Shri Guru Ram Rai University

DEHRADUN-208001 INDIA

[Estd. by Govt. of Uttarakhand, vide Shri Guru Ram Rai University Act no. 03 of 2017 & recognized by UGC u/s (2f) of UGC Act 1956]

6th Meeting of the Board of Studies (BoS) as per NEP2020

School of Basic & Applied Sciences

Department of Physics

To be held on 30th July 2024 at 11 AM in the SBAS Campus, Patelnagar, SGRR University, Dehradun.

Agenda

Item No.	Item	Annexure No.
6.1	To confirm the minutes of the 5th Meeting of the BOS held on 3rd July 2023.	6.1
6.2	To report the actions taken on the decisions taken in the 5th Meeting of the BOS held on 3rd July 2023.	6.2
6.3	Revision of old framework for UG program as per UGC& NEP-2020 for academic session 2022-2023 onwards.	6.3
6.4	Revision of old framework for UG program as per UGC& NEP-2020 for academic session 2023-2024 onwards.	6.4
6.5	Proposed new framework for UG program as per UGC& NEP-2020 for academic session 2024-2025 onwards.	6.5
6.6	Proposed new framework for 1-year PG program in Physics for BSc (Hons) students as per UGC& NEP-2020 for academic session 2024-2025 onwards.	6.6
6.7	Revision of PG (M.Sc. in Physics) course all semesters	6.7
6.8	Revision of Pre Ph.D. course work for physics core and electives	6.8
6.9	Proposal of Subject specific external experts panel for theory/ practical/dissertation viva-voce exams in Physics.	6.9
6.10	Any other item with the permission of the Chair	6.10

30/07/24

(Dr. Arun Kumar)

CHAIRPERSON BoS

Shri Guru Ram Rai University

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School of Basic & Applied Sciences

Department of Physics

To be held on 30th July 2024 at 11 AM in the SBAS Campus, Patelnagar, SGRR University, Dehradun.

ATTENDANCE SHEET

The following members were present:

S.No.	Members	Signature
1	Prof. (Dr.) Arun Kumar, (Dean, SBAS)- Chairperson	30/07/24
2	Prof. (Dr.) Bhupendra Singh Rawat-External Subject expert	
3	Mr. Sunil Kumar Pandey- Expert from Industry	30/07/2024
4	Prof. (Dr.) Kumud Saklani (Dean Academics)-Invited Member	30/07/2024
5	Dr. Pankaj Chamoli (HOD, Physics)- Convenor	
6	Dr. Archana Dhayani - Member	
7	Dr. Richa Saxena -Member	
8	Mrs. Twinkle-Member	
9	Dr. Sheetal Tyagi, (HOD, Chemistry)-Member	

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10	Dr. Kavita Tripathi, (HOD, Geology)-Member	
11	Dr. Rashi Bhargava, (HOD, Mathematics)- Member	
12	Dr. Amardeep Singh Chauhan (Defence & Strategic studies)- Member	
13	Mr. Manish (Statistics)- Member	
14	Mr. Vinay Rawat- Research Scholar, SGRRU	
15	Mr. Aman Katira- Alumni, SGRRU	

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6th Meeting of the Board of Studies (BoS) as per NEP2020

School of Basic & Applied Sciences

Department of Physics

To be held on 30th July 2024 at 11 AM in the SBAS Campus, Patelnagar, SGRR University, Dehradun.

MINUTES OF MEETING

A meeting of all the members of the Board of Studies in Physics was held on **30th July 2024** from 11 AM onwards at the School of Basic & Applied Sciences, Shri Guru Ram Rai University, Patelnagar, Dehradun. The following members were present:

1. Prof. (Dr.) Arun Kumar, Dean, School of Basic & Applied Sciences, Shri Guru Ram Rai University, Dehradun (Chairperson)
2. Prof.(Dr.) Kumud Saklani, Dean Academics, Shri Guru Ram Rai University, Dehradun (Invited Member)
3. Prof. (Dr.) Bhupendra Rawat, HOD, Department of Physics, Uttaranchal University, Dehradun (External Expert)
4. Mr. Sunil Kumar Pandey, Manager, Plant Operations, Deccan Healthcare Ltd., Plot:13, Sector 3 SIDCUL Pantnagar Uttarakhand (Expert From Industry)
5. Dr. Pankaj Chamoli, Department of Physics, School of Basic & Applied Sciences, Shri Guru Ram Rai University, Dehradun (Member)
6. Dr. Archana Dhayani, Department of Physics, School of Basic & Applied Sciences, Shri Guru Ram Rai University, Dehradun (Member)
7. Dr. Richa Saxena, Department of Physics, School of Basic & Applied Sciences, Shri Guru Ram Rai University, Dehradun (Member)
8. Ms. Twinkle, Department of Physics, School of Basic & Applied Sciences, Shri Guru Ram Rai University, Dehradun (Member)
9. Dr. Sheetal Tyagi, Department of Chemistry, School of Basic & Applied Sciences, Shri Guru Ram Rai University, Dehradun (Member)
10. Dr. Rashi Bhargava, Department of Mathematics, School of Basic & Applied Sciences, Shri Guru Ram Rai University, Dehradun (Member)
11. Dr. Kavita Tripathi , Department of Geology, School of Basic & Applied Sciences, Shri Guru Ram Rai University, Dehradun (Member)

12. Mr. Manish Kumar , Department of Statistics, School of Humanities and Social Sciences, Shri Guru Ram Rai University, Dehradun (Member)
13. Dr. Amardeep Singh Chauhan, Department of Defence & Strategic studies, School of Humanities, Shri Guru Ram Rai University, Dehradun (Member)
14. Mr. Vinay Rawat, Department of Physics, School of Basic & Applied Sciences, Shri Guru Ram Rai University, Dehradun (Research Scholar)
15. Mr. Aman Katira, Department of Physics, School of Basic & Applied Sciences, Shri Guru Ram Rai University, Dehradun (Alumni)

PROCEEDINGS AND RESOLUTIONS:

The members of the BOS discussed the agenda item wise and resolutions were made accordingly

Agenda No. 6.1: To confirm the minutes of the Fifth Board of Studies in Physics held on 3th July 2023.

Resolution: The board confirmed and approved the Fifth Board of Studies meeting held on **3th July 2023.**

Agenda No. 6.2: To report the actions taken on the decisions taken in the 5rd Meeting of the BOS held on 3th July 2023.

Resolution: The board confirmed and approved the actions taken on the decisions in the last Board of Studies meeting held on **3th July 2023** with the modification as per curriculum and Credit Framework for undergraduate and NHEQF(National Higher Education qualification Framework).

Agenda No. 6.3: Revision of old framework for UG program as per UGC& NEP-2020 from the Academic Session 2022-23 onwords.

