

BARASAT GOVT COLLEGE
POST GRADUATE DEPARTMENT OF PHYSICS
M.Sc. (Physics) CBCS Syllabus
With effect from 2021-22

Program Outcome (PO)

PO 1	Disciplinary knowledge
PO 2	Scientific reasoning
PO 3	Critical thinking
PO 4	Research-related skills
PO 5	Problem solving
PO 6	Information/digital literacy
PO 7	Analytical reasoning
PO 8	Sense of inquiry
PO 9	Scientific mindset

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Programme Specific Outcomes (PSO)

The students after completion of MSc in Physics will be able to analyze physical systems on the basis of principles of basic physics topics such as classical mechanics, electrodynamics, mathematical physics, quantum mechanics and electronics. They can also interpret experimental results in terms of existing principles and laws of Physics.

- **PSO 1:** This course can develop the critical thinking skills of the students through acquired knowledge in major branches of physics.
- **PSO 2:** Learn to carry out experiments in basic as well as certain advanced areas of physics such as Condensed Matter Physics, High Energy Physics, Statistical Mechanics and Nuclear & Particle Physics.
- **PSO 3:** They learn the deeper meaning of different branches of physics and their interrelationships. The students are also motivated to face competitive examinations and course enhance National and International competency.
- **PSO 4:** They learn to tackle and troubleshoot problems during experiments at the labs.
- **PSO 5:** They learn the very nature of performing research work in Physics during projects. They can explain their research work results in project seminars.
- **PSO 6:** The two-year PG course – Master Degree in Science (M. Sc. Course) gives them enough opportunity to align their mental faculties and attitudes to prepare for the State and National Level Examinations (SLET, NET, UGC-CSIR, DST, UPSC, etc.) for entry to recognized Institutions and Research Organizations (IACS, SINP, SNBNCBS, CGCRI, etc.).
- **PSO 7:** The students are motivated for going to abroad for Research Career by virtue of National Overseas Scholarship Schemes after completion of M. Sc. Course in Physics.

BARASAT GOVERNMENT COLLEGE
Course Outcome or Learning Outcome
Two year M.Sc. Degree Course
Under CBCS semester system
POST GRADUATE DEPARTMENT OF PHYSICS
With effect from the session: 2021 – 2022

Course Name: CORE COURSE-1

Course Code: PHSPCOR01T

Topic Name: MATHEMATICAL METHODS

Course Outcome:	CO, PO & PSO Mapping						
	SI No	Course outcome			Knowledge level Blooms Level	POs Mapping	PSOs mapping
CO1	Understand concepts in Complex Variable, Contour integration, Dirac notation, etc.			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7	
CO2	Evaluate improper integrals, which appear in several problems of physics.			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7	
CO3	Comprehend - Group Theory, Integral Transforms, Matrices,			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7	
CO4	Solve - Linear Operators, Vector Space, Ordinary Differential Equations.			L5 Evaluating	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7	
CO5	Perform improper integral on the vector space and also get the general view of operators.			L4 Analysing	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7	
CO6	Apply to Electrical Network Theory, Fourier Analysis, Laplace Transform, Quantum Mechanics, Theoretical Physics, etc.			L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7	

Program Articulation Matrix (CO-PO Matrix)																			
PO, PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CO1	3	2	3	2	3		2	2	3		3	3	3	3	3	3	3		
CO2	2	3	2	3	2		3	3	2		2	3	2	3	2	3	2		
CO3	3	3	3	3	3		3	3	1		3	2	3	2	3	2	3		
CO4	2	3	2	3	2		2	1	3		2	2	3	2	3	2	3		
CO5	3	1	3	2	2		3	2	2		2	1	1	1	1	1	1		
CO6	1	3	2	2	3		2	3	3		3	3	3	3	3	3	3		
Average	2.33	2.50	2.50	2.50	2.50		2.50	2.33	2.33		2.50	2.33	2.50	2.33	2.50	2.33	2.50		

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Course Name: CORE COURSE-2

Course Code: PHSPCOR02T

Topic Name: CLASSICAL MECHANICS

Course Outcome:	CO, PO & PSO Mapping						
	SI No	Course outcome			Knowledge level Blooms Level	POs Mapping	PSOs mapping
CO1		Understand Advance Level Course - Hamilton's principle of least action,.			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO2		Solve problems Dynamics in terms of Hamilton-Jacobi, etc.			L5 Evaluating	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO3		Comprehend - Special topics, such as O(4) symmetries.			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO4		Perform Symplectic structure of Canonical transform and Lagrangian formalism of Rigid body dynamics.			L5 Evaluating	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO5		Apply to Real-Time problems, Nonlinear Dynamics, KAM theorem.			L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO6		Identify different routes to Chaos.			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7

