



दिल्ली विश्वविद्यालय University of Delhi

परिषद शाखा - II, कमरा नं: 211, नया प्रशासनिक खंड, दिल्ली विश्वविद्यालय, दिल्ली-110007, दूरभाष: 011-27001156/54
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CNC-II/093/1/Misc./2026/52

Dated: 07.09.2026

NOTIFICATION

Sub: Amendment to Ordinance V

Following addition be made to Appendix-II-A to the Ordinance V (2-A) of the Ordinances of the University;

Add the following:

The syllabi of structure-III (Research only) in MSc. Physics for Semester-3 for two-year PG and Semester-I for one year PG in the Department of Physics under Faculty of Science based on Postgraduate Curriculum Framework 2024, are hereby notified for the information of all concerned as per Annexure-1.

REGISTRAR

UNIVERSITY OF DELHI

MASTER OF SCIENCE in PHYSICS

(Two-Year Program (2nd year) and One-Year Program-NEP)

(Research only)

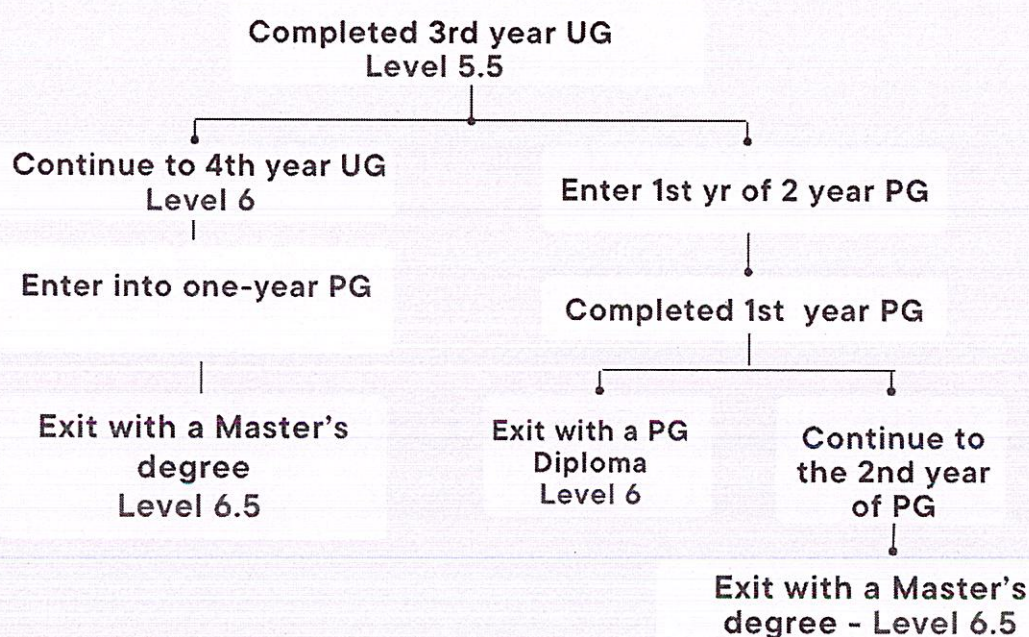
(Effective from Academic Year 2025-26)

Proposed Postgraduate Curricular Framework 2025
(based on NEP 2020)

LEVELS 6 AND 6.5



Progression from UG to PG



Programme Specific Outcomes (PSOs)

- ❖ Understanding the basic concepts of physics particularly concepts in classical mechanics, quantum mechanics, statistical mechanics and electricity and magnetism to appreciate how diverse phenomena observed in nature follow from a small set of fundamental laws through logical and mathematical reasoning.
- ❖ Learn to carry out experiments in basic as well as certain advanced areas of physics such as nuclear physics, condensed matter physics, nanoscience, lasers, and electronics.
- ❖ Understand the basic concepts of certain sub fields such as nuclear and high energy physics, atomic and molecular physics, solid state physics, and plasma physics, and astrophysics, general theory of relativity, nonlinear dynamics and complex systems.
- ❖ Gain hands-on experience to work in applied fields.
- ❖ Enhancing skills in experimental techniques and computation
- ❖ Gain a thorough grounding in the subject to be able to teach it at college and school levels.
- ❖ Viewing physics as a training ground for the mind to develop a critical attitude and a faculty of logical reasoning that can be applied to diverse fields.

