



MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY

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Bathinda-151001 (Punjab), India

Department: Department of Physics, Maharaja Ranjit Singh Punjab Technical University, Bathinda

Program: B.Sc. (Hons.)Physics

Course Articulation Matrics

Subject	S Code	Semester	Credit	Duration (Hrs)	L T P	Cos	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Electricity and Magnetism	<u>BPHYS1-101</u>	1	4	60	4 0 0	CO1	Understanding the concepts of electric field, magnetic field, magnetic properties of matter, electromagnetic potentials, dielectric and induction and electric circuits.	3	2	1	2	2	2	2	3
						CO2	Skill enhancement to solve numerical problems related with Electricity and Magnetism.	2	3	2	3	1	1	2	2

						CO3	Apply knowledge of Electricity and Magnetism to go for higher studies in diverse fields.	2	2	1	2	2	1	3	2
						CO4	To inculcate and develop the ability to think abstractly.	2	3		2	2	1	2	2
Electricity and Magnetism Lab	BPHYS1-104	1	2	60	0 0 4	CO1	Able to verify the concepts/laws of Electricity and Magnetism.	3	2	3	2	2	2	2	1
						CO2	To inculcate and develop scientific aptitude by performing the various experiments.	2	1	3	2	2	1	2	2
						CO3	Skill enhancement by solving experimental problems.	1	2	1	2	2	2	2	2
						CO4	To inculcate the spirit of team work.	1	2	2	2	1	2	2	3
Mechanics	BPHYS1-102	1	4	60	4 0 0	CO1	Understanding the concepts of fundamentals of dynamics, gravitation and central force motion, oscillations, and special theory of relativity.	3	2	1	2	2	2	2	3
						CO2	To analyse and solve numerical problems in mechanics.	2	3	2	3	1	1	2	2
						CO3	Apply knowledge of Mechanics to go for higher studies in diverse fields.	2	2	1	2	2	1	3	2
						CO4	To inculcate and develop the ability to think abstractly.	2	3	1	2	2	1	2	2
Mechanics Lab	BPHY S1-101	1	2	60	0 0 4	CO1	Able to verify the concepts/laws of Mechanics.	3	2	3	2	2	2	2	1

						CO2	To inculcate and develop scientific aptitude by performing the various experiments.	2	1	3	2	2	1	2	2	
						CO3	Skill enhancement by solving experimental problems.	1	2	1	2	2	2	2	2	
						CO4	To inculcate the spirit of teamwork.	1	2	2	2	1	2	2	3	
Computational Physics Skills	BPHYS1-108	1	2	60	004	CO1	Able to understand the concept of computational Physics.	3	2	3	2	2	2	2	2	1
						CO2	To inculcate and develop scientific aptitude.	2	1	3	2	2	1	2	2	
						CO3	Skill enhancement by solving numerical problems.	1	2	1	3	2	2	2	2	
						CO4	To inculcate the spirit of teamwork.	1	2	2	2	1	2	2	3	
Thermal Physics	BPHYS1-201	2	4	60	400	CO1	To understand the concepts related to Thermal Physics and their applications.	3	2	1	2	2	2	2	2	3
						CO2	Skill enhancement to solve numerical problems related with the laws of thermodynamics, entropy, and Maxwell's thermodynamic relations.	2	3	2	3	1	1	2	2	
						CO3	Apply knowledge of Thermal Physics to go for higher studies in diverse fields.	2	2	1	2	2	1	3	2	
						CO4	To inculcate and develop the ability to think abstractly.	2	3	1	2	2	1	2	2	

Thermal Physics Lab	BPHYS1-204	2	2	60	004	CO1	To understand the concepts related to Thermal Physics and their applications.	3	2	3	2	2	2	2	1
						CO2	Practical knowledge of concepts of Thermodynamics.	2	1	3	2	2	1	2	2
						CO3	To inculcate and develop scientific aptitude by performing the various experiments.	1	2	1	2	2	2	2	2
						CO4	Learn to draw conclusions from data and develop skills in experimental design.	1	2	2	2	1	2	2	3
Waves and Optics	BPHYS1-202	2	4	60	400	CO1	Understanding the concepts of harmonic oscillations, wave motion, wave optics, interference and diffraction.	3	2	1	2	2	2	2	3
						CO2	Skill enhancement to solve numerical problems related with Waves and Optics.	2	3	2	3	1	1	2	2
						CO3	Apply knowledge of Waves and Optics to go for higher studies in diverse fields.	2	2	1	2	2	1	3	2
						CO4	To inculcate and develop the ability to think abstractly.	2	3	1	2	2	1	2	2
Waves and Optics Lab	BPHYS1-205	2	2	60	004	CO1	Able to verify the concepts/laws of Waves and Optics	3	2	3	2	2	2	2	1
						CO2	To inculcate and develop scientific aptitude by performing the various experiments.	2	1	3	2	2	1	2	2
						CO3	Skill enhancement by solving experimental problems.	1	2	1	2	2	2	2	2

