



MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY BATHINDA-151001 (PUNJAB), INDIA

(A State University Estb. by Govt. of Punjab vide Punjab Act No. 5 of 2015 and Approved u/s 2(f) & 12 (B) of UGC; Member AIU)

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

Program: M.Sc. (Physics)

COs, POs Mapping

Subject: Classical Mechanics	Subject Code: MPHYS1-101	Semester: 1st
Credit: 4	L T P 4 0 0	Duration: 60 Hrs.

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Understand the fundamental Laws of motion and apply Lagrangian & Hamiltonian formulations to the motion of particles.	3	2	1	1	1	2	3	2
CO2	Gain the fundamental knowledge of kinematics of rigid body in detail and ideas regarding Euler's equations of motion.	3	2	1	2	2	2	2	1
CO3	Learn the theory of small oscillations in detail along with basis of free vibrations.	2	1	2	2	2	1	3	1
CO4	Acquire the skill of solving mathematical equations in terms of Poisson brackets and Hamilton-Jacobi equation.	1	3		2	1	1	2	2

Enter Correction levels 1, 2 or 3 as defined below:

1. Slight (Low) - upto 30% 2. Moderate (Medium) – above 30% and upto 70% 3. Substantial (High) – above 70%



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

Program: M.Sc. (Physics)

COs, POs Mapping

Subject: Statistical Physics	Subject Code: MPHYS1-102	Semester: <u>1st</u>
Credit: <u>4</u>	L T P <u>4 0 0</u>	Duration: <u>60 Hrs.</u>

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Understanding the concepts of statistical basis of thermodynamics, ensemble theory, Quantum Statistics, and phase transition theory.	3	2	1	2	2	2	2	3
CO2	Skill enhancement to solve numerical problems related with statistical Physics.	2	3	2	3	1	1	2	2
CO3	Apply knowledge of Statistical Physics to go for higher studies in diverse fields and Job Prospects.	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

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Department: Department of Physics
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Program: M.Sc. (Physics)

COs, POs Mapping

Subject: Mathematical Physics	Subject Code: MPHYS1-103	Semester: <u>1st</u>
Credit: <u>4</u>	L T P <u>4 0 0</u>	Duration: <u>60 Hrs.</u>

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Understand the concept of linear algebra, vector space, integral, differential equations along with special functions.	3	2	1	1	1	2	3	2
CO2	Skill enhancement to solve numerical problems related with Mathematical Physics.	3	2	1	2	2	2	2	1
CO3	Apply knowledge of Mathematical Physics to go for higher studies in diverse fields and job prospects.	2	1	2	2	2	1	3	1
CO4	To inculcate and develop the ability to think abstractly.	1	3		2	1	1	2	2

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Program: M.Sc. (Physics)

COs, POs Mapping

Subject: Electronics	Subject Code: MPHYS1-104	Semester: <u>1st</u>
Credit: <u>4</u>	L T P <u>4 0 0</u>	Duration: <u>60 Hrs.</u>

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Basics of electronic devices like: Metal oxide semiconductors, UJT, JFET, MOSFET, Charge coupled Devices and Tunnel Diode.	3	1	1	3	1	3	2	1
CO2	Basic idea about Operational Amplifier and its applications in Analog systems.	3	1	1	3	2	1	1	3
CO3	Learning Boolean algebra and its use in encoder, decoder Multiplexers and Demultiplexers.	3	1	3	3	3	3	1	1
CO4	Sound knowledge about RAM/ROM D/A & A/D converters and use of microprocessor Intel μ P 8085.	1	1	3	3	3	3	2	2

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Program: M.Sc. (Physics)

COs, POs Mapping

Subject: Electronics Lab.	Subject Code: MPHYS1-105	Semester: <u>1st</u>
Credit: <u>3</u>	L T P <u>0 0 6</u>	Duration: <u>60 Hrs.</u>

