About the College

Vivekananda College of Arts and Sciences for Women (Autonomous) was established and hailed into Women's Educational Service in the Year 1995. Angammal Educational Trust Chaired by the great Educationalist 'Vidhya Rathna Prof.Dr. M. KARUNANITHI, B.Pharm. M.S., Ph.D., D.Litt. sponsors this college and other institutions under the name of the great Saint Vivekanandha. Our institutions are situated on either side of Tiruchengode Namakkal Main Road at Elayampalayam, 6 kms away from Tiruchengode. This is biggest women's college in India with more than 7500 girl students and more than 19 departments. The strength of the college was just 65 at the time of its establishment. With the dedication, work, sacrifice and long vision of the chairman, this institution has grown into a Himalaya stage. As a result of which UGC, New Delhi, awarded 2f and 12b, extended Autonomous status for second cycle. The National Assessment and Accreditation Council reaccredited with grade 'A+' for its successful performance.

As an Autonomous Institution, academic professionals of the college farm Curriculum and Syllabi in consultation with all its stakeholders to cater the needs the young women to fulfill the women empowerment and present Industrial needs the local benefits. The students are empowering with confidence and required to face the society.

Quality Policy

To provide professional training by establishing a high level center of learning that provides quality education at par with the international standards and Provide excellence education with well-equipped infrastructure to all the rural women.

Our Vision

To be an academic institution exclusively for women, in dynamic equilibrium with the social and economic environment, strive continuously for excellence in education, research and

technological service to the nation.

Our Mission

The mission of our institution is to discover, teach and apply knowledge for the intellectual, cultural, ethical, social and economic growth of women students.

M.Sc. (Physics)

SCOPE OF THE COURSE

M.Sc. (Physics), the recent developments in Physical sciences, has been included in the enriched syllabus to meet out the present day needs of academic and research, institutions and industries. The program expects serious commitment of the student to take-up challenging students' schedules and assignments. The course involves a blend of theoretical education and practical training which run concurrently for a period of two years and equips a student with knowledge, ability, skills and other qualities required for a professional accountant.

The uniqueness of the program is its content and topic coverage, the teaching methodology and the faculty. The syllabus has been designed at a level equal to that of professional courses. The teaching methodologies include classroom lectures, industrial visits, orientation, internship, case study and research work. Focus is also on developing soft skills of the students. For Core subjects, Outsource Guest Lectures by Industrialists and Professional Men will be arranged to enable the students to get wider exposure.

SALIENT FEATURES

- ✓ Course is specially designed for a higher level Career Placement.
- ✓ Special Guest lecturers from Industrialists will be arranged.
- ✓ Exclusively caters to students interested in pursuing higher studies.
- ✓ Special Industry Orientations and Training are parts of the Degree Course.

- ✓ Project work is included in the syllabus to enhance conceptual, analytical & deductive skills.

OBJECTIVES OFTHE COURSE

- ✓ The new syllabus throws light on the recent and emerging areas of Physics
- ✓ Enable the students understand Physics and make them more relevant to the society.
- ✓ Develop the analytical ability in students so that they are become objective solving problems.
- ✓ Help the students learn practical skills in a better way.
- ✓ Inculcate research aptitude in students.
- ✓ Enable the students to go to higher levels of learning Physics.
- ✓ Improve the employability of the students.
- ✓ To inspire the students to apply their knowledge gained for the development of society in general.

ELIGIBILITYFORADMISSION

Candidates seeking admission to the first year Degree course (M.Sc. Physics) shall be required to have passed an Under Graduate degree, i.e. B.Sc. (Physics or Applied Sciences) of the Periyar University or an examination of some other University accepted by the syndicate as equivalent there to shall b permitted to be eligible.

DURATION OFTHE COURSE

The course shall extend over a period of two academic years consisting of four semesters. Each academic year will be divided into two semesters. The First semester will consist of the period from July to November and the Second semester from December to March.

The subjects of the study shall be in accordance with the syllabus prescribed from time to time by the Board of Studies of Vivekanandha College of Arts and Sciences for Women with the approval of Periyar University.

Each subject will have five hours of lecture per week apart from

practical training at the end of each semester.

CONTINUOUSINTERNAL ASSESSMENT

The performance of the students will be assessed continuously and the Internal Assessment Marks will be asunder:

Average of three Tests	-10 Marks
Seminar	- 5Marks
Assignment	- 5Marks
Attendance	- 5Marks
Total	**= 25Marks**

The distribution of attendance marks is given as follows,

76-80 %	- 1 Mark
81-85 %	- 2 Marks
86-90 %	- 3 Marks
91-95 %	- 4 Marks
96-100 %	- 5 Marks

QUESTION PAPERPATTERN:

Question Paper Pattern for the Examinations

Time:3Hours

Maximum Marks: 75

Part-A Answer all the questions (Objective Type)

(10x1=10 Marks)

Part-B Answer all the following questions (Either or Type)

(7x5=35 Marks)

Part – C Answer any three questions (out of five)

(3 x 10 = 30 Marks)

PASSING MINIMUM

In the University Examinations, the passing minimum shall be 40 % out of 75 Marks for theory (38 marks) and 40% out of 60 marks for practical (24 Marks).

ELIGIBILITYFOR EXAMINATION

A candidate will be permitted to appear for the University Examination only on earning 75 % of attendance and only when her conduct has been satisfactory. Itshallbeopentograntexemptiontoacandidateforvalidreasonssubjectto conditions prescribed.

CLASSIFICATION OFSUCCESSFULCANDIDATES

Successful candidates passing the examination of Core Courses (main and allied subjects) and securing marks

a. 75 % and above shall be declared to have passed the examination in first class with Distinction provided they pass all the examinations prescribed for the course at first appearance itself.

b. 60% and above but below 75 % shall be declared to have passed the examinations in first class without Distinction.

c. 50%and above but below 60% shall be declared to have passed the examinations in second-class.

d. All the remaining successful candidates shall be declared to have passed the examinations in third-class.

e. Candidates who pass all the examinations prescribed for the course at the first appearance itself and within a period of three consecutive academic years from the year of admission only will be eligible for University rank.

COMMENCEMENT OF THESE REGULATIONS

These regulations shall take effect from the academic year 2023 - 2024 (i.e for the students who are to be admitted to the first year of the course during the academic year 2023 – 2024 and thereafter.

SYLLABUS FRAME WORK 2023 – 2024 Onwards (Revision)

SEMESTER- I								
Subject Code		**Subject Title**	**Hrs**	**Credit**	**Exam**	**Int. Marks**	**Ent. Marks**	**Total Mark**
23P1PHC01	Core – I	Mathematical Physics	6	4	3	25	75	100
23P1PHC02	Core – II	Classical Mechanics and Relativity	5	4	3	25	75	100
23P1PHC03	Core – III	Linear and Digital ICs and Applications	5	4	3	25	75	100
23P1PHDE01	Elective – I*	Materials Science	4	3	3	25	75	100
23P1PHCP01	Practical	Practical – I	6	3	4	40	60	100
23P1PHPC01	Professional Competency Course	Semiconductor devices	2	2	3	25	75	100
23P1PHAC01	Soft Skill – I Ability Enhancement Compulsory Course	Laser Physics and its Applications	2	2	3	25	75	100
Total			**30**	**22**	**22**	**190**	**510**	**700**
SEMESTER - II								
Subject Code		**Subject Title**	**Hrs**	**Credit**	**Exam**	**Int. Marks**	**Ent. Marks**	**Total Mark**
23P2PHC04	Core - IV	Statistical Mechanics	6	4	3	25	75	100
23P2PHC05	Core - V	Quantum Mechanics –I	6	4	3	25	75	100
23P2PHDE02	Elective – II*	Physics of Nanoscience and technology	4	3	3	25	75	100
23P3PHDE03	Elective – III*	Medical Physics	4	3	3	25	75	100

23P2PHCP02	Practical	Practical - II	6	3	4	40	60	100
23P2PHS01	Skill Enhancement Course – I	Electronics in daily life	2	2	3	25	75	100
23P2PHAC02	Soft Skill – II Ability Enhancement Compulsory Course	Solar Physics	2	2	3	25	75	100
Total			**30**	**21**	**22**	**190**	**510**	**700**
SEMESTER - III								
Subject Code		**Subject Title**	**Hrs**	**Credit**	**Exam**	**Int. Marks**	**Ent. Marks**	**Total Mark**
23P3PHC06	Core - VI	Quantum Mechanics –II	6	4	3	25	75	100
23P3PHC07	Core - VII	Spectroscopy	6	4	3	25	75	100
23P3PHC08	Core - VIII	Electromagnetic Theory	5	4	3	25	75	100
23P3PHDE04	Elective – IV*	Choose any one from the Elective list III	4	3	3	25	75	100
23P3PHCP03	Core Practical - III	Practical – III	6	4	4	40	60	100
23P3HR01	Common subject	Human Rights	1	1	3	25	75	100
23P3PHS02	Skill Enhancement Course – III	Scientific Research Process	2	2	3	25	75	100
23P3C3INT01		Internship / Industrial Activity	-	2	-	-	-	-
Total			**30**	**23**	**22**	**190**	**510**	**700**

SEMESTER - IV								
Subject Code		**Subject Title**	**Hrs**	**Credit**	**Exam**	**Int. Marks**	**Ent. Marks**	**Total Mark**
23P4PHC09	Core – IX	Nuclear and Particle Physics	6	4	3	25	75	100
23P4PHC10	Core - X	Condensed Matter Physics	5	4	3	25	75	100
23P4PHC11	Core - XI	Computational techniques for Physics	5	4	3	25	75	100
23P4PHCP04	Core Practical - IV	Practical – IV	6	4	4	40	60	100
23P4PHPR01	Core - XII	Project with Viva-Voce	4	4	-	25	75	100
23P4PHAC03	Soft Skill – II Ability Enhancement Compulsory Course	Robotics, AI in Physics	2	2	3	25	75	100
23P3CHED1	EDC	Applied polymer Chemistry	2	2	3	25	75	100
		Extension Activity	-	1	-	-	-	-
Total			**30**	**25**	**19**	**190**	**510**	**700**
Total (I & II Years)			**120**	**91**	**85**	**760**	**2040**	**2800**

- Elective I, II, III & IV selected from semester the elective list

LIST OF CORE PAPRES

S.No	Code	Course Title
1.	23P1PHC01	Mathematical Physics
2.	23P1PHC02	Classical Mechanics and Relativity
3.	23P1PHC03	Linear and Digital ICs and Applications
4.	23P2PHC04	Statistical Mechanics
5.	23P2PHC05	Quantum Mechanics –I
6.	23P3PHC06	Quantum Mechanics –II
7.	23P3PHC07	Spectroscopy
8.	23P3PHC08	Electromagnetic Theory
9.	23P4PHC09	Nuclear and Particle Physics
10.	23P4PHC10	Condensed Matter Physics
11.	23P4PHC11	Numerical Methods and Computer Programming

LIST OF ELECTIVES SEMESTER 1

S.No	Code	Course Title
1	23P1PHDE01	Materials Science
2	23P1PHDE02	Crystal Growth and Thin films
3	23P1PHDE03	Analysis of Crystal Structures
4	23P1PHDE04	Energy Physics
5	23P1PHDE05	Non-linear Dynamics

LIST OF ELECTIVES SEMESTER II

S.No	Code	Course Title
1.	23P2PHDE01	Plasma Physics
2.	23P2PHDE02	Physics of Nano Science and Technology
3.	23P2PHDE03	Medical Physics
4.	23P2PHDE04	Quantum Field Theory
5.	23P2PHDE05	General Relativity and Cosmology

LIST OF ELECTIVES SEMESTER III

S.No	Code	Course Title
1.	23P3PHDE01	Advanced Mathematical Physics
2.	23P3PHDE02	Advanced Spectroscopy
3.	23P3PHDE03	Microprocessor 8085 and Microcontroller 8051
4.	23P3PHDE04	Scientific Research Process
5.	23P3PHDE05	Characterization of Materials

LIST OF ELECTIVES SEMESTER IV

1.	23P3PHDE01	Solid Waste Management (SWM)
2.	23P3PHDE02	Sewage and Waste Water Treatment and Reuse
3.	23P3PHDE03	Solar Energy Utilization
4.	23P4PHDE04	Bio Physics
5.	23P4PHDE05	Robotics, Artificial Intelligence in Physics

LIST OF PRACTICALS

S.No	Code	Course Title
1.	23P1PHCP01	Practical - I
2.	23P2PHCP02	Practical - II
3.	23P3PHCP03	Practical – III
4.	23P4PHCP04	Practical - IV

PROGRAM OUTCOMES

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK FOR POSTGRADUATE EDUCATION	
Programme	**M.Sc., Physics**
Programme Code	PPH
Duration	**PG – 2 years**
Programme Outcomes (Pos)	**PO1: Problem Solving Skill** Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context. **PO2: Decision Making Skill** Foster analytical and critical thinking abilities for data-based decision-making. **PO3: Ethical Value** Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities. **PO4: Communication Skill** Ability to develop communication, managerial and interpersonal skills. **PO5: Individual and Team Leadership Skill** Capability to lead themselves and the team to achieve organizational goals. **PO6: Employability Skill** Inculcate contemporary business practices to enhance employability skills in the competitive environment.

