Janardan Bhagat Shikshan Prasarak Sanstha's

CHANGU KANA THAKUR ARTS, COMMERCE & SCIENCE COLLEGE, NEW PANVEL (AUTONOMOUS)

Re-accredited 'A+' Grade by NAAC
'College with Potential for Excellence' Status Awarded by UGC
'Best College Award' by University of Mumbai

Program: B.Sc

Revised Syllabus of F.Y.B.Sc. Physics
Choice Based Credit & Grading System (75:25)
w.e.f. Academic Year 2019-20

Sr. No.	Heading	Particulars
1	Title of Course	Physics
2	Eligibility for Admission	12^{th} Science of all recognised Board
3	Passing marks	40%
4	Ordinances/Regulations (if any)	
5	No. of Semesters	Two
6	Level	U.G.
7	Pattern	Semester (75:25)
8	Status	Revised
9	To be implemented from Academic year	2019-2020

Preamble of the Syllabus:

The curriculum is framed to equip students to grasp the basic concepts of physics and in addition have a broader vision. A dynamic curriculum accommodates fast faced developments in the knowledge of the subject concerned by introducing innovative concepts, multidisciplinary profile and standard education.

The programme also aims to provide an intellectually stimulating environment to develop skills and enthusiasm of students to the best of their potential. It also helps in giving need based education in physics of the highest quality at the undergraduate level.

In this programme, we aim to provide a solid foundation in all aspects of physics and to show a broad spectrum of modern trends in physics and to develop experimental, computational and mathematical skills of students. The syllabus is framed in such a way that it bridges the gap between the plus two and the post graduate level of physics by providing a more complete and logical framework in almost all areas of basic physics.

Objectives of the Course:

- To develop analytical abilities towards real world problems
- To familiarize with current and recent scientific and technological developments
- To enrich knowledge through problem solving, hands on activities, study visits, projects

Course Outcome:

On successful completion of this course students will be able to:

1. Understand Newton's laws and apply them in calculations of the motion of simple systems.
2. Use the free body diagrams to analyse the forces on the object.
3. Understand the basic mathematical concepts and applications of them in physical situations
4. Apply the laws of thermodynamics to formulate the relations necessary to analyze a thermodynamic process.
5. Demonstrate quantitative problem solving skills in all the topics covered
6. Understand nuclear properties and nuclear behaviour.
7. Understand the type isotopes and their applications.
8. Demonstrate and understand the quantum mechanical concepts.
9. Understand the basics of Earth’s Magnetic Field and its application.
10. To demonstrate their practical skills.
11. To understand and practice the skills while doing physics practical.
12. To understand the use of apparatus and their use without fear.
13. To correlate their physics theory concepts through practical.
14. Understand the concepts of errors and their estimation

F. Y. B. Sc. Physics

For the subject of Physics there shall be two papers for 45 lectures each comprising of three units of 15 lectures each.

Semester-I

SEM 1		
Paper No.	**Unit No.**	***Existing Topics***
Physics I	I	Classical Physics
	II	Mathematical Physics
	III	Thermodynamics
Physics II	I	Nuclear Physics
	II	Nuclear Detectors & Nuclear Reactions
	III	Analog Electronics
SEM 2		
Paper No.	**Unit No.**	**Existing Topics**
Physics I	I	Optics
	II	Mathematical Physics
	III	Wave Motion
Physics II	I	Modern Physics
	II	DC Circuits and Digital Electronics
	III	Electrostatics and Magnetostatics, Basic Geophysics

Scheme of Examination for Each Semester:

Internal Evaluation: 25 (20 marks internal test and 05 marks for attendance)

Semester End Examination: 75 Marks will be as follows :-

I	**Theory:**	Each theory paper shall be of two and half hour duration.		
		All questions are compulsory and will have internal options.		
		Q-1	From Unit – I (having internal options.)	20 Marks
		Q-2	From Unit – II (having internal options.)	20 Marks
		Q-3	From Unit – III (having internal options.)	20 Marks
		Q-4	Questions from all the THREE Units with equal weightage of marks allotted to each unit.	15 Marks
		TOTAL		**75 Marks**
II	**Practical**	The External examination for practical course will be conducted as per the following scheme.		
		Sr. No.	Particulars of External Practical Examination	Marks%
		1	Laboratory Work	35+35 =70
		2	Journal	5+5 = 10
		3	Viva	10+10 = 20
		TOTAL		**100 Marks**

Choice Based Credit Grading and Semester System (CBCGS)
F.Y.B. Sc. Physics Syllabus
To be implemented from the Academic year 2019-2020
SEMESTER I

Course Code	Unit	Topics	Credits	L / Week
USC1PH1	**I**	Classical Physics	**2**	**1**
	II	Mathematical Physics		**1**
	III	Thermodynamics		**1**
USC1PH2	**I**	Nuclear Physics	**2**	**1**
	II	Nuclear Detectors & Nuclear Reactions		**1**
	III	Modern Physics		**1**
USC1PHP		Physics Practical	**2**	**6**

SEMESTER II

Course Code	Unit	Topics	Credits	L / Week
USC2PH1	**I**	**Optics**	**2**	**1**
	II	Mathematical Physics		**1**
	III	Wave Motion		**1**
USC2PH2	**I**	Modern Physics	**2**	**1**
	II	DC Circuits and Digital Electronics		**1**
	III	Electrostatics and Magnetostatics Basic Geophysics		**1**
USC2PHP		Physics Practical	**2**	**6**

Semester I

Name of the Programme	Duration	Semester	Subject
B.Sc.in Physics	Six semesters	I	Physics
Course Code	Title	Credits	
USC1PH1	Classical Physics, Basic Electrodynamics, Thermodynamics	2	

Unit 1

1. Newton's Laws: Newton's first, second and third laws of motion, interpretation and applications, pseudo forces, Inertial and non-inertial frames of reference. Worked out examples (with friction present)
2. Elasticity: Review of Elastic constants Y, K, η and σ; Equivalence of shear strain to compression and extension strains. Relations between elastic constants, Couple for twist in cylinder.
3. Fluid Dynamics: Equation of continuity, Bernoulli's equation, applications of Bernoulli's equation, streamline and turbulent flow, lines of flow in air foil, Poiseullies equation.

References:

1. [DSM] : D S Mathur, Element of Properties of Matter, S Chand & Co
   Unit 1: Elasticity : 8.1,8.2,8.3,8.8,8.0,8.12,8.13,8.14,8.15,8.17
   Unit 1:Fluid Dynamics : 12.1,12.3,12.5, 12.6(2),12.7,12.11,
2. [HCV] : H. C. Verma, Concepts of Physics – (Part–I), 2002 Ed. Bharati Bhavan Publishers.
   Unit 1 : Newton law of motion : 5.1,5.2,5.3,5.4,5.5,5.6,5.7

Unit 2

1. Vector Algebra: Vectors, Scalars, Vector algebra, Laws of Vector algebra, Unit vector, Rectangular unit vectors, Components of a vector, Scalar fields, Vector fields, Problems based on Vector algebra. Dot or Scalar product, Cross or Vector product, Commutative and Distributive Laws, Scalar Triple product, Vector Triple product (Omit proofs). Problems and applications based on Dot, Cross and Triple products.
2. Gradient, divergence and curl: The ∇ operator, Definitions and physical significance of Gradient, Divergence and Curl; Distributive Laws for Gradient, Divergence and Curl (Omit proofs); Problems based on Gradient, Divergence and Curl

References:

1. [MS]:Murray R Spiegel, Schaum's outline of Theory and problems of Vector Analysis, Asian Student Edition
   Unit 2 : 1.1,1.2,1.3,1.6,1.7,2.2,2.3,2.4, 4.1,4.2,4.3,4.4,4.5

Unit 3

1. Behaviour of real gases and real gas equation, Van der Waal equation
2. Thermodynamic Systems, Zeroth law of thermodynamics, Concept of Heat, The first law, Non Adiabatic process and Heat as a path function, Internal energy, , Heat Capacity and specific heat, Applications of first law to simple processes, general relations from the first law, Indicator diagrams, Work done during isothermal and adiabatic processes, Worked examples, Problems..

