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

Branch Name:	B.Sc. Physics
Program Code:	SC105
Course Name:	Advanced Quantum Physics
Course Code:	18-PHM406-4C
Pre-requisite Course:	Understanding the basic quantum Physics

Course Objectives:

1. To able to know the advanced quantum physics.
2. To understand the Schrodinger equation.
3. To know about WKB approximation

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	Scattering theory –Kinematics of the scattering process, Differential and total Wave mechanical picture of scattering, Scattering amplitude and its formal expression by Green's function. The Born approximation and its validity through examples, Partial wave analysis, Asymptotic behavior of partial waves, phase shifts and scattering amplitude, Optical theorem. Phase shifts- relation with the potential. Potential of finite range. The eikonal approximation. Applications.	16	35%
2	**Time Independent Perturbation theory:** Perturbation theory for discrete levels, Equation in various orders of perturbation theory, The non corrections, The degenerate case, The variation method: Upper bound on ground state energy. Application to excited states. The ground state of a two-electron atom. The Hydrogen molecule. **The WKB approximation:** The one-dimensional Schrödinger equation, the asymptotic solution. Solution near turning point, matching at turning points and connection formulae. The Bohr-Somerfield quantum condition.WKB solution of the radial wave equation.	17	36%
3	Evolution of system with time, The Schrödinger equation and general solution, propagators, sudden approximation, perturbative solution for transition amplitude, First ans second order transition scattering of a particle by a potential, Harmonic perturbations, amplitude transition with, change of energy, Interaction of an atom with electromagnetic radiation approximation, Einstein coefficients. Alternative pictures of time evolution, the Schrödinger picture the Heisenberg picture and the interaction picture	12	31%

Reference Books:

1. A text book of Quantum Mechanics, by Mathews &Venkatesan, TMH Publication (2010).
2. Quantum Mechanics by V. K. Thankappan
3. Quantum Mechanics by Ghatak&Loknathan; McMillan India Publication.

Physics Practical:

1. To study a voltage follower (unity gain amplifier).
2. To study regulated power supply using IC 723.
3. Op amp as current/ voltage and voltage/ current converter

List of Open Source Software/learning website:

1. https://youtu.be/RL0n2T6urKU
2. https://youtu.be/zdouC7ZNTJ0
3. https://youtu.be/77A9xWz_ugo

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Describe the WKB approximation	1 Remembering
CLO2	Discus the scattering theory	2 Understanding
CLO3	Solve the numerical part related Schrödinger equations	3 Applying
CLO4	Explain Time Independent Perturbation theory	4 Analyzing
CLO5	Evolution Schrödinger equations with time.	5 Evaluating
CLO6	Plane to apply the Schrödinger equations to another undefined problem.	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	6	1										2	
CLO2	1		1		2	1	2										3	
CLO3	2	1			1	2	1										3	
CLO4		2				2											2	
CLO5	1				2		2										3	
CLO6	2		2			1	2										3	

3: High, 2: Medium, 1: Low

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

Branch Name:	B.Sc. Physics
Program Code:	SC105
Course Title:	Nano Science and Thin Film
Course Code:	18-PHM407-4C
Pre-requisite Course:	Basics of Nano material and solid-state physics

Course Objectives:

1. To be able to know about nano material and nano physics.
2. To understand the concept of thin film.
3. To know about how to prepare thin film by different technique.

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

Course Contents:

Unit	Topic	Total Hours	Weightage
1	Introduction : Nanoscience and nanotechnology, nanostructures in nature, quantum structures, quantum confinement, surface effects of nanomaterials, Nanomaterials synthesis : Arc discharge method, laser ablation, aerosol synthesis, inert gas condensation, high energy ball milling, chemical vapor deposition, Reverse micellar/micro emulsion method, sol-gel method, Preparation of quantum nanostructures by lithography: photo, X-ray ,ion beam (FIB), neutral beam, and electron-beam, dip pen lithography. Characterization techniques of Nanostructures: Transmission electron microscopy (TEM), High Resolution TEM (HRTEM), Particle Size Analyzer, Scanning tunneling microscopy (STM), Atomic-force microscopy (AFM).	15	34%
2	Characterization techniques of Nanostructures: Scanning near field optical microscopy (SNOM), Spectroscopy of semiconductors: Excitons, Infrared surface spectroscopy, Raman Spectroscopy, Brillouin spectroscopy and Luminescence. Applications of nanostructures: Single electron tunneling, IR detectors, quantum dot lasers, medicine, targeted drug delivery, high energy density batteries, next generation computer technology, Electronics, phosphors for high-definition TV, low-cost flat panel displays, water purification, communication sector, food, fabric industry, environment, automobiles, tougher and harder cutting tools.	15	33%

3	Physics and chemistry of evaporation, evaporation rate, vapor pressure of elements, evaporation of compounds, evaporation of alloys, Deposition technology, Thermal deposition in vacuum, kinetic theory of gases and emission condition, distribution of deposit, resistance heating, thermal evaporation, flash evaporation, multi evaporation sources, RF and Induction heating, electron beam method, sputtering-ion surface interactions, sputter yield, sputtering of alloys, cathodic sputtering, glow discharges puttering, low pressure sputtering, reactive sputtering.	15	33%

Reference Books:

1. Principles of nano science and nanotechnology by M.A. Shah, Tokeer Ahmad (Narosa publishing house)
2. Nanomaterials : An introduction to synthesis,properties and applications by Dieter Vollath (Wiley-VCH Verlag GmbH & Co.KGaA)
3 Nanotechnology : Principles and practices : S. K. Kulkarni (Capital publishing company).