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Hands on in finding the characteristics of various semiconductors like diode, transistor, JFET, MOSFET, Tunnel Diode etc.	3	1	1	3	1	3	2	1
CO2	FlipFlop as a building block about memory including RAM,ROM	3	1	1	3	2	1	1	3
CO3	Microprocessor and assembly language programming with special reference to Intel μ P 8085.	3	1	3	3	3	3	1	1
CO4	Learning Adders, Subtractors, Shift Registers, and multivibrators using 555 ICs.	1	1	3	3	3	3	2	2

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Program: M.Sc. (Physics)

COs, POs Mapping

Subject: Computer Programming Lab.	Subject Code: MPhys1-106	Semester: 1st
Credit: 3	L T P 0 0 6	Duration: 90 Hrs.

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Able to understand the concept of computational Physics.	3	2	3	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 team work.	1	2	2	2	1	2	2	3

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COs, POs Mapping

Subject: Quantum Mechanics-I	Subject Code: MPHYS1-207	Semester: 2nd
Credit: 4	L T P 4 0 0	Duration: 60 Hrs.

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Understand the concept of basic formulation, quantum kinematics and dynamics, one dimensional systems and theory of angular momentum.	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		2	2	1	2	2

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COs, POs Mapping

Subject: Electrodynamics-I	Subject Code: MPhys1-208	Semester: <u>2nd</u>
Credit: <u>4</u>	L T P <u>4 0 0</u>	Duration: <u>60 Hrs.</u>

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Understand the concept of electrostatics, magneto statics, Time varying fields and electromagnetic waves.	3	2	3	2	2	2	2	1
CO2	Skill enhancement to solve numerical problems related with Electrodynamics.	2	1	3	2	2	1	2	2
CO3	Apply knowledge of Electrodynamics to go for higher studies in diverse fields.	1	2	1	2	2	2	2	2
CO4	To inculcate and develop the ability to think abstractly.	1	2	2	2	1	2	2	3

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COs, POs Mapping

Subject: Atomic Molecular Physics	Subject Code: MPHYS1-209	Semester: 2nd
Credit: 4	L T P 4 0 0	Duration: 60 Hrs.

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	To understand the interaction between the spin and orbital angular momentum of one and two electron atoms (atomic systems) and their implementation on energy levels in materials.	3	3	1	2		1	2	
CO2	To comprehend the impact of electric and magnetic fields on the spectra of different elements.	3	3	1	2	1	2	1	1
CO3	Understanding rotational, vibrational, electronic and Raman spectra of molecules and their applications.	3	3	1	3	1	2	3	1
CO4	To gain knowledge of electron spin resonance, and NMR spectroscopy required in research fields.	3	2	1	3	1	2	3	1

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COs, POs Mapping

Subject: Condensed Matter Physics	Subject Code: MPHYS1-210	Semester: 1st
Credit: 4	L T P 4 0 0	Duration: 60 Hrs.

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
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	3	2	3	3	2	2	2
CO2	Knowledge of lattice vibrations, phonons and in depth of knowledge of Einstein and Debye theory of specific heat of solids.	2	1	3	1	2	1	3	2
CO3	Understanding above the band theory of solids and must be able to differentiate insulators, conductors and semiconductors.	1	3	3	1	2	2	3	2
CO4	Secured an understanding about the magnetic, dielectric and superconducting phases of the materials.	2	1	1	2	1	1	1	2

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Program: M.Sc. (Physics)

COs, POs Mapping

Subject: Advanced Optics and spectroscopy Lab.	Subject Code: MPHYS1-211	Semester: <u>2nd</u>
Credit: <u>3</u>	L T P <u>0 0 6</u>	Duration: <u>90 Hrs.</u>

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Impart knowledge about design and applications of interferometers.	3	2	3	2	2	2	2	1
CO2	Experimental knowledge of modern days lasers.	2	1	3	2	2	1	2	2
CO3	Understand the different type of losses in signals in optical fibers and their measurements.	1	2	1	3	2	2	2	2
CO4	Understand the basic fundamentals of diffraction, polarization, refraction of light using Young's double slit experiment, Michelson interferometer, Febry-Perot interferometer, Brewster angle, Bragg's law, refractive index of a prism.	1	2	2	2	1	2	2	3

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Program: M.Sc. (Physics)

COs, POs Mapping

Subject: Condensed Matter Physics Lab	Subject Code: MPHYS1-212	Semester: 2nd
Credit: 3	L T P 0 0 6	Duration: 90 Hrs.