Resolution: The board members recommended and approved that, starting from the academic session 2022-23, the revised undergraduate program be aligned with NEP-2020. A major core paper has been introduced in the V and VI semesters, each worth 3 credits. Research and elective papers have been added to the curriculum for the VII and VIII semesters for those pursuing a Bachelor of Science (Hons) in Physics or a Bachelor of Science (Hons) in Physics with Research. Two separate choices have been provided in the VII and VIII semesters for these students. For those opting for research, a 12-credit research project is mandatory. These revisions were discussed with the honorable members, and all members, including the honorable external expert, agreed to approve them.

Agenda No. 6.4: Revision of old framework for UG program as per UGC& NEP-2020 for academic session 2023-2024 onwards.

Resolution: The board members recommended and approved that, starting from the academic session 2023-24, the revised undergraduate program be aligned with NEP-2020. A new Discipline-Specific Elective (DSE) has been introduced in the III and IV semesters, each worth 3+1 credits. Additionally, two Discipline-Specific

Courses (DSC) have been added in the V and VI semesters, each also worth 3+1 credits. Research and Intellectual Property Rights (IPR) have been introduced as DSEs in the VII and VIII semesters for students pursuing a Bachelor of Science (Hons) in Physics or a Bachelor of Science (Hons) in Physics with Research. These revisions were discussed with the honorable members, and all members, including the honorable external expert, agreed to approve them.

Agenda No. 6.5: Proposed new framework for UG program as per UGC& NEP-2020 for academic session 2024-2025 onwards.

Resolution:

After revising the four-year undergraduate program for the academic session 2024-2025, the Bachelor of Science (Hons) in Physics and the Bachelor of Science (Hons) in Physics with Research now follow the new framework introduced per UGC and NEP-2020 guidelines. The course codes in the UG program were assigned according to UGC norms, NEP guidelines, and university standards, and all members resolved to approve them. The credit system in the UG program was approved as per UGC norms and NEP guidelines, with each theory lecture worth 3 credits.

Agenda No. 6.6: Proposed new framework for 1-year PG program in Physics for BSc (Hons) students as per UGC& NEP-2020 for academic session 2024-2025 onwards.

Resolution:

One year of PG programme (Physics) with new framework (coursework + research) has been introduced for BSc (Hons) students as per UGC& NEP-2020 for academic session 2024-2025. The course codes in the UG program were assigned according to UGC norms, NEP guidelines, and university standards, and all members resolved to approve them. The credit system in the UG program was approved as per UGC norms and NEP guidelines, with each theory lecture worth 3 credits. Total credits will be 40 (20 credits in each semester). All the members have agreed to approve them following consultation with the honorable external expert. The implementation of the program will commence from the academic session 2024-2025.

Agenda No. 6.7: Revision of PG (M.Sc. in Physics) course all semesters

Resolution:

In alignment with the UGC and NEP-2020 guidelines the PG program in Physics has undergone significant revisions for the upcoming academic sessions. These revisions reflect our commitment to providing an advanced, comprehensive, and contemporary curriculum that meets the needs of our students and the evolving academic and professional landscapes. Key highlights of the revised PG Program are Curriculum update, Credit system, and Research emphasis. The revised PG program framework was developed in consultation with external academic experts, industry professionals, alumni and research scholars. The revision was presented to the all-honorable members and, after thorough discussion and consideration, the all members agreed to approve them following consultation with the honorable external expert. The implementation of the revised program will commence from the academic session 2024-2026.

Agenda No. 6.8: Revision of Pre Ph.D. course work for physics core and electives.

Resolutions: All the members of BOS were of the view that the revision of Pre-Ph.D. course work for physics and electives. The revision was presented to the all-honorable members and, after thorough discussion and consideration, the all members agreed to approve them following consultation with the honorable external expert. The implementation of the revised program will commence from the academic session 2024-2026.

Agenda No. 6.9: Proposal of subject specific external experts panel for theory/ practical/dissertation viva-voce exams in Physics.

Resolutions: The proposal of BOS panel has been placed for the approval. All honorable members and, after thorough discussion and consideration, the all members agreed to approve them following consultation with the honorable external expert.

Name	Designation	Educational Qualification	Research Area	E-Mail ID	Contact No.
Prof. (Dr.) Bhupendra Singh Rawat	Professor, HOD Physics Uttaranchal University, Dehradun (UK).	M.Sc., Ph. D.	Physics	hodphysics@uttaranchaluniversity.ac.in	8077479595
Prof. (Dr.) Rajeev Gupta	Professor, Department of Physics, University of Petroleum and Energy Studies, Dehradun Uttarakhand.	M.Sc., Ph.D.	Physics	rajeev@ddn.upes.ac.in	9897716629
Prof. (Dr.) Surbhi Sachdev	Professor, DIT University Dehradun, Uttarakhand	M.Sc. Ph.D.	Physics	surbhi.sachdev@dituniversity.edu.in	8791819695
Prof. (Dr.) P.D. Simalti	Professor, HOD Physics (Tehri campus) HNB Garhwal University, Srinagar (UK).	M.Sc. Ph.D.	Physics	semaltypd@gmail.com	9411572928
[redacted] (Dr.) R.P. Bhardwaj	Former Professor & HOD, Department of Physics, SGRR (PG) College, Pathribagh, Dehradun (UK)	M.Sc. Ph.D.	Physics	bhardwaajrp@gmail.com	9319062778
Dr. Suresh Chandra Gairola	Professor, HOD Physics (Pauri campus),HNB Garhwal University, Srinagar (UK).	M.Sc. Ph.D.	Physics	dgsureshc@yahoo.co.in	9456368043
Prof. (Dr.) S. K. Gupta	Former Professor & Dean RNC, DIT University Dehradun, Uttarakhand	M.Sc., Ph. D.	Physics	skgup@yahoo.co.in	8630141388
Dr. A.S. Rana	Associate Professor, Shri Guru Ram Rai (P.G.) College, Dehradun.	M.Sc., Ph. D.	Physics	anandrana71@gmail.om	9412954316
Dr. Anita Maliyan	Assistant Professor, Shri Guru Ram Rai (P.G.) College, Dehradun.	M.Sc., Ph. D.	Physics	anitasgrrpg.ddun@gmail.com	9808119929
Dr. Sanjeev Kimothi	Associate Professor, Graphic Era Deemed to be University, Dehradun, Uttarakhand.	M.Sc., Ph. D.	Physics	drskimothi@gmail.com	9456119959

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Dr. Manoj Baloni	Associate Professor, HOD, Shri Guru Ram Rai (P.G.) College, Dehradun.	M.Sc., Ph. D.	Physics	manojbaloni@rediffmail.com	9719447003
Dr. B.S. Tiwari	Associate Professor, GB Pant Institute of Engineering, and Technology, Ghurdori, Pauri, Uttarakhand	M.Sc., Ph. D.	Physics	bhagyasindhu@gmail.com	9412943667
Dr. Ravi Shukla	Associate Professor & HOD, Physics, DIT University Dehradun, Uttarakhand	M.Sc., Ph. D.	Physics	ravishukla82@gmail.com	7895151892

The meeting ended with a vote of thanks.