Program Articulation Matrix (CO-PO Matrix)																			
PO, PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CO1	3	3	3	3	3		3	3	3		3	2	3	2	2	3	3		
CO2	1	2	2	1	2		2	2	2		2	3	3	2	2	2	2		
CO3	2	3	2	2	3		2	3	1		3	2	2	3	3	3	3		
CO4	2	2	2	2	2		2	2	2		1	1	1	1	1	1	1		
CO5	3	3	3	3	3		3	3	3		3	3	3	3	3	3	3		
CO6	3	1	2	3	2		3	3	2		3	3	3	3	3	3	3		
Average	2.33	2.33	2.33	2.33	2.50		2.50	2.67	2.17		2.50	2.33	2.50	2.33	2.33	2.50	2.50		

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Course Name: CORE COURSE-3

Course Code: PHSPCOR03T

Topic Name: QUANTUM MECHANICS (QM) I

Course Outcome:	CO, PO & PSO Mapping									
	SI No	Course outcome			Knowledge level Blooms Level	POs Mapping	PSOs mapping			
CO1	Identify Q M I from basics to stages of advance concepts.				L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7			
CO2	Comprehend concepts of operator formalism in a la Dirac				L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7			
CO3	Perform problems with wave function				L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7			
CO4	Understand Theory of Angular Momentum, etc.				L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7			
CO5	Analyze in detail with Measurement & Interpretation.				L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7			
CO6	Apply to Wave Mechanics, Stern-Gerlach Experiment, etc.				L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7			
CO7	Evaluate perturbation theory and other approximate methods (WKB, etc.).				L5 Evaluating	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7			

Program Articulation Matrix (CO-PO Matrix)																			
PO, PSO CO \	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CO1	3	3	3	3	3		3	3	3		2	3	2	3	3	2	3		
CO2	2	3	2	3	2		2	2	2		3	2	3	2	2	3	2		
CO3	3	3	3	3	3		3	3	3		3	3	3	3	3	3	3		
CO4	1	1	1	1	1		1	1	1		1	1	1	1	1	1	1		
CO5	2	3	2	3	2		3	2	3		2	3	2	3	3	2	2		
CO6	3	2	3	2	3		2	3	2		3	2	3	2	2	2	3		
CO7	3	3	3	2	2		3	2	3		2	3	2	3	3	3	2		
Average	2.43	2.57	2.43	2.43	2.29		2.43	2.29	2.43		2.29	2.43	2.29	2.43	2.43	2.29	2.29		

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Course Name: CORE COURSE-4

Course Code: PHSPCOR04T

Topic Name: ELECTRONICS & INSTRUMENTATION

Course Outcome:	CO, PO & PSO Mapping						
	SI No	Course outcome			Knowledge level Blooms Level	POs Mapping	PSOs mapping
CO1	Understand Advanced analog electronics				L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6
CO2	Comprehend Advanced digital electronics				L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6
CO3	Analyze Physics of Semiconductor Devices				L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6
CO4	Perform study of Modern instrumentation.				L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6
CO5	Apply Modern Instrumentation.				L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6
CO6	Experience - Types of Electron Microscopy, FTIR, etc.				L5 Evaluating	1,2,3,4,5,7,8,9	1,2,3,4,5,6

Program Articulation Matrix (CO-PO Matrix)																			
PO, PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CO1	3	3	3	3	3		3	3	3		2	2	2	2	3	3			
CO2	2	3	2	3	2		2	2	2		3	3	3	3	2	2			
CO3	3	3	3	3	3		3	3	3		3	3	3	3	3	3			
CO4	1	1	1	1	1		1	1	1		1	1	1	1	1	1			
CO5	2	3	2	3	2		3	2	2		2	2	2	2	3	3			
CO6	3	2	3	2	3		2	3	3		3	3	3	3	2	2			
Average	2.33	2.50	2.33	2.50	2.33		2.33	2.33	2.33		2.33	2.33	2.33	2.33	2.33	2.33			

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Course Name: CORE COURSE-5

Course Code: PHSPCOR05P

Topic Name: GENERAL EXPERIMENTS I (NON-ELECTRONICS & ELECTRONICS LABORATORY)

Course Outcome:	CO, PO & PSO Mapping						
	SI No	Course outcome			Knowledge level Blooms Level	POs Mapping	PSOs mapping
CO1	Understand Non-Electronics Experiments - Franck-Hertz Ionization Experiment.			L2 Understanding		1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO2	Execute experiment on Photovoltaic-PV Solar Cells & GM Counter			L3 Applying		1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO3	Perform Electronics experiment on OP – AMPS and Multivibrators			L2 Understanding		1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO4	Designing of Temperature Controller, ECL, OR / NOR			L2 Understanding		1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO5	Analyze Electronics Laboratory Experiments - Field - Effect Transistors (FETs).			L3 Applying		1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO6	Create circuits for Multivibrators.			L3 Applying		1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO7	Comprehend - Relaxation Oscillators, Timers, Flip-Flops, FM Modulation, etc.			L2 Understanding		1,2,3,4,5,7,8,9	1,2,3,4,5,6,7