						CO4	To inculcate the spirit of teamwork	1	2	2	2	1	2	2	3
Analog System and Applications	BPHYS1-301	3	4	60	400	CO1	Understanding the constitution of semiconducting diode, its types like LED, Zener diode, photodiode solar cell etc. and use of diodes as rectifiers.	2	1	3	3	3	3	2	3
						CO2	In depth understanding to use Bipolar Junction Transistor in various configurations and its respective characteristics.	3	1	3	3	1	3	1	2
						CO3	Learning the use of Coupled Amplifier and its characteristics.	3	1	2	1	1	3	3	3
						CO4	Applications of Operational Amplifier in Analog systems.	3	1	3	1	1	2	3	3
Analog System and Applications Lab	BPHYS1-305	3	2	60	004	CO1	Power Supply and the role of Capacitance and Inductance filters.	1	1	3	2	1	1	1	1
						CO2	Hands on in finding the characteristics of various semiconductors like diode, transistor, JFET, MOSFET, Tunnel Diode etc.	3	2	2	3	1	1	3	3
						CO3	Realization of characteristics of BJTs by performing experiments.	1	1	1	3	1	1	3	2
						CO4	Learning use of OpAmp in Adder, Subtractor, Differentiator and Integrator.	3	2	2	2	3	3	2	2
Element	BPHYS1-301	3	4	60	400	CO1	Understanding the basic concepts in the development of modern physics.	3	2	1	1	1	2	3	1

						CO2	To establish the basic foundation of students to study the advance level course like quantum physics, particle physics and high energy physics.	3	2	1	3	1	1	2	1
						CO3	Skill enhancement to solve numerical problems related with basic quantum, nuclear and particle physics.	1	3	1	2	1	1	2	1
						CO4	To provide the knowledge of the state-of-the-art of modern days lasers and their applications in daily life.	3	2	2	2	2	3	3	2
Elements of Modern Physics Lab	BPHYS1-306	3	2	60	004	CO1	Able to verify the concepts/laws of basic quantum, nuclear and particle physics.	3	2	3	2	2	2	2	1
						CO2	To inculcate and develop scientific aptitude by performing the various experiments.	2	1	3	2	2	1	2	2
						CO3	Skill enhancement by solving experimental problems.	1	2	1	2	2	2	2	2
						CO4	To inculcate the spirit of teamwork.	1	2	2	2	1	2	2	3
Quantum	BPHYS1	3	4	60	400	CO1	Understanding of Time independent and Time dependent Schrodinger equations and their applications.	3	2	1	2	2	2	2	3

						CO2	Skill enhancement to solve numerical problems related with Quantum Mechanics.	2	3	2	3	1	1	2	2
						CO3	Apply knowledge of Quantum Mechanics to go for higher studies in diverse fields.	2	2	1	2	2	1	3	2
						CO4	To inculcate and develop the ability to think abstractly.	2	3	1	2	2	1	2	2
Digital System and Applications	BPHYS1-401	4	4	60	400	CO1	Secure first-hand idea of different components including both active and passive components to gain an insight into circuits using discrete components and also to learn about integrated circuits.	3	1	3	1	2	2	3	3
						CO2	About analog systems and digital systems and their differences, fundamental logic gates, combinational as well as sequential and number systems.	3	3	3	2	3	1	1	3
						CO3	Synthesis of Boolean functions, simplification and construction of digital circuits by employing Boolean algebra.	2	3	1	1	1	3	2	3
						CO4	Sequential systems by choosing FlipFlop as a building block-construct multivibrators, counters to provide a basic idea about memory including RAM,ROM and also about memory organization.	2	3	3	1	3	3	3	2

Digital System and Applications Lab	BPHYS1-404	4	4	60	004	CO1	Learning logic GATES and their realization using diodes and transistors.	2	2	1	2	1	3	3	3
						CO2	FlipFlop as a building block about memory including RAM,ROM	2	3	1	2	2	1	3	1
						CO3	Microprocessor and assembly language programming with special reference to Intel μ P 8085.	1	2	1	1	2	1	3	3
						CO4	Learning Adders, Subtractors, Shift Registers, and multivibrators using 555 ICs.	1	1	3	2	2	1	1	3
Solid State Physics	BPHYS1-402	4	4	60	400	CO1	A brief idea about lattice, unit cell, miller indices, reciprocal lattice, concept of Brillouin zones and diffraction of X-rays by crystalline materials.	2	2	3	1	3	1	3	3
						CO2	Knowledge of lattice vibrations, phonons and in depth of knowledge of Einstein and Debye theory of specific heat of solids.	2	2	3	1	2	1	1	1
						CO3	Understanding above the band theory of solids and must be able to differentiate insulators, conductors, and semiconductors.	3	3	3	2	1	1	1	1