30/07/24

Prof. (Dr.) Arun Kumar,
(Dean, SBAS)- Chairperson

Prof. (Dr.) Bhupendra Singh Rawat
(External Subject Expert)

30/07/2024

Prof. (Dr.) Kumud Saklani
(Dean Academics-Invited Member)

Mr. Sunil Kumar Pandey-
(Expert From Industry)

Dr. Pankaj Chamoli
(HOD-Physics, Convenor)

Dr. Archana Dhayani
(Member)

Dr. Richa Saxena
(Member)

Mrs. Twinkle
(Member)

Dr. Sheetal Tyagi, (HOD, Chemistry)
(Member)

Dr. Kavita Tripathi, (HOD, Geology)
(Member)

Dr. Rashi Bhargava, (HOD, Mathematics)
(Member)

Dr. Amardeep Singh Chauhan (Defence & Strategic studies)- (Member)

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Mr. Manish (Statistics)-
(Member)

Mr. Vinay Rawat- Research Scholar,
SGRRU

Mr. Aman Katira- Alumni, Physics,
SGRRU

SHRI GURU RAM RAI UNIVERSITY

Patel Nagar, Dehradun-248001, Uttarakhand, India

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SYLLABUS FOR

Master of Science (M.Sc.)-Physics

Only for B.Sc. Hons. Students

School of Basic & Applied Sciences

(W.E.F 2024-2025)

Master of Science (M.Sc.)-Physics

OUTCOME BASED EDUCATION

Programme outcome (POs)

Students will be able to

PO 1	Implement strong theoretical and practical knowledge of physics to solve complex scientific problems.
PO2	Identify the situation-based problems, formulation, and action is taken based on analytical thinking and principles of science.
PO3	Formulate, design, experimental techniques, scientific tools, analysis of scientific data, interpretation of data, and establish a hypothesis for various interdisciplinary research problems.
PO4	Execute effective communication through interactive and presenting skills, technical report writings, and proper documentation of ideas.
PO5	Create a new conceptual, theoretical and operational approach to address various problems in interdisciplinary fields.
PO6	Enables individuals to function effectively in cross-cultural environments as an individual, and as a member or leaders.
PO7	Understand the contribution of scientific knowledge in environmental contexts for sustainable development.
PO8	Understand ethical issues, academic and research ethics, the need and value of lifelong learning, and the scientific misconduct of a scientist to serve society.
PO9	Enhance and adopt employability skills through research, internship, and dissertation.
PO10	Successfully compete in the state level, national level, and international level exams or competitions.
PO11	Lifelong learning of knowledge of physics
PO12	Implement the learning of physics in project management and finance

Program Specific Outcome (PSOs)

PSO 1	Associate the fundamental and advanced concepts in diverse branches of physics including quantum mechanics, nuclear, Laser and Astrophysics, condensed matter physics.
PSO2	Apply suitable methods to solve a wide range of problems and handle interdisciplinary projects as well as experimental data interpretation independently.
PSO3	Employ experimental skills for multi-disciplinary research work in cutting-edge areas of physics.
PSO4	Develop job-oriented analytical skills needed in research, consultancy, defense, entrepreneurial pursuit, and industry.

Eligibility for admission:

A bachelor's degree with Honours/ Honours with Research with a minimum of 160 credits for a 1-year/2-semester master's programme at level 6.5 on the NHEQF.

Duration of the Programme: 1 Years

STUDY & EVALUATION SCHEME: Choice Based Credit System (CBCS)

First Semester

S. No.	Course Category	Couse Code	Course Name	Periods				Evaluation scheme		Subject Total
				L*	T*	P*	C*	IA*	ESE*	
Theory										
1	Core	MPHDC101	Advanced Quantum Mechanics	3	0	0	3	40	60	100
2	Core	MPHDC102	Nuclear Physics	3	0	0	3	40	60	100
3	Core	MPHDC103	Minor Project and Presentation	3	0	0	3	40	60	100
4	Elective -I	MPHDE105 0R MPHDE106	Condensed Matter Physics 0R Laser Physics	3	0	0	3	40	60	100
5	Elective -II	MPHDE107 0R MPHDE108 0R MPHDE109	Digital and Communication Electronics 0R Astrophysics 0R Research Methodology	3	0	0	3	40	60	100
6	Core	MPHDL104	Laboratory Course	0	0	10	5	40	60	100
			Total	15	0	08	20	240	360	600

* Research Methodology subject is compulsory for B.Sc. Honours Students.

*L – Lecture, T – Tutorial, P – Practical, C – Credit, IA-Internal Assessment, ESE-End Semester Examination, SSC- Self-Study course

Second Semester

S. No.	Course Category	Couse Code	Course Name	Periods				Evaluation scheme		Subject Total
				L*	T*	P*	C*	IA*	ESE*	
Thesis										
1	Core	MPHRD201	Dissertation	0	0	0	20	120	480	600**
			Total	0	0	0	20	120	480	600

*L – Lecture, T – Tutorial, P – Practical, C – Credit, IA-Internal Assessment, ESE-End Semester Examination, SSC- Self-Study course

**The distribution of marks for the Dissertation will be as below:

Periodical Presentation	120 Marks
Thesis	360 Marks
Viva Voce	120 Marks
Total	**600 Marks**

The Thesis work report shall be evaluated jointly by the supervisor and one external examiner.

Summary of the Credit

Year	Semester	Max Credit
1	1	20
	2	20
Total		**40**

Examination Scheme (Except project):

Components	Ist Internal	IInd Internal	External (ESE)
Weightage (%)	**20**	**20**	**60**

Course code	: **MPHDC101**				
Course Name	: **Advanced Quantum Mechanics**				
Semester /Year	: **I/ I**				
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objective: The main objective of the course on Advanced Quantum mechanics is to impart knowledge about various approximation methods in physics and to give them ideas about laboratory and center of mass frame and study the scattering phenomena in both these frames.

Course Contents

Unit I

Scattering Theory: General considerations: kinematics, wave mechanical picture, scattering amplitude, differential and total cross section. Green's function for scattering. Partial wave analysis: asymptotic behavior of partial waves, phase shifts, scattering amplitude in terms of phase shifts, cross-sections, Optical theorem. Phase shifts and its relation to potential, effective range theory. Application to low energy scattering; resonant scattering, Breit-Wigner formula for one level and two levels, non-resonant scattering. s-wave and p-wave resonances. Exactly soluble problems; Square-well, Hard sphere, coulomb potential. Born approximation; its validity, Born series.

Unit II

Identical Particles: The Schrodinger equation for a system consisting of identical particles, symmetric and anti-symmetric wave functions, elementary theory of the ground state of two electron atoms; ortho- and Para-helium. Spin and statistics connection, permutation symmetry and Young tableaux. Scattering of identical particles.