Program Articulation Matrix (CO-PO Matrix)																			
PO, PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CO1	3	2	3	3	2		3	2	3		2	3	2	3	2	2	3		
CO2	2	3	2	2	3		2	3	2		3	2	3	2	3	2	3		
CO3	3	3	2	3	3		3	2	3		3	3	3	3	3	3	3		
CO4	1	1	1	1	1		1	1	1		1	1	1	1	1	1	1		
CO5	2	2	2	2	2		3	3	3		2	2	2	2	2	2	2		
CO6	3	3	3	3	3		2	3	2		3	2	3	2	3	3	2		
CO7	3	3	3	3	3		3	2	3		2	3	2	3	2	2	3		
Average	2.43	2.43	2.29	2.43	2.43		2.43	2.29	2.43		2.29	2.29	2.29	2.29	2.29	2.14	2.43		

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Course Name: CORE COURSE-6

Course Code: PHSPCOR06T

Topic Name: ELECTRODYNAMICS

Course Outcome:	CO, PO & PSO Mapping						
	SI No	Course outcome			Knowledge level Blooms Level	POs Mapping	PSOs mapping
CO1	Understand different problems in relation to modern mathematics.			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7	
CO2	Solve complicated electrical circuit theory.			L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7	
CO3	Perform analysis for different anisotropic properties of solids.			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7	
CO4	Applications of Fourier and Laplace transform.			L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7	
CO5	Comprehend ordinary differential equations with different conditions.			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7	
CO6	Analyze physical problems in digital signal processing,			L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7	
CO7	Create image processing, theory of wave equations, etc.			L5 Evaluating	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7	

Program Articulation Matrix (CO-PO Matrix)																			
PO, PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CO1	3	2	3	2	3		3	3	3		3	2	3	3	2	2	2		
CO2	2	3	2	3	2		2	2	2		3	2	3	3	3	3	3		
CO3	3	3	3	3	3		3	3	3		2	3	2	2	3	3	3		
CO4	1	1	1	1	1		1	1	1		1	1	1	1	1	1	1		
CO5	2	2	2	2	2		2	2	2		2	3	2	2	3	2	3		
CO6	2	2	3	2	3		3	2	3		2	2	2	3	2	3	2		
CO7	3	3	3	3	3		2	3	2		3	3	3	3	3	3	3		
Average	2.29	2.29	2.43	2.29	2.43		2.29	2.29	2.29		2.29	2.29	2.29	2.43	2.43	2.43	2.43		

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Course Name: CORE COURSE-7

Course Code: PHSPCOR07T

Topic Name: QUANTUM MECHANICS II

Course Outcome:	CO, PO & PSO Mapping									
	SI No	Course outcome			Knowledge level Blooms Level	POs Mapping	PSOs mapping			
CO1	Understand the quantum description of transition and scattering.				L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7			
CO2	Comprehend the Symmetry principles as a very power analyzing tool.				L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7			
CO3	Analyze discrete symmetries by virtue of several examples.				L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7			
CO4	Perform theory for Relativistic quantum mechanics.				L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7			
CO5	Experience concepts in spectroscopy.				L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7			
CO6	Solve problems on the property of Lorentz Co-Variance for relativistic theory.				L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7			
CO7	Create Intricate connection to the symmetry principle				L5 Evaluating	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7			

Program Articulation Matrix (CO-PO Matrix)																			
PO, PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CO1	3	2	3	2	3		3	3	3		3	2	3	2	3	2	2		
CO2	2	3	2	3	2		2	2	2		2	3	2	3	2	3	3		
CO3	3	3	3	3	3		3	3	3		3	3	3	3	2	2	2		
CO4	1	1	1	1	1		1	1	1		1	1	1	1	1	1	1		
CO5	2	3	2	3	2		2	2	2		2	3	2	2	3	3	3		
CO6	3	3	3	3	3		3	3	3		2	2	3	2	2	2	2		
CO7	2	2	2	2	2		2	2	2		3	3	2	3	3	3	3		
Average	2.29	2.43	2.29	2.43	2.29		2.29	2.29	2.29		2.29	2.43	2.29	2.29	2.29	2.29	2.29		

