Waves and Oscillations – Dr. D. N. Tripathy, Kedarnant Ramnant Meerut, Delhi., 2020
5) The Physics of Waves And Oscillations, N. K. Bajaj, McGraw Hill Education Private Limited, 2001.
6) Waves and Oscillations, R. N. Chaudhuri, NEW AGE INTERNATIONAL (P) LIMITED, PUBLISHERS, 2001.

B.Sc. II Physics Lab Work (Practical)
DSC Physics Lab III
(DSC03PHY39)
Group I
(Thermal Physics)

1) To determine the value of Stefan's Constant.
2) High resistance by method of leakage.
3) Resistance of B.G. by half deflection method.
4) To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
5) To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
6) To study the variation of thermo e.m.f. across two junctions of a thermocouple with temperature.
7) To record and analyze the cooling temperature of hot object as a function of time using a thermocouple.
8) To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge.
9) To Calibration of Thermocouple.

Group II
(Waves, Oscillation and Sound)

1) Velocity of sound in air using resonating bottle.
2) Study of Lissajous figures using CRO.
3) To investigate the motion of coupled oscillators.
4) Determination of frequency of an electrically maintained tuning fork by Melde's experiment and to verify λ^2-T law.
5) Colpitts's oscillator.
6) Piezoelectric Oscillator.
7) Crystal Oscillator.
8) To investigate and analyze the fundamental properties of sound waves, including frequency, amplitude, and waveform.
9) To explore the concepts of sound wave interference and resonance.
10) To observe and analyze the Doppler effect by studying how the frequency of a sound wave changes as the source and observer move relative to each other.
11) To investigate how sound waves reflect off surfaces and create echoes.
12) To study the harmonic content of sound waves produced by different sources.

B.Sc. II, Semester-III
(Lab Activities of Electronic devices)
VSC-PR-I
(VSC03PHY39)

1) Verification of truth table of basic gates (AND, OR, NOT) using ICs.

2) Construction of basic gates (AND, OR, NOT) using NOR and NAND gates

3) Construction and study of half adder using NAND gates.

4) Construction and study of full adder using NAND gates.

5) Study of Colpitts oscillator

6) Study of Hartley Oscillator

7) Study of low pass and high pass filter using resistance and capacitance

8) To study input out characteristics of solar cell

9) To study about solar lighting

10) To study of solar cooker

11) To study of wind energy

12) To study of characteristics of LDR

Evaluation Scheme

- The total marks for each paper will be 50.
- There will be semester end examination (SEE) of 40 marks for each paper.
- There will be continuous internal evaluation (CIE) of 10 marks for each paper.
- There will be separate passing for SEE, CIE, practical examination and vocational skill courses (VSC).

Paper No.	Semester End Examination (SEE)	Continuous Internal Evaluation (CIE)	Total
V	40	10	50
VI	40	10	50

- There will be practical examination of 50 marks at the end of semester III
- Distribution of 50 marks of practical is as below

Group I	22
Group II	22
Journal	06
Total	**50**

- **VSC-PR-I: Distribution of 25 marks of practical is as below**

VSC-PR-II	**22**
Journal	**03**
Total	**25**

Nature of Question Paper (Semester End Examination)

Instructions:

1) All the questions are **compulsory**.
2) Figures to the right indicate **full** marks.
3) Draw neat labeled diagrams **wherever** necessary.

Time: 2 Hours **Total Marks:40**

Paper V

Q:1] Chose correct alternative

Eight Multiple Choice Questions 8 Marks

1)
2)
3)
4)
5)
6)
7)
8)

Q:2] Long Answer questions (Attempt any **TWO** out of three) 16 Marks

1)
2)
3)

Q:3] Short Answer questions (Attempt any **FOUR** out of six) 16 Marks

1)
2)
3)
4)
5)
6)

Minor

B.Sc. II, Semester-III (MIN-V)

Fundamentals of Astronomy

(MIN03PHY31)

(Credit: 2, 30 Hours)

Course Outcomes: After the completion of the course the student will be able to:

CO1	To understand the basic primary concept of ancient astronomical theories. To understand the knowledge of apparent luminosity of stars.
CO2	Students will demonstrate a proficiency in solving problems in Astronomy and Astrophysics
CO3	To understand the basic concepts of (I) Celestial objects, Celestial Sphere, Celestial Coordinates. (II) Terrestrial distances, concept of light years, distance of sun, moon and stars. (III) Identification of stars, various constellations and Comets, Asteroids and Meteors.
CO4	To develop the critical skill in students to understand Astronomy

Unit	Syllabus	Lectures
Unit 1	**History of Astronomy and Apparent Luminosity of stars** Babylonian astronomy, Greek astronomy, Aristotle work, Ptolemy's astronomical work, Copernican heliocentric theory, Tychonian system, Luminosity of stars, Magnitude scale, expression for luminosity, flux and magnitude, Luminosity measurement (1) Visual method (2) Photographic method, and (3) Photoelectric method. **The Sky, Calendar, and Celestial coordinates** The moon, Sun and stars as calendars, sidereal day, sidereal time, appearance of the celestial sphere and its parts, celestial co-ordinates, longitude, and latitude on the earth celestial co- ordinates	15
Unit 2	**The Stellar distances** Measurement of terrestrial distances, distance of moon, distance of planets, Astronomical unit aberration of star light, Definition of parallax and Geocentric parallax, Trigonometric parallax of stars, light years and parsec. **Constellations, Comets, Asteroids, Meteors** of stars, Constellations – Aries, Pisces, Orion, Asterisms – summer triangle and Big Dipper (Saptarishi). Comets, Asteroids, Meteors- Structure, chemical composition, and orbits.	15

Reference books:

1) Introductory Astronomy and Astrophysics – Zeilik and Greogary, Fort Worth: Saunders College Pub., 1998
2) Moons and Planets – William K. Hartmann, Belmont, Calif.: Wadsworth Pub. Co., 1983
3) Our Solar System – A. W. Joshi and N. Rana, New Age International Publishers, 1992.
4) The Structure of Universe – Jayant Narlikar, London; New York: Oxford University Press, 1977.
5) Astrophysics Stars & Galaxies – K. D. Abhyankar, Universities Press, 2002
6) Quasars and Active Galactic Nuclei An Introduction – A. K. Kimbhavi and Jayant Narlikar, University of Cambridge

ESOL Examinations, 1999.

B.Sc. II Semester-III (MIN-VI)
Fundamentals of Astrophysics
(MIN03PHY32)

Course Outcomes: After the completion of the course the student will be able to:

CO1	understand the Nature of Light and message of the star light
CO2	Students will learn and demonstrate Basic Tools of Astronomers
CO3	To understand the basic concepts of Various Spectrums, evolutions of stars, H-R diagram. and Different theories describing origin of stars
CO4	To develop the critical skill in students to understand Astrophysics.

Unit	Syllabus	Lectures
Unit 1	**The Nature of Light and Message of The Star Light** Light as an electromagnetic wave, Electromagnetic spectrum. Electromagnetic radiation from heated object, Doppler shift and its applications, atomic spectra-emission and absorption spectra(Fraunhofer lines), Stellar spectra, Classification of stellar spectra **Basic Tools of Astronomers** Optical telescopes-Galilean, Newtonian, Cassegrainian, Hubble space telescope, Magnifying power of telescope, Resolving power of telescope, Spectroscope (prism, grating), UV, IR, Radio, X-Ray and Gravitational waves astronomy.	15
Unit 2	**Stellar Evaluation** Birth of a star, maturity of a star, ageing of stars, death of a star, supernova explosion, pulsars and black holes. Hertzsprung-Russell (H-R) diagram- white and red dwarfs, electron in a white dwarf, Chandrasekhar limit, Neutron stars **Theories on origin of stars** Nebular hypothesis, Spectral classification of stars, O,B,A,F,G,K,M.**,** Nuclear Reactions in stars, Luminosity of star, Photon diffusion time, luminosity of star, gravitational potential energy of a star, internal temperature and pressure of a star.	15