Unit III

Relativistic Wave Equations: Generalization of the Schrodinger equation; Klein-Gordon equation, plane wave solutions, charge and current densities, interaction with electromagnetic fields, Hydrogen-like atom (to show it does not yield physical spectrum), non-relativistic limit. Extension of Klein-Gordon equation to spin 1 particles. Dirac Equation; relativistic Hamiltonian, probability density, expectation values, Dirac gamma matrices, and their properties, non-relativistic limit of Dirac equation. Covariance of Dirac equation and bilinear covariance, plane wave solution, energy spectrum of hydrogen atom, electron spin and magnetic moment, negative energy sea, hole interpretation and the concept of positron. Spin-orbit coupling, hyperfine structure of hydrogen atom.

Unit IV Quantization of wave fields: The quantization of wave fields, Classical and quantum field equations, quantization of non-relativistic Schrodinger equation, second quantization, N-representation, creation and annihilation operators.

Text book [TB]:

TB 1. P. M. Mathews and K. Venkatesan, A Text book of Quantum Mechanics (TMH)
TB 2. R.P Feynman and A.R.Hibbs; Quantum Mechanics and Path Integrals.
TB 3. L. I. Schiff, Quantum Mechanics (McGraw Hill).

Reference books [RB]:

RB 1. Thankappan, V.K., Quantum Mechanics, New Age International (2004).
RB 2. Sakurai, J.J., Advanced Quantum Mechanics, Pearson Education (2007).
RB 3. S. Davydov, Quantum Mechanics (Pergamon).

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	Define and describe scattering theory, identical particles, Relativistic Wave Equations, Quantization of wave fields
CO2	Understand various scattering techniques foe low and high energy particles, , Klein-Gordon equation, Dirac equation formulation, theory of identical particles, Quantization of wave fields
CO3	Apply partial wave and Born approximation techniques to various systems, K-G and Dirac equation, Pauli's exclusion principle to different systems.
CO4	Analyse theory of identical particles, Pauli's exclusion principle, second quantization, Covariance of Dirac equation, scattering amplitude, differential and total cross section and Green's function for scattering.
CO5	Evaluate the problems based on partial wave and Born approximation. Distinguish between Lab. Frame and center of mass frame
CO6	Formulate and develop understanding on theory of identical particles, N-representation, creation and annihilation operators, electron spin and magnetic moment, negative energy sea, hole interpretation and the concept of positron,

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	2	2	2	1	1	2	2	2	1	1	2	2	1
CO2	2	2	2	2	2	2	1	2	2	3	1	2	1	2	2	1
CO3	2	1	3	3	2	2	1	2	2	2	3	2	1	2	2	1
CO4	2	1	2	2	1	2	1	1	2	2	2	2	1	2	1	2
CO5	2	2	2	2	2	2	1	1	2	3	2	2	1	2	2	1
CO6	2	1	2	2	2	2	1	1	2	2	2	2	1	2	2	1

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code : MPHDC102				
Course Name : Nuclear Physics				
Semester /Year : I/ I				
	L	T	P	C
	3	0	0	3

Course Objective:

The objective of the course is to provide an understanding about the general nuclear properties and knowledge of nuclear models: liquid drop model, shell model and collective model. To provide knowledge and understanding of scattering process and decay phenomenon.

Course Contents

Unit I

General Properties & Models-: Nuclear size, nuclear angular momentum (Spin), Nuclear magnetic moments, statistics, Binding energy, Liquid drop model, Shell model, Collective model.

Unit II

Nuclear Forces and Detector – Ground state of deuteron, Low energy neutron-proton scattering and proton-proton scattering, Exchange and tensor forces, G.M. Counter, Electron & Proton Synchrotron.

Unit III

Radioactive decay: Radioactive decay equation equilibrium units, Gamow's theory of alpha decay and Geiger Nuttal law, Fermi's theory of beta decay, parity violation in beta decay, electromagnetic decays.

Unit IV

Nuclear Reactions- Q-value of nuclear reaction, Bohr's Theory of compound nucleus, scattering cross section of nuclear reaction (phase shift method), Breit Wigner single level resonance formula for scattering cross section.

Text book [TB]:

TB1. B.R. Martin : Nuclear & Particle Physics
TB2. Tayal, D.C. , Nuclear Physics, Himalaya Publishing House, Mumbai
TB3. Nuclear & Particle Physics-B.R. Martin & G. Shaw

Reference books [RB]:

RB1. S.B. Patel : Nuclear Physics
RB2. M.K. Pal : Theory of Nuclear Structure

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	Describe the general properties & models, nuclear forces and detector, radioactive decay, nuclear reactions
CO2	Explain the binding energy, Liquid drop model, Shell model magic number and spin parity related to shell model, Low energy neutron-proton scattering and proton-proton scattering, Exchange and tensor forces
CO3	Illustrate the Gamow's theory of alpha decay and Geiger Nuttal law, Fermi's theory of beta decay, parity violation in beta decay, radioactive decay, various decay phenomena and their process
CO4	Analyze the nuclear size, nuclear angular momentum (Spin), Nuclear magnetic moments, statistic, the principle and application of G.M counter and synchrotron.
CO5	Evaluate the Q-value of nuclear reaction, parity violation in beta decay, electromagnetic decays. Ground state of deuteron
CO6	Express the stimulation Electron & Proton Synchrotron, Nuclear magnetic moments, Binding energy

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	1	2	2	2	1	1	1	2	2	1	2	2	2	1
CO2	2	2	2	2	3	2	1	2	2	3	2	2	1	2	1	1
CO3	1	2	1	2	2	2	1	2	1	2	2	2	2	3	2	1
CO4	1	2	1	2	2	2	1	2	2	2	2	2	1	2	1	2
CO5	2	2	2	2	3	2	1	2	1	3	2	1	2	2	2	1
CO6	2	2	2	2	2	2	1	2	1	2	2	2	1	2	1	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code : **MPHDC103**				
Course Name : **Minor Project and Presentation**				
Semester /Year : **I/ I**				
	L	**T**	**P**	**C**
	0	**0**	**8**	**4**

Course Objective: The main objective of this course to analyze, construct and evaluate scientific information and research topics. Students will make a quality scientific presentation and speak in front of a scientific audience.

Course Contents

Presentation topic must be related to the student's current research and innovation, nanoscience and technology, any material characterization and analytical techniques, and current thesis or project.