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Course Name: CORE COURSE-8

Course Code: PHSPCOR08T

Topic Name: STATISTICAL MECHANICS

Course Outcome:	SI No	CO, PO & PSO Mapping										POs Mapping	PSOs mapping	
		Course outcome												
	CO1	Recall topics pertaining to Electrostatics, Magnetostatics & Electromagnetic induction - Faraday's law.										L1 Remembering	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
	CO2	Understand Maxwell's equations in stationary and moving media; Poynting vector; Maxwell's stress-tensor for electromagnetic fields; Electromagnetic momentum and Radiation Pressure.										L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
	CO3	Comprehend Gauge invariance of Electrodynamics; Inhomogeneous wave equations and their solutions by Green's function method.										L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
	CO4	Calculate radiation from various sources and Electric dipole radiation.										L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
	CO5	Solve Leinard - Wiechert potentials; Bremsstrahlung; Synchrotron radiation; Cherenkov Radiation, etc.										L5 Evaluating	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
	CO6	Contemplate on Radiation reaction, scattering and dispersion - energy conservation, characteristics of charged harmonic oscillator; scattering of e. m. radiation by free and bound electrons and Kramers-Kronig dispersion relation.										L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
	CO7	Apply the concepts of Relativistic Electrodynamics; Lorentz transformation law for the e. m. fields; Field invariants and Covariance of Lorentz force										L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7

Program Articulation Matrix (CO-PO Matrix)																			
PO, PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CO1	2	3	2	3	2		3	2	3		3	2	2	3	2	3	2		
CO2	3	2	2	2	2		2	2	2		2	2	2	2	2	2	2		
CO3	2	3	3	3	3		3	3	3		1	3	3	1	3	1	3		
CO4	1	1	2	1	1		1	1	1		2	1	2	2	2	2	2		
CO5	2	2	2	2	2		2	2	2		2	2	2	2	2	2	2		
CO6	3	3	3	3	3		3	3	3		3	3	3	3	3	3	3		
CO7	2	2	2	2	2		2	2	2		2	2	2	2	2	2	2		
Average	2.14	2.29	2.29	2.29	2.14		2.29	2.14	2.29		2.14	2.14	2.29	2.14	2.29	2.14	2.29		

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Course Name: CORE COURSE-9

Course Code: PHSPCOR09P

Topic Name: LABORATORY PRACTICAL EXPERIMENTS (NON-ELECTRONICS & ELECTRONICS)

Course Outcome:	CO, PO & PSO Mapping						
	SI No	Course outcome			Knowledge level Blooms Level	POs Mapping	PSOs mapping
CO1	Understand the experiment on Electron Spin Resonance (ESR).		L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7		
CO2	Comprehend concept on Light Emitting Diodes.		L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7		
CO3	Experience velocity of sound by Ultrasonic experiment.		L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7		
CO4	Characterize Ferrite materials by designing B-H experiment.		L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7		
CO5	Perform experiments - Converters, Decade & Counters, Amplitude Modulation & Demodulation.		L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7		
CO6	Solve problems by Programming the 8085 Microprocessor.		L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7		

Program Articulation Matrix (CO-PO Matrix)																			
PO, PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CO1	2	3	2	3	3		2	3	3		2	3	2	3	3	3	3		
CO2	3	2	3	2	2		3	2	2		3	2	3	2	2	2	2		
CO3	3	3	3	3	3		3	2	2		3	3	3	3	3	3	3		
CO4	1	2	1	2	1		1	2	1		1	2	2	2	2	2	2		
CO5	2	2	2	2	2		2	2	2		2	2	2	2	2	2	2		
CO6	3	3	3	3	3		2	3	3		3	3	3	3	3	3	3		
Average	2.33	2.50	2.33	2.50	2.33		2.17	2.33	2.17		2.33	2.50	2.50	2.50	2.50	2.50	2.50		

BARASAT GOVERNMENT COLLEGE
Course Outcome or Learning Outcome
Two year M.Sc. Degree Course
Under CBCS semester system
POST GRADUATE DEPARTMENT OF PHYSICS
With effect from the session: 2021 – 2022

Course Name: CORE COURSE-10

Course Code: PHSPCOR10P

Topic Name: COMPUTER LABORATORY

Course Outcome:	CO, PO & PSO Mapping						
	SI No	Course outcome			Knowledge level Blooms Level	POs Mapping	PSOs mapping
CO1	Understand the Fundamentals of C Language.			L2 Understanding		1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO2	Learn the concepts of FORTRAN 90.			L2 Understanding		1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO3	Comprehend the Basics of Python Languages.			L3 Applying		1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO4	Apply the Control assignment statements.			L3 Applying		1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO5	Solve for Build-in functions; Arrays; Loops.			L5 Evaluating		1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO6	Control the Switch operations' usage of break and continue statements.			L3 Applying		1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO7	Create flow charts, Algorithm and programming; Pointers; Structures; Functions; File management; Allocation of memory, etc. Application to physical and real-time problems.			L5 Evaluating		1,2,3,4,5,7,8,9	1,2,3,4,5,6,7