Reference books:

1) The Structure of Universe – Jayant Narlikar, London; New York: Oxford University Press, 1977.
2) Moons and Planets – William K. Hartmann, Belmont, Calif.: Wadsworth Pub. Co., 1983
3) Our Solar System – A. W. Joshi and N. Rana, New Age International Publishers, 1992.
4) Quasars and Active Galactic Nuclei An Introduction – A. K. Kimbhavi and Jayant Narlikar, University of Cambridge ESOL Examinations, 1999.
5) Astrophysics Stars & Galaxies – K. D. Abhyankar, Universities Press, 2002
6) A journey beyond stars life and time of, Jayant Narlikar, Vishwakarma Publications, 2023

B.Sc. II Physics SEM III
Lab Work (Minor Practical)
(MIN03PHY39)
Min-Physics Lab III

Group I

1) Total internal reflection in prism.
2) To use idea of parallax to determine large distance
3) Lummer Brothum Photometer (comparison of intensities)
4) Spherical aberration (caustic curve).
5) Resolving power of telescope.
6) Magnifying power of telescope.
7) Determination of Planck's constant using LED
8) Goniometer: Equivalent focal length
9) Study of scattering of light (Diameter of Lycopodium powder).
10) Verification of Stefan's forth power law.
11) Study of solar spectrum.
12) Sunspots activity analysis.
13) Study of line absorption spectrum and measurement of temperature of flame.

Evaluation Scheme

- The total marks for each paper will be 50.
- There will be semester end examination (SEE) of 40 marks for each paper.
- There will be continuous internal evaluation (CIE) of 10 marks for each paper.
- There will be separate passing for SEE, CIE, practical examination and vocational skill courses (VSC).

Paper No.	**Semester End Examination (SEE)**	**Continuous Internal Evaluation (CIE)**	**Total**
V	40	10	50
VI	40	10	50

- There will be practical examination of 25 marks at the end of semester III
- Distribution of 25 marks of practical is as below

Group I	22
Journal	03
Total	**25**

Nature of Question Paper (Semester End Examination)

Instructions:

1) All the questions are **compulsory**.
2). Figures to the right indicate **full** marks.
3) Draw neat labeled diagrams **wherever** necessary.

Time: 2 Hours **Total Marks:40**

Paper V

Q:1] Chose correct alternative

Eight Multiple Choice Questions 8 Marks

1)
2)
3)
4)
5)
6)
7)
8)

Q:2] Long Answer questions (Attempt any **TWO** out of three) 16 Marks

1)
2)
3)

Q:3] Short Answer questions (Attempt any **FOUR** out of six) 16 Marks

1)
2)
3)
4)
5)
6)

B.Sc. II, Semester-III (OE-PR-III)
(Home Appliances Maintenance and Repairing)
(2OE03PHY49)

1) Study of electrical Component and testing.
2) Study of digital multimeter.
3) Study of transformer.
4) Ceiling fan.
5) Table fan.
6) Exhaust fan.
7) Mixer and grinder.
8) Electric tube.
9) LED bulb.
10) Adapter (charger).
11) Electric heater.
12) Electric kettle.
13) Electric oven.
14) Study of Switch and board connections.
15) Understand domestic wiring and layout

- **Distribution of 25 marks of practical is as below**

VSC-PR-III	**22**
Journal	**03**
Total	**25**

B.Sc. II, Semester-IV (DSC-VII)

Thermal Physics and Statistical Mechanics -II

(DSC03PHY41)
(Credit: 2, 30 Hours)

Course Outcomes: After the completion of the course the student will be able to:

CO1	Demonstrate and understand the applied knowledge of Thermal Physics, Statistical Mechanics.
CO2	Students will demonstrate a proficiency in solving problems in Thermal Physics, Statistical Mechanics.
CO3	Understand the basic concepts of (I) Application of Maxwell's thermodynamic relations, cooling effect observed in case of gases, black body radiation, different radiation laws e.g. Wein's, Planck's, Rayleigh-jeans, Stefan -Boltzmann law. (II) Microstate, macro state, phase space, momentum space, thermodynamic probability, distribution of molecular speed.
CO4	Develop the critical skill in students to understand applied knowledge of Thermal Physics, Statistical Mechanics