Text book [TB]:

1. R. Williams, Non-Designer's Presentation Book, The: Principles for effective presentation design
2. N. Duarte, Slide: ology: The Art and Science of Creating Great Presentations

Reference books [RB]:

1. G. Reynolds, Presentation Zen: Simple Ideas on Presentation Design and Delivery

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	Remember scientific information.
CO2	Develop and understand quality scientific presentation.
CO3	Present and explain and apply scientific information.
CO4	Classify and analyze scientific work for presentation.
CO5	Evaluate scientific information and then analyse it.
CO6	Develop scientific understanding towards research oriented topics

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	2	2	2	1	1	1	2	2	2	1	2	2	1
CO2	1	2	2	2	3	1	2	2	2	3	2	1	2	2	1	2
CO3	3	2	1	2	2	2	1	2	1	2	2	2	3	3	2	1
CO4	2	2	2	2	3	2	1	1	2	2	2	1	2	2	1	2
CO5	2	2	1	2	2	1	2	1	1	3	2	2	2	2	2	1
CO6	2	2	1	2	2	1	2	1	1	2	2	1	2	2	1	1

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code : **MPHDE105**				
Course Name : **Condensed Matter Physics**				
Semester /Year : **I/ I**				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Objective: The main objective of the course on Condensed Matter Physics is to aware students about the defects in crystal, dielectric and magnetic properties, superconductivity, Nano Material Science and Technology etc.

Course Contents

Unit I

Defects in crystals and Magnetism: Point defect, Impurities, Vacancies, Frenkel defects, Schottky defects. Concentration of Schottky defect and Frenkel defects, intrinsic and extrinsic vacancies, Colour centres, F-Centre, V-Centre, dislocation, Line defects, edge dislocation, screw dislocation, Burger vector. Dia, Para and ferromagnetism, Langevin theory of paramagnetic, Ferromagnetism, Weiss molecular theory, Ferromagnetic domains, Antiferromagnetism, Neel's theory, Two sub lattice model, ferrites.

Unit II

Energy Bands: Origin and Magnitude of the energy gap, Bloch function, Bloch theorem, Kronig penny model, Number of possible wave function in a band, crystal momentum, the concept of effective mass and holes, hole band construction, metal, insulator and semiconductor. Nearly free electron model, One dimensional free electron case, nearly free electron case, energy bands in one-dimension, tight binding approximation, energy surfaces, Wigner Seitz cellular method, Orthogonalized plane wave (OPW) method, Pseudo potential method, Limitations of band theory (Mott Transition).

Unit III

Superconductivity: Experimental Survey, Occurrence of super conductivity, destruction of superconductivity by magnetic field and temperature, Meissner effects, Type-I and Type-II superconductors, Isotope effect, Thermodynamics of Superconducting transition, London Equations, Coherence length, BCS Theory, Cooper pairs, Josephson superconductor tunneling, AC & DC Josephson effect, High temperature superconductors, critical fields and critical currents.

Unit IV

Dielectrics and ferroelectrics: Macroscopic description of dielectric constants, static, electronic and ionic, orientational polarizability of molecules, Complex dielectric constant, Dielectric loss and relaxation time, Polarization, Macroscopic electric field, depolarization fields, local electric field and atom, ferroelectric crystals, classification of ferroelectric crystals, soft optical phonons, landau theory of phase transition, Second and first order transition, antiferroelectricity, ferroelectric domains, piezoelectricity.

Unit V

Nano Material Science and Technology: History, Origin, Quantum dots, Synthesis, Applications and advantages, Quantum wires, Quantum well & application, Fullerenes, Carbon nanobuds, carbon nanotubes as quantum wires, Areas of Nanotechnology, nanomaterials, nanoelectronics, nanobiotechnology, nanofabrication, Micro Electro Mechanical systems (MEMS)

Text book [TB]:

TB1. Handbook of Nano Structured Materials and Nano Technology: Nalva

TB2. Nano Technology: Richard Booker and Earl Boysen

Reference books [RB]:

RB1. Principle of condensed matter Physics: Chaikimand Luben sky

RB2. Solid State Physics: Kubo and Ngamia

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	Describe the defects in crystals and magnetism energy bands, Superconductivity Energy, Defects in crystals and Magnetism, dielectrics and ferroelectrics, Nano Material Science and Technology
CO2	Express the magnetic and dielectric properties of the solids, Quantum well & application, Nearly free electron model, One dimensional free electron case,
CO3	Determine the defects present in the crystals, destruction of superconductivity by magnetic field and temperature, Meissner effects, Type-I and Type-II superconductors, Isotope effect, Thermodynamics of Superconducting transition, Classify BCS Theory related to Superconductor.
CO4	Analyse the Complex dielectric constant, History, Origin, Quantum dots, Synthesis, Applications and advantages, Quantum wires, Quantum well
CO5	Evaluate Nanotechnology, ferroelectric domains, piezoelectricity, High temperature superconductors.
CO6	Express the nanobuds, carbon nanotubes as quantum wires, critical fields and critical currents, Colour centres, F-Centre, V-Centre, dislocation.

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	1	2	2	2	1	1	1	2	2	1	2	2	2	1
CO2	2	2	2	2	3	2	1	2	2	3	2	2	1	2	1	1
CO3	2	2	2	2	2	2	1	2	1	2	3	2	2	3	2	1
CO4	1	2	1	2	2	2	1	2	2	2	2	2	1	2	1	2
CO5	2	2	2	2	3	2	1	2	1	3	2	1	2	2	2	1
CO6	2	2	2	2	2	2	1	2	1	2	2	2	1	2	1	2

Course code : **MPHDE107**				
Course Name : **Digital and Communication Electronics**				
Semester /Year : **I/ I**				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course Objective:

The objective of the course is to provide an understanding about Boolean algebra and knowledge of Combinational and Sequential logic circuits, modulation and demodulation techniques used in communication system and to aware students about RADAR system.

Course content:

Unit I

Boolean Algebra ,Logic Gates & Combinational Circuits: Binary codes (Weighted, BCD,2421, Gray code, Excess 3 code, Error detecting code, Error correcting codes, ASCII, EBCDIC), De-Morgan's Theorem, Sum of Products (SOP), Product of Sums (POS), Minterms &Maxterms, Karnaugh maps and minimization. Logic Gates: AND, OR, NOT, NAND, NOR, XOR, XNOR. Adders, Subtractor, Serial adder/ Subtractor, Parallel adder/ Subtractor, Carry look ahead adder, BCD adder, Magnitude Comparator, Multiplexer, Demultiplexer, Encoder, Decoder, Parity-checker, Code converters

Unit II

Sequential Circuits: Flip flops: Latches, RS, JK, T, D and Master-Slave, Characteristic table and equation. Edge triggering, Level Triggering. Registers & Counters: Asynchronous/ Ripple counters, Synchronous counters, Modulo–n Counters, Shift registers, Universal shift register, Shift counters, Ring counters.

Unit III

Modulation -Amplitude Modulation-Theory, Plate Modulated class C amplifier, Balanced Modulator, Single Side Band modulation (phase shift method), Frequency modulation – Theory, Reactance tube modulator, transistor reactance modulator, FET reactance modulator. Digital Modulation, PAM, PPM, PWM, Principle of PCM, **Demodulation**- Envelope diode detector, Foster Seeley phase discriminator, Ratio Detector. **Transmitters & Receivers**- A.M Transmitter, F.M. transmitter, TRF Receiver, Super heterodyne receiver, amplitude limiting.