References:

1. [BSH] :Brijlal, Subramanyam and Hemne, Heat Thermodynamics and Statistical Physics, S
   Chand, Revised, Multi-coloured,2007 Ed.
   Unit 3 ; 2.1 to 2.12, 4.1 to 4.14

Additional Reference:

1. Thornton and Marion, Classical Dynamics – (5th Ed)
2. Halliday, Resnick and Walker, Fundamental of Physics (extended) – (6th Ed.), John Wiley and Sons
3. R Murugeshan and K Shivprasath, Properties of Matter and Acoustics S Chand.
4. M W Zemansky and R H Dittman, Heat and Thermodynamics, McGraw Hill.
5. D K Chakrabarti, Theory and Experiments on Thermal Physics, (2006 Ed) Central books.
6. C L Arora, Optics, S Chand.
7. Hans and Puri, Mechanics –, 2nd Ed. Tata McGraw Hill
8. Charlie Harper, Introduction to Mathematical Physics , 2009 (EEE) PHI Learning Pvt. Ltd

SEMESTER-I

Name of the Programme	Duration	Semester	Subject
B.Sc.in Physics	Six semesters	I	Physics
Course Code	Title	Credits	
USC1PH2	Nuclear Physics & Analog Electronics	2	

Unit 1

1. Review (Structure of Nuclei: Basic properties of nuclei, Composition, Charge, Size, Rutherford's expt. for estimation of nuclear size, density of nucleus), Mass defect and Binding energy, Packing fraction, BE/A vs A plot, stability of nuclei (N Vs Z plot) and problems
2. Radioactivity: Radioactive disintegration concept of natural and artificial radioactivity, Properties of α, β, γ-rays, laws of radioactive decay, half-life, mean life (derivation not required), units of radioactivity, successive disintegration and equilibriums, radioisotopes. Numerical Problems, Carbon dating and other applications of radioactive isotopes (Agricultural, Medical, Industrial, Archaeological -information from net), Age of Earth

References:

1. [Kaplan]: Nuclear Physics, Irving Kaplan, 2nd Ed. Narosa Publishing House
   Unit 1: Structure of Nuclei: 9.4, 9.5
2. [SBP]: Dr. S. B. Patel, Nuclear Physics Reprint 2009, New Age International
   Unit 1: Structure of Nuclei: 4.1.1 & 4.1.2
   Unit 1 : Radioactivity: 2.1 to 2.3, 2.6 to 2.10, 2.12, 2.13

Unit 2

1. Interaction between particles and matter, Ionization chamber, Proportional counter and GM counter, problems Nuclear Reactions: Types of Reactions and Conservation Laws. Concept of Compound and Direct Reaction, Q value equation and solution of the Q equation, problems. Fusion and fission definitions and qualitative discussion with examples

References:

1. [Kaplan]: Nuclear Physics, Irving Kaplan, 2nd Ed. Narosa Publishing House
   Unit 2: Nuclear Detectors: 2.8
2. [SBP]: Dr. S. B. Patel, Nuclear Physics Reprint 2009, New Age International
   Unit 2: Nuclear Detectors: 1.1.2, 1.1.3(i and ii)
   Unit 2: Nuclear Reactions: 3.1 to 3.5
3. [BSS]: N Subrahmanyam, Brijlal and Seshan, Atomic and Nuclear Physics Revised Ed. Reprint 2012, S. Chand
   Unit 2: Nuclear Fusion & Fission: 12.3 and 12.7

Unit 3

1. Alternating current theory:(Concept of L, R, and C: Review) AC circuit containing pure R, pure L and pure C, representation of sinusoids by complex numbers using Phasor diagram, Series L-R, C-R and LCR circuits. Resonance in LCR series circuit, Power in ac circuit. Q-factor
2. AC bridges: AC-bridges: General AC bridge, Maxwell's Bridge, de-Sauty's Bridge, Wien Bridge, Hay Bridge

References:

1.[CR]: D. Chattopadhyay, P C Rakshit , Electricity and Magnetism 7th Ed. New Central Book agency.
Unit 3: AC: 15.2, 15.5 to 15.11, 7.12(i),15.14

Additional References:

1 Arthur Beiser, Perspectives of Modern Physics : Tata McGraw Hill
2 S N Ghosal, Atomic Physics S Chand
3 S N Ghosal, Nuclear Physics 2nd ed. S Chand

SEMESTER-I

Name of the Programme	Duration	Semester	Subject
B.Sc.in Physics	Six semesters	I	Physics
Course Code	Title	Credits	
USC1PHP	Practical I	2	

A. Regular experiments:

Group 1

1. J by Electrical Method: To determine mechanical equivalent of heat
2. Torsional Oscillation: To determine modulus of rigidity η of a material of wire by torsional oscillations
3. Bifilar Pendulum
4. To determine Coefficient of Viscosity (η) of a given liquid by Poisseuli's Method
5. Surface Tension/ Angle of contact
6. To study Thermistor characteristic Resistance vs Temperature
7. Y by vibrations: To determine Y Young's Modulus of a wire material by method of vibrations- Flat spiral Spring

Group 2

1. De Sauty's bridge
2. CR Circuit: To determine value of given capacitor and Phase angle
3. Frequency of AC Mains: To determine frequency of AC mains.
4. LCR Series Resonance
5. LR Circuit: To determine the value of given inductance and phase angle
6. LDR

B. Skill Experiments:

1. Use of Vernier callipers, Micrometer Screw Gauge, Travelling Microscope
2. Graph Plotting : Experimental, Straight Line with intercept, Resonance Curve etc.
3. Spectrometer: Schuster's Method
4. Use of DMM 5 Absolute and relative errors calculation.

C. Any one out of following is equivalent to two experiments from section A and/ or B

1. Students should collect the information of at least five Physicists with their work. Report that in journal.
2. Students should carry out mini-project upto the satisfaction of professor In-charge of practical.
3. Study tour. Students participated in study tour must submit a study tour report.

- Minimum 4 experiments from each group should be completed in the first semester.
- Any four skill experiments are to be reported in journal
- Certified journal is a must to be eligible to appear for the semester end practical.

- The scheme of examination for the revised course in Physics at the First Year B.Sc.Semester end examination will be Semester End Practical Examination:
- Scheme of examination: There will be no internal assessment for practical.
- A candidate will be allowed to appear for the semester end practical examination only if the candidate submits a certified journal at the time of practical examination of the semester or a certificate from the Head of the Department /Institute to the effect that he candidate has completed the practical course of that semester of F.Y.B.Sc. Physics as per the minimum requirement.
- The duration of the practical examination will be two hours per experiment.
- There will be two experiments through which the candidate will be examined in practical.

SEMESTER-II

Name of the Programme	Duration	Semester	Subject
B.Sc.in Physics	Six semesters	II	Physics
Course Code	Title	Credits	
USC2PH1	Optics, Mathematical physics, Wave Motion	2	

Unit 1

1. Lens Maker's Formula (Review), Newton's lens equation, magnification-lateral, longitudinal and angular, Equivalent focal length of two thin lenses, thick lens, cardinal points of thick lens
2. Aberration: Spherical Aberration, Reduction of Spherical Aberration, Chromatic aberration and condition for achromatic aberration

References:

1. [BSA] : Brijlal, Subramanyam and Avadhanulu A Textbook of Optics, 25th revised ed.(2012) S. Chand
   Unit 1 : 4.2,4.3,4.8,4.9,4.10,4.11,4.12,4.17,5.2,9.1,9.2,9.5,9.10,9.11,9.13

Unit 2

1. Differential equations: Introduction, Ordinary differential equations, First order homogeneous and non- homogeneous equations with variable coefficients, Exact differentials, General first order Linear Differential Equation, Second-order homogeneous equations with constant coefficients. Problems depicting physical situations like LC and LR circuits, Simple Harmonic motion (spring mass system)
2. Transient response of circuits: Series LR, CR (Growth and decay of currents/charge**.)** LCR circuits. Growth of currents/charge**.**

References:

1. [CH] : Charlie Harper, Introduction to Mathematical Physics , 2009 (EEE) PHI Learning Pvt. Ltd.
   Unit 2 : 5.1, 5.2,5.2.1 (A, B, C) (Omit D)

2.[CR]: D. Chattopadhyay, P C Rakshit , Electricity and Magnetism 7th Ed. New Central Book agency.
Unit 2 : CR: 14.1 to 14.3

Unit 3

1. Superposition of Collinear Harmonic oscillations: Linearity and Superposition Principle. Superposition of two collinear oscillations having equal frequencies . Superposition of two perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures with equal an unequal frequency and their uses

2. Wave Motion: Transverse waves on string, Travelling and standing waves on a string. Normal modes of a string, Group velocity, Phase velocity, Plane waves, Spherical waves, Wave intensity.