Physics Practical:

1. Study of bending loss of optical fibre
2. Study of different types of regulater power supply using IC-7493
3. Study decade counter and divide by six counter using IC7490

List of Open-Source Software/learning website:

1. https://youtu.be/0EWCqCIsFOA
2. https://youtu.be/rhV4Wnz8g-U

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Describe the nano material.	1 Remembering
CLO2	Discuss the preparation of nano materials and thin films.	2 Understanding
CLO3	Use various methods foe create nano materials.	3 Applying
CLO4	Compare the nano material with normal material available in this world.	4 Analyzing
CLO5	Justify the usages of nano material in various applications.	5 Evaluating
CLO6	Create the thin films on different substrate.	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	1	2	1		1	2	2										3	
CLO2	1	2	1		2	1	1										3	
CLO3	2	1	1		1	1	1										3	
CLO4	1	2			1	1	1										3	
CLO5	1	1	2		1	1	2										2	
CLO6	1	2	2		2	1	1										2	

3: High, 2: Medium, 1: Low

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

Branch Name:	B.Sc. Physics
Program Code:	SC105
Course Name:	Elements of Experimental Physics
Course Code:	18-PHM408-4C
Pre-requisite Course:	

Course Objectives:

1. To be able to know about different types of Vaccum Pumps
2. To understand the use of XRD in higher studies and research level
3. To understand the concept of Modulation.

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	Classification of vacuum pumps, Rotary pump, Diffusion pump, Molecular drag pump, Gettering and ion pumping, Sputter ion pump, measurement of pumping speed: constant pressure method, constant volume method. Classification of gauges, McLeod gauge, Thermal conductivity gauge, Thermocouple gauge, Hot cathode ionization gauge, Bayard-Alpert gauge, Cold cathode ionization gauge, Penning gauge, Magnetron gauge.	16	35%
2	Thermal Analysis: Thermo gravimetric analysis, Differential thermal analysis and Differential scanning calorimetry, X-ray photoelectron spectroscopy, X-ray fluorescence spectroscopy, UV Visible spectroscopy, atomic absorption spectroscopy.	17	36%
3	X-ray Diffraction: X-ray sources, Production of X-rays, continuous X-rays, characteristics X-rays, X-ray filters, X-ray absorbers, Scattering by electrons, atom and unit cell, Electron Diffraction: Introduction to electron diffraction, Transmission Electron microscopes, Neutron Scattering: Slow neutron scattering in solid, Elastic Scattering, Cross – section, Coherent Scattering.	12	31%

Reference Books:

1. Vacuum Science and Technology V.V. Rao, T.B. Ghosh and K.L. Chopra Allied Publishers Limited (India)
2. Elements of X-ray diffraction Cullity and Stock
3. An introduction to lattice dynamic L.S Kothari

Physics Practical:

1. To study OP Amp as integrator.
2. To study OP Amp as differentiator
3. To study characteristics of MOSFET

List of Open Source Software/learning website:

1. https://youtu.be/Vuqk-Ag7xV4
2. https://youtu.be/a8IkseIwDQ0
3. https://youtu.be/Z5aCuGxUPpI

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 vaccum pumps	1 Remembering
CLO2	Discuss the various gauges	2 Understanding
CLO3	Application of vaccum pumps and gauges in experiments	3 Applying
CLO4	Explain the X-ray Diffraction	4 Analyzing
CLO5	Justify the usages of detector in radioactivity practicals.	5 Evaluating
CLO6	Design a various Vaccum pumps and gauges for experimental use.	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	1		1	1	1										3	
CLO2	2	1	1		1	1	1										3	
CLO3	1	2	2		2	2	1										3	
CLO4	1	1	2		2	1	2										3	
CLO5	1	2			1	1	2										2	
CLO6																	2	

3: High, 2: Medium, 1: Low

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

Branch Name:	B.Sc. Physics
Program Code:	SC105
Course Name:	Microprocessors, Programming, Interfacing & Applications
Course Code:	18-PHE402-4C
Pre-requisite Course:	

Course Objectives:

1. To be able to know microprocessor.
2. To understand the concept of programming of microprocessor.
3. To know about Interfacing & Applications.