Programme Structure

The M. Sc. programme is a two-year course divided into four semesters. A student is required to complete 88 credits (LEVEL 6 AND 6.5) for the completion of the course and the award of degree. The student who exits after one year at level 6 (44 credits) and acquires required credits shall be awarded with a PG diploma. The M.Sc. Physics Programme would make the students competent in natural science, viz., Physics, and help them understand its role in modern day technology. Overall, the course would enable the students to understand the fundamental concepts and experimental methods of physics which would help them to innovate/apply/generate new devices/applications/insights/knowledge. Knowledge gained through the open electives would be an asset in branching out in fields other than physics.

		Semester	Semester
Part – I	First Year	Semester I	Semester II
Part – II	Second Year	Semester III	Semester IV

**PG curricular structure for 2nd year of PG Programmes (3+2)
& 1 year PG Programme (4+1)
(Research only)**

Course Credit Scheme for M.Sc. Physics

S e m e s t e r	Core Courses			Elective Course course related or allied to the area identified for research			Research Methods / Tools/ Writing			Intensive problem based research	Total Credits
	No. of papers	Credits (L+T+P)	Total Credits	No. of papers	Credits (L+T+P)	Total Credits	No. of papers & Name	Credits (L+T+P)	Total Credits		
III	01 DSC7	3+1+0	04	DSE5 1 DSE	4	4	02 1. Advanced Research Methodology in Physics 2. Tool for Research in Physics	1+0+1	04	Credits: 10	22
IV				DSE6 1 DSE	4	4	01 Techniques of research writing in Physics	1+0+1	02	Credits: 16	22
Total Credits for the Course											44

The mode(s) of internal assessment will vary from course to course. The internal assessment marks will be based on performance in tests / quizzes / assignments / project work / presentations / attendance, etc. All laboratory courses will be evaluated based on continuous evaluation and end-of semester examination as per the university's rules.

2 Year M.Sc. Programme (Semester Wise)

Semester III				
Number of core courses: 2	Credits in each core course			
CORE COURSE:	Lecture	Tutorial	Practical	Credits
PH-DSC5103: Physics of Emerging Technologies	3	1	0	4
Total credits in Core courses				4
Number of Elective/Open Elective courses	Credits in each elective course			
ELECTIVE COURSES: (Select 1 DSE courses: related to identified research field)	Lecture	Tutorial	Practical	Credits
PH-DSE5111: Physics at the Nanoscale – I (Theory)	3	1	0	4
PH-DSE5113: Advanced Electronics - I (Theory)	3	1	0	4
PH-DSE5115: Advanced Nuclear Physics – I (Theory)	3	1	0	4
PH-DSE5117: Fundamentals of Spectroscopy (Theory)	3	1	0	4

PH-DSE5119:Advanced Solid State Physics –I (Theory)	3	1	0	4
PH-DSE5131:General Theory of Relativity and Cosmology I	3	1	0	4
PH-DSE5132: Condensed Matter Physics I	3	1	0	4
PH-DSE5133: Plasma Physics I	3	1	0	4
PH-DSE5134: Particle Physics I	3	1	0	4
PH-DSE5135: Quantum Field Theory I	3	1	0	4
PH-DSE5136: Basics of Astronomy and Observational Techniques	3	1	0	4

ELECTIVE COURSES	Lecture	Tutorial	Practical	Credits
PH-DSE5137: Radio Astronomy and Instrumentation	2	0	2	4
PH-DSE5138: Fluid Dynamics	3	1	0	4
PH-DSE5139: Nonlinear Dynamics	3	1	0	4
PH-DSE5140: Applied Physics	3	1	0	4
PH-DSE5141: Quantum Information and Computation	3	1	0	4
PH-DSE5142: Computational Material Science	3	0	1	4

PH-DSE5143: Quantum Optics	3	1	0	4
PH-DSE5144: Atmospheric Physics	3	1	0	4
PH-DSE5145: X-ray Spectroscopic Techniques	3	1	0	4
PH-DSE5146: Complex Systems	3	1	0	4
PH-DSE5147: Accelerator Physics	3	1	0	4
PH-DSE5148: Research Methodology in Physics	3	0	1	4
Total credits in Elective course				4
RESEARCH METHODS/TOOLS/WRITING	Lecture	Tutorial	Practical	Credits
PH-RMT5101: Advanced Research Methodology in Physics	1	0	1	2
PH-RMT5102: Tool for Research in Physics	1	0	1	2
Total credits in Research Methods/ Tools/ Writing Course				4
INTENSIVE PROBLEM BASED RESEARCH				
PH-RES5101: RESEARCH	credits: 10			10
Total credits in Intensive problem based research Course				10

Total credits in Semester III	22
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1 Year M.Sc. Programme (Semester Wise)

Semester I				
Number of core courses: 2		Credits in each core course		
CORE COURSE:	Lecture	Tutorial	Practical	Credits
PH-DSC5103:Physics of Emerging Technologies	3	1	0	4
Total credits in Core courses				4
Number of Elective course: 01		Credits in each elective course		
ELECTIVE COURSES: (Select 1 DSE course related to identified research field)	Lecture	Tutorial	Practical	Credits
PH-DSE5111:Physics at the Nanoscale – I (Theory)	3	1	0	4
PH-DSE5113: Advanced Electronics - I (Theory)	3	1	0	4
PH-DSE5115:Advanced Nuclear Physics – I (Theory)	3	1	0	4
PH-DSE5117:Fundamentals of Spectroscopy (Theory)	3	1	0	4
PH-DSE5119:Advanced Solid State Physics – I (Theory)	0	0	4	4
PH-DSE5131:General Theory of Relativity and Cosmology I	3	1	0	4

PH-DSE5132: Condensed Matter Physics I	3	1	0	4
PH-DSE5133: Plasma Physics I	3	1	0	4
PH-DSE5134: Particle Physics I	3	1	0	4
PH-DSE5135: Quantum Field Theory I	3	1	0	4
PH-DSE5136: Basics of Astronomy and Observational Techniques	3	1	0	4
PH-DSE5137: Radio Astronomy and Instrumentation	2	0	2	4
PH-DSE5138: Fluid Dynamics	3	1	0	4
PH-DSE5139: Nonlinear Dynamics	3	1	0	4
PH-DSE5140: Applied Physics	3	1	0	4
PH-DSE5141: Quantum Information and Computation	3	1	0	4
PH-DSE5142: Computational Material Science	3	0	1	4
PH-DSE5143: Quantum Optics	3	1	0	4
PH-DSE5144: Atmospheric Physics	3	1	0	4
PH-DSE5145: X-ray Spectroscopic Techniques	3	1	0	4
PH-DSE5146: Complex Systems	3	1	0	4
PH-DSE5147: Accelerator Physics	3	1	0	4

PH-DSE5161: Quantum Mechanics I	3	1	0	4
PH-DSE5162: Electronics	3	1	0	4
Total credits in Electives/General Electives				4
RESEARCH METHODS/TOOLS/WRITING	Lecture	Tutorial	Practical	Credits
PH-RMT5101: Advanced Research Methodology in Physics	1	0	1	2
PH-RMT5102: Tool for Research in Physics	1	0	1	2
Total credits in Research Methods/ Tools/ Writing Course				4
INTENSIVE PROBLEM BASED RESEARCH				
PH-RES5101: RESEARCH	credits: 10			10
Total credits in Intensive problem based research Course				10
Total credits in Semester I				22
<i>Note:</i> Core and Elective Courses from 1st-year M.Sc. can be taken as electives only if they were not studied during the UG degree				

MASTER of SCIENCE in PHYSICS
Semester III of 2-year MSc/ Semester I of 1-year MSc
Course Code: PH-DSC5103
Course Name: Physics of Emerging Technologies

Course Title and Code	Credits	Credit distribution of the course			Prerequisite of the course
		Lecture	Tutorial	Practical	
Physics of Emerging Technologies DSC	4	3	1	0	

Duration: 60 Hours (45L+15T)

Course Objective

The objective of this course is to introduce students to selected thrust areas of contemporary physics research that underpin emerging technologies aligned with National Missions. The course develops the physics of advanced materials, quantum technologies, and sustainable energy systems, with an emphasis on fundamental mechanisms, physical limits, and connections to the MSc core curriculum for students opting for the research-only structure in the M.Sc. It also introduces modern computational approaches, including density functional theory, numerical modeling, and representative problems in materials, quantum, and energy physics.

Course Learning Outcomes

On successful completion of the course, students will be able to:

1. Explain the physical principles governing selected advanced materials and relate microscopic properties to macroscopic functionality.
2. Analyze quantum information systems and relate these principles to physical qubit platforms, communication, and sensing.
3. Apply thermodynamic, kinetic and transport principles to analyse renewable-energy conversion, hydrogen technologies and electrochemical energy storage.
4. Formulate and investigate representative problems in materials, quantum and energy physics computationally, with introductory exposure to DFT, numerical simulation.

Unit I: Advanced Materials [12 hours]

Technologically important materials for applications: Semiconducting, Optical, Scintillating, Spintronics and Electrochemical materials; Photocatalytic, and Adsorptive materials, Bandgap engineering. Functional multiferroic materials: Ferroelectric, Ferromagnetic, Piezoelectric, Sensors, and Transducers. Thin films & nanostructure technology. Multi-dimensional nanostructures, Dimensionality and surface effects, quantum confinement, Graphene & Carbon nanotubes.

Unit II: Quantum Technologies [12 hours]

Historical overview and fundamentals of quantum technology; quantum cryptography, experimental platforms: superconducting qubits, trapped-ions, photonic, and spin qubits; coherent quantum control, gate fidelity, physical scaling constraints and their connectivity, crosstalk, dephasing and decoherence, coherence time, comparison among different platforms, basic principles of quantum error correction.

Unit III: Sustainable Energy [11 hours]

Renewable and nonrenewable energy sources, physical scaling of hydro, geothermal, and bioenergy systems, Electrochemical energy conversion and storage, reaction kinetics, Butler–Volmer equation; transport and polarization losses; electrolyzers and fuel cells; overview of hydrogen-storage and production, Diffusion and intercalation; electrode degradation; rechargeable Li-ion batteries and beyond, supercapacitors and hybrid storage.

Unit IV: Computational Physics [10 hours]

Electronic-structure calculations: Many-body Schrodinger equation and overview of density functional theory (DFT); Local Density Approximation and Generalized Gradient Approximations: band structures, density of states, doping and defects, materials-property calculations including magnetic properties, band gap engineering, electrochemical analysis, hydrogen production, energy-storage system simulations and thermoelectric; validation of experimental data.

Tutorials [15 hours]

Quantitative and computationally oriented problems, with emphasis on advanced-material properties, quantum dynamics and information, energy-conversion and storage limits, numerical modeling, interpretation of computational results and comparison with experimental data.

Recommended Readings

1. S. O. Kasap, *Principles of Electronic Materials and Devices*. New York, NY, USA: McGraw-Hill.(2020)
2. C. Kittel, *Introduction to Solid State Physics*. Hoboken, NJ, USA: Wiley. (2004)
3. M. A. Nielsen and I. L. Chuang, *Quantum Computation and Quantum Information*. Cambridge, U.K.: Cambridge University Press.(2010)
4. H.-P. Breuer and F. Petruccione, *The Theory of Open Quantum Systems*. Oxford, U.K.: Oxford University Press.(2007)
5. R. A. Dunlap, *Sustainable Energy*. Boston, MA, USA: Cengage Learning.(2018)
6. J. Newman and K. E. Thomas-Alyea, *Electrochemical Systems*. Hoboken, NJ, USA: Wiley.(2004)
7. R. M. Martin, *Electronic Structure: Basic Theory and Practical Methods*. Cambridge, U.K.: Cambridge University Press.(2004)
8. J. M. Thijssen, *Computational Physics*. Cambridge, U.K.: Cambridge University Press.(1999)
9. S. Chandra, *Photoelectrochemical Solar Cells*. New York, NY, USA: Gordon and Breach.(1985)
10. G. Boyle, *Renewable Energy: Power for a Sustainable Future*. Oxford, U.K.: Oxford University Press.(1996)
11. D. Linden and T. B. Reddy, Eds., *Linden's Handbook of Batteries*. New York, NY, USA: McGraw-Hill.(2010)
12. F. Giustino, *Materials Modelling Using Density Functional Theory: Properties and Applications*. Oxford, U.K.: Oxford University Press.(2014)

MASTER of SCIENCE in PHYSICS
Semester III of 2-year MSc/ Semester I of 1-year MSc
Course Code: PH-RMT5101
Course Name: Advanced Research Methodology in Physics

Course Title and Code	Credits	Credit distribution of the course			Pre-requisite of the course
		Lecture	Tutorial	Practical	
Advanced Research Methodology in Physics RMT	2	1	0	1	Research Methodology in Physics

Duration: (15L+30P) 45 Hours

Course Objectives

The objective of this course is to develop a deeper understanding of how physical models are formulated, tested, and evaluated when multiple explanations of the same data are possible. Emphasis is placed on identification of measurable quantities, determination of model parameters from experimental observations, comparison between competing physical descriptions, and interpretation of empirical relations connecting physical variables. The course develops the ability to judge whether conclusions drawn from theoretical calculations or experimental measurements are reliable within stated assumptions and approximations.

Course Learning Outcomes

Students will develop the ability to identify physical observables, model parameters, and assumptions underlying theoretical and experimental descriptions. They will learn to analyse parameter sensitivity, extract physical quantities from data, compare models, and evaluate their consistency with observations. Through scaling analysis, uncertainty estimation, and computational validation of physical models, students will develop the ability to assess the reliability, applicability, and limitations of physical descriptions across different systems.

Unit I: Physical Models and Inference

(15 Hours)

Physical observables and measurable quantities, SI units defined in terms of fundamental constants, dimensional consistency of physical relations, identification of dominant variables, role of symmetry and conservation laws in simplifying models, limiting cases and consistency checks, forward and inverse problems in physics, sensitivity of physical predictions to parameter variation, parameter correlations and degeneracy, uncertainty propagation through models, reliability and interpretation of parameter estimation, comparison between alternative physical models describing the same data, examples from oscillations, diffusion, and transport processes.

Unit II: Data Analysis and Model Validation

(30 Hours)

*Few computational exercises are given below and instructors can develop similar exercises on their own based upon Unit I. **Students should do minimum two exercises based on their research area.***

Exercise 1: Determine semiconductor band gap from temperature-dependent conductivity or optical absorption data using appropriate physical models, parameter estimation, and uncertainty analysis.

Exercise 2: Verify diffusion scaling relation using random walk simulations, identify the relevant scaling behaviour, and analyse the validity of the underlying physical assumptions and approximations.

Exercise 3: Analyse temperature dependence of electrical resistivity data, compare competing transport models, identify characteristic regimes, and determine the limits of validity of different theoretical descriptions.

Exercise 4: Propagate uncertainty in lattice parameters to calculated material properties such as density and elastic parameters, and study sensitivity of physical predictions to measurement uncertainties.

Exercise 5: Estimate nuclear decay constants and half-lives from radioactive decay data using exponential decay models, parameter estimation, and analysis of deviations from ideal behaviour.

Exercise 6: Analyse particle scattering data to extract cross sections, compare experimental results with theoretical predictions, and identify possible systematic deviations between model and observation.

Exercise 7: Analyse temperature dependence of magnetic susceptibility using the Curie–Weiss model, determine magnetic parameters from experimental data, and evaluate the range of validity of the model.

Exercise 8: Simulate a two-state statistical system to determine energy fluctuations and heat capacity, analyse the emergence of macroscopic behaviour from microscopic parameters, and examine the validity of statistical approximations.

Suggested Readings

1. P. R. Bevington and D. K. Robinson, Data Reduction and Error Analysis for the Physical Sciences, McGraw–Hill. (2003)
2. J. R. Taylor, An Introduction to Error Analysis, University Science Books. (1997)
3. W. H. Press et al., Numerical Recipes, Cambridge University Press. (2007)

4. N. W. Ashcroft and N. D. Mermin, *Solid State Physics*, Cengage Learning.(1976)
5. D. J. Griffiths, *Introduction to Elementary Particles*, Cambridge University Press.(1987)
6. R. K. Pathria and Paul D. Beale, *Statistical Mechanics*, Elsevier.(2011)

MASTER of SCIENCE in PHYSICS
Semester III of 2 year MSc/Semester I of 1 year MSc
Course Code: PH-RMT5102
Course Name: Tool for Research in Physics

Course Title and Code	Credits	Credit distribution of the course			Pre-requisite of the course
		Lecture	Tutorial	Practical	
Tools for research in Physics RMT	2	1	0	1	Research Methodology in Physics

Duration:(15L+30P) 45 Hours

Course Objectives

The objective of this course is to develop an understanding of how experimental data are analysed to extract physical parameters, test physical relations, and evaluate competing models. Emphasis is placed on uncertainty, parameter estimation, scaling behaviour, characteristic physical scales, model comparison, and the limits of validity of physical descriptions, supported by guided computational analysis of representative datasets.

Course Learning Outcome

Students will learn how experimental data are analysed to extract physical parameters, test physical relations, and compare alternative models. They will develop the ability to identify uncertainty, noise, systematic deviations, scaling behaviour, and characteristic physical scales in measured data. Through guided computational exercises, students will learn to assess the validity and limitations of physical models and to present quantitative results in a clear and reproducible form.

Unit I: Data Preparation, Calibration, and Simulation-Based Validation (15 Hours)

Physical observables and measured quantities; preparation and representation of experimental data; calibration, normalization, background correction, and measurement resolution; random and systematic uncertainties; propagation of uncertainties; extraction of physical parameters from data; sensitivity of results to parameter variation; correlation and degeneracy between parameters; use of residuals and consistency checks; identification of linear, nonlinear, and scaling behaviour; characteristic physical scales; comparison of simple physical models and determination of their range of validity; examples from nuclear physics, plasma, condensed matter, thin films, nanoscience, spectroscopy, and diffusion and transport measurements.

Unit II: Data analysis and model validation (30 Hours)

Computer-based analysis of supplied experimental datasets from nuclear physics, plasma, astrophysics, condensed matter physics, materials science, thin films, nanoscience, and spectroscopy, etc.

Exercise 1: Experimental Data and Uncertainty

Calculation of averages and spreads; use of error bars; identification of random scatter, outliers, and systematic trends.

Exercise 2: Determination of Physical Parameters from Data

Extraction of model parameters from supplied measurements; comparison of fitted and measured values; interpretation of fitted parameters and their uncertainties; study of parameter sensitivity and correlation. Examples may include resistance and temperature, optical absorption, thin-film thickness dependence, relaxation measurements, or spectral peak data.

Exercise 3: Testing a Physical Model Against Experiment

Comparison of theoretical or phenomenological predictions with experimental data; graphical inspection of agreement and deviation; analysis of residuals; identification of systematic departures from the model; distinction between experimental uncertainty and possible inadequacy of the assumed model.

Exercise 4: Identifying Power Laws and Scaling Relations

Identification of simple linear and power-law trends in experimental data; use of suitable plots to estimate characteristic scales and scaling parameters. Examples: resistivity versus temperature, film thickness versus resistance, particle size versus optical response, and frequency-dependent measurements.

Exercise 5: Model Comparison and Validity

Comparison of two simple models for the same experimental data; identification of the better fit and the range over which each model is valid. Examples: two different distribution functions fitted to a same spectral peak, linear versus nonlinear resistance–temperature behaviour, different optical absorption models.

Note: *Students should do minimum two exercises based on their research area.*

Suggested Readings.

1. W. H. Press et al., *Numerical Recipes: The Art of Scientific Computing*, Cambridge University Press (2007).
2. P. R. Bevington and D. K. Robinson, *Data Reduction and Error Analysis for the Physical Sciences*, McGraw-Hill, (2003)
3. J. R. Taylor, *An Introduction to Error Analysis*, University Science Books, (1997).
4. M. Newman, *Computational Physics*, CreateSpace Independent Publishing, (2012)

MASTER of SCIENCE in PHYSICS
Semester III of 2 year MSc/ Semester I of 1 year MSc

Course Code: PH-RES5101

Course Name: RESEARCH

Course Title and Code	Credits	Credit distribution of the course			Pre-requisite of the course
		Lecture	Tutorial	Practical	
Research	10				

Total: ... Hours

Course Objectives

The Research track aims to provide students with an opportunity to undertake independent research on a topic of current interest in physics and applied physics. It enables them to apply the theoretical, computational, and experimental skills acquired during the programme to investigate a research problem in a systematic manner.

Course Learning Outcomes

Learning outcomes of semester III of the PG Course Structure 3 focused on Research (as per the regulation of the University of Delhi)

The following four outcomes must be achieved by the end of III Semester:

- (i) Research Problem identification
- (ii) Review of literature
- (iii) Research design formulation
- (iv) Phase I of research (for e.g. Initial phase of research experimentation, completion of pilot project etc.)

Notes:

1. The Research project chosen should be an original work and not a repetition of work done in the 4th Year of the UG programme. It may be an extension though of the work done in the 4th Year of UG programme.
2. Evaluation of research work will be done as per guideline issued by the University.
3. The **Research** track will normally be available only to the **top 10% of students** in the two-year M.Sc. programme and the **top 10% of students** admitted to the one-year M.Sc. programme.
4. The exact cutoff for eligibility may vary from year to year based on academic performance and other relevant considerations.
5. The allocation of the Research Project track is subject to the availability of faculty supervisors.

6. The allocation of experimental research projects shall be contingent upon the availability of laboratory space, research facilities, scientific instrumentation, and other necessary infrastructure within the Department, as well as the availability of financial support under the supervisor's research grants or projects.
7. The Departmental Course Assignment Committee shall review the situation annually and may modify the eligibility criteria, selection process, and number of available Dissertation/Project positions as deemed appropriate.
8. Selection for the Research track will be made on a case-by-case basis in accordance with the prevailing guidelines approved by the Department.
9. Students of the two-year M.Sc. programme opting for a Research track must have **no Essential Repeat (ER)** in any course at the time of selection.

Syllabus of elective courses can be found in Structure-I (Coursework only) & II (Coursework+Research).