	PO7: Entrepreneurial Skill Equip with skills and competencies to become an entrepreneur. **PO8: Contribution to Society** Succeed in career endeavors and contribute significantly to society. **PO 9 Multicultural competence** Possess knowledge of the values and beliefs of multiple cultures and a global perspective. **PO 10: Moral and ethical awareness/reasoning** Ability to embrace moral/ethical values in conducting one's life.
Programme Specific Outcomes (PSOs)	**PSO1 – Placement** To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, and beliefs and apply diverse frames of reference to decisions and actions. **PSO 2 - Entrepreneur** To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations. **PSO3 – Research and Development** Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development. **PSO4 – Contribution to Business World** To produce employable, ethical and innovative professionals to sustain in the dynamic business world. **PSO 5 – Contribution to the Society** To contribute to the development of the society by collaborating with stakeholders for mutual benefit.

Credit Distribution for PG Programme

Semester–I	Credit	Semester-II	Credit	Semester-III	Credit	Semester–IV	Credit
Core – I	4	Core - IV	4	Core - VI	4	Core – IX	4
Core – II	4	Core - V	4	Core - VII	4	Core - X	4
Core – III	4	Elective - II	3	Core - VIII	4	Core - XI	4
Elective - I	3	Elective - III	3	Elective – IV	3	Core – XII	4
Practical I	3	Practical II	3	Core Practical - III	4	Core Practical - IV	4
Professional Competency Course	2	Skill Enhancement Course – I	2	Common subject	1	Soft Skill – II Ability Enhancement Compulsory Course	2
Soft Skill – I Ability Enhancement Compulsory Course	2	Soft Skill – II Ability Enhancement Compulsory Course	2	Skill Enhancement Course – III	2	EDC	2
				Internship /Industrial Activity (15 days)	1	Extension Activity	1
	22		**21**		**23**		**25**
	Total Credit Points						**91**

Sl. No.	Subject	No. of Papers	Credit Points	Total Credit Points
1.	Core- Papers	12	4	48
2.	Core Practical	2	3	06
		2	4	08
3.	Elective	4	3	12
4.	Skill Enhancement Course – I	2	2	04
5.	Professional Competency Course	1	2	2
6.	Ability Enhancement Course- Soft Skill -	3	2	6
7.	Extra Disciplinary Course (EDC)	1	2	2
8.	Internship/ Industrial Activity	1	1	01
9.	Extension Activity	1	1	1
10.	Human Rights	1	1	1
	Total Credit Points	30	25	91

METHOD OF EVALUATION:
THEORY COURSES

Continuous Internal Assessment		End Semester Examination		Over all passing Minimum	
Maximum marks	Passing minimum	Maximum marks	Passing minimum	Total marks	Passing minimum
25	12	75	38	100	50

Continuous Internal Assessment Breakup

Sl. No.	CIA break up	Marks
1.	CIA –I/ CIA II/Model Exam	**10**
2.	Assignment	**05**
3.	Seminar	**05**
4.	Attendance	**05**

	Total	**25**

PRACTICAL COURSES

Continuous Internal Assessment	End Semester Examination	Total
40	60	**100**

Practical courses breakup

Sl. No.	practical courses	Marks
1.	Model Exam	**20**
2.	Record & Observation	**10**
3.	attendance	**10**
	Total	**40**

Submission of Record Notebooks For Practical Examinations

Candidates taking the Practical Examinations should submit bonafide Record Note Books prescribed for the Practical Examinations with due certification by Staff in-charge and HOD is a must for External Practical Examination (for both Regular and Arrear Candidates). Otherwise, the candidates will not be permitted to take the Practical Examinations. Allocation of Marks for University Practical Examinations:

Allocation of Marks for University Practical Examinations:

Record	10 Marks
Formula and Formula Description	10 Marks
Circuit Diagrams / Diagrams	08 Marks
Observation-Tabulation and Readings	20 Marks
Calculations	15 Marks
Presentation	02 Marks
Result	05 Marks
Viva-Voce	05 Marks
TOTAL	**75 Marks**

PROJECT VIVA-VOCE

Internal assessment	External	Total
25	75	**100**

Project – Internal Marks Breakup

Sl. No.	Project	Marks
1.	Project Work	**15**
2.	Continuous Review	**10**
	Total	**25**

PROJECT AND VIVA-VOCE EXAM

Students are required to submit a Project report at the end of Semester - IV and also required to make presentation of the project work during Viva-voce Examination. The Project work shall be based on research-oriented topics both in the fields of theoretical and experimental physics under the guidance of a faculty member of the Department as a Project Supervisor. In the course of the project, the student will refer books, Journals or collect literature/data by the way of visiting research institutes / industries. He/she may even do experimental /theoretical work in his/her college. After completion of the project work by the end of semester IV, each student should submit THREE copies of the project report with a minimum of 50 pages not exceeding 70 pages to the Department on or before the date notified for the same.

FORMAT FOR PREPARATION OF PROJECT REPORT

The sequence in which the project should be arranged and bound should be as follows

1. Cover Page and Title Page
2. Certificate
3. Declaration
4. Acknowledgement (not exceeding one page)
5. Contents (12 Font size, Times New Roman with 1.5 or double line spacing)
6. List of Figures / Exhibits / Charts
7. List of tables

8. Symbols and notations
9. Chapters
10. Result and Discussion
11. Conclusion
12. References
13. Xerox Copies of Publications/Certificates of Seminar, Conference Participation

The bifurcation of marks for project will be as follows:

1. Plan of the Project : 25 Marks
2. Evaluation of the Project Report : 75 Marks
3. Viva- Voce Examination : 25 Marks

DISTRIBUTION OF MARKS FOR EVAUATION OF PROJECT REPORT & VIVA-VOCE

(a) Execution of the Plan/Collection of Data/ Organisation of Materials / Presentation of the report /Novelty of the project : 40 Marks

(b)Presentation of project in state level/National level Seminar / Publication : 10 Marks

(c).Viva-Voce (Preparation, Presentation of work and Response to questions) : 25 Marks

EXAMINATION

For the purpose of uniformity, particularly for inter-departmental transfer of credits, there will be a uniform procedure credits, there will be a uniform procedure of examinations to be adopted by all teachers offering courses.

DISTRIBUTION OF MARKS:

(a)The following are the distribution of external and internal marks for Theory papers.

. i).External Exam. : 75 Marks
Passing Minimum : 38 Marks
ii). Internal Exam : 25 Marks
Passing Minimum : 12 Marks

QUESTION PAPER PATTERN

The following question paper pattern shall be followed for the candidates admitted from the academic year 2023–2024 (revision) onwards.

Time: 3 Hours Maximum: 75 Marks

Part – A (10 x 1 = 10 Marks)

Answer ALL the Questions

Three Questions from each unit

10 multiple choice questions with four options

Part - B (5 x 7 = 35 Marks)

Answer Any TWO Questions out of FIVE

One Question from each unit with either or Type.

All Questions carry equal Marks.

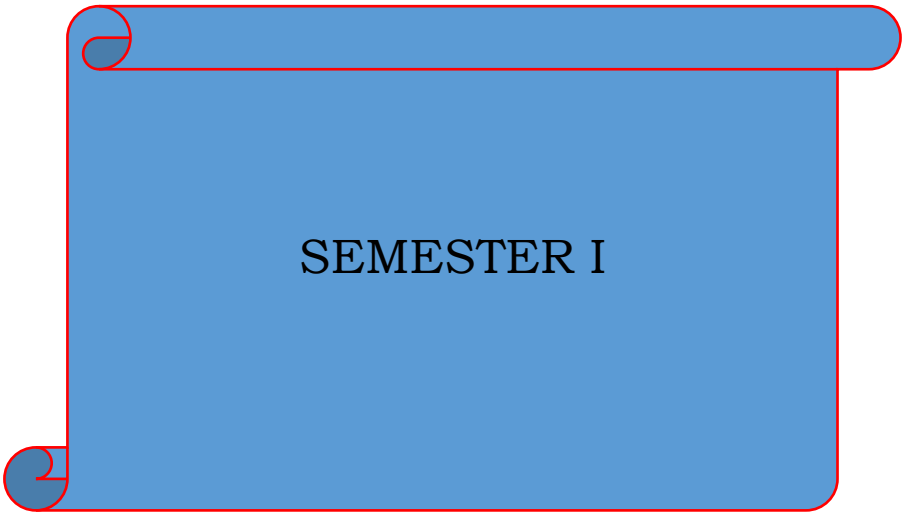
Part - C (3 x 10 = 30 Marks)

Answer ALL the Questions.

One Question from each unit.

All Questions carry equal Marks.

ONLINE COURSES
SWAYAM, NPTEL, Websites etc.


SEMESTER I

SEMESTER- I								
Subject Code		**Subject Title**	**Hrs**	**Credit**	**Exam**	**Int. Marks**	**Ent. Marks**	**Total Mark**
23P1PHC01	Core – I	Mathematical Physics	6	4	3	25	75	100
23P1PHC02	Core – II	Classical Mechanics and Relativity	5	4	3	25	75	100
23P1PHC03	Core – III	Linear and Digital ICs and Applications	5	4	3	25	75	100
23P1PHDE01	Elective – I*	Materials Science	4	3	3	25	75	100
23P1PHCP01	Practical	Practical – I	6	3	4	40	60	100
23P1PHPC01	Professional Competency Course	Semiconductor devices	2	2	3	25	75	100
23P1PHAC01	Soft Skill – I Ability Enhancement Compulsory Course	Laser Physics and its Applications	2	2	3	25	75	100
Total			**30**	**22**	**22**	**190**	**510**	**700**

Paper-1 - MATHEMATICAL PHYSICS		I YEAR - FIRST SEMESTER						
Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
23P1PHC01	**MATHEMATICAL PHYSICS**	Core				4	6	75

Pre-Requisites
Matrices, vectors, differentiation, integration, differential equations
Learning Objectives
➢ To equip students with the mathematical techniques needed for understanding theoretical treatment in different courses taught in their program ➢ To extend their manipulative skills to apply mathematical techniques in their fields ➢ To help students apply Mathematics in solving problems of Physics

