

Board of Studies in Physics
FACULTY OF SCIENCE
GONDWANA UNIVERSITY, GADCHIROLI

Syllabus of
B. Sc. Second Year (Semester pattern)
(Choice Based Credit System)

SUBJECT - PHYSICS
Semester III & Semester IV

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Teaching and Semester Examination Scheme for B.Sc(Second Year) .

Class	Semester	Paper	Teaching Scheme Per Week (Workload)			Examination Scheme			
			Theory	Total	Practical	Theory Marks		Practical Marks	Total Marks
						Paper	Internal Assessment		
B. Sc. II	III	USPHT05	3	6 + 2T	6	50	10	30	150
		USPHT06	3			50	10		
	IV	USPHT07	3	6 + 2T	6	50	10	30	150
		USPHT08	3			50	10		

B. Sc. Semester CBCS Pattern Examination Scheme :

1. There shall be total six semesters.
2. Each semester shall comprise of 90 teaching days.
3. Each Semester I to VI shall be of 150 marks.
4. Distribution of marks will be as follows

i.	Paper I	Theory	50 Marks
		Internal Assessment	10 Marks
ii.	Paper II	Theory	50 Marks
		Internal Assessment	10 Marks
iii.	Practical (section A and B)		30 Marks
Total	(i + ii + iii)		150 Marks

5. The marks on internal assessment of the student shall be compounded with the theory Paper. The passing marks will be **40 %** marks.
6. A student will have to perform at least five experiments from each section (Total **10** experiments) per semester. At the time of Practical examination every student has to perform two experiments (one from each section), each of three hours duration.
7. The distribution of marks for practical examination is as follows.

Record Book	----	6
Viva-voce	----	6
Experiment (A + B)	----	18
TOTAL	----	30

8. Evaluation of the student during the semester for internal assessment:-

For Theory internal:

Sr. No.	Work Assigned	Marks	Marks Obtained
1.	Assignment	02	
2.	Class Test	05	
3.	Active Participation Seminar/Routine Activity etc.	03	
Total		10	

Signature of teacher in-charge

Head of Department

9. The internal assessment shall be done by respective college and the marks shall be sent to the university one month prior to the final examination of each semester.
10. All theory papers shall be divided into four units. Each unit shall be cover in 15 periods of 48 minutes.
11. The theory question paper shall be of 3 hours duration and comprise of 5 questions with internal choice and with equal weightage to all units. The pattern of question paper shall be as follows.

Pattern of Question Paper
Subject – Physics

Time: 3 Hours

Maximum marks :50

Question No.	Marks Allotted
Qu. 1 EITHER	
A (From Unit – I) (i, ii, iii, two or three bits including numerical)	10
OR	
B (From Unit – I) [Four bits (a),(b), (c), (d) including numerical]	4 x 2½
Qu. 2 EITHER	
A (From Unit – II) (i, ii, iii, two or three bits including numerical)	10
OR	
B (From Unit – II) [Four bits (a),(b), (c), (d) including numerical]	4 x 2½
Qu. 3 EITHER	
A (From Unit – III) (i, ii, iii, two or three bits including numerical)	10
OR	
B (From Unit – III) [Four bits (a),(b), (c), (d) including numerical]	4 x 2½
Qu. 4 EITHER	
A (From Unit – IV) (i, ii, iii, two or three bits including numerical)	10
OR	
B (From Unit – IV) [Four bits (a),(b), (c), (d) including numerical]	4 x 2½
Qu. 5 Attempt any TEN questions from the following.	
a) From Unit I	1
b) From Unit I	1
c) From Unit I	1
d) From Unit II	1
e) From Unit II	1
f) From Unit II	1
g) From Unit III	1
h) From Unit III	1
i) From Unit III	1
j) From Unit IV	1
k) From Unit IV	1
l) From Unit IV	1

The above pattern is for all two papers of each semester of B.Sc. I (CBCS pattern) & B.Sc. II (CBCS pattern) w.e.f. **2018-19** and B.Sc. III from next subsequent years.

Proposed Syllabus for B.Sc. II CBCS (Semester Pattern) Subject – Physics

The syllabus of Physics as per semester system for the B.Sc. II will be implemented from the Academic year **2018-2019**.