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	**Introduction to 8085:** Introduction to microprocessors; Organization and Architecture of Intel-8085, PIN diagram, Op-Code and Operands, Instruction word size. Fetch and Execute Operations. Timing diagrams Instruction set of Intel 8085: Data transfer group, Arithmetic group, Logical group, Branch control group, Stack I/O and Machine control group. Subroutine. Assembly language programming of 8085 Address space partitioning, Schemes of allocation of addresses, Memory and I/O interfacing.	16	35%
2	Data Transfer and Peripheral Devices: Data transfer schemes; Synchronous, Asynchronous and Interrupt driven schemes. Interrupts ofIntel-8085, Interrupt circuits and programming, Interfacing Devices and I/O Devices, I/O ports INTEL-8255, Architecture and operating modes of INTEL-8255. Programmable DMA controller Intel-8257, Programmable interrupt controller Intel-8259. Programmable counter/interval timer INTEL-8252.	17	36%
3	Microprocessor based data acquisition system: A/D converter, Clock for A/D converter, sample and hold circuit IC LF-398, Analog multiplexer, ADC 0800-Interfacing and programming, Interfacing and Programming of ADC-0800, Analog Multiplexer AM-3705 and Sample and Hold circuit LF-398, ADC 0801 Series. D/A converter, Operating Principle, DAC0800-Interfacing, Realization of A/D converter using D/A converter.	12	31%

Reference Books:

1.Fundamentals of Microprocessors and Microcomputers, B. Ram (Dhanpat Rai and Sons,Delhi)

2. Microprocessor Architecture, Programming and Applications with the 8085/8080AR. S. Gaonkar, Wiley Eastern Ltd.

3. Microprocessors: Theory and Applications, M. Rafiquzzaman, Printice Hall International Inc.

Physics Practical:

1. UJT: Basic Characteristics and its application as relaxation oscillator
2. Schmidt trigger circuit
3. Charccteristics of solar cell

List of Open Source Software/learning website:

1. https://youtu.be/gAJDC8lN00I
2.

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Describe the Architecture of Intel-8085	1 Remembering
CLO2	Discuss use of microprocessor.	2 Understanding
CLO3	Calculate some important parameter used in microprocessor.	3 Applying
CLO4	Explain Microprocessors, Programming, Interfacing & Applications	4 Analyzing
CLO5	Justify the usage of various ICs in microprocessor.	5 Evaluating
CLO6	Develop the microprocessor as per need.	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	1	`	2	1	1											3
CLO2	1	1	2		1	1	2											2
CLO3	2	1	1		1	1	2											3
CLO4	2	1	1		1	1	1											2
CLO5		2					2											2
CLO6	2	2			2	2	3											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:	Absorption & Emission Spectroscopy
Course Code:	18-PHE402-4O
Pre-requisite Course:	

Course Objectives:

1. To understand the principle of atomic and molecular spectroscopy
2. To apply spectroscopy field such as bio physics and environmental monitoring.
3. To learn the fabrication of lasers.

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	**Laser Spectroscopy:** Emission and absorption spectroscopy: UV-visible-IR absorption (introduction),Classical view of Einstein coefficients; two-level system, Three-level Laser system, Variation of Laser power around threshold.NH3 maser, He-Ne Laser (energy level diagram), CO2 Laser, Semiconductor Lasers,	16	35%
2	Rayleigh and Raman scattering, Stimulated Raman effect, Hyper-Raman effect: Classical treatment, Quantum mechanical treatment, Coherent anti-stokes Raman scattering (CARS), Spin- flip Raman Laser, Free-electron Laser. separation of electronic and nuclear Motion: the born oppenheimer approximation.Types of molecular spectra. types of molecular energy states and aaociated spectra. nature of raman effect	17	36%
3	Experimental arrangement for raman spectra, classical theory of raman effect, quantum theoy of raman effect, raman spectra and molecular structure. infrared spectra versus Raman effect spectra. Salient Features of Molecular Electronic spectra. Foramation of electronic spectra	12	31%

Reference Books:

1. Physics of Atoms and Molecules, by B. Bransden and C. J. Joachain (Pearso Publication)
2. Atomic & Molecular-Spectra by Rajkumar, kedarNathRamnath, Delhi(2005)
3. Atomic Physics by J.B.Rajam (5th Edition -1960) S.Chand &Co
4. Lasers and Non-linear Optics, by B. B. Laud (New Age International P Ltd., India, 2ndedition, 1996).

Physics Practical:

1. UJT: Basic Characteristics and its application as relaxation oscillator
2. Schmidt trigger circuit
3. Charccteristics of solar cell

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List of Open Source Software/learning website:

1. https://youtu.be/Ml9xsYdLFwc
2. https://youtu.be/CefOcjpUP-A

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Describe Laser spectroscopy.	1 Remembering
CLO2	Discuss the atoms and molecules in term of quantum mechanics.	2 Understanding
CLO3	Justify the born Oppenheimer approximation. Types of molecular spectra.	3 Applying
CLO4	Explain nature of Raman effect	4 Analyzing
CLO5	Compare infrared effect spectra vs Raman effect spectra	5 Evaluating
CLO6	Design the laser by using various methods.	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	1			1	2										2	
CLO2	2	1	1		1	2	1										3	
CLO3	1		1		1	1											3	
CLO4	2	1				1											2	
CLO5	1	1															3	
CLO6	1	2	2	2		2	3										3	

3: High, 2: Medium, 1: Low