UNITS	**Course Details**
UNIT I: **LINEAR VECTOR SPACE**	Basic concepts – Definitions- examples of vector space – Linear independence - Scalar product- Orthogonality – Gram-Schmidt orthogonalization procedure –linear operators – Dual space- ket and bra notation – orthogonal basis – change of basis – Isomorphism of vector space – projection operator – Eigen values and Eigen functions – Direct sum and invariant subspace – orthogonal transformations and rotation
UNIT II: **COMPLEX ANALYSIS**	Review of Complex Numbers -de Moivre's theorem-Functions of a Complex Variable- Differentiability -Analytic functions-Harmonic Functions- Complex Integration- Contour Integration, Cauchy – Riemann conditions – Singular points – Cauchy's Integral Theorem and integral Formula -Taylor's Series - Laurent's Expansion- Zeros and poles – Residue theorem and its Application: Potential theory - (1) Electrostatic fields and complex potentials - Parallel plates, coaxial cylinders and an annular region (2) Heat problems - Parallel plates and coaxial cylinders
UNIT III: **MATRICES**	Types of Matrices and their properties, Rank of a Matrix - Conjugate of a matrix - Adjoint of a matrix - Inverse of a matrix - Hermitian and Unitary Matrices -Trace of a matrix-Transformation of matrices - Characteristic equation - Eigen

	values and Eigen vectors - Cayley–Hamilton theorem – Diagonalization
UNIT IV: **FOURIER TRANSFORMS & LAPLACE TRANSFORMS**	Definitions -Fourier transform and its inverse - Transform of Gaussian function and Dirac delta function -Fourier transform of derivatives - Cosine and sine transforms - Convolution theorem. Application: Diffusion equation: Flow of heat in an infinite and in a semi - infinite medium - Wave equation: Vibration of an infinite string and of a semi - infinite string. Laplace transform and its inverse - Transforms of derivatives and integrals – Differentiation and integration of transforms - Dirac delta functions - Application - Laplace equation: Potential problem in a semi - infinite strip

UNIT V: **DIFFERENTIAL EQUATIONS**	Second order differential equation- Sturm-Liouville's theory - Series solution with simple examples - Hermite polynomials - Generating function - Orthogonality properties - Recurrence relations – Legendre polynomials - Generating function - Rodrigue formula – Orthogonality properties - Dirac delta function- One dimensional Green's function and Reciprocity theorem -Sturm-Liouville's type equation in one dimension & their Green's function.
UNIT VI: PROFESSIONAL COMPONENTS	Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism
TEXT BOOKS	1. *George Arfken and Hans J Weber, 2012, Mathematical Methods for Physicists – A Comprehensive Guide (7th edition), Academic press.* 2. *P.K. Chattopadhyay, 2013, Mathematical Physics (2nd edition), New Age, New Delhi* 3. A W Joshi, 2017, Matrices and Tensors in Physics, 4th Edition (Paperback), New Age International Pvt. Ltd., India 4. H. K. Dass and Dr. Rama Verma, 2014, Mathematical Physics, Seventh Revised Edition, S. Chand & Company Pvt. Ltd., New Delhi.
REFERENCE BOOKS	1. E. Kreyszig, 1983, Advanced Engineering Mathematics, Wiley Eastern, New Delhi, 2. D. G. Zill and M. R. Cullen, 2006, Advanced Engineering Mathematics, 3rd Ed. Narosa, New Delhi. 3. S. Lipschutz, 1987, Linear Algebra, Schaum's Series,

	McGraw - Hill, New York 3. E. Butkov, 1968, Mathematical Physics Addison, Wesley, Reading, Massachusetts. 4. P. R. Halmos, 1965, Finite Dimensional Vector Spaces, 2nd Edition, Affiliated East West, New Delhi.
WEB SOURCES	1. www.khanacademy.org 2. https://youtu.be/LZnRlOA1_2I 3. http://hyperphysics.phy-astr.gsu.edu/hbase/hmat.html#hmath 4. https://www.youtube.com/watch?v=_2jymuM7OUU&list=PLhkiT_RYTEU27vS_SlED56gNjVJGO2qaZ 5. https://archive.nptel.ac.in/courses/115/106/115106086/

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Understand use of bra-ket vector notation and explain the meaning of complete orthonormal set of basis vectors, and transformations and be able to apply them	**K1, K2**
CO2	Able to understand analytic functions, do complex integration, by applying Cauchy Integral Formula. Able to compute many real integrals and infinite sums via complex integration.	**K2, K3**
CO3	Analyze characteristics of matrices and its different types, and the process of diagonalization.	**K4**
CO4	Solve equations using Laplace transform and analyze the Fourier transformations of different function, grasp how these transformations can speed up analysis and correlate their importance in technology	**K4, K5**
CO5	To find the solutions for physical problems using linear differential equations and to solve boundary value problems using Green's function. Apply special functions in computation of solutions to real world problems	**K2, K5**
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** and program specific outcomes **(PSO)** in the 3-point scale of STRONG (3), MEDIUM (2) andLOW (1)**.**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	3	3	3	2	3	2
CO2	2	3	3	3	3	3	3	2	2	2
CO3	3	3	3	2	2	3	3	2	3	2
CO4	3	3	3	3	2	3	3	2	2	2
CO5	3	2	3	3	2	3	3	2	2	3

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	3	3	3	3	3	3	3	2	3	2
CO2	2	3	3	3	3	3	3	2	2	2
CO3	3	3	3	2	2	3	3	2	3	2
CO4	3	3	3	3	2	3	3	2	2	2
CO5	3	2	3	3	2	3	3	2	2	3

CLASSICAL MECHANICS AND RELATIVITY	I YEAR - FIRST SEMESTER

Subject Code	Subject Name	Category	L	T	P	Credits	Inst. Hours	Marks
23P1PHC02	**CLASSICAL MECHANICS AND RELATIVITY**	Core				4	5	75

Pre-Requisites
Fundamentals of mechanics, Foundation in mathematical methods.
Learning Objectives
➢ To understand fundamentals of classical mechanics. ➢ To understand Lagrangian formulation of mechanics and apply it to solve equation of motion. ➢ To understand Hamiltonian formulation of mechanics and apply it to solve equation of motion. ➢ To discuss the theory of small oscillations of a system. ➢ To learn the relativistic formulation of mechanics of a system.

UNITS	Course Details
UNIT I: PRINCIPLES OF CLASSICAL MECHANICS	Mechanics of a single particle – mechanics of a system of particles – conservation laws for a system of particles – constraints – holonomic & non-holonomic constraints – generalized coordinates – configuration space – transformation equations – principle of virtual work.
UNIT II: LAGRANGIAN FORMULATION	D'Alembert's principle – Lagrangian equations of motion for conservative systems – applications: (i) simple pendulum (ii) Atwood's machine (iii) projectile motion.
UNIT III: HAMILTONIAN FORMULATION	Phase space – cyclic coordinates – conjugate momentum – Hamiltonian function – Hamilton's canonical equations of motion – applications: (i) simple pendulum (ii) one dimensional simple harmonic oscillator (iii) motion of particle in a central force field.
UNIT IV: SMALL OSCILLATIONS	Formulation of the problem – transformation to normal coordinates – frequencies of normal modes – linear triatomic molecule.
UNIT V: RELATIVITY	Inertial and non-inertial frames – Lorentz transformation equations – length contraction and time dilation – relativistic addition of velocities – Einstein's mass-energy relation –

	Minkowski's space – four vectors – position, velocity, momentum, acceleration and force in for vector notation and their transformations
UNIT VI: PROFESSIONAL COMPONENTS	Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism

TEXT BOOKS	1. H. Goldstein, 2002, *Classical Mechanics*, 3rd Edition, Pearson Edu. 2. J. C. Upadhyaya, *Classical Mechanics*, Himalaya Publshing. Co. New Delhi. 3. Panat P.V, Introduction to Classical Mechanics – CBS publishers and distributors Pvt. Ltd, New Delhi, 1905. 4. N. C. Rana and P.S. Joag, Classical Mechanics - Tata McGraw Hill, 2001
REFERENCE BOOKS	1. S. N. Biswas, , *Classical Mechanics*, Books & Allied, Kolkata. 1999 2. Gupta and Kumar, *Classical Mechanics*, Kedar Nath. 3. T.W.B. Kibble, *Classical Mechanics*, ELBS. 4. B.D. Gupta, Satya Prakash, *Classical Dynamics*, KNRN Publications, Meerut.
WEB SOURCES	1. http://poincare.matf.bg.ac.rs/~zarkom/Book_Mechanics_Goldstein_Classical_Mechanics_optimized.pdf 2. https://pdfcoffee.com/classical-mechanics-j-c-upadhyay-2014-editionpdf-pdf-free.html 3. https://nptel.ac.in/courses/122/106/122106027/ 4. https://ocw.mit.edu/courses/physics/8-09-classical-mechanics-iii-fall-2014/lecture-notes/ 5. https://www.britannica.com/science/relativistic-mechanics

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Understand the fundamentals of classical mechanics.	**K2**
CO2	Apply the principles of Lagrangian and Hamiltonian mechanics to solve the equations of motion of physical systems.	**K3**
CO3	Apply the principles of Lagrangian and Hamiltonian mechanics to solve the equations of motion of physical systems.	**K3, K5**

CO4	Analyze the small oscillations in systems and determine their normal modes of oscillations.	**K4, K5**
CO5	Understand and apply the principles of relativistic kinematics to the mechanical systems.	**K2, K3**
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** and program specific outcomes **(PSO)** in the 3-point scale of STRONG (3), MEDIUM (2) and LOW (1)**.**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	2	3	3	3	2	2	2	3	2	2
CO2	2	3	3	3	2	2	2	3	2	2
CO3	2	3	3	3	2	2	2	3	2	2
CO4	2	3	3	3	2	2	2	3	2	2
CO5	2	3	3	3	2	2	2	3	2	2

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1	3	3	3	3	3	3	3	2	3	2
CO2	2	3	3	3	3	3	3	2	2	2
CO3	3	3	3	2	2	3	3	2	3	2
CO4	3	3	3	3	2	3	3	2	2	2
CO5	3	2	3	3	2	3	3	2	2	2

LINEAR AND DIGITAL ICs & APPLICATIONS	I YEAR - FIRST SEMESTER

Subject Code	Subject Name	Category	L	T	P	Credits	Inst. Hours	Marks
23P1PHC03	**LINEAR AND DIGITAL ICs AND APPLICATIONS**	Core				4	5	75

Pre-Requisites
Knowledge of semiconductor devices, basic concepts of digital and analog electronics
Learning Objectives
➢ To introduce the basic building blocks of linear integrated circuits. ➢ To teach the linear and non-linear applications of operational amplifiers. ➢ To introduce the theory and applications of PLL. ➢ To introduce the concepts of waveform generation and introduce one special function ICs. ➢ Exposure to digital IC‘s

UNITS	**Course Details**
UNIT I: INTEGRATED CIRCUITS AND OPERATIONAL AMPLIFIER	Introduction, Classification of IC‘s, basic information of Op-Amp 741 and its features, the ideal Operational amplifier, Op-Amp internal circuit and Op-Amp. Characteristics.
UNIT II: APPLICATIONS OF OP-AMP	LINEAR APPLICATIONS OF OP-AMP: Solution to simultaneous equations and differential equations, Instrumentation amplifiers, V to I and I to V converters. NON-LINEAR APPLICATIONS OF OP-AMP: Sample and Hold circuit, Log and Antilog amplifier, multiplier and divider, Comparators, Schmitt trigger, Multivibrators, Triangular and Square waveform generators.
UNIT III: ACTIVE FILTERS & TIMER AND PHASE	ACTIVE FILTERS: Introduction, Butterworth filters – 1st order, 2nd order low pass and high pass filters, band pass, band reject and all pass filters. **TIMER AND PHASE LOCKED LOOPS:** Introduction to IC 555 timer, description of functional diagram, monostable

LOCKED LOOPS	and astable operations and applications, Schmitt trigger, PLL - introduction, basic principle, phase detector/comparator, voltage controlled oscillator (IC 566), low pass filter, monolithic PLL and applications of PLL
UNIT IV: VOLTAGE REGULATOR & D to A AND A to D CONVERTERS	**VOLTAGE REGULATOR**: Introduction, Series Op-Amp regulator, IC Voltage Regulators, IC 723 general purpose regulators, Switching Regulator. **D to A AND A to D CONVERTERS:** Introduction, basic DAC techniques -weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A to D converters -parallel comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC Specifications.