Unit	Syllabus	Hours
Unit 1	**Thermodynamic Potentials:** Energy functions of Enthalpy, Gibbs free energy, Helmholtz free energy, Internal energy, Maxwell's thermodynamical relations, Joule-Thomson effect, Clausius- Clapeyron equation, Expression for ($C_P - C_V$), C_P/C_V, TdS equations, Application of TDS. **Theory of Radiation:** Introduction of Black body radiation (Thermal radiations, Blackbody radiation and its importance, Black body in practice and its temperature dependence, Emissive power, Absorptive power, Pressure of radiation.) Experimental study of black body radiation spectrum, Concept of energy density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh-Jeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law.	15
Unit 2	**Classical statistics:** Degrees of freedom, Momentum space, Position space, Phase space, Microstate and Macrostate, Accessible microstates, Priory probability, Thermodynamic probability, Probability distribution, Maxwell-Boltzmann distribution law, Evaluation of constants α and β, Entropy and thermodynamic probability, Distribution of molecular speeds. **Quantum statistics:** Need of quantum statistics, Partition function, Comparison of M.B., B.E., and F.D. statistics, Bose-Einstein distribution law, Photon gas, Fermi-Dirac distribution law.	15

Reference Books:

1) Heat and Thermodynamics- Brij Lal and N. Subramanyam, S. Chand and Co. Ltd., 2002
2) Theory and Experiments on Thermal Physics - P K Chakrabarti, New Central Book Agency (P) Limited, 2013
3) Text book of heat- J.B. Rajam, S. Chand and company Ltd, 1967
4) Statistics and Thermal Physics – S. Lokanathan, R. Gambhir, PHI learning Pvt. Ltd., 2011
5) Thermodynamics and Statistical Physics – Sharma and Sarkar, Himalaya Publishing House, 2005
6) Heat Thermodynamics and Statistical physics- J.P. Agrawal and SatyaPrakash, Pragati Prakashan, 2020

B.Sc. II, Semester-IV (DSC-VIII)
Optics
(DSC03PHY42)
(Credit: 2, 30 Hours)

Course Outcomes: After the completion of the course the student will be able to:

CO1	Demonstrate and understand the applied knowledge of Optics.
CO2	Students will demonstrate a proficiency in solving problems in Optics.
CO3	Understand the basic concepts of (I) Geometrical optics, cardinal points, lens system, resolving power of various optical instrument (II) Detail concepts of polarization, interference, and diffraction.
CO4	Develop the critical skill in students to understand applied knowledge of Optics.

Unit	Syllabus	Hours
Unit 1	**Cardinal points:** Combination of lenses (system), Cardinal points of an optical system (definitions only), Graphical construction of image using cardinal points, Newton's formula, Relation between f and f' for any optical system, Relation between lateral, axial and angular magnifications, Ramsden and Huygens eyepiece. **Resolving Power of optical instruments:** Concept of Resolution, Rayleigh's criterion for the limit of resolution, Modified Rayleigh's criterion, Comparison between magnification and resolution, resolving power of plane diffraction grating and prism. **Interference:** Division of amplitude and division of wave front, Division of wave front – Lloyd's single mirror (determination of wavelength of monochromatic source), Division of amplitude- Interference in thin parallel films (reflected light only), Wedge shaped films, Newton's rings and its application for determination of wavelength and refractive index of light, Michelson Interferometer.	15
Unit 2	**Diffraction:** Revision of wave fronts and diffraction, Fraunhofer diffraction - elementary theory of plane diffraction grating, Determination of wavelength of light using diffraction grating, Theory of Fresnel's half period zones, Zone plate (construction, working and its properties), Fresnel's diffraction at a straight edge. **Polarization of light:** Revision of plane of vibration, Plane of polarization, Perpendicular vibration, Parallel vibrations, Polarization by reflection and refraction, Polarization by double refraction, Huygen's explanation of double refraction through uniaxial crystals, Nicol prism (construction and working), Optical rotation - laws of rotation of plane of polarization, Polarimeter.	15