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Learning characteristics of LED, phot-diode, solar cell etc.	1	2	3	2	1	2	2	2
CO2	Characterization of material properties like: magneto-resistive, M(H), Ten Delta, Curie temperature etc.	1	1	2	2	3	2	2	3
CO3	Use of X-Ray diffraction tool for crystal structure analysis of the material.	1	3	1	1	1	1	3	2
CO4	Acquaintance with thin film preparation techniques.	2	2	3	1	3	2	2	1

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Program: M.Sc. (Physics)

COs, POs Mapping

Subject: Seminar	Subject Code: MPHYS1-213	Semester: <u>1st</u>
Credit: <u>1</u>	L T P <u>0 0 2</u>	Duration: <u>30 Hrs.</u>

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Student shall learn presentation skills	3	1	3	2	3	1	2	2
CO2	Improve communication skills	1	2	1	1	3	2	1	3
CO3	Acquaintance with teaching aptitude.	3	3	1	1	1	1	2	2
CO4	Improve learning by 'Teaching and Learning Method'	1	2	1	1	3	2	1	1

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Program: M.Sc. (Physics)

COs, POs Mapping

Subject: Nuclear Physics	Subject Code: MPHYS1-314	Semester: 3rd
Credit: 4	L T P 4 0 0	Duration: 60 Hrs.

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Understanding the structure and general properties of nucleus and nuclear forces and build the foundation for seeking research in the field of nuclear physics nuclear astrophysics, and high energy physics.	3	2	1	1	2	1	1	1
CO2	Learn the mechanism of different nuclear reactions and their controlling conditions/parameters that gives a basic idea of how nuclear power can be generated.	3	2		1	2		2	2
CO3	Acquire the skill of finding unknown properties (charge, spin-parity, angular momentum etc.) of various nuclei using different nuclear models.	3	3	1	3	1	1	2	3
CO4	Learn the detailed nuclear beta decay process, nuclear isomerism and selection rules for allowed and forbidden beta decay.	3	2	1	1	2	1	1	1

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Program: M.Sc. (Physics)

COs, POs Mapping

Subject: Quantum Mechanics-II	Subject Code: MPHYS1-315	Semester: 3rd
Credit: 4	L T P 4 0 0	Duration: 60 Hrs.

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Understand the concept of Identical particles, time dependent and time independent approximation methods, scattering theory and relativistic quantum Mechanics.	3	2	3	2	2	2	2	1
CO2	Skill enhancement to solve numerical problems related with Quantum Mechanics.	2	1	3	2	2	1	2	2
CO3	Apply knowledge of Quantum Mechanics to go for higher studies in diverse fields and job prospects.	1	2	1	2	2	2	2	2
CO4	To inculcate and develop the ability to think abstractly.	1	2	2	2	1	2	2	3

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Program: M.Sc. (Physics)

COs, POs Mapping

Subject: Condensed Matter Physics-II	Subject Code: MPHYS1-316	Semester: 3rd
Credit: 4	L T P 4 0 0	Duration: 60 Hrs.

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	In-depth knowledge of magnetic-, dielectric-, and superconducting materials.	2	3	3	3	2	2	2	1
CO2	Acquaintances various Models describing material properties and its implementation in material science.	2	2	1	3	2	1	2	1
CO3	Learning of materials handling and application.	1	3	2	2	1	2	3	2
CO4	Basic knowledge about electron emissions from metals like Thermal-, Field- and Photo- emission.	1	1	3	2	2	1	1	2

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COs, POs Mapping

Subject: Seminar	Subject Code: MPHYS1-318	Semester: 3rd
Credit: 1	L T P 0 0 2	Duration: 30 Hrs.