Unit IV

Transmission Lines– TL Equations and their solutions, characteristic impedance, lossless open and short-circuited lines, standing wave ratio and refection coefficient, stub matching. **Antenna** – Radioactive field strength, power and radiation patterns of an elementary electric doublet and linear antenna, effects of ground reflection. Hertz antenna, Yagi antenna, loop antenna, direction finding, Resonant & Non resonant Antenna, Antenna array (Broad side & End fire arrays), Horn Antenna, Parabolic reflectors, Lens Antenna.

Unit V

Radar Systems- Principle of Radar, Basic arrangement of Radar system, Azimuth and Range measurement, operating, Characteristics of systems, Radar transmitters and Receivers, Duplexers, Indicator unit, maximum range of a Radar set.

Text book [TB]:

TB1. A. Anand Kumar : Fundamentals Of Digital Circuit

TB2. Thomas L. Floyd: Digital Fundamentals

Reference books [RB]:

RB1. Malvino& Leach: Digital Principles and Applications
RB2. Morris Mano: Digital Design

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	Describe Boolean Algebra ,Logic Gates & Combinational Circuits, Sequential Circuits, Modulation & Demodulation, Transmission Lines, Modulation, Radar Systems
CO2	Explain the flip flops, counter, register and its logic circuit, antenna, RADAR, TL Equations and their solutions, characteristic impedance
CO3	Determine the application of modulation and demodulation techniques, Principle of Radar, Basic arrangement of Radar system, Registers & Counters, Logic Gates
CO4	Illustrate modulation, Demodulation, Multiplexer, Demultiplexer, Encoder, Decoder, transmitters and receivers, Adder and Subtractor
CO5	Evaluate the Hertz antenna, Yagi antenna, loop antenna, direction finding, Resonant & Non resonant Antenna, Registers, Asynchronous and Synchronous Counters, Adders and Subtractors.
CO6	Express the Logic Gates, Ring counters, use of K-map to simplify the Boolean algebra expression, Excess 3 code

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4

CO1	2	1	1	1	1	2	1	1	1	2	2	1	1	2	2	1
CO2	1	2	2	2	3	1	2	2	2	3	2	1	2	2	1	2
CO3	3	3	2	2	2	2	2	2	1	2	2	1	3	3	1	2
CO4	2	2	2	2	3	2	2	1	2	2	2	1	2	2	2	1
CO5	2	2	2	2	2	1	2	2	1	3	2	1	2	2	2	1
CO6	2	2	2	2	2	1	2	2	1	2	2	1	2	2	1	1

Course code	**: MPHDE106**				
Course Name	**: Laser Physics**				
Semester /Year	**: III/ 2nd**				
	L	**T**	**P**	**C**	
	3	**0**	**0**	**3**	

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlate

Course Objective: The main objective of the course on Laser physics is to aware students about the laser and its types and phenomena of laser spectroscopy, optical fibres and principles of holography.

Course contents:

Unit I

Basic principles and modulators: Basic principles and theory of absorption and emission of radiation, Einstein's coefficients, line-broadening mechanisms, rate equations for three and four level laser systems, population inversion, spatial and temporal coherence, Electro optic effect, longitudinal and transverse phase modulation, consideration of modulator designs and circuit aspects, acoustic optic effect, Raman and Bragg regimes, acoustic optic modulators, magneto-optic effect, optical directional couplers and optical switches, phase modulators.

Unit II

Types of lasers, Optical sources and detectors: Gas lasers, He-Ne, argon ion, N_2, CO_2 lasers; dye lasers, solid state, Semiconductor lasers: Ruby, Nd:YAG and Nd:glass lasers, diode lasers, spin flip lasers, laser spikes, mode locking Q-switching, Laser devices, LED structures, liquid crystal diodes, photoelectric, photovoltaic and photoconductive methods of detection of light, photodiodes: structure, materials and working, PIN photodiodes, avalanche photodiodes, micro channel plates, photo detector, noise responsivity and efficiency, photomultipliers, image intensifier tubes, Videocon and CCD.

Unit III

Non- linear optics and Fiber optics: Theory of non-linear phenomenon, second and third harmonic generation, phase matching, parametric generation, self-focusing, Basic characteristics of optical fibers, structure and fundamentals of waveguides, step and graded index fibers, signal degradation in optical fibers, absorption scattering, radiation and core

cladding losses, Design considerations of a fiber optical communication system, analogue and digital modulation, optical fiber amplifiers.

Unit IV

Laser spectroscopy: Laser fluorescence spectroscopy using CW and pulsed lasers, Single photon counting. Laser Raman spectroscopy, multiphoton processes, photo acoustic and photon electron spectroscopy, stimulated Raman spectroscopy, Coherent anti-stokes Raman spectroscopy.

Unit V

Holography: Basic principles, construction and reconstruction of holograms, applications of holography, laser interferometry, laser applications in industry and medicines

Text book [TB]:

TB1. K.R. Nambiar: Lasers: Principles, types and Applications

Reference books [RB]:

RB1. Lasers: Ghatak and Thyagrajan
RB2. O. Svelto: Principles of Lasers

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	Describe the Basic principles and modulators, Types of lasers, Optical sources and detectors, Non- linear optics and Fiber optics, and Laser spectroscopy Holography
CO2	Illustrate the Gas lasers, He-Ne, argon ion, N2, CO2 lasers; dye lasers, solid state, Semiconductor lasers: Ruby, Nd:YAG and Nd:glass lasers, diode lasers
CO3	Explain Laser interferometry, PIN photodiodes and modulator, Basic principles and theory of absorption and emission of radiation, Einstein's coefficients, line-broadening mechanisms, rate equations for three and four level laser systems, population inversion
CO4	Analyse the photo detector, LED etc. for practical purposes, optical fiber, LED structures, liquid crystal diodes, photoelectric, photovoltaic and photoconductive methods of detection of light
CO5	Evaluate Distinguish laser interferometry, PIN photodiodes, Electro optic effect, photo acoustic and photon electron spectroscopy, stimulated Raman spectroscopy, Coherent anti-stokes Raman spectroscopy
CO6	Express various applications of laser in research field, Einstein's coefficients, Design considerations of a fiber optical communication system, analogue and digital modulation, optical fiber amplifiers

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	1	2	2	2	1	1	1	2	2	1	2	2	2	1
CO2	2	2	2	2	3	2	1	2	2	3	2	2	1	2	1	1
CO3	1	2	1	2	2	2	1	2	1	2	2	2	2	3	2	1
CO4	2	2	1	2	2	2	1	2	2	2	2	2	1	2	1	2
CO5	2	2	2	2	3	2	1	2	1	3	2	1	2	2	2	1
CO6	2	2	2	2	2	2	1	2	1	2	2	2	1	2	1	2

Course code : MPHDE108				
Course Name : Astrophysics				
Semester /Year : III/ 2nd				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course Objective: The main objective of the course on astrophysics is to impart knowledge about the physics of stars and aware students about photometry, spectroscopy, interstellar matter, classification of galaxies and cosmology.