Reference books:

1) Text book of optics for B.Sc.- Brij Lal and N. Subrahmanyam, S. Chand & Co. Ltd. New Delhi, 2006.
2) Optics- Ajay Ghatak, 2nd Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2012
3) Wave Optics- R. K. Verma, Discovery Publishing House New Delhi, 2006
4) A text book of light - D. N. Vasudeva, 8th Edition, Atma Ram & Sons, Delhi,1976
5) Fundamentals of Optics -Francies A. Jenkins and Harvey E. White, 4th Edition, Tata McGraw-Hill Education Private Ltd., New Delhi,2011.
6) Introduction to Modern Optics, Grant R. Fowles, Dover Publications, 1989.

B.Sc. II Physics Lab Work (Practical)
DSC Physics Lab IV
(DSC03PHY49)
Group I
(Thermal Physics and Statistical Mechanics II)

1) To determine the temperature coefficient of resistance using post office box.
2) To verify Stefan's fourth power law.
3) To study negative temperature coefficient (NTC).
4) To study positive temperature coefficient (PTC).
5) To determine the Temperature of flame.
6) To determine the coefficient of thermal conductivity of glass in the form of tube.
7) To determine the thermal conductivity of metal bar by Forbes's method.
8) To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.

Group II
(Optics)

1) Goniometer I (Cardinal Points)
2) Goniometer II (Equivalent Focal Length)
3) Resolving Power of Prism
4) Determination of Cauchy's constant
5) Resolving power of grating
6) Determination of wavelength of light using Newton's ring
7) Determination of thickness of thin film using interference of wedge-shaped thin film
8) Polarimeter

B.Sc. II, Semester-IV (VSC-PR-III)
(Lab Activities of Electronics Devices)
(VSC03PHY49)

1) Study of P-N Junction Diode Characteristics
2) Zener Diode as a Voltage Regulator
3) Half-Wave Rectifier
4) Full-Wave Rectifier
5) Study of Transistor Characteristics (CE Confi.)
6) Study of JFET Characteristics
7) Frequency Response of CS-FET Amplifier
8) RC Coupled Amplifier
9) Study of LED Characteristics
10) Study of Photodiode Characteristics
11) Study Logic Gates
12) Study to Minimization of Logic Circuit

Evaluation Scheme

- The total marks for each paper will be 50.
- There will be semester end examination (SEE) of 40 marks for each paper.
- There will be continuous internal evaluation (CIE) of 10 marks for each paper.
- There will be separate passing for SEE, CIE, practical examination and vocational skill courses (VSC).

Paper No.	Semester End Examination (SEE)	Continuous Internal Evaluation (CIE)	Total
V	40	10	50
VI	40	10	50

- There will be practical examination of 50 marks at the end of semester IV
- Distribution of 50 marks of practical is as below

Group I	22
Group II	22
Journal	06
Total	**50**

- **VSC-PR-III : Distribution of 25 marks of practical is as below**

VSC-PR-III	**22**
Journal	**03**
Total	**25**

Nature of Question Paper (Semester End Examination)

Instructions:

1) All the questions are **compulsory**.
2). Figures to the right indicate **full** marks.
3) Draw neat labeled diagrams **wherever** necessary.

Time: 2 Hours **Total Marks:40**

Paper V

Q:1] Chose correct alternative

Eight Multiple Choice Questions 8 Marks

1)
2)
3)
4)
5)
6)
7)
8)

Q:2] Long Answer questions (Attempt any **TWO** out of three) 16 Marks

1)
2)
3)

Q:3] Short Answer questions (Attempt any **FOUR** out of six) 16 Marks

1)
2)
3)
4)
5)
6)

Minor

B.Sc. II, Semester-IV (MIN-VII)

Galaxies, Cosmology and Solar system

(MIN03PHY41)
(Credit: 2, 30 Hours)

CO1	Understand the basic knowledge about galaxies Cosmology, solar system and cosmic electrodynamics.
CO2	Demonstrate a proficiency in solving problems in galaxies Cosmology, solar system and cosmic electrodynamics.
CO3	Understand Origin of the solar system and planets
CO4	Develop the critical skill in students to understand applied knowledge of Galaxies, Cosmology, solar system, and cosmic electrodynamics.

Course Outcomes: After the completion of the course the student will be able to:

Unit	Syllabus	Lectures
Unit 1	**Galaxies** Components of the Universe: Introduction of Stars, Planets, Asteroids, Meteors, Comets, Galaxies, Formation of galaxies, visual morphology of galaxy, Types of galaxies-Elliptical, Spiral, Barred spiral, irregular, Hubble tuning fork diagram, peculiar galaxies, Radio galaxies, Seyfert galaxy, Quasars. [Galaxy: Nomenclature, observation theory, Types and morphology, properties, formation and evolution, large scale structure] **Milky Way galaxy** Shape of the galaxy, interstellar medium and molecules, Radio emission from interstellar carbon monoxide, clusters of stars, Galactic clusters. [Appearance, size and mass, contents, structure, formation, environment, astronomical history]	15
Unit 2	**Cosmology** The expanding universe, Big Bang universe, the steady state cosmology and oscillating universe, Hubble law. Hubble constant, cosmological tests. **The Solar system** Origin of the solar system and planets, Basic structure of Sun -Sun's interior, the photosphere, the solar atmosphere (chromospheres and corona). Sunspots, Sun's rotation and Solar magnetic field, Explanation for observed features of sunspots, Planetary properties and quick facts of Mercury, Venus, and Mars. Moon-different theories of the moon, Structure of the moon and its quick facts	15

Reference books:

1) Introduction to cosmology, Jayant Narlikar, Boston: Jones and Bartlett, 1983
2) Our Solar System – A. W. Joshi and N. Rana, New Age International Publishers, 1992.
3) Introductory Astronomy and Astrophysics – Zeilik and Greogary, Fort Worth: Saunders College Pub., 1998.
4) Quasars and Active Galactic Nuclei an Introduction – A. K. Kimbhavi and Jayant Narlikar, University of Cambridge

ESOL Examinations, 1999.
5) Astrophysics Stars & Galaxies – K. D. Abhyankar, Universities Press, 2002
6) A journey beyond stars life and time of, Jayant Narlikar, Vishwakarma Publications, 2023

B.Sc. II, Semester-IV (MIN-VIII)

Cosmic Electrodynamics

(MIN03PHY42)

(Credit: 2, 30 Hours)

Course Outcomes: After the completion of the course the student will be able to:

CO1	Understand the basic knowledge about perfect fluids
CO2	Demonstrate Scalar electric potential (φ), Vector magnetic potential(A), Poisson's and Laplace's equation, Maxwell's equation in vacuum
CO3	Understand the concept of Magneto hydrodynamics
CO4	Develop the critical skill in solving problems in Equation of continuity - conservation of mass, Ideal fluid and Euler's equation of motion, Navier-Stokes equation for viscous fluid.

Unit	Syllabus	Lectures
Unit 1	**Fluids** Perfect Fluid: Assumptions, Equation of state, equation of motion, TOV equation, stars of uniform density, limit of mass to radius ratio. Basic equations of fluid mechanics, Energy equation, continuity equation viscosity, gas dynamics, waves and instabilities, turbulence, orbit theory, properties, **Electrodynamics** Scalar electric potential (φ), Vector magnetic potential(A), Poisson's and Laplace's equation, Maxwell's equation in vacuum, Electromagnetic waves in vacuum- wave equation and wave velocity, scattering of light, scattering cross section, Thomson's and Rayleigh scattering, explanation for blue color of the sky, red color of sunset and sunrise.	15
Unit 2	**Magneto hydrodynamics** Motion of charged particle in electromagnetic field, Ideal hydro magnetic equation, Characteristics of plasma in magnetic field - Diffusion and frozening effect, Magnetohydrodynamic equation -magnetic pressure and magnetic tension, confinement of plasma **Hydrodynamics** Equation of continuity - conservation of mass, Ideal fluid and Euler's equation of motion, Navier-Stokes equation for viscous fluid.	15

Reference books:

1) Introduction to Electrodynamics 4th Edition by David J. Griffiths, Cambridge University Press, 2017.
2) Classical Electrodynamics by John David Jackson, Wiley, 2007.
3) Electrodynamics by Gupta, Kumar, and Singh, Pragati Prakashan, 2023.
4) Introduction to Quantum Electrodynamics and Particle Physics by Deep Chandra Joshi, TechSar Pvt. Ltd, 2013.
5) Principles of Electrodynamics, Melvin Schwartz, Dover Publications, 2012.
6) Classical Electrodynamics by P Sengupta, New Age International Private Limited, 2015.

B.Sc. II Physics SEM VI
Lab Work (Minor Practical)
(MIN03PHY49)
Min-Physics Lab IV

Group III

1) I-V Characteristics of solar cell and verification of inverse square law of intensity.
2) Velocity of sound using CRO and microphone.
3) Study of Lissageous figures using CRO.
4) D.C. Amplifier using Operational amplifier.
5) Measurement of Earth's magnetic field using Earth inductor.
6) Measurement of wavelength of given LASER source using diffraction grating.
7) Phase shift measurement RC network using CRO.
8) Study of hysteresis curve using CRO.
9) Calibration of spectrometer.
10) Study of Balmer lines.
11) Measurement and identification of spectral lines.
12) Band absorption spectrum of liquid ($KMnO_4$ solution).

Evaluation Scheme

- The total marks for each paper will be 50.
- There will be semester end examination (SEE) of 40 marks for each paper.
- There will be continuous internal evaluation (CIE) of 10 marks for each paper.
- There will be separate passing for SEE, CIE, practical examination and vocational skill courses (VSC).

Paper No.	**Semester End Examination (SEE)**	**Continuous Internal Evaluation (CIE)**	**Total**
VII	40	10	50
VIII	40	10	50

- There will be practical examination of 25 marks at the end of semester IV
- Distribution of 25 marks of practical is as below

Group I	22
Journal	03
Total	**25**

Nature of Question Paper (Semester End Examination)

Instructions:

1) All the questions are **compulsory**.
2). Figures to the right indicate **full** marks.
3) Draw neat labeled diagrams **wherever** necessary.

Time: 2 Hours **Total Marks:40**

Paper V

Q:1] Chose correct alternative

Eight Multiple Choice Questions 8 Marks

1)
2)
3)
4)
5)
6)
7)
8)

Q:2] Long Answer questions (Attempt any **TWO** out of three) 16 Marks

1)
2)
3)

Q:3] Short Answer questions (Attempt any **FOUR** out of six) 16 Marks

1)
2)
3)
4)
5)
6)

B.Sc. II, Semester-IV (OE-PR-IV)
(Lab Activities on Physics Workshop Skill)
(2OE03PHY49)

1. CRO as A versatile measuring device.
2. Circuit tracing of Laboratory electronic equipment's.
3. Use of digital multimeter
4. Winding coil/transformers.
5. Trouble shooting a circuit.
6. Balancing of bridges.
7. Unit measurement and its conversion (SI , CGS, BTU).
8. Dimension measurement of solid block, volume of cylindrical beaker/ glass, diameter of thin wire, thickness of metal sheet.
9. Cutting of metal sheets using blade, drilling of holes of different diameters in metal sheet and wooden block
10. Soldering of electrical circuits having discrete components (R,L,C, diode etc.) on PCB .
11. Testing different electronic components using CRO/ Multimeter.
12. Understanding of gear system, wheel breaking system, pulleys etc. (Demonstration)

- **Distribution of 25 marks of practical is as below**

VSC-PR-III	**22**
Journal	**03**
Total	**25**