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Student shall learn presentation skills	3	1	1	3	3	3	3	2
CO2	Improve communication skills	1	3	2	3	2	3	2	3
CO3	Acquaintance with teaching aptitude.	3	3	1	3	2	3	2	1
CO4	Improve learning by 'Teaching and Learning Method'	2	1	3	3	2	3	2	3

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COs, POs Mapping

Subject: Particle Physics	Subject Code: MPHYS1-419	Semester: 4th
Credit: 4	L T P 4 0 0	Duration: 60 Hrs.

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Understand and appreciate the formation and evolution of elementary particles that are fundamental building blocks of matter and anti-matter.	3	2	1	1	1	2	3	2
CO2	Acquainted with the knowledge of symmetries and conservations laws of high energy particles; Need of standard model and its limitations and the properties of simple Quark Model.	3	2	1	2	2	2	2	1
CO3	Establish the basic foundation of students to seek research opportunities in high energy physics.	2	1	2	2	2	1	3	1
CO4	Enable to learn and use the basic rules of Feynman diagrams to solve Weak interaction between quarks and how that this is responsible for β decay.	1	3		2	1	1	2	2

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COs, POs Mapping

Subject: Electrodynamics-II	Subject Code: MPHYS1-101	Semester: <u>1st</u>
Credit: <u>4</u>	L T P <u>4 0 0</u>	Duration: <u>60 Hrs.</u>

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Understand the concept of electromagnetic wave guides, relativistic formulations of electrodynamics, radiating systems and charge particle Dynamics.	3	2	3	2	2	2	2	1
CO2	Skill enhancement to solve numerical problems related with Electrodynamics.	2	1	3	2	2	1	2	2
CO3	Apply knowledge of Electrodynamics to go for higher studies in diverse fields.	1	2	1	2	2	2	2	2
CO4	To inculcate and develop the ability to think abstractly.	1	2	2	2	1	2	2	3

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COs, POs Mapping

Subject: Advanced Physics Lab	Subject Code: MPHYS1-421	Semester: 1st
Credit: 3	L T P 0 0 6	Duration: 90 Hrs.

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Able to handle the experiments related to computational and Nuclear Physics.	3	2	3	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 team work.	1	2	2	2	1	2	2	3

Enter Correction levels 1, 2 or 3 as defined below:

1. Slight (Low) - upto 30% 2. Moderate (Medium) – above 30% and upto 70% 3. Substantial (High) – above 70%



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(A State University Estb. by Govt. of Punjab vide Punjab Act No. 5 of 2015 and Approved u/s 2(f) & 12 (B) of UGC; Member AIU)

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

Program: M.Sc. (Physics)

COs, POs Mapping

Subject: Soft Matter Physics	Subject Code: MPHYS1-464	Semester: 4th
Credit: 4	L T P 4 0 0	Duration: 60 Hrs.

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Knowledge about soft matter and glass transitions.	1	1	3	2	1	3	2	3
CO2	Learning about polymers, polymer chains and its properties.	2	3	3	1	3	2	3	2
CO3	Visco-elastic behaviour and its utilization in Physics.	3	1	2	3	2	1	1	1
CO4	Identification and knowledge about Liquid crystals and Collides.	2	2	2	2	2	2	1	3

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

Program: M.Sc. (Physics)

COs, POs Mapping

Subject: Physics of Materials	Subject Code: MPHYS1-462	Semester: <u>4th</u>
Credit: <u>4</u>	L T P <u>4 0 0</u>	Duration: <u>60 Hrs.</u>