Course contents:

Unit I

Physics of the Stars: Apparent and Mean Position of stars. Effects of atmospheric refraction, aberration, parallax, precession, nutation and proper motion on the coordinates of stars. Reduction from apparent to mean places and vice versa. Spectra of Stars. Distribution of stars in space. Statistical parallaxes. Solar motion and its determination. Peculiar velocities. Single and Two star stream hypothesis. Velocity ellipsoid. Comparison with solar neighborhood. Bottlinger's diagram. HR diagram, HD and MK spectral classification of stellar spectra. Explanation of stellar spectra in terms of Boltzmann and Saha equations. Spectroscopic parallax.

Unit II

Fundamental Equations, Detectors, Photometry and Spectroscopy: Equation of mass distribution. Equation of hydrostatic equilibrium. Equation of energy transport by radiative and convective processes. Equation of thermal equilibrium. Stellar models: Russell- Voigt theorem. Dimensional discussions of mass-luminosity law. Astronomical photometry and spectroscopy. Simple design of an astronomical photometer. Observing technique with a Photometer Correction for atmospheric extinction. Radio Astronomy Techniques. Electro-magnetic spectrum. Radio window. Design and construction of a simple radio telescope. Receiver systems. Design and construction of a simple radio interferometer.

Unit III

Galactic System and Extragalactic Systems: Interstellar Matter, Oort limit. Interstellar extinction. Estimate of color excess. Visual absorption. Interstellar reddening law and Polarisation. Spin temperature. Interstellar magnetic fields. Stromgren's theory of H II regions. Physical processes in planetary nebulae. Galactic Structure: General galactic rotational law. Oort's theory of galactic rotation. Determination of Oort's constants. Spiral structure of our Galaxy from optical and radio Observations. Size and mass of our galaxy. Classification of galaxies and clusters of galaxies. Hubble sequence. Galaxy interactions. Determination of the masses and extragalactic distances. Active Galaxies: Active galaxies and galactic nuclei. Properties of Radio galaxies and Quasar.

Unit IV

Super dense Objects: Mechanism of Mass transfer in Binary Stars. Use of polytropic models for completely degenerate stars. Mass-radius relation. Non-degenerate upper layers and abundance of Hydrogen. Stability of white dwarfs. Final cooling of white dwarfs. Accretion by white dwarfs and its consequences. Pressure ionisation and mass-radius relation for cold bodies. Formation, features and properties of Neutron stars, Pulsars and black holes.

Unit V

Gravitation & Cosmology: Conceptual foundations of GR and curved space-time: Principle of equivalence, Connection between gravity and geometry, Form of metric in Newtonian, limit Metric tensor and its properties, Einstein's field equations, observational tests of general relativity. Models of the universe: Steady State Models. Standard Model: The expanding universe, Hubble's law. Microwave background radiation Friedman-Robertson-Walker models, the early universe, Elementary ideas on structure formation. Implications of the dark matter in modern cosmology.

Text book [TB]:

TB 1 W.M.Smart: Text book of Spherical Astronomy

TB2. K.D.Abhyankar: Astrophysics:Stars and Galaxies (Tata McGraw Hill Publication)

Reference books [RB]:

RB1. D.Mihalas: Galactic Astronomy
RB2. S.Chandrasekhar: Principles of Stellar Dynamics

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	Describe the Physics of the Stars, Fundamental Equations, Detectors, Photometry and Spectroscopy, Galactic System and Extragalactic Systems, Super dense Objects, Gravitation & Cosmology
CO2	Explain the stellar evolution, the concept of Black holes, Statistical parallaxes. Solar motion and its determination. Peculiar velocities. Single and Two-star stream hypothesis. Velocity ellipsoid. Comparison with solar neighbourhood.

	Bottlinger's diagram. HR diagram.
CO3	Explain the types of binary stars, Design and construction of telescope Stability of white dwarfs. Final cooling of white dwarfs. Accretion by white dwarfs and its consequences. Pressure ionisation and mass-radius relation for cold bodies
CO4	Analyse the classify stellar energy and mass distribution in research field. Einstein's field equations, observational tests of general relativity. Models of the universe: Steady State Models. Standard Model: The expanding universe, Hubble's law. Microwave background radiation Friedman-Robertson-Walker models, the early universe
CO5	Distinguish Mass and radius relation, Galactic Structure, Mechanism of Mass transfer in Binary Stars. Use of polytropic models for completely degenerate stars. Mass-radius relation.
CO6	Express Non-degenerate upper layers and abundance of Hydrogen. Stability of white dwarfs, Determination of the masses and extragalactic distances, Galaxy Interaction

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1	1	2	2	1	1	1	2	2	1	2	2	2	1
CO2	3	2	1	2	3	2	1	2	2	3	2	2	1	2	1	1
CO3	2	2	1	2	2	2	1	2	1	2	2	2	2	3	2	1
CO4	2	2	1	2	2	2	1	2	2	2	2	2	1	2	1	2
CO5	3	2	1	2	3	2	1	2	1	3	2	1	2	2	2	1
CO6	2	2	1	2	2	2	1	2	1	2	2	2	1	2	1	2

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	: MPHDE109				
Course Name	: Research Methodology				
Semester /Year	: VII				
		L	T	P	C
		3	0	0	3

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

1. To introduce with meaning, functions of research and research process.
2. To highlights the various postulates of research problems, research Design, interpretation and report writing.
3. To expose the student to concepts of measure of central tendency and variation and their application to analyze the statistical data.
4. To acquire the knowledge of correlation, regression, data analysis and hypothesis testing using suitable test of statistical significance.

UNIT-I: Meaning &Functions of Research

Meaning of Research, Characteristics of Research, Steps involved in Research, Research in Pure and Applied Sciences, Inter Disciplinary Research, Trans disciplinary research, Significance of Research, Research and scientific methods, Research Process, Criteria of good Research, Problems encountered by Researchers, Literature review.

UNIT –II: Research Problem and Research Design

Selecting the Research problem, Necessity of defining the problem, Goals and Criteria for identifying problems for research, Perception of Research problem, Formulation of Research design, Need for Research design, Features of good design, Basic principles of experimental designs, Computer and internet in designs.