Program Articulation Matrix (CO-PO Matrix)																			
PO, PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CO1	3	2	3	3	3	3	2	3		3	2	2	3	2	3	3			
CO2	2	3	3	2	2		2	3	2		2	2	2	2	2	2	2		
CO3	3	2	2	3	3		3	2	3		3	3	3	3	3	3	3		
CO4	2	2	3	1	2		2	3	2		2	1	2	1	2	1	2		
CO5	2	3	2	2	2		2	2	2		2	2	2	2	2	2	2		
CO6	3	3	3	3	3		3	2	3		3	3	3	3	3	3	3		
CO7	3	2	2	3	3		2	3	2		3	3	3	3	3	3	2		
Average	2.57	2.43	2.57	2.43	2.57		2.43	2.43	2.43		2.57	2.29	2.43	2.43	2.43	2.43	2.43		

BARASAT GOVERNMENT COLLEGE
Course Outcome or Learning Outcome
Two year M.Sc. Degree Course
Under CBCS semester system
POST GRADUATE DEPARTMENT OF PHYSICS
With effect from the session: 2021 – 2022

Course Name: CORE COURSE-11

Course Code: PHSPCOR11T

Topic Name: ATOMIC, MOLECULAR & LASER PHYSICS

Course Outcome:	CO, PO & PSO Mapping									
	SI No	Course outcome			Knowledge level Blooms Level	POs Mapping	PSOs mapping			
CO1	After completion of this course the student will be able to				L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7			
CO2	Understand about Interaction of radiation with One & Many-electron atom.				L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7			
CO3	Realize the Line shape & width along with Relativistic one-electron atom.				L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7			
CO4	Study Nuclear motion, Microwave, IR & Electronic Spectroscopy				L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7			
CO5	Comprehend Molecular Symmetry & Group Theory with Raman effect.				L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7			
CO6	Learn about physics of LASERS in the modern optical technologies.				L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7			
CO7	Application of LASERS				L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7			

Program Articulation Matrix (CO-PO Matrix)																			
PO, PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CO1	3	2	3	3	2		2	2	2		3	3	3	3	3	3	3		
CO2	3	3	3	3	3		3	3	3		2	3	2	3	2	3	2		
CO3	1	2	2	2	2		2	2	2		1	1	1	1	1	1	1		
CO4	2	2	2	2	2		2	2	2		3	2	3	2	3	2	3		
CO5	2	2	2	2	2		3	3	3		2	2	2	2	2	2	2		
CO6	3	3	3	3	3		3	3	3		2	3	2	3	2	3	2		
CO7	2	2	2	2	2		2	2	2		2	2	2	2	2	2	2		
Average	2.29	2.29	2.43	2.43	2.29		2.43	2.43	2.43		2.14	2.29	2.14	2.29	2.14	2.29	2.14		

BARASAT GOVERNMENT COLLEGE
Course Outcome or Learning Outcome
Two year M.Sc. Degree Course
Under CBCS semester system
POST GRADUATE DEPARTMENT OF PHYSICS
With effect from the session: 2021 – 2022

Course Name: CORE COURSE-12

Course Code: PHSPCOR12T

Topic Name: SOLID STATE PHYSICS

Course Outcome:	CO, PO & PSO Mapping						
	SI No	Course outcome			Knowledge level Blooms Level	POs Mapping	PSOs mapping
CO1	Understand the Crystal Structure and Band theory of Solids.			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7	
CO2	Lattice Dynamics.			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7	
CO3	Comprehend Dielectric & Magnetic properties of solids.			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7	
CO4	Apply the fundamentals of Magnetic Resonance.			#REF!	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7	
CO5	Know about Imperfections in Solids & Optical properties.			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7	
CO6	Learn the concepts in Superconductivity.			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7	
				L3 Applying			

Program Articulation Matrix (CO-PO Matrix)																			
PO, PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CO1	3	2	3	3	2		2	2	2		3	3	3	3	3	3	3		
CO2	3	3	3	3	3		3	3	3		2	3	2	3	2	3	2		
CO3	1	2	2	2	2		2	2	2		1	1	1	1	1	1	1		
CO4	2	2	2	2	2		2	2	2		3	2	3	2	3	2	3		
CO5	2	2	2	2	2		3	3	3		2	2	2	2	2	2	2		
CO6	3	3	3	3	3		3	3	3		2	3	2	3	2	3	2		
Average	2.33	2.33	2.50	2.50	2.33		2.50	2.50	2.50		2.17	2.33	2.17	2.33	2.17	2.33	2.17		

BARASAT GOVERNMENT COLLEGE
Course Outcome or Learning Outcome
Two year M.Sc. Degree Course
Under CBCS semester system
POST GRADUATE DEPARTMENT OF PHYSICS
With effect from the session: 2021 – 2022

Course Name: CORE COURSE-13

Course Code: PHSPCOR13T

Topic Name: NUCLEAR & PARTICLE PHYSICS

Course Outcome:	CO, PO & PSO Mapping						
	SI No	Course outcome			Knowledge level Blooms Level	POs Mapping	PSOs mapping
CO1		Understand the Nuclear properties and Two-body bound state & scattering.			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO2		Comprehend Nuclear Structure & Reactions.			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO3		Learn Beta-decay, Weak & Strong Interactions.			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO4		Apply Electroweak theory			L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO5		Perform Experimental Techniques in Nuclear Physics.			L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO6		Know about Big Bang Nucleosynthesis.			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7

Program Articulation Matrix (CO-PO Matrix)																			
PO, PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CO1	3	2	3	3	2		2	2	2		3	2	3	2	3	2	3		
CO2	2	3	2	3	3		3	3	3		2	3	2	3	2	3	2		
CO3	3	2	2	2	2		2	2	2		2	1	1	2	1	2	1		
CO4	1	2	3	2	2		2	2	2		2	2	3	2	3	2	3		
CO5	3	2	2	2	2		3	3	3		3	2	2	2	2	2	2		
CO6	3	3	3	3	3		2	3	2		2	3	2	3	2	3	2		
Average	2.50	2.33	2.50	2.50	2.33		2.33	2.50	2.33		2.33	2.17	2.17	2.33	2.17	2.33	2.17		

BARASAT GOVERNMENT COLLEGE
Course Outcome or Learning Outcome
Two year M.Sc. Degree Course
Under CBCS semester system
POST GRADUATE DEPARTMENT OF PHYSICS
With effect from the session: 2021 – 2022

Course Name: CORE COURSE-14

Course Code: PHSPCOR14M

Topic Name: PROJECT PAPER (PROJECT REPORT, PRESENTATION & VIVA-VOCE)

Course Outcome:	CO, PO & PSO Mapping						
	SI No	Course outcome			Knowledge level Blooms Level	POs Mapping	PSOs mapping
CO1	Identify topics of interest for PG Course Project work.				L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO2	Learn to Focus on a definite problem after undergoing the PG Course.				L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO3	Execute a project work on a topic related to recent research interest in physics under the supervision / assistance of a supervisor (Teaching Faculty Members).				L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO4	Perform Theoretical / Experimental / Computational Investigation				L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO5	Calculate Specific Physical Parameters				L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO6	Present Project Talk for completion of the PG Course.				L4 Analysing	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7

Program Articulation Matrix (CO-PO Matrix)																			
PO, PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CO1	3	2	3	3	2		3	2	3		3	3	3	3	3	3	3		
CO2	2	3	2	3	3		3	3	3		2	2	2	3	2	3	2		
CO3	2	2	2	2	2		2	2	2		2	2	1	1	1	1	1		
CO4	2	2	3	2	2		2	2	2		3	3	3	2	3	2	3		
CO5	3	2	3	2	2		3	3	3		2	2	3	2	3	2	3		
CO6	3	3	3	3	3		2	3	2		2	3	2	3	2	3	2		
Average	2.50	2.33	2.67	2.50	2.33		2.50	2.50	2.50		2.33	2.50	2.33	2.33	2.33	2.33	2.33		

BARASAT GOVERNMENT COLLEGE
Course Outcome or Learning Outcome
Two year M.Sc. Degree Course
Under CBCS semester system
POST GRADUATE DEPARTMENT OF PHYSICS
With effect from the session: 2021 – 2022

Course Name: DISCIPLINE SPECIFIC ELECTIVE-1

Course Code: PHSPDSE01T

Topic Name: MATERIALS PHYSICS

Course Outcome:	CO, PO & PSO Mapping						
	SI No	Course outcome			Knowledge level Blooms Level	POs Mapping	PSOs mapping
CO1		Understand Equilibrium & Kinetics for material formation.			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO2		Comprehend Density Functional Theory (DFT).			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO3		Learn the aspects for preparation and characterization of material compounds.			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO4		Know the fundamentals for Thin Film formation & their properties.			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO5		Perform basics of Nano-materials.			L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO6		Learn the elements of Bio-compounds			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7

Program Articulation Matrix (CO-PO Matrix)																			
PO, PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CO1	3	2	3	3	2		3	2	3		3	3	3	3	3	3	3		
CO2	2	3	2	3	3		3	3	3		2	2	2	3	2	3	2		
CO3	2	2	2	2	2		2	2	2		2	2	1	1	1	1	1		
CO4	2	2	3	2	2		2	2	2		3	3	3	2	3	2	3		
CO5	3	2	3	2	2		3	3	3		2	2	3	2	3	2	3		
CO6	3	3	3	3	3		2	3	2		2	3	2	3	2	3	2		
Average	2.50	2.33	2.67	2.50	2.33		2.50	2.50	2.50		2.33	2.50	2.33	2.33	2.33	2.33	2.33		

BARASAT GOVERNMENT COLLEGE
Course Outcome or Learning Outcome
Two year M.Sc. Degree Course
Under CBCS semester system
POST GRADUATE DEPARTMENT OF PHYSICS
With effect from the session: 2021 – 2022

Course Name: DISCIPLINE SPECIFIC ELECTIVE-2

Course Code: PHSPDSE02T

Topic Name: STATISTICAL MECHANICS

Course Outcome:	CO, PO & PSO Mapping						
	SI No	Course outcome			Knowledge level Blooms Level	POs Mapping	PSOs mapping
CO1		Understand the Classical & Quantum Ising Model.			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO2		Comprehend the Principles of Computer Simulations.			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO3		Learn the concepts in Phase Transitions			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO4		Determine the Critical Phenomena.			L4 Analyzing	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO5		Perform to Real Gas systems			L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO6		Apply to Quantum Statistical Mechanics			L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7

Program Articulation Matrix (CO-PO Matrix)																			
PO, PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CO1	2	3	2	3	2		3	2	3		2	3	2	3	2	3	2		
CO2	3	3	2	3	3		3	3	3		2	2	2	3	2	3	2		
CO3	3	2	2	2	2		2	2	2		3	2	1	1	1	1	1		
CO4	2	2	3	2	2		2	2	2		3	3	3	2	3	2	3		
CO5	2	2	3	2	2		3	3	3		2	2	3	2	3	2	3		
CO6	3	3	3	3	3		2	3	2		2	3	2	3	2	3	2		
Average	2.50	2.50	2.50	2.50	2.33		2.50	2.50	2.50		2.33	2.50	2.17	2.33	2.17	2.33	2.17		

BARASAT GOVERNMENT COLLEGE
Course Outcome or Learning Outcome
Two year M.Sc. Degree Course
Under CBCS semester system
POST GRADUATE DEPARTMENT OF PHYSICS
With effect from the session: 2021 – 2022

Course Name: DISCIPLINE SPECIFIC ELECTIVE-3

Course Code: PHSPDSE03T

Topic Name: GRAVITATION

Course Outcome:	CO, PO & PSO Mapping						
	SI No	Course outcome			Knowledge level Blooms Level	POs Mapping	PSOs mapping
CO1		Understand Gravitation with an approach to Special Relativity			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO2		Relate to Lorentz transformation			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO3		Comprehend the Equivalence Principle & Geometrical Basis			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO4		Apply to General Theory of Relativity			L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO5		Determine the Schwarzschild solution			L4 Analysing	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO6		Realize the potential Research on Gravitation - An overview			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7

Program Articulation Matrix (CO-PO Matrix)																			
PO, PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CO1	2	3	2	3	2		3	2	3		2	3	2	3	2	3	2		
CO2	3	3	2	3	3		3	3	3		2	2	2	3	2	3	2		
CO3	3	2	2	2	2		2	2	2		3	2	1	1	1	1	1		
CO4	2	2	3	2	2		2	2	2		3	3	3	2	3	2	3		
CO5	2	2	3	2	2		3	3	3		2	2	3	2	3	2	3		
CO6	3	3	3	3	3		2	3	2		2	3	2	3	2	3	2		
Average	2.50	2.50	2.50	2.50	2.33		2.50	2.50	2.50		2.33	2.50	2.17	2.33	2.17	2.33	2.17		

BARASAT GOVERNMENT COLLEGE
Course Outcome or Learning Outcome
Two year M.Sc. Degree Course
Under CBCS semester system
POST GRADUATE DEPARTMENT OF PHYSICS
With effect from the session: 2021 – 2022

Course Name: DISCIPLINE SPECIFIC ELECTIVE-4

Course Code: PHSPDSE04T

Topic Name: CONDENSED MATTER PHYSICS ADVANCE – I (ADVANCE PAPER I)

Course Outcome:	CO, PO & PSO Mapping						
	SI No	Course outcome			Knowledge level Blooms Level	POs Mapping	PSOs mapping
CO1	Understand the Fundamentals of Many-Electron System in CMP		L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7		
CO2	Comprehend the concepts pertaining to Quasi-Electron & Plasmon.		L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7		
CO3	Learn the Spin-Spin Interaction		L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7		
CO4	Know the Advance principles in Superconductivity		L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7		
CO5	Realize the basics for Disordered Systems.		L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7		
CO6	Solve problems on the above stated topics.		L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7		