References:

1.[HP]: Hans and Puri, Mechanics, 2nd Edition, Tata McGraw Hill
Unit 3: Pages 279 to 284
2.[SPP]: S. P. Puri, Fundamentals of Vibrations and Waves, Tata McGraw Hill
Unit 3: 2.4.3 and 2.4.4

Additional References:

1. A K Ghatak, Chua, Mathematical Physics, 1995, Macmillan India Ltd.
2. Ken Riley, Michael Hobson and Stephen Bence, Mathematical Methods for Physics and Engineering, Cambridge (Indian edition).
3. H. K. Dass, Mathematical Physics, S. Chand & Co.
4. Jon Mathews & R. L. Walker, Mathematical Methods of Physics: W A Benjamin Inc. 11
5. Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
6. The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
7. The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.

SEMESTER-II

Name of the Programme	Duration	Semester	Subject
B.Sc.in Physics	Six semesters	II	Physics
Course Code	Title	Credits	
USC2PH2	Modern Physics, DC Circuits and Digital Electronics, Electrostatics, Magnetostatics & Geophysics	2	

Unit 1

1. Origin of Quantum theory, Black body (definition), Black Body spectrum, Wien's displacement law, Matter waves, wave particle duality, Heisenberg's uncertainty Principle. Davisson-Germer experiment, G. P. Thompson experiment.
2. .X-Rays production and properties. Continuous and characteristic X-Ray spectra, X-Ray Diffraction, Bragg's Law, Applications of X-Rays.

References :

1. [BSS]: N Subrahmanyam, Brijlal and Seshan, Atomic and Nuclear Physics Revised Ed. Reprint 2012, S. Chand

Unit 1: Origin of Quantum Mechanics: 2.1 to 2.6, 3.1 to 3.6 and 3.9(without applications)

X- Rays: 6.2 to 6.4

2. [AB]: Arthur Beiser, Concepts of Modern Physics 6th Ed. Tata McGraw Hill

Unit 1: X- Rays: 2.5, 2.6

Compton Effect: 2.7 to 2.9

Unit 2

1. Circuit theorems: (Review: ohm's law, Kirchhoff's laws) Superposition Theorem, Thevenin's Theorem, Ideal Current Sources, Norton's Theorem, Reciprocity Theorem, Maximum Power Transfer Theorem. Numericals related to circuit analysis using the above theorems.
2. DC power supply: Bridge rectifier, its PIV and its Ripple factor, Capacitor Filte, Inductor filter, CLC or Pi Filter. Zener diode as voltage stabilizer
3. Digital Electronics: Logic gates (Review), NAND and NOR as universal building blocks. EX-OR gate: logic expression, logic symbol, truth table, Implementation using basic gates and its applications, Boolean algebra, Boolean theorems. De-Morgan theorems, Half adder and Full adder

References :

1. [CR]: D. Chattopadhyay, P C Rakshit, Electricity and Magnetism 7th Ed. New Central Book agency.

Unit 2: Circuit Theorems: 7.7 to 7.11

2.[VKM]: V K Mehta and R Mehta Electronics Principals, Multi coloured Revised 11th Ed. reprint in 2012, S Chand.

Unit 2: DC: 6.8 to 6.15, 6.17 to 6.20, 6.21, 6.27

Unit 2: Digital electronics: 26.15 to 26.17, 26.20, 26.21, 26.22, 26.32

Unit 3

1. Review (The Electric Field, Coulomb's Law) Continuous charge Distribution, Electric Potential, Introduction to Potential, Comments on Potential, The Potential of a Localized Charge Distribution,
2. Introduction to Geophysics, its Branches, its relationship with other sciences, Geomagnetism, Elements of Earth's magnetism, Internal External fields and their causes, environmental magnetic analysis relating to magnetic minerals and environmental systems.
3. Magnetostatics: Magnetic Fields The Biot Savart Law: Steady Currents, The Magnetic Field of a Steady Current, Helmholtz coil and solenoid.

Note: A good number of numerical examples are expected to be covered during the prescribed lectures

References:

1.[DJG]: David J. Griffiths: Introduction to Electrodynamics, Prentice Hall India(EEE)3rd Ed.

Unit 3: 2.1.1 to 2.1.4, 2.3.1, 2.3.2, 2.3.4, 2.4.1, 2.4.2, 5.1.1, 5.2.1, 5.2.2

2.[BS]: Mechanics & Electrodynamics, Revised Edition, 2005, Brij Lal, Subramanyam & Jeevan Seshan

Unit 3: 16.10, 16.11

Additional References:

1. B.L. Theraja and A.K. Theraja , A Textbook of Electrical Technology Vol. I , S. Chand Publication
2. A B Bhattacharya, Electronics Principlesand Applications, Central publisher.
3. A P Malvino, Digital Principles and Applications: Tata McGraw Hill
4. Tokhiem, Digital electronics, 4thed, McGraw Hill International Edition.
5. BN Boylestad and Nashelsky, Electronic devices and Circuit Theory: 7th edition, Prentice Hall of India.

SEMESTER-II

Name of the Programme	Duration	Semester	Subject
B.Sc.inPhysics	Six semesters	II	Physics
CourseCode	Title	Credits	
USC2PHP	Practical II	2	

A. Regular experiments:

Group 1:

1. Flywheel
2. Newton's Rings To determine radius of curvature of a given convex lens using Newton's rings
3. Spectrometer: To determine refractive index μ of the material of prism
4. Spectrometer: To determine of angle of Prism.
5. Combination of Lenses To determine equivalent focal length of a lens system by magnification method.
6. Simple Pendulum

Group 2

1. To study Zener Diode as Regulator
2. To study load regulation of a Bridge Rectifier
3. To study EX-OR Gate, half adder and full adder and verify their truth tables.
4. To verify De Morgan's Theorems
5. Norton's Theorem

B. List of Demo-experiments: (Min. four)

1. Angular Momentum conservation (Rotating Platform)
2. Light dependent switch
3. Laser beam divergence, Intensity
4. Use of Oscilloscope
5. Charging and discharging of a capacitor

C. Any one out of following is equivalent to two experiments from section A and/or B

1. Students should collect the information of at least five Physicists with their work. Report that in journal.
2. Students should carry out mini-project upto the satisfaction of professor In-charge of practical.
3. Study tour. Students participated in study tour must submit a study tour report.

- Minimum 4 experiments from each group should be completed in the second semester.
- Any four skill experiments are to be reported in journal.

- Certified journal is a must to be eligible to appear for the semester end practical.
- The scheme of examination for the revised course in Physics at the First Year B.Sc.Semester end examination will be Semester End Practical Examination:
- Scheme of examination: There will be no internal assessment for practical.
- A candidate will be allowed to appear for the semester end practical examination only if the candidate submits a certified journal at the time of practical examination of the semester or a certificate from the Head of the Department /Institute to the effect that he candidate has completed the practical course of that semester of F.Y.B.Sc. Physics as per the minimum requirement.
- The duration of the practical examination will be two hours per experiment.
- There will be two experiments through which the candidate will be examined in practical.