						C04	Secured an understanding about the magnetic, dielectric and superconducting phases of the materials.	3	2	3	2	2	3	3	3
Solid State Physics Lab	BPHYS1-405	4	2	60	004	C01	Learning characteristics of LED, photodiode, solar cell etc.	3	2	2	2	2	3	1	1
						C02	Characterization of material properties like: magneto-resistive, M(H), Ten Delta, Curie temperature etc.	3	2	1	1	3	3	3	3
						C03	Use of X-Ray diffraction tool for crystal structure analysis of the material.	3	1	1	2	3	1	1	2
						C04	Acquaintance with thin film preparation techniques.	3	2	1	2	1	2	2	2
Constitution of India Constitution of India.	BMNCCO-001	4		30	200	C01	Understanding the meaning, emergence, evolution and structure of Constitution of India.		1		1	2			2
						C02	Know their fundamental rights and duties and directive principles of state policy.	1	1	1	2	3	3	3	3

						CO3	Will know the organs of governance with detailed study of Indian parliament, its composition and working. Also gain the knowledge of judiciary system, its powers and functions.	1	1	1	2	3	2	2	3
						CO4	Acquire the understanding of aims and decentralization in India by explaining about the uses of Panchayath Raj system in India and its duties.	1	1	1	2	3	3	2	3
Mathematical Physics – I	BPHYS1-501	5	6	90	4 2 0	CO1	Understand the concepts related with complex analysis, vector differentiation, vector integration and tensors.	3	2	1	2	2	2	2	3
						CO2	Skill enhancement to solve numerical problems related with Mathematical Physics.	2	3	2	3	1	1	2	2
						CO3	Apply knowledge of Mathematical Physics to go for higher studies in diverse fields.	2	2	1	2	2	1	3	2
						CO4	To inculcate and develop the ability to think abstractly.	2	3		2	2	1	2	2
Statistical Mechanics	BPHYS1-502	5	4	60	4 0 0	CO1	Understand the concepts of microstate, macrostate, phase space, thermodynamic probability, partition function, properties and Laws associated with thermal radiations and kinetic theory of gases.	3	2	1	2	2	2	2	3

						C02	Skill enhancement to solve numerical problems related with Statistical Mechanics.	2	3	2	3	1	1	2	2
						C03	Apply knowledge of Statistical Mechanics to go for higher studies in diverse fields.	2	2	1	2	2	1	3	2
						C04	To inculcate and develop the ability to think abstractly.	2	3	1	2	2	1	2	2
Statistical Mechanics Lab	BPHYS1-503	5	2	60	004	C01	Able to understand computationally and experimentally the various Statistical mechanics problems.	3	2	3	2	2	2	2	1
						C02	To inculcate and develop scientific aptitude by performing the various experiments.	2	1	3	2	2	1	2	2
						C03	Learn to draw conclusions from data and develop skills in experimental design.	1	2	1	2	2	2	2	2
						C04	To inculcate the spirit of team work.	1	2	2	2	1	2	2	3

Basic Instrumentation Skills	BPHYS1-504	5	2	60	004	CO1	Basic knowledge of sensitivity and resolution of instrument with processing of error in measurement which is essential of instrument operation.	3	3	3	3	1	3	1	3
						CO2	Operational knowledge of CRO with its applications towards measuring different type of ac and dc signals.	3	2	2	2	1	2	1	3
						CO3	Knowledge of generating and testing different type of signals using signal generator and their analysis.	2	3	2	3	3	3	1	2
						CO4	Conceptual knowledge of different type of LCR bridges and their balancing applications.	2	3	2	3	1	2	1	2
Nano Materials and Applications	BPHYD1-513	5	4	60	400	CO1	Understanding the Nano systems and its implications in modifying the properties of materials at the nanoscale.	3	3	3	2	1	2	2	3
						CO2	Concept of Quantum confinement, 3D,2D,1D and 0D nanostructure with examples.	3	3	3	1	3	1	1	3
						CO3	Different synthesis techniques including top down and bottom-up approaches.	3	3	3	3	2	1	3	3

