SANKALCHAND PATEL UNIVERSITY, VISNAGAR

Faculty of Science & Humanities

Structure, Teaching Scheme and Syllabus of

B. Sc. (Physics) Honours with Research

Sem-5 as per NEP-2020

Program Code: SC105

With effect from: 2023-24

Semester- 5

Faculty of Science and Humanities
B.Sc. (Physics) (Semester - 5)
In Effect from Academic Year 2023-24

Branch Name:	B.Sc. Physics
Program Code:	SC105
Course Name:	Quantum, Classical and mathematical Physics-II
Course Code:	15-PHM301-3C
Pre-requisite Course:	

Course Objectives:

1. Develop an actual understanding of the Mathematical Physics.
2. To know the basic concept of quantum mechanics.
3. Understand the concept of classical mechanics.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
				Theory (Marks)		Practical (Marks)		
Lecture (L)	Tutorial (T)	Practical (P)	Credit	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	Total (Marks)
3	--	2	4	50	25	--	25	100

Subject contents:

Unit	Content	Lectures	Weightage
1	**a) Differential Equations** Some partial differential Equations Physics, The method of separation of variables, Separation of Helmholtz equation in Cartesian Coordinates, Separation of Helmholtz equation in spherical polar Coordinates, separation of Helmholtz equation in cylindrical coordinates, Laplace's equation in various coordinate systems. **(b) Second order differential Equations** Ordinary and singular points, Series solution around and ordinary point, Series Solution around a regular singular point (The method of Frobenius).	15	33%
2	**(a) Lagrangian Formulation** Constraints, generalized coordinates, D'aleffibert's principle, Lagrange's equations, A general expression for kinetic energy, Symmetries and the laws of conservation, Cyclic or ignorable coordinates, Velocity dependent potential of electromagnetic field **(b) Motion of Rigid Body** Euler's theorem, Angular momentum and kinetic energy, The inertia tensor, Euler's equation motion.	15	33%
3	**General formalism of Wave Mechanics** The Schrodinger equation and Probability interaction for N-particle system, The fundamental postulates of wave mechanics, Adjoint of an operator and self Adjointness, The Eigen value problem, Degeneracy, Eigen values and Eigen functions of self-adjoint operators, The Dirac delta function, Observables, completeness and normalization of Eigen functions, Closer, physical interpretation of Eigen values, Eigen function and expansion coefficients, Momentum Eigen functions : wave functions in momentum space, uncertainly Principle, States with minimum value for uncertainly product, commuting observable : Removal of degeneracy, Evolution of system with time Constants of the motion.	15	34%

Basic Reference book:

1. Mathematical Physics by P. K. Chatopadhyay. Wiley East Ltd.

2. Mathematical Physics by B.D.Gupta.
3. Elements of solid state State Physics J. Psrivastava
4. Introduction to classical mechanics by Takawale and Puranic. THM Publication.
5. Physics- 205 Nirav Prakashan

Physics Practical:

1. Acceleration due to gravity (g) using Katters's Pendulum (with Movable and Fixed knife edges)
2. Comparision of capacity (C1/C2) using method of mixture.
3. e/m Thomson method

List of Open Source Software/learning website:

1. https://www.youtube.com/watch?v=sB4KS4rpccE
2. https://www.youtube.com/watch?v=fY6TrK24ZK0&list=PLNU8gQTp

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Describe the some deferential equations physics	1 Remembering
CLO2	Discuss second order differential equations	2 Understanding
CLO3	Solve the Lagrangian equations	3 Applying
CLO4	Explain the motion of the rigid body	4 analyzing
CLO5	Justify the general formulation of wave mechanics.	5 evaluating
CLO6	Create some numerical problem regarding wave mechanics	6 creating

Mapping of CLOs with POs & PSOs

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2
CLO1		2															1	
CLO2					3												2	
CLO3						2				2							2	
CLO4					1												1	
CLO5		3															2	
CLO6			2														3	

3: High, 2: Medium, 1: Low

Faculty of Science and Humanities
B.Sc. (Physics) (Semester -5)
In Effect from Academic Year 2023-24

Branch Name:	B.Sc. Physics
Program Code:	SC105
Course Name:	Solid state and statistical mechanics-II
Course Code:	15-PHM302-3C
Pre-requisite Course:	

Course Objectives:

1. To know the concept of solid state Physics.
2. To develop an actual understanding of the Statistical Mechanics.
3. To understand the concept of superconductivity.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
				Theory (Marks)		Practical (Marks)		
Lecture (L)	Tutorial (T)	Practical (P)	Credit	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	Total (Marks)
3	--	2	4	50	25	--	25	100

Subject content:

Basic Reference book:

Unit	Content	Lectures	Weightage
1	**Elements of crystallography**: Symmetry elements, Classification of crystals, Zone and forms, Miller indices, Lattice types, Effect of symmetry, Atomic packing: packing of equal spheres in two and three dimension, hexagonal lattice, fcc lattice, bcc and Simple Cubic lattice, classification of closed packing, voids, voids in closed packing, Pauling's rule and its applications, Common Crystal structures: simplest crystals CsCl, NaCl, alkali metals, Diamond and hexagonal, Transformation theory	15	34%
2	**Some Application of Statistical Mechanics** Thermodynamics, Reversible and Irreversible processes, The Laws of Thermodynamics (i) Zeros (ii) First Law (iii) Second Law, Statistical interpretation of the basics thermodynamic variables, Thermodynamic functions in terms of grand partition function, Ideal gas, Gibbs's Paradox Inclusive Sackur-Tetrode equation, The equipartition theorem.	15	33%
3	**Superconductivity** : Phenomena without observable Quantization, Zero resistance and persistent currents, Perfect Diamagnetisms : Meissner Effect, London Equation, Critical Field : Type I and Type II super conductors, BCS Theory : A qualitative approach, Cooper pair formation, BCS ground state, Important predictions of the BCS theory and comparison with experiments, Critical temperature, Ginzburg-Landau Theory, Magnetic flux Quantization , Coherence Length, Type-II superconductivity, Josephson tunnelling, Applications.	15	33%

1. Fundamentals of Statistical Mechanics by B. B. Laud. New Age International Publisher
2. Elements of Solid State Physics by J.P. Srivastava, PHI New Delhi 2003
3. Statistical Mechanics by B. K. Agarwal- Melvin Eisner. New Age Int. Pub.
4. Introduction to Solid State Physics by C. Kittle. 7th Edition, John Willy and Sons
5. Physics-302 Nirav Prakashan

Physics Practical:

1. A study of transmitted colpit oscillator using CRO/ wave meter
2. Negative feedback amplifier
3. To determine frequency of AFO Using wein bridge

List of Open Source Software/learning website:

1. https://www.youtube.com/watch?v=D1RzvXDXyqA2.
2. https://www.youtube.com/watch?v=D-9M3GWoBrw

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Describe the elements of crystallography	1 Understanding
CLO2	Describe the Some Application of Statistical Mechanics	2 remembering
CLO3	Discuss the Statistical ensenble	3 Applying
CLO4	Justify the Applications of Super conductor in various fields.	4 Analyzing
CLO5	Explain the London equation and Bcs theory.	5 evaluating
CLO6	Design a various crystal structure.	6 creating

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2
CLO1		2															2	
CLO2										2							1	
CLO3		1								3							3	
CLO4			2														1	
CLO5		2			3												2	
CLO6				3													3	

3: High, 2: Medium, 1: Low

Faculty of Science and Humanities
B.Sc. (Physics) (Semester - 5)
In Effect from Academic Year 2023-24

Branch Name:	B.Sc. Physics
Program Code:	SC105
Course Name:	Electrodynamics - I
Course Code:	15-PHM303-3C
Pre-requisite Course:	

Course Objectives:

1. To develop an actual understanding of the Electromagnetic waves.
2. To Know basic concept of electrodynamics
3. To be able to know the energy and momentum in electromagnetic waves

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
				Theory (Marks)		Practical (Marks)		
Lecture (L)	Tutorial (T)	Practical (P)	Credit	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	Total (Marks)
3	--	2	4	50	25	-	25	100

Subject Contents:

Unit	Topic	Total Hours	Weightage
1	**Boundary Value Problems in Electrostatic Fields :Special Techniques** Laplace's Equation, Introduction, Laplace's Equation in two dimensions, Laplace's Equation in three dimensions, Boundary conditions and Uniqueness theorems, The method of images, The classic image problem, Induced surface charge, Force and energy, other image problems, Separation of variables, Cartesian Coordinates, Spherical coordinates, Multipole Expansion, Approximate Potential at large distances, The monopole and dipole terms, Origin of Coordinates in Multipole Expansions.	15	34%
2	Maxwell's equations in matter, Continuity equation, Poynting theorem – Momentum conservation, Maxwell's stress tensor – Angular momentum. Electromagnetic Waves in Vacuum: Wave equation for E and B fields, Monochromatic plane waves – Energy & momentum in electromagnetic waves, Polarization of electromagnetic waves: linear and circular polarization. Electromagnetic waves in matter: Propagation in linear media- Boundary conditions Reflection and Refraction – Snell's law. Reflection and Transmission at normal and oblique incidence – Fresnel's equations.	15	33%
3	**Electromagnetics waves**: Conductor and Dielectrics, Polarization, Reflection by a perfect conductor -normal incidence ,Reflection by a perfect conductor -oblique incidence , Reflection by a perfect Dielectric –normal incidence , Reflection by a perfect Dielectric conductor -oblique incidence , surface impedance,	15	33%

Reference Books:

1. Introduction to Electrodynamics by David J. Griffths. 3rd EditionPearson Education Asia.
2. Electromagnetics by B. B. Laud. Willley Eastern Ltd.
3. Physics Paper 302 .Semester 3, Nirav Prakashan

Physics Practical:

1. A study of Half subtarctor
2. Measurement of frequency and Pase difference 'ɵ' of A.c Wave using CRO
3. Determination of thermal conductivity 'k' of Rubber tube

List of Open Source Software/learning website:

1. https://www.youtube.com/watch?v=TQ-RNp1iiu8

2. https://www.youtube.com/watch?v=p5JKz5qsluU

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Describe Boundary Value Problems in Electrostatic Fields	1 Remembering
CLO2	Discuss the Cartesian Coordinates and Spherical coordinates.	2 Understanding
CLO3	Solve the Continuity equation	3 Applying
CLO4	Explain Poynting theorem.	4 Analyzing
CLO5	Justify the electromagnetic waves	5 Evaluating
CLO6	Design the perfect dielectric substances	6 Creating

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2
CLO1	3				2												2	
CLO2		2								2							2	
CLO3	2	1															1	
CLO4					2												2	
CLO5	3									2							2	
CLO6			3														1	

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Physics
Program Code:	SC105
Course Name:	Electronics -II
Course Code:	15-PHE301-3C
Pre-requisite Course:	

Course Objectives:

1. To understand the basic concept of Vector Space.
2. To understand the concept of Linear Transformations.
3. To be able to understand the concept of Inner Product Space.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
				Theory (Marks)		Practical (Marks)		
Lecture (L)	Tutorial (T)	Practical (P)	Credit	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	Total (Marks)
3	--	2	4	50	25	-	25	100

Subject Contents:

Sr. No	Topic	Total Hours	Weightage
1	**(a) Network Transformations:** Principle of duality, Reduction of Complicated network, Conversions between T and π sections, The bridged-T network, The Lattice Network, The Reciprocity theorem, The compensation theorem, Driving point impedance, transfer impedance, The parallel-T network. **(b) Photo Electric Devices and Thyristors:** Classification of Photoelectric devices, Photoconductive cells, Photovoltaic cells, SCR, Triac and Diac.	15	34%
2	**(a) Basic Transistor Amplifiers:** Current and Voltage amplifiers, Common Emitter Amplifiers with Emitter Resistor, Simplified Common Emitter Hybrid Model, Effect of An Emitter Bypass Capacitor in low frequency Response. **(b) Multistage Amplifiers:** Multistage Transistor Amplifiers, R-C- coupled Amplifiers, Transformer Coupled Amplifiers and Direct coupled Amplifiers, Effect of cascading on Band width.	15	33%
3	**(a) BCD Codes and Digital Circuits:** Review of Binary Coded Decimal codes, Boolean functions, Min-terms and Max-terms. Karnaugh Mapping, Tri-state logic, positive and negative logic, signed binary numbers. **(b) Arithmetic logic circuits:** Adders- Half adder and Full adder, Substractor, comparators, Combinational and Sequential Circuits- Decoders, Demultiplexers, Encoders, Multiplexers, Registers and Counters.	15	33%

Reference Books:

1. Networks, Lines and Fields by J. D.Ryder. Pretice Hall.
2. Electronics and Radio Engineering by M. L. Gupta. 9th Enlarged Edition reprint 2002. Dhanpat Rai Publication.
3. Hand Book of Electronics by Gupta and Kumar. 30th revised Edition 2002.
4. Programming in ANSI C by E. Balaguruswami (THM) (3rd Edition)

Physics Practical:

1. G.M. Counter (plateau characterises)
2. Waves shaping circuits using R.C.D
3. Frequency response of LDR using different filters

List of Open Source Software/learning website:

1..https://www.youtube.com/watch?v=c_QX170sPIg&list=PLXbLuD5WNAbiiGdTt
2. https://www.youtube.com/watch?v=YfhYE6_v6fI
3. https://www.youtube.com/watch?v=KM_HJmygBtA

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom'sTaxonomyLevel
CLO1	Describe the network transform theorems	1 Remembering
CLO2	Discuss the Photo Electric Devices and Thyristors.	2 Understanding
CLO3	Solve various types of example depend on Inner Product Space.	3 Applying
CLO4	Explain Schwarz's & Triangular inequality.	4 Analyzing
CLO5	Justify Linear dependence and Independence.	5 Evaluating
CLO6	Designing the register and counter.	6 creating

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2
CLO1	3				2												2	
CLO2			2		1												2	
CLO3	3					2											3	
CLO4	2																2	
CLO5					1												1	
CLO6	2																1	

3: High, 2: Medium, 1: Low

Faculty of Science and Humanities
B.Sc. (Physics) (Semester - 5)
In Effect from Academic Year 2023-24

Branch Name:	B.Sc. Physics
Program Code:	SC105
Course Title:	Atomic cohesion & crystal binding
Course Code:	15-PHE301-3O
Pre-requisite Course:	

Course Objectives:

1. To know the concept of Crystal binding
2. To develop an actual understanding of the Polarons
3. To understand the concept of Fermi surfaces

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
				Theory (Marks)		Practical (Marks)		
Lecture (L)	Tutorial (T)	Practical (P)	Credit	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	Total (Marks)
3	-	2	4	50	25	-	25	100

Course Contents:

Unit	Topic	Total Hours	Weightage
1	**Free Electron Theory of Metal** Thermal conductivity of metals, The F.D. distribution function, The Somerfield Model, Density of states, The free electron gas at 0◦ K, Energy of electron at 0◦ K, The electron heat capacity, The Somerfield Theory of conduction in metals, The Hall coefficient.	15	34%
2	**Application to Plasmons, Polaritons and Polarons** Application to Plasma, Plasma oscillations, Transverse optical mode in plasma, Application to optical phonon modes in ionic crystals, The longitudinal optical mode, Transverse optical mode, The interaction of electromagnetic waves with optical modes.	15	33%
3	**Mobile Electrons and Fermi Surfaces :** Concept of Holes, Effective Mass, Construction of the Fermi Surfaces, Electrons in a Uniform Magnatic Field –Free Electrons and Bloch Electrons, Anomalous Skin Effect, Cyclotron Resonance-Semiconductor and Metals, Closed Orbits and Open Orbits, de Hass –van Alphen Effect.	15	33%

Reference Books:

1. Elements of Solid state Physics by J.P.Srivastava, PHI, New Delhi.
2. Introduction to Solid State Physics by C. Kittle. 7th Edition, John Willy and Sons
3. Physics- Nirav Prakashan

Physics Practical:

1. G.M. Counter (plateau characterises)
2. Waves shaping's circuits using R.C.D
3. Frequency response of LDR using different filters

List of Open-Source Software/learning website:

1. https://www.youtube.com/watch?v=v_lwiLkzavg
2. https://www.youtube.com/watch?v=31oUMumUleI
3. https://www.youtube.com/results?search_query=fermi+dirac+distribution

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom'sTaxonomyLevel
CLO1	Describe Free electron theory of metal	1 Remembering
CLO2	Discuss the F.D Distribution Function	2 Understanding
CLO3	Solve Somerfield theory of metal conduction in metals	3 Applying
CLO4	Explain transverse optical mode on Plasmon	4 Analyzing
CLO5	Justify closed orbits and open orbits	5 Evaluating
CLO6	Creating crystal structure and thin film	6 creating

Mapping of CLOs with POs

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2
CLO1					2												1	
CLO2	2					3											2	
CLO3	3																3	
CLO4				2													1	
CLO5					1												2	
CLO6	3																2	

3: High, 2: Medium, 1: Low

Faculty of Science and Humanities
B.Sc. (Physics) (Semester - 5)
In Effect from Academic Year 2023-24

Branch Name:	B.Sc. Physics
Program Code:	SC105
Course Name:	Analog and Digital electronics-I
Course Code:	15-PHE302-3C
Pre-requisite Course:	

Course Objectives:

1. To be able to know P-N Junction based devices.
2. To understand the use of non linear integrated circuits.
3. To know about application of digital circuits.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
				Theory (Marks)		Practical (Marks)		
Lecture (L)	Tutorial (T)	Practical (P)	Credit	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	Total (Marks)
3	-	2	4	50	25	-	25	100

Subject Contents:

Sr. No	Topic	Total Hours	Weightage
1	**PN Junction Based Devices:** Carrier Statistics in P-N junction-Barrier Potential and I-V Characteristics, Applications of P-N junctions- Diode as clipper, Diode as a clamper circuit, Diode as a switch, Reverse Recovery time of diode, optoelectronic devices, light emitting diode, photodiode and phototransistor, solar cells, Uni-junction Transistor, Silicon control rectifier, DIAC and TRIAC.	15	34%
2	**Non-linear Integrated Circuits** Block diagram of Operational Amplifier IC 741, Characteristics and parameters of Op-Amp, Non-Linear Applications of Op-Amp- comparator, Schmitt Trigger, UTP and LTP adjustments, Voltage Controlled Oscillator using IC-741, Timer IC 555 block diagram, Timing waveform generators using IC 555-astable multivibrator and monostable multivibrator.	15	33%
3	**Applications of Digital Circuits** Memories: Read Only Memory, Programmable Read Only Memory, Erasable Programmable Read Only Memory & Random Access Memory, expanding memory size. Digital to Analog and Analog to Digital Convertors: Resistive divider, Binary ladder, Digital to Analog Convertor using OPAMP, specifications, parallel comparators, counter method & approximation methods.	15	33%

Reference Books:

1. Solid State Pulse Circuits by David A. Bell; Prentice Hall of India, New Delhi
2. Digital Electronics by Malvino & Leech.
3. Microelectronics: Digital and Analog by K. R. Botkar.
4 .Integrated Electronics by K. R. Botkar.

Physics Practical:

1. To determine the keter pendulum keeping Fix distance between k1 & k 2
2. To determine thickness (T) and refractive (μ) of thin transparent sheet
3. To measure the input and output impedance of R.C. Couple CE amplifier

List of Open Source Software/learning website:

1. https://youtu.be/fimdwSfxNKw
2. https://youtu.be/cejFlDczVP4
3. https://youtu.be/0d8ocumCCRA

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom'sTaxonomy Level
CLO1	Describe PN Junction Based Devices	1 Remembering
CLO2	Discuss Non-linear Integrated Circuits	2 Understanding
CLO3	Various Applications of op-amp comparators	3 Applying
CLO4	Compare the stable and multi stable circuits	4 Analyzing
CLO5	Explain the applications of digital circuits	5 Applying
CLO6	Create a new circuits by using Digital Circuits	6 Creating

Mapping of CLOs with Pos & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2
CLO1		3																2
CLO2			1															1
CLO3		2			2													1
CLO4					1												2	
CLO5	2																3	
CLO6			3		2												1	

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Physics
Program Code:	SC105
Course Name:	Concept of Langrangian Mechanics
Course Code:	15-PHE302-3O
Pre-requisite Course:	

Course Objectives:

1. To know basic concepts of classical mechanics.
2. To know the basic Application of Langrangian mechanics
3. T o understand about various function of classical mechanics.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
				Theory (Marks)		Practical (Marks)		
Lecture (L)	Tutorial (T)	Practical (P)	Credit	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	Total (Marks)
3	--	2	4	50	25	-	25	100

Subject Contents:

Unit	Topic	Total Hours	Weightage
1	A brief review of Lagrange's & Hamilton's formalism-conservation theorem, No-ether's theorem and symmetry properties, Lagrangian and Hamiltonian formulation of relativistic mechanics, Canonical transformations, Equations of Canonical transformations, Canonical transformations for the Harmonic Oscillator, Poisson brackets and canonical invariants, equations of motion, Infinitesimal CT and conservation theorems in the Poisson bracket formulation	17	36%
2	Stable and unstable equilibriums, Small Oscillation in a system with one degree of freedom, Small Oscillation in a system with more than one degree of freedom, Normal coordinates and Normal frequencies of vibration. Rotating Frame, Euler angles, Inertia tensor, Euler's equations of motion of a rigid body, Free motion of a rigid body, Motion of a symmetric top.	16	35%
3	Tensors: Types of tensors and their algebra, Contraction and inner product, Metric tensors, Quotient rule, Dual and irreducible tensors, Christoffel symbols, covariant derivative, Geodesic equation.	12	29%

Reference Books:

1. Introduction to classical mechanics by R. G. Takwale and P. S. Puranik 1979 TMH, New Delhi
2. Classical mechanics-A Text Book by Suresh Chandra, Narosa Publishing House New Delhi.
3. Classical mechanics-by G.Aruldas, PHI Learning private ,New delhi

Physics Practical:

1. To determine the keter pendulum keeping Fix distance between k1 & k 2
2. To determine thickness (T) and refractive (μ) of thin transparent sheet
3.To measure the input and output impedance of R.C. Couple CE amplifier

List of Open Source Software/learning website:

1. https://www.youtube.com/watch?v=8uA_nhiLShc
2. https://www.youtube.com/watch?v=hICKf-iz-RU
3. https://www.youtube.com/watch?v=nuZo8KYiWoo

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Describe Hamitonian's formalism-conservation theorm	1 Remembering
CLO2	Discuss the canonical transformations.	2 Understanding
CLO3	Solve the equation of canonical transformations	3 Applying
CLO4	Explain various meters used in practicals.	4 Analyzing
CLO5	Justify the stable and unstable equillibrium	5 Evaluating
CLO6	Design motion of symmetric top	6 creating

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2
CLO1		2															2	
CLO2			1														1	
CLO3	3																2	
CLO4			1														2	
CLO5			2														3	
CLO6			3														2	

3: High, 2: Medium, 1: Low

Faculty of Science and Humanities
B.Sc. (Physics) (Semester - 5)
In Effect from Academic Year 2023-24

Branch Name:	B.Sc. Physics
Program Code:	SC105
Course Name:	Experimental and Measurement Techniques
Course Code:	15-SEC301-3C
Pre-requisite Course:	Basic knowledge of Instruments.

Course Objectives:

1. To understand the use of Optical Instruments.
2. To know the basic concept of G M Counter.
3. To develop an actual understanding of Cathode Ray Oscillator

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
				Theory (Marks)		Practical (Marks)		
Lecture (L)	Tutorial (T)	Practical (P)	Credit	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	Total (Marks)
2	--	--	2	25	25	--	--	50

Subject Contents:

Sr. No	Topic	Total Hours	Weightage (%)
1	Introduction, Attenuation of light in optical medium, Thermal Equilibrium, Interaction of light with matter, Einstein relations, Light amplification, Population inversion, Active medium, Pumping, Metastable states, Principal pumping schemes, optical resonant cavity, Axial modes, Gain curve and laser operating frequencies, Transverse modes, Types of Lasers, Rubby Lasers, Helium-Neon Laser, Applications.	15	50%
2	**(a) C.R.O.** CR Tube, Electrostatic Deflection Sensitivity, Magnetic Deflection Sensitivity, CRT connections, Uses of C.R.O. **(b) G. M. Counter** Principle, Construction, Working, Dead time, recovery time, True counting rate, Efficiency of counting, Quenching of G M counter, Operation and testing of G.M. counter, Plateau, Applications of GMC, Advantages and limitations of GMC.	15	50%

Reference Books:

1. An Advanced Course in Practical Physics by D.Chattopadhyay, P.C. Rakshit, B.SAHA,New Central Book Ltd.
2. A text book of OPTICS by Dr. N, Subrahmanyam, Brijlal, Dr, M,N, Avadhanulu S.Chand.
3. Mechanics by D.S. Mathur S.Chand. (For Vacuum pumps)

List of Open Source Software/learning website:

1. https://www.youtube.com/watch?v=il_VDR3f57
2. https://www.youtube.com/watch?v=cIxICyBV2Ic

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Describe the Equilibrium in Laser Concept.	1 Remembering
CLO2	Discuss the Principle, Construction and Working of Laser	2 Understanding
CLO3	Solve the problems based on setting of instruments in laboratory	3 Applying
CLO4	Explain Cathode ray Oscillator.	4 Analyzing
CLO5	Justify the use of G M Counter in nuclear field.	5 Evaluating
CLO6	Design a Led by using of Einstein Theory	6 creating

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2
CLO1		2															2	
CLO2			1														1	
CLO3	3																3	
CLO4			2														2	
CLO5			2														1	
CLO6			3														2	

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Physics
Program Code:	SC105
Course Title:	Instruments
Course Code:	15-SEC302-3C
Pre-requisite Course:	

Course Objectives:

1. To meet the growing demand of Specialization and Advanced Courses in applied science.
2. To make student understand about different terms use in green chemistry.
3. To learn about the basic concepts about green chemistry.

Teaching and Examination Scheme:

Teaching Scheme(Hours per week)				Evaluation Scheme (Marks)				
				Theory (Marks)		Practical (Marks)		
Lecture (L)	Tutorial (T)	Practical (P)	Credit	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	Total (Marks)
2	-	-	2	25	25	-	-	50

Course Contents:

Unit No	Topic	Total Hours	Weightage (%)
1	**a) Michelson's Interferometer** Principle, Construction, Working, Circular fringes ,Localized fringes, White light fringes, Visibility of fringes, Applications of Michelson Interferometer, Measurement of wavelength, Determination of difference in the wavelengths of two waves, Thickness of a thin transparent sheet, Determination of the refractive index. **(b) Babinet Compensator** Construction, Production of polarized light, analysis of elliptically polarized light.	15	50%
2	**(a) Fabry- Parot Interferometer and Etalon** Formation of fringes, Determination of wavelength, Measurement of difference in wavelength. **(b) Electron Microscope** Principle, electrostatic focusing, magnetic focusing, description, use of electron microscope..	15	50%

Reference Books:

1. A textbook of Optics by Dr.N.Subrahmanyam, Brijlal and Dr.M.N. Avadhanulu, S. Chand & Co. (for M.I and B.C.)
2. Hand Book of Electronics by Gupta and Kumar. 30th revised Edition 2002. (For CRO)
3. Refresher Course in Physics Vol-III, S. Chand & Co. Ltd.(7th edition-2006) (for GMC, Ch-28)

List of Open-Source Software/learning website:

1. https://www.youtube.com/watch?v=T2gt7J3jhms
2. https://www.youtube.com/watch?v=ka2GY1iG60c

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Describe the Babinet Compensator.	1 Remembering
CLO2	Discuss the Principle, Construction and Working of Michelson's Interferometer	2 Understanding
CLO3	Solve the problems based on setting of instruments in laboratory.	3 Applying
CLO4	Explain Fabry- Parot Interferometer and Etalon.	4 Analyzing
CLO5	Justify the use of Electron Microscope in various field	5 Evaluating
CLO6	Design a grating by using of optics.	6 creating

Mapping of CLOs with POs

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2
CLO1		2															2	
CLO2			1														1	
CLO3	3																3	
CLO4			2														2	
CLO5			2														1	
CLO6			3														2	

1: High, 2: Medium, 3: Low