Janardan Bhagat Shikshan Prasarak Sanstha's

CHANGU KANA THAKUR ARTS, COMMERCE & SCIENCE COLLEGE,

NEW PANVEL (AUTONOMOUS)

Re-accredited 'A+' Grade by NAAC
'College with Potential for Excellence' Status Awarded by UGC
'Best College Award' by University of Mumbai

Program: B.Sc

Revised Syllabus of S.Y.B.Sc. Physics
Choice Based Credit & Grading System (75:25)
w.e.f. Academic Year 2020-21

Sr. No.	Heading	Particulars
1	Title of Course	Physics
2	Eligibility for Admission	S.Y.BSC
3	Passing marks	40%
4	Ordinances/Regulations (if any)	
5	No. of Semesters	Two
6	Level	U.G.
7	Pattern	Semester (75:25)
8	Status	Revised
9	To be implemented from Academic year	2020-2021

Preamble of the Syllabus:

Physics is one of the most fundamental scientific disciplines. The main goal of physics is to explain how things move in space and time and understand how the universe behaves. It studies matter, forces and their effects. It is concerned with understanding the world on all scales of length, time, and energy. The methods of physics are diverse, but they share a common objective to develop and refine fundamental models that quantitatively explain observations and the results of experiments. Physics is very important in the development of new technologies, such as airplanes, televisions, computers and nuclear weapons. Mechanics, a branch of physics, helped develop the mathematical field of calculus.

The Department of Physics provides instructional programs in introductory Physics to a broad range of students through an understandable and effective method that enables them to integrate this knowledge into their normal thought processes. Through this Physics programme, we vividly elaborate its nature and promise the outcomes that are to be accomplished by studying the courses. The emphasis will be more on providing the students with a flavour of the subject than on an in-depth exposition.

S. Y. B. Sc. Physics

For the subject of Physics there shall be three papers for 75 lectures each comprising of three units of 15 lectures each.

Semester-III		
Paper No.	Unit No.	Existing Topics
Physics I	I	Classical Mechanics
	II	Classical Mechanics
	III	Thermodynamics
Physics II	I	Vector Calculus
	II	Analogue Electronics
	III	Analogue Electronics
Physics III	I	Acoustics, Laser, Fibre optics
	II	Crystal Physics
	III	Material Physics & Geophysics
Semester-IV		
Paper No.	Unit No.	Existing Topics
Physics I	I	Interferometry
	II	Fresnel & Fraunhoffer Diffraction
	III	Polarisation
Physics II	I	Basic Quantum Mechanics
	II	Applications of Quantum Mechanics-1
	III	Applications of Quantum Mechanics-2
Physics III	I	Digital Electronics
	II	Microprocessor
	III	Radio Communication & Modulation

Scheme of Examination for Each Semester:

Internal Evaluation: 25 (20 marks internal test and 05 marks for attendance)

Semester End Examination: 75 Marks will be as follows :-

<table>
<tr><td rowspan="13">Theory</td><td colspan="3">Each theory paper shall be of two and half hour duration.</td></tr>
<tr><td colspan="3">All questions are compulsory and will have internal options.</td></tr>
<tr><td rowspan="3">Q-1
(Unit – I)</td><td>Attempt any one out of two.</td><td>08 Marks</td></tr>
<tr><td>Attempt any one out of two.</td><td>08 Marks</td></tr>
<tr><td>Attempt any one out of two.</td><td>04 Marks</td></tr>
<tr><td rowspan="3">Q-2
(Unit – II)</td><td>Attempt any one out of two.</td><td>08 Marks</td></tr>
<tr><td>Attempt any one out of two.</td><td>08 Marks</td></tr>
<tr><td>Attempt any one out of two.</td><td>04 Marks</td></tr>
<tr><td rowspan="3">Q-3
(Unit – III)</td><td>Attempt any one out of two.</td><td>08 Marks</td></tr>
<tr><td>Attempt any one out of two.</td><td>08 Marks</td></tr>
<tr><td>Attempt any one out of two.</td><td>04 Marks</td></tr>
<tr><td rowspan="2">Q-4
(Unit-I,II, III)</td><td>Multiple Choice Questions</td><td>12 Marks</td></tr>
<tr><td>Answer in one line</td><td>03 Marks</td></tr>
<tr><td colspan="2">TOTAL</td><td>75 Marks</td></tr>
<tr><td rowspan="6">Practical</td><td colspan="3">The External examination for practical course will be conducted as per the following scheme.</td></tr>
<tr><td>Sr. No.</td><td>Particulars of External Practical Examination</td><td>Marks %</td></tr>
<tr><td>1</td><td>Laboratory Work</td><td>40 + 40 + 40</td></tr>
<tr><td>2</td><td>Journal</td><td>05+05+05</td></tr>
<tr><td>3</td><td>Viva</td><td>05+05+05</td></tr>
<tr><td colspan="2">TOTAL</td><td>150 Marks</td></tr>
</table>

Choice Based Credit Grading and Semester System (CBCGS)

S.Y.B. Sc. Physics Syllabus

To be implemented from the Academic year 2020-2021

SEMESTER III

Course Code	Unit	Topics	Credits	L / Week
USC3PH1	I	Classical Mechanics	2	1
	II	Classical Mechanics		1
	III	Thermodynamics		1
USC3PH2	I	Vector Calculus	2	1
	II	Analogue Electronics		1
	III	Analogue Electronics		1
USC3PH3	I	Acoustics, Laser, Fibre optics	2	1
	II	Crystal Physics		1
	III	Material Physics & Geophysics		1
USC3PHP		Physics Practical	2	6

SEMESTER IV

Course Code	Unit	Topics	Credits	L / Week
USC4PH1	I	Interferometry	2	1
	II	Fresnel & Fraunhoffer Diffraction		1
	III	Polarisation		1
USC4PH2	I	Basic Quantum Mechanics	2	1
	II	Applications of Quantum Mechanics-1		1
	III	Applications of Quantum Mechanics-2		1
USC4PH3	I	Digital Electronics	2	1
	II	Microprocessor		1
	III	Radio communication & Modulation		1
USC4PHP		Physics Practical	2	6

Semester III

Name of the Programme	Duration	Semester	Subject
B.Sc.in Physics	Six semesters	III	Physics
Course Code	Title	Credits	
USC3PH1	**Mechanics and Thermodynamics**	2	

Objectives of the Course:

- To introduce various kinds of oscillatory motions and their applications.
- To make the learners understand all the laws of thermodynamics and their applications in the working of heat engines and refrigerators.

Course Outcome:

On successful completion of this course Learners will be able to:

- Learners will have a detailed theoretical and mathematical understanding of different kinds of oscillatory motions and their applications.
- Learners will understand all the laws of thermodynamics and their applications.
- Learners will have detailed knowledge about the construction, working and the efficiency of different heat engines.

USC3PH1: MECHANICS AND THERMODYNAMICS

UNIT – I: Classical Mechanics

1. DYNAMICS OF SYSTEM OF PARTICLES

Center Of Mass, Motion Of The Center Of Mass, Linear Momentum Of A Particle Linear Momentum Of A System Of Particles, Linear Momentum w.r.t. CM Coordinate (I.E Shift Of Origin From Lab To CM), Conservation Of Linear Momentum, Some Applications Of The Momentum Principle, System Of Variable Mass Torque Acting On A Particle, Angular Momentum Of A Particle, Angular Momentum Of System Of Particles, Total Angular Momentum w.r.t. CM Coordinate, Conservation of Angular Momentum, Numericals.

[MHP]: 4.2, 4.3, 4.4 , 9.1, 9.1.1(1 &4)

[MMH]: 6.1-6.8 , 6.12, 6.13, 6.14

[PRH]: 9.1-9.7 , 15.1-15.8

2. SIMPLE HARMONIC OSCILLATIONS

The Simple Harmonic Oscillator , Relation Between Simple Harmonic Motion And Uniform Circular Motion, Two Body Oscillations, Compound Pendulum, Expression For Period, Maximum And Minimum Time Period, Centres Of Suspension And Oscillations Reversible Compound Pendulum, Bessel's Formula, Kater's Reversible Pendulum, Compound Pendulum And Simple Pendulum- A Relative Study, Numericals.

[MHP]: 4.2, 4.3, 4.4, 9.1, 9.1.1(1 &4)
[MMH]: 7.1, 7.2, 7.3, 7.7.1, 7.7.2, 7.8
[PRH]: 9.1-9.7, 15.1-15.8

UNIT –II: Classical Mechanics

1. DAMPED HARMONIC OSCILLATIONS

Damped Harmonic Oscillator, Over-Damped, Critically Damped, Under-Damped, Energy Of Damped Oscillator, Quality Factor Of Damped Oscillator, Logarithmic Decrement, Relaxation Time, Numericals.

[MHP]: 9.3, 9.4, 9.6, 9.7
[MMH]: 8.1, 8.2, 8.3, 8.4
[PRH]: 15.9, 15.10

2.FORCED HARMONIC OSCILLATIONS

Forced damped harmonic oscillator, three cases, dependence of phase angle on driving frequency and damping, Amplitude resonance, velocity resonance, Quality factor of a driven oscillator, Numerical.

[MHP]: 9.3, 9.4, 9.6, 9.7
[MMH]: 8.6, 8.7, 8.8, 8.9
[PRH]: 15.9, 15.10

UNIT –III: Thermodynamics

Review Of Basic Concepts Of Thermodynamics, Zeroth Law Of Thermodynamics, First Law Of Thermodynamics, Different Types Of Thermodynamical Processes.

1. IDEAL HEAT ENGINE

Conversion of Heat into Work, Heat Engine, Efficiency of Heat Engines, Slope of Isothermal and Adiabatic Process on P-V Graph, Carnot's Ideal Heat Engine, Carnot's Cycle, Net Work Done in One Cycle, It's Efficiency, Numerical.

[HBS]: 4.2-4.7, 4.21-4.27

2. SECOND LAW OF THERMODYNAMICS

Second Law of Thermodynamics, Kelvin-Planck Statement, Clausius Statement, Equivalence of Kelvin-Plank & Clausius Statement, Carnot's Theorems, Reversible And Irreversible Process, Absolute Scale of Temperature.
[HBS]: 4.20, 4.28-4.29, 5.11-5.13

3. COMBUSTION ENGINES

Steam Engine, Rankine Cycle, Otto Engine, Efficiency Of Otto Cycle, Diesel Cycle, Efficiency Of Diesel Cycle, Comparison Between Otto And Diesel Engine.
[HBS]: 4.30-4.33 (pg.141-148)

References:

[MHP] Mechanics : H. S. Hans and S. P. Puri, Tata McGraw Hill (2nd edition)
[MMH] Mechanics : Prof. D. S. Mathur and Dr. P.S. Hemne, S. Chand Publication
[PRH] Physics – I : Robert Resnick and David Halliday
[HBS] Heat thermodynamics and Statistical Physics, Brijlal, N.Subramanyam, P. S. Hemne, S. Chand, edition 2007
[TGR] Thermal Physics, AB Gupta and H. Roy, Book and Allied (P) Ltd, Reprint 2009.

Additional reference:

1. KRS: Mechanics by K.R Symon.
2. Classical Dynamics of particles and systems by Thornton and Marian, (CENGAGE Learning)
3. Classical mechanics by Kleppener , Kollenkov
4. Mechanics and Electrodynamics Rev edn. 2005 by Brijlal and Subramanyan and Jeevan Seshan.
5. Basic Thermodynamics: Evelyn Guha (Narosa Publications)
6. A treatise on heat: Meghanad Saha and BN Srivastava , 1969, India Press.

Name of the Programme	Duration	Semester	Subject
B.Sc.in Physics	Six semesters	III	Physics
Course Code	Title	Credits	
USC3PH2	**Mathematical Physics, Analog Electronics**	2	

Objectives of the Course:

- Develop ability to understand and create rigorous formal mathematical arguments. Apply basic mathematical logic.
- This course is to familiarize the Learners about the transistor, its types of biasing and operational amplifier.

Course Outcome:

On successful completion of this course Learners will be able to:

- Evaluate line and surface integrals.
- Understand the various integral theorems relating line, surface and volume integrals.
- Apply Fundamental Theorem of Line Integrals, Green's Theorem, Stokes' Theorem, or Divergence Theorem to evaluate integrals.
- Learners are able to analyze where and how analog and digital components are
- Design basic amplifier circuits using Opamp

USC3PH2 Mathematical Physics, Analog Electronics

Unit I: Vector Calculus

1. LINE INTGRAL

Line, Surface and Volume Integrals, The Fundamental Theorem of Calculus, The Fundamental Theorem of Gradient, The Fundamental Theorem of Divergence , The Fundamental Theorem of Curl (Statement and Geometrical interpretation is included, Proof of these theorems are omitted). Problems based on these theorems are required to be done.

[MLB] :6.8,6.10,6.11

[SLS] :5.1,5.3,5.4,5.5,6.1,6.2,6.3

2. COORDINATE SYSTEM

Curvilinear Coordinates: Cylindrical Coordinates, Spherical Coordinates

[SLS] : 7.1,7.2,7.3,7.4,7.5

References :

[SLS] :Vector Analysis , Murray Spiegel, Seymour Lipschutz, Deniis Spellman, 2nd Edition

[MLB] :Mathematical Methods in Physical Sciences, 3rd Edition, Mary Ll. Boas

Unit II: Analog Electronics

1. TRANSISTOR BIASING

Inherent Variations of Transistor Parameters, Stabilisation, Essentials of a Transistor Biasing Circuit, Stability Factor, Methods of Transistor Biasing, Base Resistor Method, Emitter Bias Circuit, Biasing with Collector Feedback Resistor, Voltage Divider Bias Method, Stability factor for Potential Divider Bias.

[VKM] : 9.1 – 9.13

2. GENERAL AMPLIFIER CHARACTERISTICS

Concept of amplification, amplifier notations, current gain, Voltage gain, power gain, input resistance, output resistance.

Practical circuit of transistor amplifier, phase reversal, frequency response, Decibel gain and Band width

[AM] :7.1-7.8,

[VKM] :13.1, 13.4

Unit III: Analog Electronics

1. FEEDBACK

General theory of feedback, Types of Feedback, Advantage of Negative Voltage feedback, reasons for negative feedback, loop gain.

[AM]: 10.2,10.3,10.4,10.5

2. OSCILLATORS

Introduction, effect of positive feedback. Requirements for oscillations, phase shift oscillator, Wien Bridge Oscillator, Colpitt's oscillator, Hartley oscillator

[VKM] :14.1,14.2,14.3,14.5,14.6,14.8,14.10,14.11,14.13,14.14

3. OPERATIONAL AMPLIFIERS

Introduction, Schematic symbol of OPAMP, Output voltage from OPAMP, AC analysis, Bandwidth of an OPAMP, Slew rate, Frequency Response of an OPAMP, OPAMP with Negative feedback, Inverting Amplifier, Non-Inverting Amplifier, Voltage Follower, Summing Amplifier, Applications of Summing amplifier, OPAMP Integrator and Differentiator, Critical frequency of Integrator

[VKM] : 25.1, 25.2, 25.3,

25.4,25.5,25.8,25.16,,25.17,25.19,25.20,25.23,25.24,25.26,25.27,25.35 ,25.36,25.37

References :

[VKM] : Principles of Electronics – V. K. Mehta and Rohit Mehta. (S. Chand – Multicoloured illustrative edition)

[AM] : [Electronic devices and circuits – An introduction Allan Mottershead (PHI Pvt. Ltd.– EEE – Reprint – 2013)

Name of the Programme	Duration	Semester	Subject
B.Sc.in Physics	Six semesters	III	Physics
Course Code	Title	Credits	
USC3PH3	Material Physics & Geophysics	2	

Objectives of the Course:

- To introduce the learners application of physics in the branches like Acoustics, Fibre optics and material physics.
- To develop the knowledge among the learners about Crystal Physics.

Course Outcome:

After the completion of the course , learners will be able to

- understand the Factors affecting Acoustics and use of Optical fibre in optical communication.
- understand the different types of crystal structures.

Unit 1: Acoustics, LASER and fibre optics

1. ACOUSTICS OF BUILDINGS:

Reverberation, Explanation of Sabine's formula &Importance of Sabine's Formula, Absorption Coefficient, Acoustics of Buildings,Factors Affecting Acoustics of Buildings, Sound Distribution in an Auditorium.

[RK]: 5.9, 5.10, 5.12, 5.13, 5.14 & 5.15

2. LASER:

Introduction, transition between Atomic energy states, Principle of Laser,Properties of Laser: Coherence Properties of LASER, Spatial Coherence Length,Directionality, Intensity, Helium–Neon Laser, Application of Laser, Holography

[SP]: 9.1, 9.2, 9.3, 9.4, 9.4.1, 9.4.2, 9.4.3, 9.4.4, 9.6& 9.10

3. Fibre Optics:

Light propagation through Fibres, Fibre Geometry, Internal reflection, Numerical Aperture, Step-Index and Graded-Index Fibres, Applications of Optical Fibres.
[SP]: 13.3, 13.3.1, 13.3.2, 13.3.3, 13.5 & 13.9

References:

[SP]: Modern Physics Concept and Applications – Sanjeev Puri, Narosa Publication.
[RK]: Properties of matter and Acoustics – R Murugeshan and K. Shivaprasath, SChand & Co.Ltd. (2005-Ed)

Unit II: Crystal Physics

1. Lattice points and space lattice, The basis and crystal structure, Unit Cells and lattice parameters, Primitive Cells, Crystal Systems, Crystal Symmetry, Bravais space lattices
2. Metallic crystal structures, relation between the density of crystal material and lattice constant in a cubic lattice, Directions, Planes, Miller Indices, Important planes in simple cubic structure, separation between lattice planes in a cubic crystal.

[SOP] : Chapter 4 : II,III,IV,V, VI, VII, XIV,XV, XVI, XVIII, XX, XXII, XXV,XXVI

Unit III: Properties of Material & Geophysics

1. Electrical properties of Materials:

Review of energy band diagram for materials ,conductors, semiconductors and insulators, Electrical conductivity in metals, semiconductors and insulators (dielectrics), effect of temperature on conductivity.
[VR] : 14.1, 14.2, 14.3
[RH] : 7.3, 8.1

2. Magnetic properties of materials:

Origin of magnetism in solids (basic idea), Types of magnetic order (paramagnetism, diamagnetism, antiferromagnetism, ferromagnetism, ferrimagnetism),magnetic hysteresis.
[RH] : 15.1.1, 15.1.2, 15.1.3, 15.1.4, 15.1.5

3. Geophysics

Introduction to Geology & relation of geology with other fields, Earth and solar system, Age of Earth and various methods of determination, Earth & Solar system, Planetary evolution of the Earth and its internal structure, Elastic waves and variation

of physical and chemical properties in the interior of Earth, Continental drift, Plate tectonics, Types of plates, Cause of Earthquake.

Reference books :

[SP] : Modern Physics Concept and Applications – Sanjeev Puri, Narosa Publication
[RK] : Properties of matter and Acoustics – R Murugeshan and K. Shivaprasath, S Chand & Co.Ltd. (2005-Ed)
[SOP] : Solid State Physics – S.O.Pillai, New Age International (P) Ltd,Publishers.
[RH] : Electronic Properties of Materials, Rolf E Hummel.
[VR] : Materials Science and Engineering: A First Course by V. Raghavan
Introduction to applied Geophysics : Exploring the shallow Subsurface, H.R.Burger, A.F. Sheehan and C.H.Jones, W.W.Norton, New York (2006).

Name of the Programme	Duration	Semester	Subject
B.Sc.in Physics	Six semesters	III	Physics
Course Code	Title	Credits	
USCPH3	**Practicals**	2	

USCPHP3: Practical course -3

Instructions:

- All the measurements and readings should be written with proper units in SI system only.
- After completing all the required number of experiments in the semester and recording them in journal, Learner will have to get their journal certified and produce the certified journal at the time of practical examination.
- While evaluating practical, weight age should be given to circuit/ray diagram, observations, tabular representation, experimental skills and procedure, graph, calculation and result.
- Skill of doing the experiment and understanding physics concepts should be more important than the accuracy of final result.

Learning outcomes :

On successful completion of this course Learners will be able to :

- Understand & practice the skills while performing experiments.
- Understand the use of apparatus and their use without fear & hesitation.
- Correlate the physics theory concepts to practical application.
- Understand the concept of errors and their estimation.

Group A

1. Bar pendulum: determination of g (Graph Lvs T and L vs LT2)
2. Y by bending.
3. Determination of thermal conductivity of bad conductor by Lee's Method
4. Helmholtz resonator- determination of unknown frequency
5. Brewster law
6. Single slit diffraction
7. Young's modulus by Koenig's method
8. Moment of Inertia of compound pendulum by method of coincidence.
9. Surface tension by Jaeger's Method
10. Searle's experiment: determination of Y

Group B

1. Verification of Stefan's law (electrical method)
2. Temperature coefficient of resistance of conducting material
3. LCR parallel resonance
4. RC Low Pass Filter
5. RC High Pass Filter
6. NAND & NOR as Universal Building Block
7. Determination of absolute capacitance, current sensitivity using BG
8. High resistance by mirror galvanometer
9. AC & DC Series Capacitance Bridge.
10. e/m by Thomson's method

Group C

1. Bridge rectifier: Ripple (using CRO), Load regulation. (with C filter)
2. RC Band pass filter (using Breadboard)
3. CE amplifier: determination of bandwidth
4. CE amplifier: variation of gain with load
5. Opamp: Inverting amplifier with different gains
6. Opamp: Noninverting amplifier with different gains
7. Figure of merit of a mirror galvanometer.
8. C1/C2 by de- Sauty's method.
9. High resistance by leakage using BG.
10. Wien bridge Oscillator using transistor

D) Skill experiments:

1. Component testing, colour code of resistors, capacitors etc
2. Wiring of a simple circuit using bread board
3. Use of oscilloscope

4. Travelling microscope (radius of capillary)
5. Spectrometer: mean μ of yellow doublet of mercury source, Sodium Source

References:

1. Advanced course in Practical Physics D. Chattopadhya, PC Rakshit & B Saha. (6th Edition) Book and Allied Pvt.Ltd.
2. B.Sc PRACTICAL Physics – Harnam Singh S.Chand & Co. Ld. 2001
3. A test book of advanced practical PHYSICS _ SAMIR Kumar Ghosh, New Central Book Agency (3rd edition)
4. B.Sc. Practical Physics – CL Arora (1st Edition) -2001 S.Chand and Co Ltd.
5. Practical Physics CL Squires (3rd Edition) Cambridge University
6. University Practical Physics – DC Tayal. Himalaya Publication
7. Advanced Practical Physics – Worsnop &Flint.

Note:-

- For a certified journal, Minimum 6 from each group and in all maximum 18 experiments must be reported in journal. Learners are required to report all these experiments in the journal.
- All the skill experiments are required to be completed compulsorily.
- Evaluation in viva voce will be based on regular experiments and skill experiments.
- A learner will be allowed to appear for the semester and practical examination only if he submits a certified journal of Physics or a certificate that the learner has completed the practical course of Physics Semester III as per the minimum requirements
- For practical examination, the learner will be examined in three experiments (one from each group). Each experiment will be of three hours' duration.

.

Semester IV

Name of the Programme	Duration	Semester	Subject
B.Sc.in Physics	Six semesters	IV	Physics
Course Code	Title	Credits	
USC4PH1	Wave Optics	2	

Objectives of the Course:

- To explore the field of optics and make learners understand vast variety of natural phenomena related to light.
- To develop scientific approach among students towards light.
- To introduce the wave nature of light to the learners

Course Outcome:

On successful completion of this course Learners will be able to :

- Understand various natural phenomenon related to light.
- Understand the wave nature of light in details by learning the phenomenons like interference, diffraction and polarization.
- View various naturally occurring phenomenons with a scientific approach.

Unit – I

(Review about Interference: Introduction to Interference, constructive interference, destructive interference and their conditions.)

1. MICHELSON'S INTERFEROMETER:

Principle, Construction, Working, Circular Fringes, Localized Fringes, White Light Fringes, Visibility of Fringes, Applications of Michelson's Interferometer: Measurement of Wavelength, Determination of the Difference in the wavelength of the two waves, Determination of Thickness of a thin transparent sheet, Determination of the Refractive Index of Gases, Standardization of the meter.

[OSB]: 15.7, 15.8

[OAG]: 15.11, 16.3,16.4

2. FABRY-PEROT INTERFEROMETER AND ETALON:

Principle, Construction, Working, Formation of Fringes, Determination of Wavelength, Measurement of Difference In Wavelength.

[OSB]: 15.12

[OAG]: 15.11, 16.3,16.4

UNIT II

(Review of Huygens's - Fresnel theory, Distinction between interference and diffraction, Fresnel and Fraunhoffer types of diffraction)

1. FRESNEL'S DIFFRACTION:

Fresnel's assumptions, Rectilinear propagation (Half period zones) of light, Diffraction pattern due to straight edge, Positions of maxima and minima in intensity, Intensity at a point inside the geometrical shadow(straight edge), Diffraction due to a narrow slit, Diffraction due to a narrow wire

[OSB]: 17.1-17.5, 17.10-17.12

[OAG]: 20.1, 20.2, 20.6, 20.7

2. FRAUNHOFFER DIFFRACTION :

Introduction, Fraunhoffer diffraction at a single slit, Intensity distribution in diffraction pattern due to a single slit, Fraunhoffer diffraction at a double slit, Distinction between single slit and double slit diffraction pattern and missing orders, Plane diffraction Grating, Theory of plane transmission grating, Width of principal maxima

[OSB]: 18.2, 18.4, 18.7

[OAG]: 18.1, 18.2, 18.6, 18.7, 18.8

Unit III

(Introduction of Polarization, Natural light is unpolarized, Unpolarized and Polarized light, Brewster's law, Polaroid sheets)

1.POLARIZATION:

Types of polarization, Plane polarized light, Circularly polarized light, Elliptically polarized light, Partially polarized light, Production of Plane polarized light, Polarization by reflection from dielectric surface, Polarization by refraction –pile of plates, Polarization by scattering, Polarization by selective Absorption, Polarization by double refraction, Polarizer and Analyzer, Malus' Law, Anisotropic crystal, Calcite crystal, Optic Axis, Double refraction in calcite crystal, Huygens' explanation of double refraction, Ordinary and Extra ordinary rays, Positive and Negative crystals, Superposition of waves linearly polarized at right angles, Superposition of e-Ray and o-Ray, Retarders, Quarter wave plate, Half wave plate, Production of linearly polarized light,Production of elliptically polarized light, Production of circularly polarized light, Analysis of polarized light, Applications of polarized light.

[OSB]: 20.1-20.11, 20.18-20.22, 20.26

[OAG]: 22.1-22.7

References:

[OSB]: A Text Book Of Optics: Dr. N. Subrahmanyam, Brijlal, Dr M. N. Avadhaanulu (S. Chand, 25th Revised edition 2012 Reprint 2013)
[OAG]: OPTICS (5th Edition): Ajoy Ghatak

Name of the Programme	Duration	Semester	Subject
B.Sc.in Physics	Six semesters	IV	Physics
Course Code	Title	Credits	
USC4PH2	**Quantum Mechanics**	2	

Objectives of the Course:

- To have systematic introduction to fundamental non-relativistic quantum mechanics.
- To acquire working knowledge of the Quantum Mechanics postulate on the evolution of physical systems.
- To apply the postulates of Quantum Mechanics to simple physical systems.

Course Outcome:

On successful completion of this course , Learners will be able to

- gain knowledge about basic non-relativistic quantum mechanics, the time-dependent and time-independent Schrödinger equation for simple potentials like for instance the harmonic oscillator and hydrogen like atoms
- solve the time-independent Schrodinger equation as an intermediate step to solve the time-dependent Schrodinger equation.
- apply boundary conditions to constraint the set of possible states.
- apply boundary conditions to obtain the spectra of the Hamiltonian and identifies it as the set of allowed values of the energy.
- computes the energy eigenlevels and evolution of a particle in a box
- computes the energy eigenlevels and evolution of the quantum simple harmonic oscillator.
- find the transmission and reflection coefficients for one-dimensional barriers.

Unit –I: The Schrodinger wave equation

Concept of wave function, Born interpretation of wave function. Concepts of operator in quantum mechanics examples, position, momentum and energy operators. Eigenvalue equations,expectation values of operators. Schrodinger equation. Postulates of Quantum Mechanics. Analogy between Wave equation and Schrodinger equation. Time dependent and time independent (Steady State) Schrodinger equation, Stationary

State Superposition principle. Probability current density, Equation of continuity and its physical significance. Numericals
[BMC] :5.1-5.7
[SBS] :4.1-4.12

Unit-II: Applications of Schrodinger steady state equation- I

Free particle. Particle in infinitely deep potential well (one - dimension).Particle in finitely deep potential well (one - dimension).Step potential. Particle in three dimension rigid box, degeneracy of energy state, Numericals
[CR] :3.1,3.2,4.2,4.3
[SBS] :5.1-5.3,6.1,6.2,6.3

Unit-III: Applications of Schrodinger steady state equation –II

Potential barrier (Finite height and width) penetration and tunneling effect ,Theory of alpha particle decay from radioactive nucleus, Harmonic oscillator (one-dimension), correspondence principle,Numericals
[SBS] :5.4,5.5,6.4
[CR] :4.1,4.4,5.1

Reference Books:

[BMC] :Concepts of Modern Physics – A. Beiser, Mahajan, Choudhary (6th Ed.) Tata McGraw Hill.
[SBS] :Quantum Mechanics – S P Singh, M K Bagade, Kamal Singh, - S. Chand : 2004 Ed.
[CR] :Quantum Mechanics, Statistical Mechanics and Solid State Physics: An introduction , D. Chattopadhyay, P.C.Rakshit

Additional References

1. Quantum Mechanics of Atoms, Molecules, Solids, Nuclei and particles. - By R. Eisberg and R. Resnik Published by Wiley.
2. Introduction to Quantum Mechanics. - By D. Griffiths Published by Prentice Hall.
3. Quantum Mechanics. - By Ghatak and Lokanathan Published by Mc. Millan.
4. Quantum Mechanics. - By L. I. Schiff.

Name of the Programme	Duration	Semester	Subject
B.Sc.in Physics	Six semesters	IV	Physics
Course Code	Title	Credits	
USC4PH3	**Digital Electronics & Radio Communication**	2	

Objectives of the Course:

- To explore the world of Geophysics to the learners to understand the cause of natural disasters like earthquake, tsunami etc.
- To introduce first microcomputer 8085 to the learners and also various communication technologies.

Course Outcome:

After the completion of the course

- leaners will understand the internal structure of the earth in detail.
- learners will develop the skill of programming using microprocessor 8085
- learners will also understand the various modulation techniques used in the communication system.

Unit I : Digital Electronics

1. NUMBER SYSTEM

Binary number system , Arithmetic building blocks , Types of registers,Digital IC signal levels, Binary to Decimal ,Decimal to binary , Hexadecimal number, Hexadecimal to decimal Conversion, Decimal to hexadecimal conversion, Hexadecimal to binary conversion, Binary to hexadecimal conversion, Binary addition, Unsigned binary numbers, Sign magnitude numbers , 1's complement , 2's complement , Converting to and from 2's complement representation , 2's complement arithmetic, The adder-subtractor (ignore IC specific diagrams)

[LMS] : 5.1, 5.2, 5.3, 5.5, 6.1, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8

2. FLIP-FLOPS

RS Flip-Flops (only NOR gate latch, NAND gate latch) , Gated Flip-Flops, Edge-Triggered RS Flip-Flop, Edge- Triggered D Flip-Flop, Edge-Triggered J-K Flip-Flop, JK Master- Slave Flip-Flops, Bounce elimination switch

[LMS] : 8.1, 8.2, 8.3, 8.4, 8.5, 8.8, 8.9

3. SHIFT REGISTERS AND COUNTERS

SISO , SIPO, PISO , PIPO [in this chapter the teacher should make all IC specific diagrams into general diagrams ie. Ignore pin numbers and IC numbers]

Asynchronous counter -3 bit (ignore IC specific diagrams), Synchronous counter only mod 8, Decade Counters Mod5 and Mod10
[LMS] : 9.1, 9.2, 9.3, 9.4, 9.5, 10.1, 10.3, 10.4, 10.5

Unit II : Microprocessor

1. BUILDING CONCEPT OF MICROPROCESSOR

Introduction, Study of Memory, Input Device , Output Device , Input/output Device Central Processing Unit.
[VB] : Chapter 3 : 3.1 , 3.2 , 3.3 (3.3.1 , 3.3.2 , 3,.3.3) , 3.4. , 3.5 , 3.6 , 3.7

2. 8085 MICROPROCESSOR

Introduction , Features of Inter 8085 , Pin Diagram of 8085 , 8085 CPU Architecture Arithmetic and Logical Group (ALU , Accumulator , Temporary Register , Flag Register (PSW)) , Register Group (Temporary Registers (W and Z) , General purpose registers , Special Purpose registers) , Interrupt Control , Serial I/O Control Group ,Instruction Register Decoder and Control Group (Instruction Register , Instruction Decoder , Timing and Control)
[VB] :Chapter 4 : 4.1 ,4.2 , 4.3. , 4.4 , 4.5 (4.5.1 , 4.5.2 , 4.5.3 , 4.5.4) , 4.6 (4.6.1 , 4.6.2 , 4.6.3),4.7 , 4.8 , 4.9 (4.9.1 , 4.9.2 , 4.9.3)

3. 8085 INSTRUCTION SET

Introduction , Flowchart , Classification of Instruction Set (Data Transfer Group ,Arithmetic Group , Logical Group , Branching Group , Stack and Machine ControlGroup) , Notations used in Instructions and Opcode , Data Transfer Group ,Program Examples for Data Transfer Group , Arithmetic Operation Group , Branch Group , Logical Group , Addressing Modes , 8085 Programmers Model.
[VB] :Chapter 6 : 6.1 , 6.2 , 6.3 6.4 , 6.5 , 6.6 , 6.7 , 6.8 (6.8.1 , 6.8.2 , 6.8.3 , 6.8.8 , 6.8.9, 6.8.10 ,6.8.11 (A part Block Transfer) , 6.9 (6.9.1 upto 6.9.19) , 6.12 , 6.13

Unit III : Radio Communication

1. BASICS OF COMMUNICATION:

Block diagram of communication system, types of communication system: simplex, duplex, analog and digital communication, Electromagnetic spectrum, base band and broad band communication. Noise concept and types, signal to noise ratio, noise figure, noise temperature.
[LF] : 1.1, 1.2, 1.3, 1.4, 1.5, 1.6
[GK] : 1.1 – 1.6, 2.1 – 2.6

2. AMPLITUDE MODULATION:

Need of modulation, concept of modulation, AM waveform, mathematical expression of AM, concept of sideband, demodulation principles. AM Receiver: TRF and super heterodyne receiver.

[GK] : 3.2, 7.2.1, 7.2.3, 7.3.1, 7.3.2

3. FREQUENCY MODULATION:

Definition, mathematical representation, frequency spectrum, bandwidth and modulation index.

Concept of ASK, PSK, FSK..

[GK] : 6.2.1, 6.2.2, 6.2.3

Reference Books:

[LMS] : Digital Principles and Aplications By Leach, Malvino, Saha Seventh edition.

[VB] : V.J. Vibhute & P.B. Borole, Fifth Revised Edition

[GK] : Electronics Communication Systems by George Kennedy, Bernard Davis & S R M Prasanna, fifth edition, McGraw Hill Education (India) Pvt. Ltd.

[LF] : Communication Electronics: Principles and applications by Louis E Frenzel, 3rd edition TMH Publications.

Name of the Programme	Duration	Semester	Subject
B.Sc.in Physics	Six semesters	IV	Physics
Course Code	Title	Credits	
USCPH4	**Practicals**	2	

USCPHP4: Practical course -3

Instructions:

- All the measurements and readings should be written with proper units in SI system only.
- After completing all the required number of experiments in the semester and recording them in journal, Learner will have to get their journal certified and produce the certified journal at the time of practical examination.
- While evaluating practical, weight age should be given to circuit/ray diagram, observations, tabular representation, experimental skills and procedure, graph, calculation and result.
- Skill of doing the experiment and understanding physics concepts should be more important than the accuracy of final result.

Learning outcomes :

On successful completion of this course Learners will be able to :

- Understand & practice the skills while performing experiments.
- Understand the use of apparatus and their use without fear & hesitation.
- Correlate the physics theory concepts to practical application.
- Understand the concept of errors and their estimation.

Sem 4

Group A

1. Optical lever: determination of Refractive Index
2. Determination of Couchy's constants.
3. Resolving power of telescope.
4. Resolving Power of grating
5. Determination of refractive Index of liquid by Laser
6. Kater pendulum: determination of acceleration due to gravity
7. Cylindrical obstacle: determination of wavelength
8. Fresnel's bi-prism: determination of wavelength
9. Double refraction
10. Flat Spiral spring: to determine Modulus of rigidity

Group B

1. Half adder and full adder using EXOR gate (IC7486, IC 7408)
2. Study of MS-JK flip flop (IC 7476)
3. Study of Latch (IC 7400/ IC 7402)
4. Study of 8:3 Priority Encoder (IC 74LS148)
5. Study of 3:8 Decoder (IC 74LS138)
6. Shift Register (IC 74194)
7. Opamp: Integrator
8. Opamp: Differentiator.
9. UJT characteristics
10. Colpitt's oscillator. Using transistor

Group C

1. Study of 8085 microprocessor kit and commands
2. Two digit Decimal addition, subtraction
3. To find largest number/ smallest number
4. Memory block transfer from one location to another
5. Arrange number in ascending/descending order
6. Arrange Even /odd number
7. Amplitude modulation

8. Frequency Modulation
9. Time Division Multiplexing circuit
10. Square wave oscillator using OPAMP IC 741

Demonstration experiments

1. Error analysis of a given experiment
2. Wave form generator using Op-amp
3. PC simulations: graph, curve fitting etc.
4. Straight edge Fresnel diffraction
5. First order active filter.
6. DAD instruction.

References:

1. Advanced course in Practical Physics D. Chattopadhya, PC Rakshit & B Saha. (6th Edition) Book and Allied Pvt.Ltd.
2. B.Sc PRACTICAL Physics – Harnam Singh S.Chand & Co. Ld. 2001
3. A test book of advanced practical PHYSICS _ SAMIR Kumar Ghosh, New Central Book Agency (3rd edition)
4. B.Sc. Practical Physics – CL Arora (1st Edition) -2001 S.Chand and Co Ltd.
5. Practical Physics CL Squires (3rd Edition) Cambridge University
6. University Practical Physics – DC Tayal. Himalaya Publication
7. Advanced Practical Physics – Worsnop &Flint.

Note:-

- For a certified journal, Minimum 6 from each group and in all maximum 18 experiments must be reported in journal. Learners are required to report all these experiments in the journal.
- All the skill experiments are required to be completed compulsorily.
- Evaluation in viva voce will be based on regular experiments and skill experiments.
- A learner will be allowed to appear for the semester and practical examination only if he submits a certified journal of Physics or a certificate that the learner has completed the practical course of Physics Semester IV as per the minimum requirements
- For practical examination, the learner will be examined in three experiments (one from each group). Each experiment will be of three hours' duration.