Program Articulation Matrix (CO-PO Matrix)																			
PO, PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CO1	3	3	2	3	2		3	2	3		3	3	2	3	2	3	3		
CO2	3	3	2	3	3		3	3	3		2	2	2	3	2	3	2		
CO3	2	2	1	2	2		2	2	2		2	2	1	2	2	1	2		
CO4	2	2	3	2	2		2	2	2		3	3	3	2	3	2	3		
CO5	2	2	2	2	2		3	3	3		2	2	3	2	3	2	3		
CO6	3	3	3	3	3		2	3	2		3	3	3	3	2	3	2		
Average	2.50	2.50	2.17	2.50	2.33		2.50	2.50	2.50		2.50	2.50	2.33	2.50	2.33	2.33	2.50		

BARASAT GOVERNMENT COLLEGE
Course Outcome or Learning Outcome
Two year M.Sc. Degree Course
Under CBCS semester system
POST GRADUATE DEPARTMENT OF PHYSICS
With effect from the session: 2021 – 2022

Course Name: DISCIPLINE SPECIFIC ELECTIVE-6

Course Code: PHSPDSE06T

Topic Name: CONDENSED MATTER PHYSICS ADVANCE – II (ADVANCE PAPER II)

Course Outcome:	CO, PO & PSO Mapping						
	SI No	Course outcome			Knowledge level Blooms Level	POs Mapping	PSOs mapping
CO1		Understand Symmetry in Crystals based on Point Groups & Bravais Lattices.			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO2		Comprehend Lattice Dynamics along with Dispersion Relations.			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO3		Learn about Electron States and concepts in Photo Electron Spectroscopy.			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO4		Know about the basics concerning Electronic Properties - I & II.			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO5		Solve Boltzmann Transport Equation			L4 Analysing	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO6		Distinguish between Hall Effect and Magnetoresistance in metals and semiconductors.			L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO7		Apply to Thermal processes, Cyclotron resonance, Landau Diamagnetism & de Hass-van Alphen Effect.			L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7

Program Articulation Matrix (CO-PO Matrix)																			
PO, PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CO1	3	3	2	3	2		3	2	3		3	3	2	3	2	3	3		
CO2	3	3	2	3	3		3	3	3		2	2	2	3	2	3	2		
CO3	2	2	1	2	2		2	2	2		2	2	1	2	2	2	2		
CO4	3	2	3	2	2		2	2	2		3	3	3	2	3	2	3		
CO5	2	3	2	2	2		3	3	3		2	2	3	2	3	2	3		
CO6	1	1	2	2	3		2	3	2		2	3	3	2	3	2	3		
CO7	2	2	3	2	2		2	2	2		3	2	3	2	3	3	3		
Average	2.29	2.29	2.14	2.29	2.29		2.43	2.43	2.43		2.43	2.43	2.43	2.43	2.43	2.57	2.57		

BARASAT GOVERNMENT COLLEGE
Course Outcome or Learning Outcome
Two year M.Sc. Degree Course
Under CBCS semester system
POST GRADUATE DEPARTMENT OF PHYSICS
With effect from the session: 2021 – 2022

Course Name: DISCIPLINE SPECIFIC ELECTIVE-8

Course Code: PHSPDSE08T

Topic Name: CONDENSED MATTER PHYSICS ADVANCE – II (ADVANCE PRACTICAL PAPER II)

Course Outcome:	CO, PO & PSO Mapping						
	SI No	Course outcome			Knowledge level Blooms Level	POs Mapping	PSOs mapping
CO1		Understand the concepts related to Mono & Di Atomic Lattice.			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO2		Comprehend on Van-der Pauw method for semiconductors.			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO3		Exploit the 4-Probe method for metal films and semiconductors.			L2 Understanding	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO4		Analyze the basics for Magnetoresistance.			#REF!	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO5		Study the characteristics in Frequency dependence dielectric constant.			L4 Analysing	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
CO6		Apply Quincke's method to study magnetic susceptibility of FeCl ₃ / MnSO ₄			L3 Applying	1,2,3,4,5,7,8,9	1,2,3,4,5,6,7
					L4 Analysing		

Program Articulation Matrix (CO-PO Matrix)																			
PO, PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CO1	3	3	2	3	2		3	2	3		3	3	2	3	2	3	3		
CO2	3	3	2	3	3		3	3	3		2	2	2	3	2	3	2		
CO3	2	2	3	2	2		2	2	2		2	2	1	2	2	2	2		
CO4	3	2	3	2	2		2	2	2		3	3	3	2	3	2	3		
CO5	2	3	3	2	2		3	3	3		2	2	3	2	3	2	3		
CO6	1	1	2	2	3		2	3	2		2	3	3	3	2	3	2		
Average	2.33	2.33	2.50	2.33	2.33		2.50	2.50	2.50		2.33	2.50	2.33	2.50	2.33	2.50	2.50		