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	A brief idea about lattice, unit cell, miller indices, reciprocal lattice, concept of Brillouin zones and diffraction of X-rays by crystalline materials.	1	3	2	1	2	3	2	1
CO2	Knowledge of lattice vibrations, phonons and in depth of knowledge of Einstein and Debye theory of specific heat of solids.	3	1	3	3	3	2	1	1
CO3	Understanding above the band theory of solids and must be able to differentiate insulators, conductors and semiconductors.	2	3	1	1	1	3	1	3
CO4	Secured an understanding about the magnetic, dielectric and superconducting phases of the materials.	2	2	3	2	2	2	2	1

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Department: Department of Physics
Maharaja Ranjit Sng h Punjab Technical University, Bathinda

Program: M.Sc. (Physics)

COs, POs Mapping

Subject: Radiation Physics	Subject Code: MPHYS1-461	Semester: <u>1st</u>
Credit: <u>4</u>	L T P <u>4 0 0</u>	Duration: <u>60 Hrs.</u>

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Understanding the sources and properties nuclear radiations, their exposure rate and radiation dose, that prepares them to undertake diverse fields in higher studies.	3	3	2	3	1	2	3	1
CO2	Employ independent learning methods to self-evaluate and update professional knowledge of innovations in medical radiation physics.	3	2	1	2	2	3	2	2
CO3	Learn to classify and understand the concepts and methods of dosimetry measurement and applications of radiation physics in archeology, smoke detection in industries and radiotherapy.	3	2		2	2	3	3	3
CO4	Identify the biological effects of radiation on human body and learning radiation safety practices.	3	1	1	3	2	3	3	3

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Program: M.Sc. (Physics)

COs, POs Mapping

Subject: Nuclear Accelerators, Reactors and Detectors	Subject Code: MPHYS1-101	Semester: <u>1st</u>
Credit: <u>4</u>	L T P <u>4 0 0</u>	Duration: <u>60 Hrs.</u>

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Acquainted with the theoretical knowledge of neutron discovery, sources and its interaction with matter.	3	3	2	3	1	2	3	1
CO2	Various theoretical techniques and equipment to detect nuclear particles and learn about safely managing nuclear fuel and waste.	3	2	1	2	2	3	2	2
CO3	Technical details of accelerator technology used to accelerate nuclear particles and primary aspects of nuclear reactors.	3	2		2	2	3	3	3
CO4	Update with the latest innovations in nuclear particle detection, acceleration and reaction techniques.	3	1	1	3	2	3	3	3

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Department: Department of Physics
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Program: M.Sc. (Physics)

COs, POs Mapping

Subject: Fibre Optics and Laser Techniques	Subject Code: MPHYS1-101	Semester: <u>1st</u>
Credit: <u>4</u>	L T P <u>4 0 0</u>	Duration: <u>60 Hrs.</u>

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Understanding the phenomenon of light/signal propagation through optical fibres, fibre fabrication methods and controlling parameters which lay the basic foundation for higher courses in diverse fields.	3	3	1	3	1	3	2	2
CO2	To impart knowledge of fibre drawing process, coating on fibre and cable designing which is highly relevant for fibre industry.	3	3	1	3	1	3	2	2
CO3	To comprehend the basic understanding about the construction and working of different type of lasers and their application in modern life.	3	2	1	3	1	3	2	2
CO4	Acquire the skill of solving numerical problems related to optimization of efficiency and purity of optical fibres and different Lasers.	3	3	1	3	1	2	1	2

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

Program: M.Sc. (Physics)

COs, POs Mapping

Subject: Dissertation	Subject Code: MPHYS1-101	Semester: <u>1st</u>
Credit: 3	L T P <u>0 0 6</u>	Duration: <u>90 Hrs.</u>

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Students shall plan and engage in, an independent systematic and critical investigation of a chosen research topic and use appropriate methodologies and techniques to draw conclusions.	3	3	3	2	2	3	1	3
CO2	Understand and apply ethical standards of conduct in the collection and evaluation of data and other resources.	3	3	3	3	3	3		2
CO3	Enhance the communication and presentation skills.	3	3	3	3	3	3	1	2
CO4	Build the ethical human values and spirit of team work.	2	3	1	2	3	1	1	3

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