Name of programme	Duration	Semester	Subject: Physics	Code	Title
B. Sc. II	Two Semester	Sem- III	Theory	USPHT05	Thermal Physics
				USPHT06	Radiation & Statistical Physics
			Practical	USPHP03	10 experiments
		Sem- IV	Theory	USPHT07	Waves, Acoustic & Laser
				USPHT08	Optical Physics
			Practical	USPHP04	10 experiments

Syllabus of B. Sc. Second year (Semester pattern)
(Choice Based Credit System) Subject- PHYSICS (Sem-III and Sem-IV)

Sem-III Paper-I (Thermal Physics)
USPHT05: THERMAL PHYSICS (Paper I)

Aim: To make the students to understand the basic concepts of Thermal physics as core part of the subject.

Unit- I (Kinetic Theory of Gases & Transport Phenomena):

Assumptions of Kinetic theory of gases, Pressure exerted by gas (no derivation), Derivation of Maxwell's law of distribution of velocities and its experimental verification, Degree of Freedom (Mono, Di and Polyatomic gases), Law of equipartition of energy, Mean free path, Expression for mean free path and its dependency on temperature and pressure.

Transport of momentum & viscosity of gas(η), Transport of energy & thermal conductivity (K), interrelationship between η & K, dependency η & K on temperature and pressure, Transport of mass (diffusion). *Numericals.*

Unit- II (Concept of Thermodynamics):

Thermodynamic system, Thermodynamic variables (Intensive and Extensive), Thermodynamic equilibrium, Thermodynamic process (Isothermal, Adiabatic, Isobaric, Isochoric), Zeroth law of thermodynamics and its importance.

Concept of Internal Energy, First law of Thermodynamics and its applications and limitations, Derivation of Work done during isothermal and adiabatic process, Adiabatic relations between P, V and T, Specific heat (Definition), General relation between C_p and C_v , Thermal expansion and Compressibility. *Numericals.*

Unit- III (Second and Third laws of Thermodynamics):

Reversible and irreversible process, Second law of Thermodynamics (Statements), Heat Engine and its efficiency, Carnot's Ideal heat engine, Carnot's cycle, Carnot's Theorem (Only statement).

Concept of entropy, Second law of Thermodynamics in terms of entropy, Entropy changes in reversible and irreversible process, T-S diagram and derivation of Work done and efficiency, Third law of Thermodynamics. *Numericals.*

Unit- IV (Thermodynamics Functions):

Internal energy function, Enthalpy function, Gibb's function, Helmholtz function, Derivations of Maxwell's thermodynamics relations, First and second Tds equations.

Latent heat (definition), First latent heat equation (Clausius-Clapeyron equation), Second latent heat equation (Clausius equation), Joule – Thomson effect, Porus-Plug experiment and its application (To show enthalpy constant). *Numericals.*

Sem-III Paper-II (Radiation and Statistical Physics)
USPHT06: RADIATION AND STATISTICAL PHYSICS

Aim: To make the students to understand the Thermal radiation laws and basic concepts of statistical analysis and as core part of the subject.

Unit- I (Theory of Radiation):

Black body radiation, Spectral distribution, Concept of energy density, Derivation of Planck's law, Wien's distribution law, Rayleigh-Jeans law, Stefan's Boltzmann law and Wien's displacement law from Planck's law. *Numericals.*

Unit- II (Statistical basis of thermodynamics):

Probability and thermodynamic probability, Principle of equal priori probabilities, Mu- space, Phase space, macrostate and microstate, Constraint, Accessible and inaccessible states, Entropy and thermodynamic probability, Equilibrium between two system in thermal contact. *Numericals.*

Unit- III (M-B Statistics):

Fundamental postulates of statistical mechanics, M-B statistics applicable to ideal gas, Maxwell- Boltzmann energy distribution law, Most probable speed, Average speed and root mean square speed, Maxwell- Boltzmann law of distribution of velocity. *Numericals.*

Unit- IV (B-E and F-D Statistics):

Fundamental postulates of B-E statistics, Bose- Einstein's energy distribution law, Photon gas, Planck's radiation law.

Postulates of Fermi- Dirac statistics, F-D energy distribution law, Fermi energy, Expression for Fermi energy of electrons in metal, Fermi energy for electron at absolute zero (E_{F_0}), Comparison between M-B, B-E and F-D statistics. *Numericals.*

Reference Books:

1. Fundamentals of Physics – Halliday and Resnick (6th edition).
2. Concepts of Physics Vol. I and II - H.C. Verma.
3. Properties of Matter – Brijlal.
4. Waves and Oscillations – Chaudhari R.N.
5. Berkely Physics Course – Vol. I.
6. Physics for degree students B.Sc. First Year – C.L. Arora, Dr P.S. Hemne.
7. Physics for degree students B.Sc. Second Year – C.L. Arora, Dr P.S. Hemne.
8. Mechanics – D.S. Mathur , Dr. P.S. Hemne.
9. A Text Book of First year Physics, M. K. Bagde, S. Chand Publication.
10. University Physics- FW Sears, MW Zemansky and HD Young.
11. Engineering Mechanics- Basudeb Bhattacharya.
12. University Physics- Ronald Lane Reese.

USPHP03 : (Practical)

Every student will have to perform at least five (05) experiments from each group. This odd semester practical examination shall be conducted by **Internal Examiner**.

Group A:

1. To determine the coefficient of thermal conductivity of copper. (by Searle's Apparatus or other method).
2. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
3. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
4. To study the variation of thermo-emf across two junctions of a thermocouple with temperature.
5. To determine heating efficiency of electrical kettle using voltages.
6. To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge.
7. To determine Mechanical Equivalent of Heat (J). (by Callender and Barne's constant flow method or other method).
8. To determine Mechanical Equivalent of Heat (J) by Joule's Calorimeter.

Group B:

1. Measurement of Planck's constant using black body radiation.
2. To determine Stefan's Constant.
3. To verify the Stefan's law of variation by using an incandenscent lamp
4. To verify the laws of probability distribution throwing one coin, tow coin and ten coins.
5. To show the deviation of probability from theoretical value decrease with increase in the number of event.
6. Study of statistical distribution from the given data and to find most probable, average and rms value.
7. Study of random decay of nuclear disintegration and determination of decay constant using dices.
8. To record and analyze the cooling temperature of an hot object as a function of time.(cooling law)

Reference Books:

1. Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4thEdition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
4. A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal, 1985, Vani Publication.
5. B.Sc. Practical Physics – Dr. P.S. Hemne, Harnam Singh, S. Chand Publication.

Sem-IV Paper-I (Waves, Acoustics & Laser)
USPHT07: WAVES, ACOUSTICS & LASER (Paper I)

Aim: To make the students to understand the basic concepts Sound Waves, Acoustics and Laser as core part of the subject.

Unit- I (Superposition of two Harmonic Oscillations):

Super position of two SHMs having slightly different frequencies along same line (Beats), Lissajous's Figures, Super position of two Perpendicular Harmonic Oscillations- Graphical and Analytical Methods with equal (1:1) frequencies and unequal (1:2) frequencies, Formation of Lissajous's Figures by CRO and optical method. Application of Lissajous's Figures. *Numericals.*

Unit- II (Wave Motion and Fourier's Theorem):

Transverse waves on a string, Progressive and standing waves on a string, Normal Modes of a vibration of string, Group velocity, Phase velocity and their relations, Wave intensity.

Fourier's Theorem-statement, evaluation of Fourier coefficients, Its application to saw tooth wave and square wave, Limitations. *Numericals.*

Unit- III (Ultrasonic and Acoustics):

Ultrasonic waves and its properties, Production by piezoelectric effect, detection, applications (depth of sea, signalling & medical uses).

Noise and music, characteristics of musical sound, Intensity and loudness of sound, Bel and Decibels, musical notes, musical scale, Echo, Reverberation and time of reverberation, Absorption coefficient, Sabine's formula, Requirements of good auditorium. *Numericals.*

Unit- IV (Laser):

Coherence, spatial and temporal coherence, Einstein's coefficients (absorption, spontaneous and stimulated emission), population inversion, optical pumping, characteristics of laser beam, Ruby laser, Semiconductor laser, He-Ne Laser, applications of lasers. *Numericals.*

Sem-IV Paper-II (Optical Physics)
USPHT08: OPTICAL PHYSICS (Paper II)

Aim: To make the students to understand the basic concepts of Light Waves and properties of light waves as core part of the subject.

Unit I (Interference of Light):

Definition and Properties of wave front, Huygens Principle of propagation of wave front, Principle of superposition and interference of light, Division of amplitude and division of wave front, Fresnel's Biprism, Phase change on Reflection- Stokes' treatment, Interference in Thin Films: due to reflected and transmitted light in parallel film, Fringes of equal inclination (Haidinger Fringes), Interference in wedge-shaped film, Fringes of equal thickness(Fizeau Fringes). *Numericals.*

Unit II (Newton's Rings & Michelson's Interferometer):

Newton's Rings: Experimental setup & theory, application of Newton's ring for measurement of wavelength and refractive index.

Michelson's Interferometer- construction and working, types of fringes (circular and localised), Determination of wavelength and Wavelength difference, Refractive index and Visibility of fringes. *Numericals.*

Unit III (Diffraction):

Basic concept of diffraction, types of diffraction, Fresnel's Diffraction: Definition, Half-period zones, Zone plate, Diffraction due to straight edge and narrow slit. Fraunhofer's diffraction: Definition, Single slit, Double Slit, Diffraction Grating- construction, theory, its application to determine wavelength. *Numericals.*

Unit IV (Polarization):

Concept of polarisation, Plane polarized light(PPL), production of PPL by reflection, double refraction, Brewster's law, Uniaxial and biaxial crystal, positive and negative crystal, Nicol's prism- construction and working, Nicol as a polariser and analyser, Circular and elliptical polarization, phase retardation (quarter and half wave plate). *Numericals.*

Reference Books:

1. Fundamentals of Optics, F A Jenkins and H E White, 1976, McGraw-Hill.
2. Principles of Optics, B.K. Mathur, 1995, Gopal Printing.
3. Fundamentals of Optics, H. R. Gulati and D.R. Khanna, 1991, R. Chand Publication.
4. University Physics. FW Sears, MW Zemansky and HD Young 13/e, 1986. Addison-Wesley.
5. A Text Book of Optics, N. Subramanyam and Brijlal, S. Chand Publication.
6. A Text Book of First year Physics, M. K. Bagde and S. P. Singh, S. Chand Publication.
7. Optics and spectroscopy, R. Murugesan, S. Chand Publication.
8. Physics for degree students, B. Sc. Second Year, C. L. Arora and Dr. P. S. Hemne, S. Chand Publications

USPHP04 : (Practicals)

Every student will have to perform at least five (05) experiments from each group. This even semester practical examination shall be conducted by **Internal and external examiner both.**

Group A:

1. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment and to verify $\lambda^2 - T$ Law.
2. To study Lissajous Figures by using CRO.
3. To determine the frequency of a tuning fork using sonometer.
4. To determine the velocity of transverse wave on stretched string using sonometer.
5. To determine the velocity of sound by using resonance tube.
6. To determine the unknown frequency by using Helmholtz resonator.
7. To determine velocity of ultrasonic waves in a given liquid.
8. To determine the wavelength of Laser beam.
9. To study the divergence of Laser beam.
10. To study the mono-chromaticity of Laser beam.
11. To study the characteristics of loudspeaker.

Group B:

1. Familiarization with Schuster's focussing; determination of angle of prism.
2. Determination of angle of minimum deviation of prism using different colour.
3. To determine the Refractive Index of the Material of a given Prism using Sodium Light.
4. To determine Dispersive Power of the Material of a given Prism using Mercury Light.
5. To determine the value of Cauchy Constants of a material of a prism.
6. To determine the Resolving Power of a Prism.
7. To determine wavelength of sodium light using Fresnel Biprism.
8. To determine wavelength of sodium light using Newton's Rings.
9. To determine the wavelength of Laser light using Diffraction of Single Slit.
10. To determine wavelength of (1) Sodium & (2) spectrum of Mercury light using plane diffraction Grating.
11. To determine the Resolving Power of a Plane Diffraction Grating.
12. To determine the Resolving power of telescope.
13. To determine focal length of long focus convex lens using short focus convex lens.

Reference Books:

1. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
4. B.Sc. Practical Physics – Dr. P.S. Hemne, Harnam Singh, S. Chand Publication.