॥ विद्या विनयेन शोभते ॥

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: Bachelor's in Science (B. Sc.)

Credits: 132

SYLLABUS

(Approved in the Academic council meeting held on…….)

S. Y. B. Sc. Physics

Revised as per
Choice Based Credit System (60:40)
w. e. f. Academic Year 2023-24

BACHELOR'S IN SCIENCE (B. Sc.)
Programme Outcomes

S. N.	After completion of B.Sc. program students will acquire	Graduate Attribute
PO1	The knowledge of the disciplines and in-depth and extensive knowledge, understanding and skills in a specific field of interest.	Disciplinary knowledge
PO2	An ability to develop and conduct experiments, analyse, and interpret data and use scientific judgement to draw conclusions	Scientific reasoning
PO3	An ability to use current technology, and modern tools necessary for creation, analysis, dissemination of information.	Digital literacy
PO4	Innovative, professional, and entrepreneurial skills needed in various disciplines of science.	Life-long learning
PO5	An ability to achieve high order communication skills.	Communication skills
PO6	An ability to collect, analyse and evaluate information and ideas and apply them in problem solving using conventional as well as modern approaches	Problem solving
PO7	A sense of social responsibility; intellectual and practical skills and demonstration of ability to apply it in real-world settings.	Reflective thinking
PO8	An ability to engage in independent and life-long learning through openness, curiosity, and a desire to meet new challenges.	Life-long learning
PO9	A capacity to relate, collaborate, and lead others, and to exchange views and ideas to work in a team to achieve desired outcomes	Teamwork
PO10	An ability to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	Leadership
PO11	An ability to understand values, ethics, and morality in a multidisciplinary context.	Moral and ethical awareness

Preamble:

The new curriculum offers courses in the core areas of Mechanics, Acoustics, optics, Theory of Relativity and Quantum physics etc. The courses will train students with sound theoretical and experimental knowledge that suits the needs of academics and industry. In addition to the theoretical course work, students also learn physics laboratory methods for different branches of physics, specialised measurement techniques, analysis of observational data, including error estimation.

Students will have a deeper understanding of laws of nature through subjects like classical mechanics, quantum mechanics, statistical physics etc. Students' ability to problem solving will be enhanced. Students can apply principles in physics to real life problems. Subjects like Integrated electronics and Microprocessors will enhance logical skills as well as employability skills. Numerical methods and Mathematical Physics provide analytical thinking and provide a better platform for higher level physics and research.

Examination Scheme

The performance of the learners shall be evaluated into two components. The learner's Performance shall be assessed by Internal Assessment with 40% marks in the first component by conducting the Semester End Examinations with 60% marks in the second component.
The allocation of marks for the Internal Assessment and Semester End Examinations are as shown below: -

A) Internal Assessment: 40 % 40 Marks

Sr. No.	Particular	Marks
01	One periodical class test / online examination	20 Marks
02	1. Test on Practical Skills 2. Open Book Test	20 Marks

B) Semester End Examination: 60 % 60 Marks

S.Y.B.Sc. (Sem. III & IV)

- Duration: The examination shall be of 2 hours duration.

Theory question paper pattern
1. There shall be four questions of 15 marks each (30 marks with internal options). 2. On each unit there will be one question and the fourth question will be based on the entire syllabus. 3. All questions shall be compulsory with internal options. 4. Questions may be subdivided into sub-questions a, b, c… and the allocation of marks depends on the weightage of the unit.

Question Paper Pattern for Semester End Examination

Theory	All questions are compulsory and will have internal options.		
	Q-1 (Unit – I)	A) Attempt any one out of two.	08 Marks
		B) Attempt any one out of two.	07 Marks
	Q-2 (Unit – II)	A) Attempt any one out of two.	08 Marks
		B) Attempt any one out of two.	07 Marks
	Q-3 (Unit III)	A) Attempt any one out of two.	08 Marks
		B) Attempt any one out of two.	07 Marks
	Q-4 (Unit-I, II, III)	A) Multiple Choice Questions (Attempt any 12 out of 15)	12 Marks
		B) Answer in one line (Attempt 3 out of 6)	03 Marks
	TOTAL		60 Marks

Question Paper Pattern for Continuous Internal Assessment

Sr.No.	Particular	Marks
1	Match the Column / Fill in the Blanks / Multiple Choice Questions/ True/False/Answer in One or Two Lines (Concept based Questions) (1 Marks each)	20
2	Open Book Test - High order thinking questions (HOTS)	20(converted to 10)
3	Test on Practical Skills	20 (converted to 10)
3.1	Demonstration of skill	5
3.2	Viva	5
3.3	Report	5
3.4	Problem solving ability	5

Question Paper Pattern for Practical Examination

Practical	The External examination for practical courses will be conducted as per the following scheme.		
	Sr. No.	Particulars of External Practical Examination	Marks
	1	Laboratory Work	40 + 40 +40
	2	Journal	05 + 05+ 05
	3	Viva	05 + 05 +05
	TOTAL		150 Marks

Course Descriptions	
Semester	**III**
Course Name	**Physics-1**
Course Code	**USC3PH1**
Eligibility for the Course	
Credit	**02**
Hours	**45 hours**

Course Objectives

- To enrich knowledge through laws of conservation of momentum & energy and their applications.
- To introduce concepts of Simple Harmonic Oscillation,various kinds of oscillatory motions and their applications.
- To make the learners understand Various Kind of Error and their applications in the calculations and measurements in the experiments.

Course Outcomes

After completing the course, Student will able to:

CO1 explain the laws of conservation of momentum & energy, compound pendulum, damped & forced harmonic oscillator, basics of theory of measurement

CO2 formulate equations for the motion of the rocket, conditions for forced & damped harmonic oscillator, time period of compound pendulum,The Normal Distribution,

CO3 solve numerical problems based on laws of conservation of momentum & energy, compound pendulum, damped harmonic oscillator, forced harmonic oscillator,Fractional Uncertainty ,Significant Digits, The Estimation of Errors in means and in Single Measurement.

CO4 distinguish between thermodynamic processes, Otto Engine & Diesel Engine, Simple Pendulum & Compound Pendulum, Damped Oscillations & Forced Oscillations, Absolute Errors and Relative Errors.

Module/ Unit	Course Description	Hrs	CO No.	PO No.
1.1	**DYNAMICS OF SYSTEM OF PARTICLES** Centre Of Mass, Motion Of The Centre 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	15 hrs		

	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			
1.2	**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			
2.1	**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	15hrs		
2.2	**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			
3.1	**THEORY OF MEASUREMENT** Measurement, Significant Digits, Dropping Non-significant Digits, Rounding of Numbers, Absolute and Relative Errors, Relative error and Significant Digits, Errors of Computation, Accuracy of a Function [JCP]: 1.1, 1.2, 1.2(a), 1.2(b), 1.3, 1.4, 1.5,1.6.	15hrs		
3.2	**ELEMENTARY THEORY OF ERRORS** Introduction, Various Kind of Error, Different Ways of Measuring Random Error, Uncertainty and Significant Digits, Fractional Uncertainty and Significant Digits, Significance of Uncertainty. [JCP]: 2.1, 2.2, 2.3, 2.7, 2.7(a), 2.9			
3.3	**THE ESTIMATION OF ERRORS**			

	The Normal Distribution, The Average or Mean Value of Measurements, The Estimation of Errors, Error in Single Measurement, The Error in the Mean, Reliability of Measurement [JCP]: 3.4, 3.5, 3.6, 3.10, 3.10(a), 3.11.			

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
[JCP] The Theory of ERRORS in PHYSICAL MEASUREMENTS.

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.

Course Descriptions : Mathematical Physics,Analog Electronics	
Semester	**III**
Course Name	**Physics-2**
Course Code	**USC3PH2**
Eligibility for the Course	
Credit	**02**
Hours	**45 hours**

Course Objectives

- Understand the basic mathematical concepts and application of them in Physical situation.
- Demonstrate quantitative problem solving skills in all topics covered in syllabus.
- To familiarize about the semiconductor, its applications, transistor, its types of biasing and operational amplifier, oscillators.

Course Outcomes

After completing the course, Student will able to:

CO1 solve vector calculus and Fundamental Theorem of Line Integrals, Green's Theorem, Divergence Theorem to evaluate integrals,

CO2 determine the operating point, stability factor for different transistor biasing methods, frequency of oscillator, voltage gain of opamp in different applications

CO3 Discuss basic of Semiconductor and its Application,Transistors,Oscillators, Opamp,Gradient, Culr, Divergence terms & its applications.

CO4 design basic circuits using Op-amp , transistor , oscillator

Module/ Unit	Course Description	Hrs	CO No.	PO No.
1.1	**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. [MS]:4.1,4.2,4.3,4.4,4.5	15hrs		
1.2	**LINE INTEGRAL** Line, Surface and Volume Integrals, The Fundamental Theorem of Gradient (statement & Problems), The Fundamental Theorem of Divergence (statement & Problems) , The Fundamental Theorem of Curl(statement & Relevance) [MLB] :6.8,6.10,6.11 [SLS] :5.1,5.3,5.4,5.5,6.1,6.2,6.3			
2.1	**Practical Applications of Semiconductor:** Review of Semiconductor Diodes: p and n type semiconductors. Barrier Formation in PN Junction Diode, Forward and Reverse Biased Diode. PN junction and its characteristics. Principle and structure of LEDs, Photodiode, Seven segment display [VKM]:5.1,5.8,5.9,5.10,5.11,5.14,5.16,5.19,7.2,7.3, 7.4,7.5,7.6,7.7,7.9,7.10	15hrs		

2.2	**TRANSISTOR BIASING** Inherent Variations of Transistor Parameters, Stabilisation, Essentials of a Transistor Biasing Circuit, Stability Factor, Methods of Transistor Biasing, Base Resistor Method, Voltage Divider Bias Method, Stability factor for Potential Divider Bias. [VKM] : 9.1 – 9.13			
2.3	**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			
3.1	**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	15hrs		
3.2	**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			
3.3	**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 :

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

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

[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)

[MS]:Murray R Spiegel, Schaum's outline of Theory and problems of Vector Analysis,

Asian Student Edition

Course Descriptions	
Semester	**III**
Course Name	**Physics-3**
Course Code	**USC3PH3**
Eligibility for the Course	
Credit	**02**
Hours	**45 hours**

Course Objectives

Course Outcomes

After completing the course, Student will able to:

CO1 explain the factors affecting Acoustics of buildings, Principle of operation of LASER and Propagation of light through Optical Fiber, variation of Physical and Chemical properties in the interior of the Earth, Continental drift, Plate tectonics, Types of plates and Cause of Earthquake.

CO2 explain the significance of Michelson Morley experiment and failure of the existing theories to explain the null result

CO3 explain the importance of postulates of special relativity, Lorentz transformation equations.

CO4 compare the materials on the basis of Electrical conductivity and relative magnetic permeability.

Module/ Unit	Course Description	Hrs	CO No.	PO No.
	UNIT I ACOUSTICS			
1.1	**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			
1.2	**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	15 hrs		

1.3	**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			
	UNIT II : SPECIAL THEORY OF RELATIVITY			
2.1	Experimental background of Special theory of relativity, Galilean transformations, Newotonian relativity, Electromagnetism and Newtonian relativity, Lorentz transformation,	15hrs		
2.2	Attempts to locate absolute frame: Michelson-Morley experiment, attempts to preserve the concept of a preferred ether frame: Lorentz Fitzgerald contraction and ether drag hypothesis, attempts to modify electrodynamics, postulates of the special theory of relativity RR: 1.1 to 1.9, 2.1 to 2.5			
	Unit III: Properties of Material & Geophysics			
3.1	**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	15hrs		
3.2	**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			
3.3	**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.			

References

[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)
[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).
[RR] : Introduction to Special Relativity, Robert Resnick, John Wiley and sons.

Course Descriptions : Wave Optics	
Semester	**III**
Course Name	**Physics Practical**
Course Code	**USC3PHP**
Eligibility for the Course	
Credit	**02**
Hours	**45 hours**

Course Objectives

Course Outcomes

After completing the course, Student will able to:

CO1 experiment with bridge rectifiers, oscillators, Ballistic galvanometers.
CO2 inspect Stefan's law, Brewster's law, e/m by Thomson's method, passive filters, applications of op-amp, CE amplifier, NAND & NOR as Universal Building Block
CO3 construct electronic circuits using resistor, capacitor, diode, transistor, IC-741 (Op-Amp), logic gates.
CO4 estimate physical constants related to solids.

Module/ Unit	**Course Description**	Hrs	CO No.	PO No.
A	**Regular experiments**			
A.1	**Group 1** 1. Bar pendulum: determination of g 2. Y by bending. 3. Determination of thermal conductivity of bad conductor by Lee's Method 4. Helmholtz resonator 5. Brewster law 6. Single slit diffraction 7. Young's modulus by Koenig's method	15 hrs	CO3, CO4	PO1, PO2, PO3, PO6

	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			
A.2	**Group 2** 1. Temperature coefficient of resistance of conducting material 2. Verification of Stefan's law (electrical method) 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	15 hrs	CO2, CO4	PO1, PO2, PO3, PO6
	Group 3 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			
B	**Skill Experiments**:(Any 3) 1. Component testing, colour code of resistors, capacitors etc 2. Wiring of a simple circuit using a breadboard. 3. Use of oscilloscope 4. Travelling microscope (radius of capillary)	15 hrs	CO1	PO1, PO3, PO6
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 a journal. 2. Students should carry out mini-project upto the satisfaction of professor In-charge of practical. 3. Study tour. Students participating in the study tour must submit a study tour report.	15 hrs	CO1, CO2, CO3, CO4	-

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.

- Minimum 4 experiments from each group should be completed in the each 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 Exam.
- The scheme of examination for the revised course in Physics at the Third Year B.Sc. Semester end examination will be Semester End Practical Examination:
- Scheme of examination for Practical: 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 S.Y.B.Sc. Physics as per the minimum requirement.
- The duration of the practical examination will be two hours per experiment.
- There will be three experiments through which the candidate will be examined in practical examination.

Course Descriptions : Wave Optics	
Semester	**IV**
Course Name	**Physics-1**
Course Code	**USC4PH1**
Eligibility for the Course	
Credit	**02**
Hours	**45 hours**

Course Objectives

- To introduce Advanced concepts of Electrostatics, its Application in Matter and Wave nature of light to the learners.
- To Explore the field of Optics and make learners understand a vast variety of natural phenomena related to light.
- To develop a scientific approach amongst students towards light.

Course Outcomes

After completing the course, Student will able to:

CO1 Understand the laws of electrodynamics and be able to perform calculations using them and explain the Construction and Working of Michelson's Interferometer, Fresnel's class of Diffraction and the phenomenon of polarization.

CO2 Develop quantitative problem solving skills of Electrostatics, solve numerical problems related to Michelson's Interferometer, Fresnel's Diffraction and Brewster's law

CO3 formulate equations for Coulomb & Gauss Law, Gauss Law in Dielectrics, the wavelength of light, difference in wavelength of light, refractive index of gases using Michelson's Interferometer, separation between diffraction minima & maxima in Fresnel's class of Diffraction.

CO4 distinguish between the Poisson's Equation and Laplaces's Equation, Interference and Diffractions, unpolarized light, plane polarized light, circularly polarized light & elliptically polarized light.

Module/ Unit	Course Description	Hrs	CO No.	PO No.
1.1	**ELECTROSTATICS** Coulomb & Gauss Law, The Divergence of **E**, Applications of Gauss' Law, The Curl of **E**, Poisson's Equation and Laplaces's Equation, Solution and Properties of 1D Laplace Equation. [DG]: 2.1.2, 2.2.1-2.2.4, 2.3.3, 3.1.2	15hrs		
1.2	**ELECTROSTATICS IN MATTER**			

	Dielectrics, Induced Dipoles, Alignment of Polar Molecules, Polarization, Bound Charges and Their Physical Interpretation, Gauss Law in Dielectrics, Susceptibility, Permittivity, Dielectric Constants & Relation Between Them. [DG]: 4.1.1-4.1.4, 4.2.1-4.2.2, 4.3.1, 4.4.1			
2.1	(Review of Huygens's - Fresnel theory, Distinction between interference and diffraction, Fresnel and Fraunhoffer types of diffraction) **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	15hrs		
2.2	**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			
3.1	(Introduction of Polarization, Natural light is unpolarized, Unpolarized and Polarized light, Brewster's law, Polaroid sheets) **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 Extraordinary 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	15hrs		

	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

[DG]: Introduction to Electrodynamics, by David J. Griffiths (3rd Ed) Prentice Hall of India.
[OSB]: A TextBook Of Optics: Dr. N. Subrahmanyam, Brijlal, Dr M. N. Avadhaanulu (S. Chand, 25th Revised edition 2012 Reprint 2013)
[OAG]: OPTICS (5th Edition): Ajoy Ghatak

Course Descriptions	
Semester	**IV**
Course Name	**Physics-2**
Course Code	**USC4PH2**
Eligibility for the Course	
Credit	**02**
Hours	**45 hours**

Course Objectives

Course Outcomes

After completing the course, Student will able to:

CO1 Explain postulates of quantum mechanics, operators, expectation values in quantum mechanics and Schrodinger's equation.

CO2 apply boundary conditions to calculate the transmission and reflection coefficients for free & bound states.

CO3 Solve the Schrodinger steady state equation in free and bound state.

CO4 elaborate Schrodinger's equation to radioactive decay and harmonic oscillator.

Module/ Unit	**Course Description**	Hrs	CO No.	PO No.
1.1	**Basic Concepts of Quantum Mechanics : I** Concept of wave function, Born interpretation of wave function. Normalisation of wave functions, stationary states,Postulates of Quantum Mechanics. Superposition principle, Numericals [BMC] :5.1-5.7 [SBS] :4.1-4.12	15hrs		

1.2	.**Basic Concepts of Quantum Mechanics : II** Concepts of operator in quantum mechanics examples, position, momentum and energy operators. Eigenvalue equations,expectation values of operators			
2.1	**Applications of S.T.I.E** Free particle. Particle in infinitely deep potential well (one - dimension).step potential,Particle in three dimension rigid box, degeneracy of energy state,Theory of alpha particle decay from radioactive nucleus, [CR] :3.1,3.2,4.2,4.3 [SBS] :5.1-5.3,6.1,6.2,6.3	15hrs		
2.2	**Applications of S.T.I.E** Potential barrier (Finite height and width) penetration and tunnelling effect , Numericals			
3.1	**Schrodinger Equation in Polar Coordinate system** Cartesian Coordinate system, Polar coordinate system, conversion between Cartesian & polar coordinate system, Express schrodinger equation in polar coordinate system.Analogy between Wave equation and Schrodinger equation. Time dependent and time independent (Steady State) Schrodinger equation	15hrs		
3.2	**Practical Applications of S.T.I.E:** Rigid Rotator, Moment of Inertia of Rigid Rotator, Wave equation, Energy level of Rigid Rotator			

References

[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 Reference:

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.

Course Descriptions	
Semester	**IV**
Course Name	**Physics-3**
Course Code	**USC4PH3**
Eligibility for the Course	
Credit	**02**
Hours	**45 hours**

Course Objectives

Course Outcomes

CO1 After completing the course, Student will able to:
explain Flip-Flop, 555 timer, 8085 microprocessor architecture and modulation techniques used in wireless communication system

CO2 Explain the basic concepts of timing pulse generation

CO3 elaborate the circuits using Flip-Flop and logic gates.

CO4 design a programme logic for an 8085 microprocessor using various 8085 instructions.

Module/ Unit	Course Description	Hrs	CO No.	PO No.
1.1	**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	15hrs		
1.2	555 Timer: Review Block diagram, Monostable, Bistable and Astable operation Voltage Controlled Oscillator, Pulse Width modulator, Pulse Position Modulation, Triggered linear ramp generator. KVR: 14.5.2.1, 14.5.2.5, 14.5.2.6, 14.5.4.1			

2.1	**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	15hrs		
2.2	**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)			
2.3	**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			
3.1	**BASICS OF COMMUNICATION:** Block diagram of communication system, types of communication system: simplex, duplex, analog and digital communication, Electromagnetic spectrum, baseband and broadband 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	15hrs		
3.2	**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			

3.3	**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			

References

[LMS] : Digital Principles and Applications 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.
KVR: Functional Electronics, K.V. Ramanan-TMH Publication

Course Descriptions : Wave Optics	
Semester	**IV**
Course Name	**Physics Practical**
Course Code	**USC4PHP**
Eligibility for the Course	
Credit	**02**
Hours	**45 hours**

Course Objectives

Course Outcomes

After completing the course, Student will able to:

CO1 determine physical constants of solids, the Resolving power of telescope & grating, wavelength of the monochromatic light, refractive index.

CO2 design & construct MS-JK flip flop (IC 7476), Latch (IC 7400/IC 7402) , 8:3 Priority Encoder (IC 74LS148) and 3:8 Decoder (IC 74LS138), shift register, oscillator, Half adder and full adder using EX-OR gate, Op-amp as a Differentiator and Integrator.

CO3 Write a programme using 8085 microprocessor

CO4 Experiment with IC-7486, IC-7408, IC-7476, IC-7400, IC-7402, IC-74148, IC-74138, IC-74194, IC-741, spectrometer, telescope.

Module/ Unit	**Course Description**	Hrs	CO No.	PO No.
A	**Regular experiments**			
A.1	**Group 1** 1. Optical lever: determination of Refractive Index 2. Determination of Cauchy's constants. 3. Resolving power of telescope.	15 hrs	CO3, CO4	PO1, PO2, PO3, PO6

	4. Resolving Power of grating 5. Determination of refractive Index of liquid by Laser 6. Kater's 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			
A.2	**Group 2** 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. Colpitts oscillator. Using transistor	15 hrs	CO2, CO4	PO1, PO2, PO3, PO6
	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			
B	**Skill Experiments**:(Any 3) 1. Use of Breadboard- Circuit Designing 2. Testing of IC 3. Schuster method 4. Error Analysis	15 hrs	CO1	PO1, PO3, PO6
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 a journal.	15 hrs	CO1, CO2, CO3, CO4	-

	2. Students should carry out mini-project upto the satisfaction of professor In-charge of practical. 3. Study tour. Students participating in the study tour must submit a study tour report.			

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

- Minimum 4 experiments from each group should be completed in the each 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 Exam.
- The scheme of examination for the revised course in Physics at the Third Year B.Sc. Semester end examination will be Semester End Practical Examination:
- Scheme of examination for Practical: 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 S.Y.B.Sc. Physics as per the minimum requirement.
- The duration of the practical examination will be two hours per experiment.
- There will be three experiments through which the candidate will be examined in practical examination.