						CO4	Applications of nanostructured materials in making devices namely MEMS, NEMS and other heterostructures for solar cell and LEDs.	3	1	2	2	1	2	3	1
Nano Materials and Applications Lab	BPHYD1-514	5	2	60	004	CO1	Student shall gain expertise in synthesis of nano-particles by chemical route.	3	1	1	1	2	1	3	3
						CO2	Use of X-Ray diffraction tool for crystal structure analysis of the material.	2	2	1	1	1	1	1	2
						CO3	Acquaintance with thin film preparation techniques.	2	3	3	2	1	3	3	2
						CO4	Use of UV visible spectrometer for analysis of nano-particles.	1	1	3	1	3	1	2	3
Mathematical Physics-II	BPHYS1-601	6	6	90	420	CO1	Understand the concepts related with Frobenius method, theory of errors and special functions and integrals, and group theory.	3	2	1	2	2	2	2	3
						CO2	Skill enhancement to solve numerical problems related with Mathematical Physics.	2	3	2	3	1	1	2	2

						C03	Apply knowledge of Mathematical Physics to go for higher studies in diverse fields.	2	2	1	2	2	1	3	2
						C04	To inculcate and develop the ability to think abstractly.	2	3	1	2	2	1	2	2
Electromagnetic Theory	BPHYS1-602	6	4	60	400	C01	Understand the concepts related with Maxwell's equations, propagation of EM waves, polarization, production and detection of EM waves, and optical fibres.	3	2	1	2	2	2	2	3
						C02	Skill enhancement to solve numerical problems related with Electromagnetic Theory	2	3	2	3	1	1	2	2
						C03	Apply knowledge of Electromagnetic Theory to go for higher studies in diverse fields.	2	2	1	2	2	1	3	2
						C04	To inculcate and develop the ability to think abstractly.	2	3	1	2	2	1	2	2
Electromagnetic Theory Lab	BPHYS1-603	6	2	60	004	C01	Able to understand computationally and experimentally the various concept of electromagnetic theory.	3	1	1	1	2	1	3	3

						CO2	To inculcate and develop scientific aptitude by performing the various experiments.	2	2	1	1	1	1	1	2
						CO3	Learn to draw conclusions from data and develop skills in experimental design.	2	3	3	2	1	3	3	2
						CO4	To inculcate the spirit of team work.	1	1	3	1	3	1	2	3
Nuclear and Particle Physics	BPHYD1-521	5	4	60	400	CO1	Understanding of basic properties of nuclei like nuclear size, shape, mass, binding energy and nuclear stability etc through various nuclear models and potentials associated with them.	3	2		2		3	2	1
						CO2	Learn the processes and conditions of nuclear reactions with emphasis on beta and gamma decays.	3	2	2			2	3	
						CO3	Acquire an understanding of how nuclear radiations interact with matter and theoretical knowledge of nuclear detectors used for nuclear radiation measurements. .	3	2	1	2	1	2	2	1
						CO4	A brief introduction of elementary particle physics that would motivate the students for higher studies in the field of high energy physics.	3			1	1	2	3	

Medical Physics	BPHYD1-621	6	4	60	400	CO1	To provide knowledge of physics behind the working mechanisms of different organs in human body.	3			3		3	3	
						CO2	Understanding the impact of radiation exposure to human body. Use of radiation dosimeters, radiation detectors/instrumentations for radiation monitoring.	2	2	1	3	1	3	3	2
						CO3	Use of X-rays for medical diagnosis and application of radiations for therapeutic uses.	2	2		3	2	3	3	2
						CO4	Acquiring the knowledge of medical imaging, physical principles of diagnostic radiology, image quality and quality assurance.	2	2	1	3	2	3	3	2
Medical Physics Lab	BPHYD1-622	6	2	60	004	CO1	Able to use and measure manual Hg blood pressure monitor and optical eye-testing machine.	2	3	3		3	3	3	2
						CO2	To inculcate and develop scientific aptitude by performing the various experiments.	1	3	3	1	3	3	2	3

						CO3	Learn to use combination of lenses on an optical bench and draw conclusions from data and develop skills in experimental design.		3	3		3	3	3	3
						CO4	To inculcate the spirit of teamwork.	1	1		2		1		3
Classical Dynamics	BPHYD1-611	6	6	90	420	CO1	Understand the fundamental Laws of motion and apply Lagrangian & Hamiltonian formulations to the motion of particles.	3	2	1			2	3	2
						CO2	Gain the fundamental knowledge of rotational motion and solve the numerical problem in spherical and cylindrical coordinates for kinetic energy and moment of inertia of rotating bodies.	3	3	1	1		2	3	2
						CO3	Learn the theory of small oscillations in detail along with basis of free vibrations.	3	2	1	1		2	3	2
						CO4	Course will build a foundation of students for higher studies in diverse fields.	3					1		1
Communication Systems	BPHYD1-515	5	4	60	400	CO1	Understand the fundamentals of communication systems and to perform amplitude and angle modulation and demodulation of analog signals		2	3			1	2	2

						C02	Perform and analyze angle modulation i.e. PAM, PCM and PWM	1	2	3	1		2		1
						C03	Understand and solve problems related to digital modulation (FDM and TDM) systems.	1	2	3	1		2		1
						C04	Design and conduct experiments, using modern communication tools necessary for various engineering applications.	1	3	3	3	1	3	2	2
Communication Systems Lab	BPHYD1-516	5	2	60	004	C01	Able to understand computationally and experimentally the various concepts of Quantum mechanics.	3	2	3	2	2	2	2	1
						C02	To inculcate and develop scientific aptitude by performing the various experiments.	2	1	3	2	2	1	2	2
						C03	Learn to draw conclusions from data and develop skills in experimental design.	1	2	1	2	2	2	2	2
						C04	To inculcate the spirit of teamwork.	1	2	2	2	1	2	2	3

Mathematics-I	BMATH5-101	1	4	60	310		To implement the idea of system of linear equations		2		3					
							Use vector and scalar product in terms of area and volume		3		2		1			
							To implement the idea of vector differentiation, divergence and curl of vector field		2		3		2			
							To implement the idea of vector integration with theorems		2		2		1	1		
Basic Mathematics-I	BMATH5-102	1	4	60	310	CO1	Get knowledge about the basic concept of limit continuity		2		3					
						CO2	To determine the nth derivative of well-known functions		3		2		1	1		
						CO3	Tracing of Cartesian curves, parametric and polar curves		2		3		2			

						CO4	Able to solve applications of definite integral		2		2		1		
Inorganic Chemistry -I	(BCHMS1-101)	1	4	60	400	CO1	The completion of this course will make student to acquire the knowledge of:	1		1	3				
						CO2	Wave mechanics, atomic theories and shapes of orbitals	1		1	3				
						CO3	Periodic table and various periodic properties	1		1	3				
						CO4	Ionic bond, covalent bond, metallic bond and various weak chemical forces	1		1	3				
							Redox reactions and applications of redox reactions								
Inorganic Chemistry Lab.I	(BCHMS1-103)	1	2	30	002	CO1	Preparation of solutions	1		3	1				

						CO2	Estimation of carbonates, bicarbonates and free alkalis in solution with acid base titrations	1		3	1				
						CO3	Estimation of Fe(II) and oxalic acid with oxidation reduction titrimetry	1		3	1				
						CO4	Estimation of Fe(II) and oxalic acid with oxidation reduction titrimetry	1		3	1				
Physical Chemistry -I	(BCHMS1-102)	3	4	60	400	CO1	Kinetic modular model of gases, behaviour of ideal and real gases.	1		1	3				
						CO2	Concept of equilibrium, its types and the factors affecting the state of equilibrium	1		1	3				
						CO3	Different type of crystal systems, Bragg's law and Miller indices.	1		1	3				
						CO4	Comparison of the behaviour of ideal and real gases.	1		1	3				

Organic Chemistry -I	(BCHMS1-201)	2	4	60	400	CO1	Stereochemistry concepts	1		1	3				
						CO2	Reaction intermediates, electronic effects and types of reactions	1		1	3				
						CO3	Formation of carbon-carbon sigma and pi bonds	1		1	3				
						CO4	Conformational analysis of cycloalkanes	1		1	3				
Physical Chemistry lab I	BCHMS1-104)	3	2	30	002	CO1	Surface tension and Viscosity measurement	1		3	1				
						CO2	Preparation of buffer solution	1		3	1				
						CO3	pH metric titrations.	1		3	1				

Organic Chemistry lab I	BCHMS1-203)	3	2	30	002	CO1	Purification of organic compound using various solvent combinations	1		3	1				
						CO2	Determination of melting and boiling points of various organic compound	1		3	1				
						CO3	Chromatographic techniques	1		3	1				
Physical Chemistry -II)	(BCHMS1-202	4	4	60	400	CO1	Systematic knowledge of concepts of thermodynamics and able to identify and describe energy exchange processes.	1		1	3				
						CO2	Concept of chemical equilibrium, and the factors affecting the state of equilibrium	1		1	3				
						CO3	Variation of system properties with composition.	1		1	3				
						CO4	Solutions and their properties.	1		1	3				