UNIT- III: Interpretation and Report Writing

Meaning and Technique of interpretation, Precautions in interpretation, Significance of report writing, Different steps in writing a report, Layout of a Research report, Types of report, Mechanics of writing a research report, Precautions for writing a research report

UNIT-IV: Statistical Techniques and Tools -I

Introduction of statistics, frequency distribution, Graphical representation of data, Measures of central tendency, Mean, Median, Mode, Standard deviation, Co-efficient of variation, Probability & distribution

UNIT-V: Statistical Techniques and Tools –II

Correlation, coefficient of correlation, Scatter diagram, Regression, Sampling distribution, Standard error, Hypothesis testing, Level of significance, Degree of freedom, Chi Square, T-test, Analysis of variance (ANOVA)

Text Books:

TB1. Ganesan R, Research Methodology for Engineers, MJP Publishers, Chennai. 2011

TB2. C.R.Kothari, "Research Methodology", 5th edition, New Age Publication,

TB3. Cooper, "Business Research Methods", 9th edition, Tata McGraw hills publication

Reference Books:

RB1. Anderson B.H., Dursaton, and Poole M.: Thesis and assignment writing, Wiley Eastern 1997.

RB2. Bordens K.S. and Abbott, B.b.: Research Design and Methods, McGraw Hill, 2008.
RB3. Morris R Cohen: An Introduction to logic and Scientific Method (Allied Publishers) – P 197-222; 391–403

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1.	Define various kind of research, objectives of doing research, research process and research design.
CO2.	Discuss the ability to choose methods appropriate to research aims and objectives.
CO3.	Explain analyze data and draw reasonable interpretations as well as communicate research findings in a clear and well-organized way.
CO4.	Explain Statistical tools and techniques to carry out data analysis and hypothesis testing using suitable test of statistical significance.
CO5.	Summarize the properties of mechanism of research methodology
CO6.	Create and Formulate a research methodology

Course code	: MPHDL 104				
Course Name	: Laboratory Course				
Semester /Year	: I/ I				
		L	T	P	C
		0	0	10	5

Course Objective: The main objective of this Lab. course is to impart practical knowledge in different fields such as solid state physics, electronics, Laser physics etc. to the students.

Course contents:

Condensed Matter Physics:

List of experiments: At least 5 experiments are to be performed

1. Determination of elastic constant of crystals by optical methods
2. Study of fluorescence spectra of a given compound
3. Study of color centers
4. Determination of lattice parameters using powder method.
5. Determination of hall coefficient using Hall effect
6. Determination of Energy gay of a semiconductor by four probe method
7. ESR
8. Dielectric constant

Electronics:

List of experiments: At least 5 experiments are to be performed

1. Study of regulated power supply (723).
2. Study of Timer (555).
3. A to D and D to A convertor
4. 1 of 16 Decoder/Encoder
5. Study of Multiplexer/Demultiplexer
6. Study of Comparator and Decoder
7. Study of different flip- flop circuits (RS, JK, D type, T-type, Master slave).
8. Study of Digital combinational and sequential circuits
9. Study of Microprocessor (8085)
10. Study of SCR, DIAC, TRIAC
11. Study of IC- Based Power supply

12. Microwave experiment.

13. Shift Registers

14. Fiber Optics communication

Laser Physics:

List of experiments: At least 5 experiments are to be performed

1. Study of the vibrational levels of Iodine.

2. Measurement of the fluorescence spectra of Uranyl Nitrate Hexahydrate.

3. Determination of the intrinsic life time for a dye molecule.

4. Determination of change in dipole moment in excited state using Solvatochromic shift method.

5. Measurement of non-radiative decay rate for a known sample.

6. Determination of the quantum yield of known samples using steady state spectroscopy.

7. Study of electro optic effect

8. Study of Acousto-optic effect

Astrophysics:

List of experiments: At least 5experiments are to be performed

1. Study of Hubble's law (from given data)

2. Study of constant density neutron star

3. Study of the static parameters of a Neutron Star model with inverse square density distribution

4. Study of star cluster from a given data

5. Study of Extinction coefficients

6. Study of variability of stars

High Energy Physics:

List of experiments: At least 5 experiments are to be performed

1. Characteristic curve of a GM Detector and Absorption coefficient of a using aluminum GM Detector.

2. Energy spectrum of gamma rays using gamma ray spectrometer.

3. Absorption coefficient of aluminum using gamma-ray spectrometer.

4. Characteristics of Scintillation Detector.

5. Study of gamma-gamma unperturbed angular correlations.

6. Study of particle tracks using a Nuclear Emulsion Detector.

7. Classification of tracks in interaction with Nuclear Emulsion and determination of excitation energy. 8. Mossbauer spectrometer

Note: Students have to perform those experiments which are related to their chosen elective Paper

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	Recognize the set up and calibrate the experimental setup.
CO2	Describe the basic principles of experiments.
CO3	Illustrate the experiment, tabulate the readings and interpret the data by drawing graphs.
CO4	Analyse the readings and interpret the data.
CO5	Find errors in interpret the data
CO6	Examine the verification of in the study of phenomenon such as Condensed Matter Physics Electronics/ Laser Physics/ Astrophysics to calculate several physical parameters.

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2	2	2	2	1	1	2	2	2	1	1	2	2	1
CO2	1	2	2	2	3	1	1	2	2	3	2	2	2	2	2	1
CO3	3	2	2	2	2	2	1	2	2	2	2	1	3	3	2	1
CO4	2	2	2	2	3	2	1	1	2	2	2	1	2	2	1	2
CO5	2	2	2	2	2	1	1	1	2	3	2	2	2	2	2	1
CO6	2	2	2	2	2	1	1	1	2	2	2	1	2	2	2	1

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course code	**: MPHRD201**			
Course Name	**: Dissertation**			
Semester /Year	**: II/ Ist**			
L	**T**	**P**	**C**	
0	**0**	**40**	**20**	

Course Objective: The main objective of the course is to carry out extensive research. Student will able to identify gap, development of methodology for problem solving, interpretation of findings, presentation of results and discussion of findings in context of national and international research.

Course contents:

This course will be based on preliminary research-oriented topics both in theory and experiment. The teachers who will act as supervisors for the projects will float projects and any one of them will be allocated to the students. At the completion of the project by the semester end, the student will submit Project Report in the form of dissertation which will be examined by the examiners. The examinations shall consist of presentation and comprehensive viva-voce.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	Observe practical experience of the research process.
CO2	Understands the principles of research.
CO3	Apply principles of research design to solve the problems in the field of research.
CO4	Create, analyse and critically evaluate various research solutions.
CO5	Evaluate links between theory and methods within their field of study
CO6	Create various research solution.

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1	2	2	2	2	1	1	2	2	2	1	1	2	2	1
CO2	1	2	2	2	3	1	1	2	2	3	2	2	2	2	2	1
CO3	3	2	2	2	2	2	1	2	2	2	2	1	3	3	2	1
CO4	2	2	2	2	3	2	1	1	2	2	2	1	2	2	1	2
CO5	2	2	2	2	2	1	1	1	2	3	2	2	3	2	2	1
CO6	2	2	2	2	2	1	1	1	2	2	2	1	2	2	2	1

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated