Faculty of Science and Humanities
B.Sc. (Physics) (Semester - VII)
Honours/ Honours with Research
In Effect from Academic Year 2023-24

Branch Name:	B.Sc. Physics
Program Code:	SC105
Course Name:	Theoretical Condensed Matter Physics
Course Code:	17-PHM401-4C
Pre-requisite Course:	Basic concept of superconductivity and condensed matter physics.

Course Objectives:

1. To be able to know condensed matter physics.
2. To understand the concept of semiconductor crystal.
3. To know about superconducting phenomena.

Teaching and Examination Scheme:

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

Subject contents:

Unit	Content	Lectures	Weightage
1	Introduction, electron moving in a one-dimensional potential well, three-dimensional potential well, quantum state and degeneracy, the density of states, Fermi-Dirac statistics, effect of temperature on Fermi distribution function, the electronic specific heat, the electrical conductivity of metals, relaxation time and mean free path, electrical conductivity and Ohms law, Weidman Franz-Lorentz law, the electrical resistivity of metals, thermionic emission, the Hall effect.	15	33%
2	**(**Semiconductor Crystals: Band gap, Equations of motion, Holes, Effective mass: physical interpretation, Effective masses in semiconductors. Dielectrics: Macroscopic electric field, depolarization field, Local electric field at an atom, Lorentz field , Field of dipoles inside cavity, dielectric constant and Polarizability, electronic polarizability, classical theory of electronic polarizability, Magnetism: Langevin's diamagnetism equation, Para magnetism–Quantum theory, Cooling by isentropic demagnetization, Nuclear demagnetization, Paramagnetic susceptibility of conduction electrons, Ferromagnetic order, Curie point and exchange integral	15	33%
3	Superconductivity-its occurrence and experimental survey, Meissner effect, Heat capacity, energy gap, Microwave and infrared properties, Isotope effects, Theoretical survey, Thermodynamics of superconducting transition and London equation, Coherence length, BCStheory of superconductivity, Flux quantization in a superconducting ring, Type II superconductors, single particle tunnelling and Josephson superconductor tunnelling, Fullerenes.	15	34%

Basic Reference book:

1. Introduction to Solid State Physics by C. Kittle (John Wiley & Sons)
2. Elements of Solid-State Physics by J.P. Srivastava (Prentice Hall of India)
3. Solid State Physics: Structure and Properties of Materials by M. A. Wahab (Narosa Publishers).
4. Elementary Solid-State Physics by M. A. Omar (Addison-Wesley Publishing Company).
5. Elements of X-ray Diffraction- B. D. Cullity

Physics Practical:

1. To study the characteristics of OP-Amp IC 741
2. Study the omp as inverter
3. To determine the wave length of a Laser source

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 moving electron in potential well.	1 Remembering
CLO2	Discuss semiconductor crystals.	2 Understanding
CLO3	Numerical part based on superconductivity	3 Applying
CLO4	Compare the super conductor to other conductors.	4 Analyzing
CLO5	Evaluating various theorem in condensed matter physics	5 Evaluating
CLO6	Create the semiconductor, Crystals.	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	3											3	
CLO2		2	1			3											3	
CLO3	1					2											2	
CLO4	2		3		2												3	
CLO5																	2	
CLO6	1		3			1	2										3	

3: High, 2: Medium, 1: Low

Faculty of Science and Humanities
B.Sc. (Physics) (Semester -VII)
Honours/ Honours with Research
In Effect from Academic Year 2023-24

Branch Name:	B.Sc. Physics
Program Code:	SC105
Course Name:	Classical and Quantum Mechanics
Course Code:	17-PHM402-4C
Pre-requisite Course:	Basic understanding of classical mechanics and quantum physics

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

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory (Marks)		**Practical/viva voce (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:

Unit	Content	Lectures	Weightage
1	A brief review of Lagrange's & Hamilton's formalism-conservation theorem, Noether'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.	15	34%
2	Hamilton Jacobi theory, Application to harmonic oscillator problem, Transition to quantum mechanics. Transition from a Discrete to a continuous system, Langrangian formulation for Continuous system. Types of equilibrium, Theory of Small Oscillations, Secular equation, eigenvectors and eigen Frequencies, Orthogonality of eigenvectors; Normal coordinates; coupled Oscillation,; Linear triatomic molecule. Small oscillations of particles on string. Introduction to nonlinear oscillations.	15	33%
3	Representation of state vectors.Dynamical variables as matrix operators.Product of operators. Self-adjointness and Hermiticity, diagonalization, Continuous basis, The Schrödinger Representation. Degeneracy-Labeling by commuting observables. Change of	15	33%

	basis,Unitarytransformations. Unitary transformations induced by change of coordinate system-translations,Unitary transformation induced by rotation of coordinate system.The algebra ofrotation generators and the transformations of dynamical variables, concept of parity.		

Basic Reference book:

1. Classical Mechanics, by V. B. Bhatia; Narosa
2. Introduction to Classical Mechanics by R. G. Takwaleand P. S. Puranik; TMH
3. A text book of Quantum Mechanics, by P.M. Mathews and K. Venkatesan (TMH)
4. Quantum Mechanics by G. Aruldas, Prentice-Hall India, Pvt., Ltd.

Physics Practical:

1. Application of OP-AMP as Integrator and Differentior
2. To study/ learn the amplitude modulation and demodulation
3. Optical Absorption of I_2 molecule and estimation of its dissociation energy

List of Open Source Software/learning website:

1. https://youtu.be/sCZ80l6UarM
2. https://youtu.be/x-PS5QirFu8

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Describe the Lagrange's & Hamilton's formalism	1 Remembering
CLO2	Discuss the Hamilton Jacobi theory in classical mechanics.	2 Understanding
CLO3	Application to harmonic oscillator problem in quantum and classical mechanics.	3 Applying
CLO4	Explain eigen value in quantum Mechanics.	4 Analyzing
CLO5	Justify the Langrangian formulation for Continuous system.	5 Evaluating
CLO6	Solve the problem related classical mechanics.	3 Applying

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	1		2	1	2										3	
CLO2	1	2	2		1	2	3										2	
CLO3	2		1			3	1										2	
CLO4	1		2			2	2										3	
CLO5	1	2	1			2											2	
CLO6	3	2			3	2	1										2	

H: High, M: Medium, L: Low

Faculty of Science and Humanities
B.Sc. (Physics) (Semester - VII)
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Branch Name:	B.Sc. Physics
Program Code:	SC105
Course Name:	Electrodynamics -II
Course Code:	17-PHM403-4C
Pre-requisite Course:	Basic concept of electromagnetic

Course Objectives:

1. To be able to know Maxwell's equations and its application.
2. To understand the point charge and it's important in electrodynamics.
3. To know about Electromagnetic radiation.

Teaching and Examination Scheme:

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

Subject Contents:

Unit	Topic	Total Hours	Weightage
1	Radiation from Moving point charges: Lienard-Wiechert potentials- Fields of a moving point charge- Power radiated by a point charge (Larmor formula), Radiation from a slowly moving charges, Radiation from relativistic ally moving charges, Larmor's generalization to relativistic case – Synchrotron radiation – Bremsstrahlung radiation. Thomson Scattering – Scattering of radiation from quasi free charges –Cerenkov radiation, Radiation Reaction: Abraham –Lorentz formula – Physical basis of radiation reaction.	15	34%
2	Total internal reflections, EM waves in isotropic linear conducting media – Reflection at conducting surface. Wave Guides and Resonant Cavities: Bounded waves – TE, TM, TEM modes, rectangular wave guides –Circular cylindrical wave guides – Resonant cavities, Q of a cavity Dielectric wave guides (Optical fiber): H E Modes.	15	33%
3	Electromagnetic Radiation: Electromagnetic potentials Scalar and vector potentials Gauge transformations Gauge conditions (Lorentz and Coulomb gauges). Retarded Potentials-Jefimenko's equations for the E and B fields. Radiations from extended sources: Electric dipole radiation Magnetic dipole and electric quadrupole radiations, Centre-fed linear antenna- Hertzian dipole antenna – Small loop antenna. Rayleigh's scattering at long wavelength and blueness of sky- Scalar diffraction theory.	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
4. Classical Electrodynamics by J D Jackson, 2nd Ed; Wiley Eastern Ltd. 1975.

Physics Practical:

1. A study of Hall Effect at different temperature
2. Characteristics of optoelectronic devices
3. Study of Magnetic hysteris loop(B-H) Curve

List of Open Source Software/learning website:

1. https://www.youtube.com/watch?v=TQ-RNp1iiu8
2. https://youtu.be/bsybS5fZGjY

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Describe the various laws in electromagnetic field.	1 Remembering
CLO2	Discuss the Maxwell's equations in matter	2 Understanding
CLO3	Solve the numerical part in case of moving charge.	3 Applying
CLO4	Explain wave guides.	4 Analyzing
CLO5	Evaluate various equations in electromagnetic fields.	5 Evaluating
CLO6	Application of antennas in electrodynamics.	3 Applying

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	1	2	2														3	
CLO2	2	1	1														2	
CLO3	1	2	1		1												3	
CLO4	2	1	1		1												3	
CLO5	1	2	1		2												2	
CLO6	1	2			3												3	

3: High, 2: Medium, 1: Low

Faculty of Science and Humanities
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Branch Name:	B.Sc. Physics
Program Code:	SC105
Course Name:	Microwave communication: Electronic and Technology
Course Code:	17-PHE401-4C
Pre-requisite Course:	Basics Concepts of electronics

Course Objectives:

1. To be able to know transmission line.
2. To understand the concept of microwave communication.
3. To know about use of antennas in communication.

Teaching and Examination Scheme:

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

Subject Contents:

Sr. No	**Topic**	**Total Hours**	**Weightage**
1	Microwave tubes: Klystrons- Reflex Klystrons. Performance characteristics and applications Cavity magnetron, Travelling Wave Tube (TWT), Microwave Transistors: Constructional features of BJT and MOSFET, Varactor diode, PIN diode, Schottky diode, Negative Resistance Microwave Devices- Tunnel diode, Gunn diode and Impatt diodes.	15	34%
2	Wave-Propagation in free space, Propagation characteristics, Ground waves, Space waves, Idea about tropospheric propagation and its range, Ionospheric layers, Ionospheric propagation and its range, Radio horizon, Critical frequency, critical angle, Maximum usable frequency, Virtual height, Fading, multiple hope transmission, satellite communication.	15	33%
3	Antennas- Classification of antennas, Radiation fields and antenna patterns, Vertical antennas,Folded antennas, construction and working of Loop antennas, Ferrite rode antennas, structure and operation of Driven arrays. VHF, UHF and Microwave antenna- structure and working of Horn antenna, Parabolic antenna, Structure of Dish Antenna, radiation mechanism in dish antenna, operation of dish antenna.	15	33%

Reference Books:

1. Electronic Communication D. Roody and J. Coolen Prentice Hall.
2. Electronic Communication Systems G. Kennedy, Mc-Graw Hill.
3. East-West Press Modern Microwave Technology V. F. Velley, Prentice Hall.
4. Handbook of Electronics: Gupta and kumar

Physics Practical:

1. 555 as Multi vibrator
2. Curie temperature measurement of a ferroelectric material
3. Thermo electric power of a semiconducting material

List of Open-Source Software/learning website:

1. https://youtu.be/SSVHRUmGSIw
2. https://youtu.be/wKL6WsEOl00

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Describe the communications.	1 Remembering
CLO2	Discuss the microwave communications.	2 Understanding
CLO3	Use of antenna as a tool of communications.	3 Applying
CLO4	Explain Transmission Lines and Wave Guides	4 Analyzing
CLO5	Justify the importance of antennas in communications.	5 Evaluating
CLO6	Develop new antennas for communications.	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	1	2	2		2	2												3
CLO2	1	1	1		1	1	2											2
CLO3	2		2		2	2												3
CLO4	2	1	2		1	2	2											3
CLO5	2	1	2		1	1	3											2
CLO6	1		2			3	2											3

3: High, 2: Medium, 1: Low

Faculty of Science and Humanities
B.Sc. (Physics) (Semester - VII)
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Branch Name:	B.Sc. Physics
Program Code:	SC105
Course Title:	Bio Physics
Course Code:	17-PHE401-4O
Pre-requisite Course:	Basic concept of crystallography

Course Objectives:

1. To be able to know various methods in crystal physics
2. To understand the use of XRD in crystal physics
3. T know about Bio crystal and its application

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
				Theory (Marks)		Practical/viva-voce (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	Single crystal X-ray diffractometry, Intensity data collection from single crystal specimen, Normalized structure factor – Wilson plot, Primary & secondary extinction, systematic absences and determination of space group from intensity data. Violation of Friedel`s law, Fourier method in structure determination – estimation of relative phases. Refinement of molecular structure and interpretation of the results.	15	34%
2	Protein – Amino acids and the primary structure and secondary structure of proteins, tertiary structure, quaternary structure. Organization of nucleic acid - Primary, secondary, tertiary structure of DNA, Structure of RNA, Sequencing of nucleic acids, antigens and antibodies. Crystallization of protein – few general methods of crystallization – vapor diffusion and micro techniques. Biological applications of delocalization in molecules, radiation damage in biological molecules, ESR studies of Myoglobin and haemoglobin molecules, electronic properties of proteins, enzyme studies, carcinogenic activity, NMR applications: biochemistry, biophysics and in medicine.	15	33%
3	Spectroscopic techniques used for studying biological molecules: Light scattering, small angle X-ray scattering, Mass Spectrometry: MALDI-TOF, Ultraviolet/visible spectroscopy, circular dichroism (CD)and optical rotatory dispersion (ORD), fluorescence spectroscopy, Infrared spectroscopy, Raman Spectroscopy.	15	33%

Reference Books:

1. Biophysics – Vasantha Pattabhi, N. Gautham
2. Solid State Physics by M.A.Wahab
3. Basic Biophysics for biologist by M. Daniel.
4. Elements of Solid State Physics – J. P. Srivastava

Physics Practical:

1. 555 as Multi vibrator
2. Curie temperature measurement of a ferroelectric material
3. Thermo electric power of a semiconducting material

List of Open-Source Software/learning website:

1. https://youtu.be/R0sw85RkKCY
2. https://youtu.be/R-2gaeB-dic

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Describe the various methods in structural determinations	1 Remembering
CLO2	Discuss the bio crystal material	2 Understanding
CLO3	Use the various methods to know structure of bio crystals.	3 Applying
CLO4	Explain Spectroscopic techniques used for studying biological molecules	4 Analyzing
CLO5	Justification of use Single crystal X-ray diffractometry method use in bio physics	5 Evaluating
CLO6	Develop various bio crystals by different methods.	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