UNIT V: CMOS LOGIC, COMBINATIONAL CIRCUITS USING TTL 74XX ICs & SEQUENTIAL CIRCUITS USING TTL 74XX ICs	**CMOS LOGIC:** CMOS logic levels, MOS transistors, Basic CMOS Inverter, NAND and NOR gates, CMOS AND-OR-INVERT and OR-AND-INVERT gates, implementation of any function using CMOS logic. COMBINATIONAL CIRCUITS USING TTL 74XX ICs: Study of logic gates using 74XX ICs, Four-bit parallel adder (IC 7483), Comparator (IC 7485), Decoder (IC 74138, IC 74154), BCDto 7-segment decoder (IC7447), Encoder (IC74147), Multiplexer (IC74151), Demultiplexer (IC 74154). **SEQUENTIAL CIRCUITS USING TTL 74XX ICs:** Flip Flops (IC 7474, IC 7473), Shift Registers, Universal Shift Register (IC 74194), 4- bit asynchronous binary counter (IC 7493).
UNIT VI: PROFESSIONAL COMPONENTS	Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism
TEXT BOOKS	1. Ramakant A. Gayakwad, (2012), OP-AMP and Linear Integrated Circuits, 4th edition, Prentice Hall / Pearson Education, New Delhi. 2. B.L. Theraja and A.K. Theraja, 2004, A Textbook of Electrical technology, S. Chand & Co. 3. V.K. Mehta and Rohit Mehta, 2008, Principles of Electronics, S. Chand & Co, 12th Edition. 4. V. Vijayendran, 2008, Introduction to Integrated electronics (Digital & Analog), S. Viswanathan Printers & Publishers Private Ltd, Reprint. V.
REFERENCE BOOKS	1. Sergio Franco (1997), Design with operational amplifiers and analog integrated circuits, McGraw Hill, New Delhi. 2. Gray, Meyer (1995), Analysis and Design of Analog

	Integrated Circuits, Wiley International, New Delhi. 3. Malvino and Leach (2005), Digital Principles and Applications 5th Edition, Tata McGraw Hill, New Delhi 4. Floyd, Jain (2009), Digital Fundamentals, 8th edition, Pearson Education, New Delhi. 5. Digital and Integrated Electronics, Millman & Halkias, Tata McGraw Hill, 17th Reprint (2000)
WEB SOURCES	1. https://nptel.ac.in/course.html/digital circuits/ 2. https://nptel.ac.in/course.html/electronics/operational amplifier/ 3. https://www.allaboutcircuits.com/textbook/semiconductors/chpt-7/field-effect-controlled-thyristors/ 4. https://www.electrical4u.com/applications-of-op-amp/ 5. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Learn about the basic concepts for the circuit configuration for the design of linear integrated circuits and develops skill to solve problems	**K1, K5**
CO2	Develop skills to design linear and non-linear applications circuits using Op-Amp and design the active filters circuits.	**K3**
CO3	Gain knowledge about PLL, and develop the skills to design the simple circuits using IC 555 timer and can solve problems related to it.	**K1, K3**
CO4	Learn about various techniques to develop A/D and D/A converters.	**K2**
CO5	Acquire the knowledge about the CMOS logic, combinational and sequential circuits	**K1, K4**
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** and program specific outcomes **(PSO)** in the 3-point scale of STRONG (3), MEDIUM (2) andLOW (1)**.**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	3	3	3	2	2	3	3	3	2
CO2	3	3	3	3	1	3	3	3	2	1

CO3	3	3	3	3	1	3	3	3	2	1
CO4	3	3	3	3	1	3	3	3	2	1
CO5	3	3	3	2	1	1	2	3	2	1

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1	3	3	3	3	2	2	3	3	3	2
CO2	3	3	3	3	1	3	3	3	2	1
CO3	3	3	3	3	1	3	3	3	2	1
CO4	3	3	3	3	1	3	3	3	2	1
CO5	3	3	3	2	1	1	2	3	2	1

Elective-I : MATERIALS SCIENCE		I YEAR- FIRST SEMESTER						
Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**Credits**	**Inst.Hours**	**Marks**
23P1PHDE01	**MATERIAL SSCIENCE**	**ELECTIVE**				**3**	**4**	**75**

Pre-Requisites
➢ Basic knowledge on different types of materials
Learning Objectives
➢ To gain knowledge on optoelectronic materials ➢ To learn about ceramic processing and advanced ceramics ➢ To understand the processing and applications of polymeric materials ➢ To gain knowledge on the fabrication of composite materials ➢ To learn about shape memory alloys, metallic glasses and nanomaterials

UNITS	**Course details**
UNIT I: OPTO ELECTRONICMATERIALS	Importance of optical materials properties: Bandgap and lattice matching – optical absorption and emission – charge injection, quasi-Fermi levels and recombination–optical absorption, loss and gain. Optical processes in quantum structures: Inter-band and intra-band transitions Organic semiconductors. Light propagation in materials–Electro-optic effect and modulation, electro-absorption modulation–exciton quenching.
UNIT II: CERAMICMATERIALS	Ceramic processing: powder processing, milling and sintering structural ceramics :zirconia, almina, silicon carbide, tungsten carbide–electronic ceramics–refractories – glass and glass ceramics
UNIT III : POLYMERICMATERIALS	Polymers and copolymers – molecular weight measurement – synthesis: chain growth polymerization–polymerization techniques–glass transition temperature and its measurement – visco elasticity – polymer processing techniques–applications: conducting polymers, bio polymers and high temperature polymers.

UNIT IV : COMPOSITE MATERIALS	Particle reinforced composites – fiber reinforced composites– mechanical behavior –fabrication methods of polymer matrix composites and metal matrix composites–carbon/carbon composites: fabrication and applications.
UNITV: NEWMATERIALS	Shape memory alloys: mechanisms of one-way and two-way shape memory effect, reverse transformation, thermo-elasticity and pseudo-elasticity, examples and applications - bulk metallic glass: criteria for glass formation and stability, examples and mechanical behavior-nanomaterials: classification, size effect on structural and functional properties, processing and properties of Nanocrystalline materials, single walled and multi-walled carbon nanotubes
UNIT VI:PROFESSIONAL COMPONENTS	Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement Social Accountability and Patriotism
TEXT BOOKS	1. Jasprit Singh, Electronic and optoelectronic properties of semiconductor structures, Cambridge UniversityPress, 2007 2. P.K.Mallick. Fiber- Reinforced Composites. CRC Press, 2008. 3. V.Raghavan, 2003, Materials Science and Engineering, 4thEdition, Prentice-HallIndia, New Delhi (For units 2,3, 4 and 5) 4. G.K.Narula, K.S.Narulaand V.K.Gupta,1988, Materials Science,Tata McGraw-Hill 5. M. Arumugam, 2002, Materials Science, 3rd revised Edition, Anuratha Agencies
REFERENCE BOOKS	1. B. S. Murty, P. Shankar, B. Raj, B. B. Rath and J. Murday. Textbook of Nanoscience and Nanotechnology. Springer-Verlag, 2012. 2. K. Yamauchi, I. Ohkata, K. Tsuchiya and S. Miyazaki (Eds). Shape Memory and Super Elastic Alloys: Technologies and Applications. Woodhead Publishing Limited, 2011. 3. Lawrence H. Van Vlack, 1998. Elements of Materials Science and Engineering, 6thEdition, Second ARE Ereprint, Addison-Wesley.

	4. H. Iabch and H. Luth, 2002, Solid State Physics – An Introduction to Principles ofMaterials Science,2nd Edition, Springer. 5. D. Hull & T.W. Clyne, An introduction to composite materials, Cambridge University Press,2008.
WEB SOURCES	1. https://onlinecourses.nptel.ac.in/noc20_mm02/preview 2. https://nptel.ac.in/courses/112104229 3. https://archive.nptel.ac.in/courses/113/105/113105081 4. https://nptel.ac.in/courses/113/105/113105025/ 5. https://eng.libretexts.org/Bookshelves/Materials_Science/Supplemental_MModules_(Materials_Science)/Electronic_Properties/Lattice_Vibrations

COURSEOUTCOMES:

At the end of the course, the student will be able to:

CO1	Acquire knowledge on opto electronic materials	**K1**
CO2	Be able to prepare ceramic materials	**K3**
CO3	Beabletounderstandtheprocessingandapplicationsofpolymericmaterials	**K2, K3**
CO4	Beware of the fabrication of composite materials	**K5**
CO5	Be knowledge able of shape memory alloys, metallic glasses and Nano materials	**K1**
K1-Remember;K2–Understand;K3-Apply;K4 -Analyze;K5-Evaluate;		

MAPPINGWITHPROGRAMOUTCOMES:

Map course outcomes (CO)for each course with program outcomes (PO) and program specific outcomes (PSO) in the 3-pointscale of STRONG (3),MEDIUM(2) and LOW(1).

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	2	3	3	2	2	2	2	1	2	3
CO2	2	3	3	2	2	2	2	1	2	2
CO3	2	3	2	2	2	2	2	2	2	2
CO4	1	3	2	3	2	3	2	2	2	2

CO5	2	3	2	2	2	2	2	2	2	2

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1	2	3	3	2	2	2	2	1	2	3
CO2	2	3	3	2	2	2	2	1	2	2
CO3	2	3	2	2	2	2	2	2	2	2
CO4	1	3	2	3	2	3	2	2	2	2
CO5	2	3	2	2	2	2	2	2	2	2

Professional Competency Course –1 **SEMICONDUCTOR DEVICES**		**I YEAR- FIRSTSEMESTER**						
Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**Credits**	**Inst.Hours**	**Marks**
23P1PHPC01	**SEMICONDUCTOR DEVICES**	Professional Competency Course				2	2	75

Pre-Requisites
➢ Basic knowledge on Semiconductor devices and its applications
Learning Objectives
➢ To gain knowledge on various semiconductor diodes and their characteristics and applications. ➢ To learn about characteristics and applications of metal semiconductor devices. ➢ To understand the various power control devices and its applications. ➢ To gain knowledge on the characteristics and applications of microwave device. ➢ To learn about characteristics of various photonic devices.

UNITS	**Course details**
UNIT I: SEMICONDUCTOR DIODE	Semiconductors – characteristics and applications of PN Junction diode– Zener diode– Gunn diode–Varactor diode–Schottky diode –LED
UNITII METAL-SEMICONDUCTOR DEVICES	JFET - Structure and Characteristics - MOSFET - Depletion and Enhancement type MOSFET
UNIT III **POWER CONTROL DEVICES**	Construction, V-I characteristics and applications of UJT, SCR, DIAC, TRIAC
UNIT IV **MICROWAVE**	Tunnel diode – I-V characteristics of Tunnel diode – IMPATT diode – MISS diode

DEVICES	
UNITV: PHOTONIC DEVICES	Photoconductor, Photodiode, quantum efficiency, PIN photodiode, hetero junction photodiode, avalanche photodiode - Photo transistors.
UNIT VI:PROFESSIONAL COMPONENTS	Expert Lectures, Online Seminars - Webinars Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism
TEXT BOOKS	1. Principles of Electronics, V.K.Mehta, S. Chand and Company, New Delhi(2015). 2. A text book of Applied Electronics, R.S.Sedha,S.Chand&Company,NewDelhi(2017). 3. Modern Digital Electronics, R.P.Jain, Tata McGraw-Hill Edn., Publishing Company Ltd., New Delhi(2010). 4. Solid State Electronic Devices, B.G. Streetman, S. Banerjee, Prentice Hall(2009). 5. Physics of Semiconductor Devices, S.M.Sze, Kwok K.Ng, John Wiley & Sons, New Delhi (2011).
REFERENCE BOOKS	1. SemiconductorPhysicsandDevices:BasicPrinciples,D. A.Neamen,McGraw-Hill (2003). 2. Physicsof SemiconductorDevices,DilipK.Roy,UniversityPres s(India)PrivateLimited,Hyderabad(2004). 3. Principles of Electronics, Partha Kumar and Ganguly, PHI Learning (P)Ltd., New Delhi (2015). 4. Physics of Photonic Devices, Shun Lien Chuang, JohnWiley&Sons,2ndEdition(2009).
WEBSOURCES	1. https://open.umn.edu/opentextbooks/textbooks/573 2. https://www.khanacademy.org/science/electrical-engineering/ee-semiconductor-devices 3. https://www.cambridge.org/core/books/abs/computational-electromagnetics-for-rf-and- microwave-engineering/web-resources/5DFE109913C5411D2E60C828A4F96F77 4. https://technav.ieee.org/topic/microwave-devices 5. https://www.nature.com/subjects/photonic-devices

COURSEOUTCOMES:

At the end of the course, the student will be able to:

CO1	Acquire knowledge on semiconductor diodes and applications	**K1**
CO2	Be able to understand the working of various metal semiconductor devices	**K3**
CO3	Be able to understand the characteristics of various power control devices	**K2, K3**
CO4	Beware of the microwave devices and its applications	**K5**
CO5	Be knowledgeable various photonic devices	**K1**
K1-Remember;K2–Understand;K3-Apply;K4 -Analyze;K5-Evaluate;		

MAPPINGWITHPROGRAMOUTCOMES:

Map course outcomes **(CO)**for each course with program out comes **(PO)** and program specific out comes **(PSO)** inthe 3-pointscale of STRONG (3),MEDIUM(2)and LOW(1)**.**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	2	3	3	2	2	2	2	1	2	3
CO2	2	3	3	2	2	2	2	1	2	2
CO3	2	3	2	2	2	2	2	2	2	2
CO4	1	3	2	3	2	3	2	2	2	2
CO5	2	3	2	2	2	2	2	2	2	2

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1	2	3	3	2	2	2	2	1	2	3
CO2	2	3	3	2	2	2	2	1	2	2
CO3	2	3	2	2	2	2	2	2	3	2
CO4	1	3	2	3	2	3	2	2	2	2
CO5	2	3	2	2	2	2	2	2	2	2

Soft Skill - I : Ability Enhancement Compulsory Course - LASER PHYSICS AND APPLICATIONS	**I YEAR- FIRSTSEMESTER**

SubjectCode	**Subject Name**	**Category**	**L**	**T**	**P**	**Credits**	**Inst.Hours**	**Marks**
23P1PHAC01	**LASER PHYSICS AND APPLICATIONS**	Soft Skill - I				2	2	75

Pre-Requisites
➢ Basic knowledge on laser and its applications
Learning Objectives
➢ To gain knowledge on principle of laser. ➢ To learn about characteristics of laser. ➢ To understand the components of laser. ➢ To gain knowledge on the different types of laser. ➢ To learn about the applications of laser.

UNITS	**Course Details**
UNIT I: PRINCIPLE OF LASER	Interaction of Light with matter– absorption– transmission-Stimulated Absorption-spontaneous and stimulated emission-Einstein Coefficient–their relations – population inversion.
UNITII CHARACTERISTICS OF LASER	Mono chromaticity– Coherence– Directionality-Brightness-Short Time Duration–Light Amplification-laser pumping–two level laser– three level laser– four level laser.
UNIT III COMPONENTS OF LASERS	Components of Laser-resonators–vibrational modes of resonators–open resonators-control resonators–Q-factor–losses in the resonance cavity-Modes of Laser beam–transverse modes.
UNIT IV TYPES OF LASERS	Five types of lasers- Gas laser– $C0_2$– Solid state laser–Helium Neon laser –Fiber laser–Liquid laser–Dye laser–Semiconductor laser–diode laser.
UNITV: APPLICATIONS	Application of lasers in industry – medicine – Science - Research – instrumentation

UNIT VI:PROFESSIONAL COMPONENTS	Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism
TEXTBOOKS	1. M.N. Aravamudhan, An introduction to Laser theory and application, S. Chand & Co. Pvt. Ltd, 2012. 2. Nityan and Chowdry and Richa Verma, Laser systems and applications, PHI, 2011. 3. R. Murugeshan and Kiruthiga sivaprasath, Optics and Spectroscopy, S.Chand& Co, 2010. 4. Subrahmanyam and Brijlal, A textbook of Optics, S.Chand& Co., 2001, 5. R. Murugeshan and Kiruthiga sivaprasath, Modern Physics, S.Chand & Co, 2014.
REFERENCEBOOKS	1. Lasers, Fundamentals and Applications,K.Thyagarajan,AjoyGhatak,Springer,2011. 2. Lasers and Nonlinear Optics-B.B.Laud,Cambridge UniversityPress,SecondEdition,2004. 3. Laser Physics, Peter W. Milonni, JosephH. Eberly, John Wiley & Sons, Inc., 2010. 4. An Advances in Optics, Photonics and Optoelectronics, PremB Bishit, IOP Publishing Ltd,2022. 5. An introduction to Laser Spectroscopy, DavidL. Andrews and Andrey, A.Demidov, Springer(India)PrivateLimited,NewDelhi,1995
WEBSOURCES	1. https://ocw.mit.edu/courses/res-6-005 understanding-lasers-and-fiberoptics-spring-2008/resources/laser-fundamentalsi/ 2. https://ehs.msu.edu/_assets/docs/laser/laser-fundamentals-pt1-springer-2005.pdf 3. https://technav.ieee.org/topic/laser-applications 4.https://onlinelibrary.wiley.com/doi/book/10.1002/9780470409718 5.https://www.olympuslifescience.com/en/icroscope-resource/primer/lightandcolor/lasersintro/

COURSEOUTCOMES:

At the end of the course, the student will be able to:

CO1	Acquire knowledge on working principle of laser.	**K1**
CO2	Be able to understand the characteristics of laser.	**K2**
CO3	Be able to understand the various components of laser	**K3**
CO4	Beware of the working process of different types lasers	**K2, K4**
CO5	Be knowledge able of applications of laser.	**K4**
K1-Remember;K2–Understand;K3-Apply;K4 -Analyze;K5-Evaluate;		

MAPPINGWITHPROGRAMOUTCOMES:

Map course outcomes (CO) **for each course with program outcomes** (PO) **and program specific outcomes** (PSO) **in the 3-pointscale of STRONG (3),MEDIUM (2) and LOW(1)**.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	2	3	3	2	2	2	2	1	2	3
CO2	2	3	3	2	2	2	2	1	2	2
CO3	2	2	2	2	2	2	2	2	2	2
CO4	1	3	2	3	2	3	2	2	3	2
CO5	2	3	2	2	2	2	2	2	2	2

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1	2	3	3	2	2	2	2	1	2	3
CO2	2	3	3	2	2	2	2	1	2	2
CO3	2	3	2	2	2	2	2	2	2	2
CO4	2	3	2	3	1	3	2	2	2	2
CO5	2	3	2	2	2	2	2	2	2	2

Paper 4 - PRACTICAL I	**I YEAR - FIRST SEMESTER**

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
23P1PHCP01	**PRACTICAL I**	Core				3	6	75

Pre-Requisites

Knowledge and hands on experience of basic general and electronics experiments of Physics

Learning Objectives

- To understand the concept of mechanical behavior of materials and calculation of same using appropriate equations.
- To calculate the thermodynamic quantities and physical properties of materials.
- To analyze the optical and electrical properties of materials.

Course Details

(Any Twelve Experiments)

1. Determination of Young's modulus and Poisson's ratio by Hyperbolic fringes - Cornu's Method
2. Determination of Viscosity of the given liquid – Meyer's disc
3. Measurement of Coefficient of linear expansion- Air wedge Method
4. B-H loop using Anchor ring.
5. Determination of Thickness of the enamel coating on a wire by diffraction
6. Determination of Rydberg's Constant - Hydrogen Spectrum
7. FP Etalon
8. Determination of Thickness of air film. - Solar spectrum – Hartmann's formula. Edser and Butler fringes.
9. Measurement of Band gap energy- Thermistor
10. Determination of Planck Constant – LED Method
11. Determination of Specific charge of an electron – Thomson's method.
12. Determination of Compressibility of a liquid using Ultrasonics
13. Determination of Wavelength, Separation of wavelengths - Michelson Interferometer
14. GM counter – Characteristics, inverse square law and absorption coefficient.

15. Measurement of Conductivity - Four probe method.
16. Arc spectrum – Iron.
17. Molecular spectra – AlO band.
18. Measurement of wavelength of Diode Laser / He – Ne Laser using Diffraction grating.
19. Determination of Diffraction pattern of light with circular aperture using Diode/He-Ne laser.
20. Study the beam divergence, spot size and intensity profile of Diode/He-Ne laser.
21. Measurements of Standing wave and standing wave co-efficient, Law of Inverse square, Receiver end transmitter behavior, Radiation Pattern - Microwave test bench
22. UV-Visible spectroscopy – Verification of Beer-Lambert's law and identification of wavelength maxima – Extinction coefficient
23. Construction of relaxation oscillator using UJT
24. FET CS amplifier- Frequency response, input impedance, output impedance
25. Study of important electrical characteristics of IC741.

26. V- I Characteristics of different colors of LED.
27. Study of attenuation characteristics of Wien's bridge network and design of Wien's bridge oscillator using Op-Amp.
28. Study of attenuation characteristics of Phase shift network and design of Phase shift oscillator using Op-Amp.
29. Construction of Schmidt triggers circuit using IC 741 for a given hysteresis-application as squarer.
30. Construction of square wave Triangular wave generator using IC 741
31. Construction of a quadrature wave using IC 324
32. Construction of pulse generator using the IC 741 – application as frequency divider
33. Construction of Op-Amp- 4 bit Digital to Analog converter (Binary Weighted and R/2R ladder type)
34. Study of Binary to Gray and Gray to Binary code conversion.
35. Study of R-S, clocked R-S and D-Flip flop using NAND gates
36. Study of J-K, D and T flip flops using IC 7476/7473
37. Arithmetic operations using IC 7483- 4-bit binary addition and subtraction.
38. Study of Arithmetic logic unit using IC 74181.
39. Construction of Encoder and Decoder circuits using ICs.

TEXT BOOKS	1. Practical Physics, Gupta and Kumar, PragatiPrakasan. 2. Kit Developed for doing experiments in Physics-

	Instruction manual, R. Srinivasan K.R Priolkar, Indian Academy of Sciences. 3. Electronic Laboratory Primer a design approach, S. Poornachandra, B. Sasikala, Wheeler Publishing, New Delhi. 4. Electronic lab manual Vol I, K ANavas, Rajath Publishing. 5. Electronic lab manual Vol II, K ANavas, PHI eastern Economy Edition
REFERENCE BOOKS	1. Advanced Practical Physics, S.P Singh, PragatiPrakasan. 2. An advanced course in Practical Physics, D. Chattopadhayay, C.R Rakshit, New Central Book Agency Pvt. Ltd 3. Op-Amp and linear integrated circuit, Ramakanth A Gaykwad, Eastern Economy Edition. 4. A course on experiment with He-Ne Laser, R.S. Sirohi, John Wiley & Sons (Asia) Pvt. Ltd. 5. Electronic lab manual Vol II, Kuriachan T.D, Syam Mohan, Ayodhya Publishing.

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Understand the strength of material using Young's modulus.	**K2**
CO2	Acquire knowledge of thermal behavior of the materials.	**K1**
CO3	Understand theoretical principles of magnetism through the experiments.	**K2**
CO4	Acquire knowledge about arc spectrum and applications of laser	**K1, K3**
CO5	Improve the analytical and observation ability in Physics Experiments	**K3, K5**
CO6	Conduct experiments on applications of FET and UJT	**K4**
CO7	Analyze various parameters related to operational amplifiers.	**K4**
CO8	Understand the concepts involved in arithmatic and logical circuits using IC's	**K2**
CO9	Acquire knowledge about Combinational Logic Circuits and Sequential Logic Circuits	**K1**
CO10	Analyze the applications of counters and registers	**K4**
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

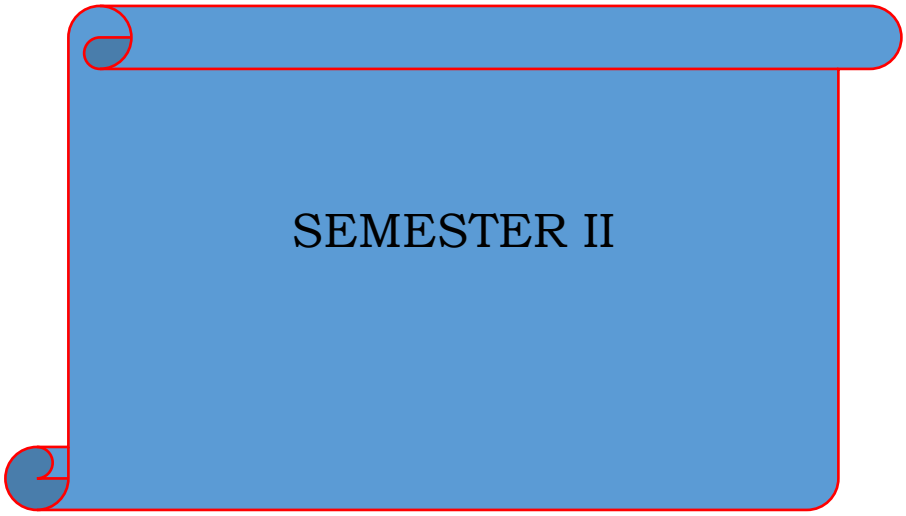
MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)**

and program specific outcomes **(PSO)** in the 3-point scale of STRONG (3), MEDIUM (2) and LOW (1)**.**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	2	2	2	3	2	2	2	1	2	3
CO2	2	2	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3
CO4	3	2	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	2	2	2	2
CO6	2	2	2	3	3	1	1	1	3	3
CO7	2	2	3	3	3	1	1	1	3	3
CO8	3	3	3	3	3	3	2	2	3	3
CO9	3	3	3	3	3	3	1	1	1	1
CO10	3	3	3	3	3	3	1	1	1	1

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1	2	2	2	3	2	2	2	1	2	3
CO2	2	2	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3
CO4	3	2	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	2	2	2	2
CO6	2	2	2	3	3	1	1	1	3	3
CO7	2	2	3	3	3	1	1	1	3	3
CO8	3	3	3	3	3	3	2	2	3	3
CO9	3	3	3	3	3	3	1	1	1	1
CO10	3	3	3	3	3	3	1	1	1	1


SEMESTER II

SEMESTER - II								
Subject Code		**Subject Title**	**Hrs**	**Credit**	**Exam**	**Int. Marks**	**Ent. Marks**	**Total Mark**
23P2PHC04	Core - IV	Statistical Mechanics	6	4	3	25	75	100
23P2PHC05	Core - V	Quantum Mechanics – I	6	4	3	25	75	100
23P2PHDE02	Elective – II*	Physics of Nanoscience and technology	4	3	3	25	75	100
23P3PHDE03	Elective – III*	Medical Physics	4	3	3	25	75	100
23P2PHCP02	Practical	Practical - II	6	3	4	40	60	100
23P2PHS01	Skill Enhancement Course – I	Electronics in daily life	2	2	3	25	75	100
23P2PHAC02	Soft Skill – II Ability Enhancement Compulsory Course	Solar Physics	2	2	3	25	75	100
Total			**30**	**21**	**22**	**190**	**510**	**700**

Paper 5 - STATISTICAL MECHANICS		I YEAR - SECOND SEMESTER						
Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
23P2PHC04	**STATISTICAL MECHANICS**	Core				4	6	75

Pre-Requisites
Laws of thermodynamics, phase transition, entropy, ensembles, partition function, classical and quantum statistics, thermal equilibrium, Brownian motion
Learning Objectives
➢ To acquire the knowledge of thermodynamic potentials and to understand phase transition in thermodynamics ➢ To identify the relationship between statistic and thermodynamic quantities ➢ To comprehend the concept of partition function, canonical and grand canonical ensembles ➢ To grasp the fundamental knowledge about the three types of statistics ➢ To get in depth knowledge about phase transitions and fluctuation of thermodynamic properties that vary with time

UNITS	**Course Details**
UNIT I: PHASE TRANSITIONS	Thermodynamic potentials - Phase Equilibrium - Gibb's phase rule - Phase transitions and Ehrenfest's classifications –Third law of Thermodynamics. Order parameters – Landau's theory of phase transition - Critical indices - Scale transformations and dimensional analysis.
UNIT II: STATISTICAL MECHANICS AND THERMODYNAMICS	Foundations of statistical mechanics - Specification of states of a system - Micro canonical ensemble - Phase space – Entropy - Connection between statistics and thermodynamics – Entropy of an ideal gas using the micro canonical ensemble - Entropy of mixing and Gibb's

	paradox.
UNIT III: CANONICAL AND GRAND CANONICAL ENSEMBLES	Trajectories and density of states - Liouville's theorem - Canonical and grand canonical ensembles - Partition function - Calculation of statistical quantities - Energy and density fluctuations.
UNIT IV: CLASSICAL AND QUANTUM STATISTICS	Density matrix - Statistics of ensembles - Statistics of indistinguishable particles - Maxwell-Boltzmann statistics - Fermi-Dirac statistics – Ideal Fermi gas – Degeneracy - Bose-Einstein statistics - Plank radiation formula - Ideal Bose gas - Bose-Einstein condensation.
UNIT V: REAL GAS, **ISING MODEL AND FLUCTUATIONS**	Cluster expansion for a classical gas - Virial equation of state – Calculation of the first Virial coefficient in the cluster expansion - Ising model - Mean-field theories of the Ising model in three, two and one dimensions - Exact solutions in one dimension. Correlation of space-time dependent fluctuations - Fluctuations and transport phenomena - Brownian motion - Langevin's theory - Fluctuation-dissipation theorem - The Fokker-Planck equation
UNIT VI: PROFESSIONAL COMPONENTS	Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism
TEXT BOOKS	1. S. K. Sinha, 1990, Statistical *Mechanics*, Tata McGraw Hill, New Delhi. 2. B. K. Agarwal and M. Eisner, 1998, *Statistical Mechanics,* Second Edition New Age International, New Delhi. 3. J. K. Bhattacharjee, 1996, *Statistical Mechanics*: An Introductory Text, Allied Publication, New Delhi. 4. F. Reif, 1965, *Fundamentals of Statistical and Thermal Physics,* McGraw -Hill, New York. 5. M. K. Zemansky, 1968, *Heat and Thermodynamics,* 5th edition, McGraw-Hill New York.
REFERENCE BOOKS	1. R. K. Pathria, 1996, *Statistical Mechanics,* 2nd edition, Butter WorthHeinemann, New Delhi. 2. L. D. Landau and E. M. Lifshitz, 1969, *Statistical Physics,*

	Pergamon Press, Oxford. 3. K. Huang, 2002, *Statistical Mechanics,* Taylor and Francis, London 4. W. Greiner, L. Neise and H. Stoecker, *Thermodynamics and Statistical Mechanics,* Springer Verlang, New York. 5. A. B. Gupta, H. Roy, 2002, *Thermal Physics*, Books and Allied, Kolkata.
WEB SOURCES	1. https://byjus.com/chemistry/third-law-of-thermodynamics/ 2. https://web.stanford.edu/~peastman/statmech/thermodynamics.html 3. https://en.wikiversity.org/wiki/Statistical_mechanics_and_thermodynamics 4. https://en.wikipedia.org/wiki/Grand_canonical_ensemble 5. https://en.wikipedia.org/wiki/Ising_model

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	To examine and elaborate the effect of changes in thermodynamic quantities on the states of matter during phase transition	**K5**
CO2	To analyze the macroscopic properties such as pressure, volume, temperature, specific heat, elastic moduli etc. using microscopic properties like intermolecular forces, chemical bonding, atomicity etc. Describe the peculiar behavior of the entropy by mixing two gases Justify the connection between statistics and thermodynamic quantities	**K4**
CO3	Differentiate between canonical and grand canonical ensembles and to interpret the relation between thermodynamically quantities and partition function	**K1**
CO4	To recall and apply the different statistical concepts to analyze the behavior of ideal Fermi gas and ideal Bose gas and also to compare and distinguish between the three types of statistics.	**K4, K5**
CO5	To discuss and examine the thermodynamically behavior of gases	**K3**

	under fluctuation and also using Ising model	
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** and program specific outcomes **(PSO)** in the 3-point scale of STRONG (3), MEDIUM (2) andLOW (1)**.**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	3	3	1	1	2	3	1	1	3
CO2	3	3	3	1	1	2	3	1	1	3
CO3	3	3	3	1	1	2	3	2	1	3
CO4	3	3	3	1	1	2	3	2	1	3
CO5	3	3	3	1	1	2	3	1	1	3

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1	3	3	3	1	1	2	3	1	1	3
CO2	3	3	3	1	1	2	3	1	1	3
CO3	3	3	3	1	1	2	3	2	1	3
CO4	3	3	3	1	1	2	3	2	1	3
CO5	3	3	3	1	1	2	3	1	1	3

QUANTUM MECHANICS – I		I YEAR - SECOND SEMESTER						
Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
23P2PHC05	**QUANTUM MECHANICS – I**	Core				4	6	75

Pre-Requisites
Newton's laws of motion, Schrodinger's equation, integration, differentiation.
Learning Objectives
➢ To develop the physical principles and the mathematical background important to quantum mechanical descriptions. ➢ To describe the propagation of a particle in a simple, one-dimensional potential. ➢ To formulate and solve the Schrodinger's equation to obtain eigenvectors and energies for particle in a three-dimensional potential. ➢ To explain the mathematical formalism and the significance of constants of motion, and see their relation to fundamental symmetries in nature ➢ To discuss the Approximation methods like perturbation theory, Variational and WKB methods for solving the Schrödinger equation.

UNITS	**Course Details**
UNIT I: **BASIC FORMALISM**	Interpretation of the wave function – Time dependent Schrodinger equation –Time independent Schrodinger equation – Stationary states – Ehrenfest's theorem – Linear vector space – Linear operator – Eigen functions and Eigen Values – Hermitian Operator – Postulates of Quantum Mechanics – Simultaneous measurability of observables – General Uncertainty relation
UNIT II: ONE DIMENSIONAL AND THREE-DIMENSIONAL ENERGY EIGEN VALUE	Square – well potential with rigid walls – Square well potential with finite walls – Square potential barrier – Alpha emission – Bloch waves in a periodic potential – Kronig-penny square – well periodic potential – Linear harmonic oscillator: Operator method – Particle moving in a spherically symmetric potential – System of two

PROBLEMS	interacting particles – Hydrogen atom – Rigid rotator
UNIT III: **GENERAL FORMALISM**	Dirac notation – Equations of motions – Schrodinger representation – Heisenberg representation – Interaction representation – Coordinate representation – Momentum representation – Symmetries and conservation laws – Unitary transformation – Parity and time reversal
UNIT IV: **APPROXIMATION METHODS**	Time independent perturbation theory for non-degenerate energy levels – Degenerate energy levels – Stark effect in Hydrogen atom – Ground and excited state – Variation method – Helium atom – WKB approximation – Connection formulae (no derivation) – WKB quantization – Application to simple harmonic oscillator.
UNIT V: **ANGULAR MOMENTUM**	Eigenvalue spectrum of general angular momentum – Ladder operators and their algebra – Matrix representation – Spin angular momentum – Addition of angular momenta – CG Coefficients – Symmetry and anti – symmetry of wave functions – Construction of wave-functions and Pauli's exclusion principle.
UNIT VI: PROFESSIONAL COMPONENTS	Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism
TEXT BOOKS	1. P. M. Mathews and K. Venkatesan, A Text book of Quantum Mechanics, 2nd edition(37th Reprint),Tata McGraw-Hill, New Delhi, 2010. 2. G. Aruldhas, Quantum Mechanics, 2nd edition, Prentice Hall of India, New Delhi, 2009. 3. David J Griffiths, Introduction to Quantum Mechanics. 4th edition, Pearson, 2011. 4. SL Gupta and ID Gupta, Advanced Quantum Theory and Fields, 1st Edition, S.Chand& Co., New Delhi, 1982. 5. A. Ghatak and S. Lokanathan, Quantum Mechanics: Theory and Applications, 4thEdition, Macmillan, India, 1984.
REFERENCE BOOKS	1. E. Merzbacher, Quantum Mechanics, 2nd Edition, John Wiley and Sons, New York, 1970. 2. V. K. Thankappan, Quantum Mechanics, 2nd Edition, Wiley Eastern Ltd, New Delhi, 1985. 3. L. D. Landau and E. M. Lifshitz, Quantum Mechanics, 1st edition, Pergomon Press, Oxford, 1976. 4. S. N. Biswas, Quantum Mechanics, Books and Allied Ltd., Kolkata, 1999. 5. V. Devanathan, Quantum Mechanics, 2nd edition, Alpha

	Science International Ltd, Oxford , 2011.
WEB SOURCES	1. http://research.chem.psu.edu/lxjgroup/download_files/chem 565-c7.pdf 2. http://www.feynmanlectures.caltech.edu/III_20.html 3. http://web.mit.edu/8.05/handouts/jaffe1.pdf 4. https://hepwww.pp.rl.ac.uk/users/haywood/Group_Theory_L ectures/Lecture_ 1.pdf 5. https://theory.physics.manchester.ac.uk/~xian/qm/chapter3. pdf

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Demonstrates a clear understanding of the basic postulates of quantum mechanics which serve to formalize the rules of quantumMechanics	K1, K5
CO2	Is able to apply and analyze the Schrodinger equation to solve one dimensional problems and three dimensional problems	**K3, K4**
CO3	Can discuss the various representations, space time symmetries and formulations of time evolution	**K1**
CO4	Can formulate and analyze the approximation methods for various quantum mechanical problems	**K4, K5**
CO5	To apply non-commutative algebra for topics such as angular and spin angular momentum and hence explain spectral line splitting.	**K3, K4**
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** and program specific outcomes **(PSO)** in the 3-point scale of STRONG (3), MEDIUM (2) andLOW (1)**.**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	3	3	3	3	2	3	2	2	3
CO2	3	3	3	3	3	S	3	2	2	3
CO3	2	3	3	2	3	2	3	2	2	3

CO4	3	3	3	3	3	2	3	3	2	3
CO5	3	3	3	2	3	S	3	3	2	3

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1	3	3	3	3	3	2	3	2	2	3
CO2	3	3	3	3	3	S	3	2	2	3
CO3	2	3	3	2	3	2	3	2	2	3
CO4	3	3	3	3	3	2	3	3	2	3
CO5	3	3	3	2	3	S	3	3	2	3

Elective - II: PHYSICS OF NANOSCIENCE AND TECHNOLOGY	**I YEAR – SECOND SEMESTER**

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
23P2PHDE02	**PHYSICS OF NANOSCIENCE AND TECHNOLOGY**	**Elective**				**3**	**4**	**75**

Pre-Requisites
Nanoscience fundamentals, Nanomaterials properties, Characterization and applications of materials
Learning Objectives
➢ Physics of Nanoscience and Technology is concerned with the study, creation, manipulation and applications at nanometer scale. ➢ To provide the basic knowledge about Nanoscience and technology. ➢ To learn the structures and properties of Nanomaterials. ➢ To acquire the knowledge about synthesis methods and characterization techniques and its applications.

UNITS	**Course Details**
UNIT I: FUNDAMENTALS OF NANOSCIENCE AND TECHNOLOGY	Fundamentals of NANO – Historical Perspective on Nanomaterial and Nanotechnology –– Classification of Nanomaterials – Metal and Semiconductor Nanomaterials - 2D, 1D, 0D nanostructured materials - Quantum dots – Quantum wires – Quantum wells - Surface effects of nanomaterials.
UNIT II: PROPERTIES OF NANOMATERIALS	Physical properties of Nanomaterials: Melting points, specific heat capacity, and lattice constant - Mechanical behavior: Elastic properties – strength - ductility - superplastic behavior - Optical properties: - Surface Plasmon Resonance – Quantum size effects - Electrical properties - Conductivity, Ferroelectrics and dielectrics - Magnetic properties – super para magnetism –

	Diluted magnetic semiconductor (DMS).
UNIT III: SYNTHESIS AND FABRICATION	Physical vapour deposition - Chemical vapour deposition - sol-gel – Wet deposition techniques - electrochemical deposition method – Plasma arching - Electrospinning method - ball milling technique - pulsed laser deposition - Nanolithography: photolithography – Nanomanipulator.
UNIT IV: CHARACTERIZATION TECHNIQUES	Powder X-ray diffraction – X-ray photoelectron spectroscopy (XPS) - UV-visible spectroscopy – Photoluminescence - Scanning electron microscopy (SEM) - Transmission electron microscopy (TEM) - Scanning probe microscopy (SPM) - Scanning tunneling microscopy (STM) – Vibrating sample Magnetometer.

UNIT V: APPLICATIONS OF NANOMATERIALS	Sensors: Nanosensors based on optical and physical properties - Electrochemical sensors – Nano-biosensors. Nano Electronics: Nanobots - display screens - GMR read/write heads - Carbon Nanotube Emitters – Photocatalytic application: Air purification, water purification -Medicine: Imaging of cancer cells – biological tags - drug delivery - photodynamic therapy - Energy: fuel cells - rechargeable batteries - supercapacitors - photovoltaics.
UNIT VI: PROFESSIONAL COMPONENTS	Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism
TEXT BOOKS	1. A textbook of Nanoscience and Nanotechnology, Pradeep T., Tata McGraw-Hill Publishing Co. (2012). 2. Principles of Nanoscience and Nanotechnology, M.A. Shah, Tokeer Ahmad, Narosa Publishing House Pvt Ltd., (2010). 3. Introduction to Nanoscience and Nanotechnology, K. K. Chattopadhyay and A.N. Banerjee, PHI Learning Pvt. Ltd., New Delhi, (2012). 4. Nanostructured Materials and Nanotechnology, Hari Singh Nalwa, Academic Press, (2002). 5. Nanotechnology and Nanoelectronics, D.P. Kothari, V. Velmurugan and Rajit Ram Singh, Narosa Publishing House Pvt. Ltd, New Delhi. (2018)

REFERENCE BOOKS	1. Nanostructures and Nanomaterials – Huozhong Gao – Imperial College Press (2004). 2. Richard Booker and Earl Boysen, (2005) Nanotechnology, Wiley Publishing Inc. USA 3. Nano particles and Nano structured films; Preparation, Characterization and Applications, J. H. Fendler John Wiley and Sons. (2007) 4. Textbook of Nanoscience and Nanotechnology, B. S. Murty, et al., Universities Press. (2012) 5. The Nanoscope (Encyclopedia of Nanoscience and Nanotechnology), Dr. Parag Diwan and Ashish Bharadwaj (2005) Vol. IV - Nanoelectronics Pentagon Press, New Delhi.
WEB SOURCES	1. www.its.caltec.edu/feyman/plenty.html 2. http://www.library.ualberta.ca/subject/nanoscience/guide/index.cfm 3. http://www.understandingnano.com 4. http://www.nano.gov 5. http://www.nanotechnology.com

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Understand the basic of Nanoscience and explore the different types of Nanomaterials and should comprehend the surface effects of the Nanomaterials.	**K1, K2**
CO2	Explore various physical, mechanical, optical, electrical and magnetic properties Nanomaterials.	**K1**
CO3	Understand the process and mechanism of synthesis and fabrication of Nanomaterials.	**K2, K3**
CO4	Analyze the various characterization of Nano-products through diffraction, spectroscopic, microscopic and other techniques.	**K4**
CO5	Apply the concepts of Nanoscience and technology in the field of sensors, robotics, purification of air and water and in the energy devices.	**K3**
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate;		

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** and program specific outcomes **(PSO)** in the 3-point scale of STRONG (3), MEDIUM (2) andLOW (1)**.**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	3	3	2	1	1	3	3	3	3
CO2	3	3	3	2	1	1	3	3	3	3
CO3	3	3	2	2	1	1	3	3	3	3
CO4	3	3	3	2	1	1	3	3	3	3
CO5	3	3	2	2	1	1	3	3	3	3

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1	3	3	3	2	1	1	3	3	3	3
CO2	3	3	3	2	1	1	3	3	3	3
CO3	3	3	2	2	1	1	3	3	3	3
CO4	3	3	3	2	1	1	3	3	3	3
CO5	3	3	2	2	1	1	3	3	3	3

Elective – III: MEDICAL PHYSICS	**I YEAR – SECOND SEMESTER**

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
23P2PHDE03	**MEDICAL PHYSICS**	**Elective**				**3**	**4**	**75**

Pre-Requisites
Fundamentals of physiological concepts, Basics of instruments principle,
Learning Objectives
➢ To understand the major applications of Physics to Medicine ➢ To study the aid of different medical devices such as X-ray machines, gamma camera, accelerator and nuclear magnetic resonance. ➢ To outline the principles of Physics of different medical radiation devices and their modern advances, especially in medical radiation therapy and different applications in medical physics. ➢ To introduce the ideas of Radiography. ➢ To form a good base for further studies like research.

UNITS	**Course Details**
UNIT I: X-RAYS AND TRANSDUCERS	Electromagnetic Spectrum – Production of X-Rays – X-Ray Spectrum –Bremsstrahlung – Characteristic X-Ray – X-Ray Tubes – Coolidge Tube – X-Ray Tube Design – Thermistors – photo electric transducers – Photo voltaic cells – photo emissive cells –Photoconductive cells– piezoelectric transducer
UNIT II: BLOOD PRESSURE MEASUREMENTS	Introduction – sphygmomanometer – Measurement of heart rate – basic principles of electrocardiogram (ECG) – Basic principles of electro-neurography (ENG) – Basic principles of magnetic resonance imaging (MRI).
UNIT III: RADIATION PHYSICS	Radiation Units – Exposure – Absorbed Dose – Rad to Gray – Kera Relative Biological Effectiveness –Effective Dose – Sievert (Sv) – Inverse Square Law – Interaction of radiation with Matter – Linear Attenuation Coefficient – Radiation Detectors –Thimble Chamber – Condenser Chambers – Geiger Counter – Scintillation Counter

UNIT IV: MEDICAL IMAGING PHYSICS	Radiological Imaging – Radiography – Filters – Grids – Cassette – X-Ray Film – Film processing – Fluoroscopy – Computed Tomography Scanner – Principal Function – Display – Mammography – Ultrasound Imaging – Magnetic Resonance Imaging – Thyroid Uptake System – Gamma Camera (Only Principle, Function and display)

UNIT V: RADIATION PROTECTION	Principles of Radiation Protection – Protective Materials – Radiation Effects – Somatic – Genetic Stochastic and Deterministic Effect – Personal Monitoring Devices – TLD Film Badge – Pocket Dosimeter
UNIT VI: PROFESSIONAL COMPONENTS	Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism
TEXT BOOKS	1. Dr. K. Thayalan , *Basic Radiological Physics*, Jayapee Brothers Medical Publishing Pvt. Ltd. New Delhi, 2003. 2. Curry, Dowdey and Murry, *Christensen's Physics of Diagnostic Radiology: -Lippincot*Williams and Wilkins, 1990. 3. FM Khan, *Physics of Radiation Therapy*, William and Wilkins, 3rd ed, 2003. 4. D. J. Dewhurst, *An Introduction to Biomedical Instrumentation*, 1st ed, Elsevier Science, 2014. 5. R.S. Khandpur, *Hand Book of Biomedical Instrumentations*, 1st ed, TMG, New Delhi, 2005.
REFERENCE BOOKS	1. Muhammad Maqbool, *An Introduction to Medical Physics*, 1st ed, Springer International Publishing, 2017. 2. Daniel Jirák, FrantišekVítek, *Basics of Medical Physics*, 1st ed, Charles University, Karolinum Press, 2018 3. Anders Brahme, *Comprehensive Biomedical Physics*, Volume 1, 1st ed, Elsevier Science, 2014. 4. K. Venkata Ram, *Bio-Medical Electronics and Instrumentation*, 1st ed, Galgotia Publications, New Delhi, 2001.

	5. John R. Cameron and James G. Skofronick, 2009, Medical Physics, John Wiley Interscience Publication, Canada, 2nd edition.
WEB SOURCES	1. https:nptel.ac.in/courses/108/103/108103157/ 2. https://www.studocu.com/en/course/university-of-technology-sydney/medical-devices-and-diagnostics/225692 3. https://www.technicalsymposium.com/alllecturenotes_biomed.html 4. https://lecturenotes.in/notes/17929-note-for-biomedical-instrumentation-bi-by-deepraj-adhikary/78 5. https://www.modulight.com/applications-medical/

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Learn the fundamentals, production and applications of X-rays.	**K1**
CO2	Understand the basics of blood pressure measurements. Learn about sphygmomanometer, EGC, ENG and basic principles of MRI.	**K2**
CO3	Apply knowledge on Radiation Physics	**K3**
CO4	Analyze Radiological imaging and filters	**K4**
CO5	Assess the principles of radiation protection	**K5**
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate;		

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** and program specific outcomes **(PSO)** in the 3-point scale of STRONG (3), MEDIUM (2) **and** LOW (1)**.**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	3	3	1	1	2	3	3	1	3
CO2	3	3	3	2	1	2	3	3	1	3

CO3	3	3	3	2	1	2	3	3	1	3
CO4	3	3	3	2	1	2	3	3	1	3
CO5	3	3	3	1	1	2	3	3	1	3

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1	3	3	3	1	1	2	3	3	1	3
CO2	3	3	3	2	1	2	3	3	1	3
CO3	3	3	3	2	1	2	3	3	1	3
CO4	3	3	3	2	1	2	3	3	1	3
CO5	3	3	3	1	1	2	3	3	1	3

Skill Enhancement Course – I: ELECTRONICS IN DAILY LIFE	**I YEAR – SECOND SEMESTER**

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
23P2PHS01	**ELECTRONICS IN DAILY LIFE**	**SEC**				**2**	**2**	**75**

Pre-Requisites
Electronic components and home electrical appliances, Communication devices and safety mechanics of electronic devices.
Learning Objectives
➢ To understand the basic electronic components. ➢ To study the working of various electrical appliances. ➢ To outline the principles of home electronic appliances. ➢ To introduce the ideas about the communication devices. ➢ To form a good awareness on safety mechanism of electronic devices.

UNITS	**Course Details**
UNIT I: **ELECTRONIC COMPONENTS**	Resistors – Capacitors – Resistance values – Capacitor value – Fuse wire – Transistors – Integrated chips.
UNIT II: **ELECTRICAL APPLIANCES**	Switch board – Main box – Metal circuit breakers (MCB) – AC – DC currents – Two Phase – Three Phase electrical connections – generators – un intrepid power supply (UPS)- stabilizer – voltage regulators – Electrical devices – Iron box – Fan – Electrical Oven – water Heaters Air conditioners – Refrigerators – washing machines.
UNIT III: **ELECTRONIC HOME APPLIANCES**	Radio – Audio tape - speaker- televisions – VCR – CD Players – DVD – calculators – Computers – scanner – Printer – Digital

	Camera – LCD Projectors – Display devices.
UNIT IV: COMMUNICATIONS ELECTRONICS	Principles of optical fiber Cables (OFC) – Telephone – Mobile phones – wireless phone – Antenna - Internet - Intranet.
UNIT V: **SAFETY MECHANISM**	Handling Electrical appliances - Power saving methods – Hazards Prevention Methods - Protection of Hi –Fi electronic devices.

TEXT BOOKS	1. S.S. Kamble – Electronics and Mathematics Data book – Allied publishers Ltd, 1997. 2. William David Cooper, Electronic Instrumentation and Measurement Technique, Second Edition, Prentice-Hall, 1978. 3. Electronics In Every Day Life, William Charles Vergara, Dover Publications, 1983. 4. The Importance of Electronics in Modern Life, Edubirdie, 2022.

REFERENCE BOOKS	1. Electronics in Every Day Life, Text book solutions, HW Solutions, 2003-2023, Chegg Inc. 2. Making Every day Electronics Work: A Yourself Guide, Stan Gibilisco, First Edition, 2013. 3. Human Activity Recognition: Using wearable Sensors and Smart phones, Miguel A.Labrador, Oscar D. Lara Yejas, Chapman and Hall / CRC Computer and Information Science Series, First Edition, 2013. 4. Study of Electrical Appliances and Devices –Bhatia, Kanna Publications, 2014.
WEB SOURCES	1. https://byjus.com/physics/electronics-in-daily-life/ 2. https://www.linkedin.com/pulse/e-commerce-our-daily-life-dash-technologies-inc 3. https://www.quora.com/What-are-the-most-important-electronic-devices-for-everyday-life 4. https://edubirdie.com/examples/the-importance-of-electronics - in modern - life/

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO 1	Learn the construction and working of basic electronic components.	**K1**
CO 2	Understand the mechanism of various electrical appliances.	**K2**
CO 3	Apply knowledge home electrical appliances.	**K3**
CO 4	Analyze various communication devices.	**K4**
CO5	Assess the safety mechanism of electronic devices.	**K5**
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate;		

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** and program specific outcomes **(PSO)** in the 3-point scale of STRONG (3), MEDIUM (2) andLOW (1)**.**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**

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

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1	3	3	3	1	1	2	2	3	1	3
CO2	3	3	3	2	1	2	2	3	1	3
CO3	3	3	3	2	1	2	2	3	1	3
CO4	3	3	3	2	1	2	2	3	1	3
CO5	3	3	3	1	1	2	2	3	1	3

Practical - PRACTICAL - II	I YEAR - SECOND SEMESTER

Subject Code	Subject Name	Category	L	T	P	Credits	Inst. Hours	Marks
23P2PHCP02	PRACTICAL - II	Core				2	6	60

Pre-Requisites

Knowledge and handling of basic general and electronics experiments of Physics

Learning Objectives

- To understand the concept of mechanical behavior of materials and calculation of same using appropriate equations.
- To calculate the thermodynamic quantities and physical properties of materials.
- To analyze the optical and electrical properties of materials.
- To observe the applications of FET and UJT.
- To study the different applications of operational amplifier circuits.
- To learn about Combinational Logic Circuits and Sequential Logic Circuits

Course Details

(Any Twelve Experiments)

1. Determine the Young's modulus of a given material by the method of Elliptical fringes.
2. Determine the magnetic susceptibility of a given liquid by Quincke's method.
3. Determine the specific charge of an electron using Spectrometer.
4. Determine Rydberg's Constant using diffraction grating and Hydrogen discharge tube.
5. Determine the Thermal Conductivity of a metal by Forbe's Method.
6. Determine the Resistivity of the given Semiconductor at different temperature by using Four Probe Method and calculate energy band gap.
7. Study the multiplexer and Demultiplexer and verify their truth table.
8. Study the decode counter by using IC 7447, IC 7490 and Seven segment display and verify the truth table.

9.	Construct a square wave generator using IC 555 timer and verify the result.
10.	Solve simultaneous equation using IC 741 analog computation and verify the result.
11.	Construct and verify the active filters (Low pass and High pass) using the operational amplifier IC 741.
12.	Convert Voltage to Current using IC 741 and study their result. Iodine absorption spectra
13.	Molecular spectra – CN bands
14.	Determination of Refractive index of liquids using diode Laser/ He – Ne Laser
15.	Determination of Numerical Apertures and Acceptance angle of optical fibers using Laser Source.
16.	Measurement of Dielectricity - Microwave test bench
17.	Hall Effect in Semiconductor. Determine the Hall coefficient, carrier concentration and carrier mobility
18.	Interpretation of vibrational spectra of a given material
19.	Determination of I-V Characteristics and efficiency of solar cell.
20.	IC 7490 as scalar and seven segment display using IC7447
21.	Solving simultaneous equations – IC 741 / IC LM324
22.	Op-Amp –Active filters: Low pass, High pass and Band pass filters (Second Order) Batter worth filter
23.	Construction of Current to Voltage and Voltage to Current Conversion using IC 741.
24.	Construction of second order butter worth multiple feedback narrow band pass filter
25.	Realization of analog to digital converter (ADC) using 4-bit DAC and synchronous counter IC74193
26.	Construction of square wave generator using IC 555 – Study of VCO
27.	Construction of Schmidt trigger circuit using IC555 for a given hysteresis – Application as squarer
28.	Construction of pulse generator using the IC 555 – Application as frequency divider
29.	BCD to Excess- 3 and Excess 3 to BCD code conversion
30.	Study of binary up / down counters - IC 7476 / IC7473

TEXT BOOKS	1. Practical Physics, Gupta and Kumar, Pragati Prakasan 2. Kit Developed for doing experiments in Physics-Instruction manual, R. Srinivasan K.R Priolkar, Indian Academy of Sciences

	3. Op-Amp and linear integrated circuit, Ramakanth A Gaykwad, Eastern Economy Edition. 4. Electronic lab manual Vol I, K ANavas, Rajath Publishing 5. Electronic lab manual Vol II, K ANavas, PHI eastern Economy Edition
REFERENCE BOOKS	1. An advanced course in Practical Physics, D. Chattopadhayay, C.R Rakshit, New Central Book Agency Pvt. Ltd 2. Advanced Practical Physics, S.P Singh, Pragati Prakasan 3. A course on experiment with He-Ne Laser, R. S. Sirohi, John Wiley & Sons (Asia) Pvt. ltd 4. Electronic lab manual Vol II, Kuriachan T.D, Syam Mohan, Ayodhya Publishing 5. Electronic Laboratory Primer a design approach, S. Poornachandra, B. Sasikala, Wheeler Publishing, New Delhi

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Understand the strength of material using Young's modulus	K2
CO2	Acquire knowledge of thermal behavior of the materials	K1
CO3	Understand theoretical principles of magnetism through the experiments.	K2
CO4	Acquire knowledge about arc spectrum and applications of laser	K1
CO5	Improve the analytical and observation ability in Physics Experiments	K4
CO6	Conduct experiments on applications of FET and UJT	K5
CO7	Analyze various parameters related to operational amplifiers	K4
CO8	Understand the concepts involved in arithmetic and logical circuits using IC's	K2
CO9	Acquire knowledge about Combinational Logic Circuits and Sequential Logic Circuits	K3
CO10	Analyze the applications of counters and registers	K4
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** and program specific outcomes **(PSO)** in the 3-point scale of STRONG (3), MEDIUM (2) and LOW (1)**.**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	2	2	2	S	S	2	2	2	3	3
CO2	2	2	S	S	S	2	2	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3
CO4	3	2	3	3	3	3	2	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3
CO6	2	2	2	3	3	2	2	2	3	3
CO7	2	2	3	3	3	2	2	3	3	3
CO8	3	3	3	3	3	3	3	3	3	3
CO9	3	3	3	3	3	3	3	3	3	3
CO10	3	3	3	3	3	3	3	3	3	3

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1	2	2	2	3	3	2	2	2	3	3
CO2	2	2	3	3	3	2	2	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3
CO4	3	2	3	3	3	3	2	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3
CO6	2	2	2	3	3	2	2	2	3	3
CO7	2	2	3	3	3	2	2	3	3	3
CO8	3	3	3	3	3	3	3	3	3	3
CO9	3	3	3	3	3	3	3	3	3	3
CO10	3	3	3	3	3	3	3	3	3	3

SEMESTER III

SEMESTER - III								
Subject Code		**Subject Title**	**Hrs**	**Credit**	**Exam**	**Int. Marks**	**Ent. Marks**	**Total Mark**
23P3PHC06	Core - VI	Quantum Mechanics –II	6	4	3	25	75	100
23P3PHC07	Core - VII	Spectroscopy	6	4	3	25	75	100
23P3PHC08	Core - VIII	Electromagnetic Theory	5	4	3	25	75	100
23P3PHDE03	Elective – IV*	Microprocessor 8085 and Microcontroller 8051	4	3	3	25	75	100
23P3PHCP03	Core Practical - III	Practical – III	6	4	4	40	60	100
23P3HR01	Common subject	Human Rights	1	1	3	25	75	100
23P3PHS02	Skill Enhancement Course – III	Scientific Research Process	2	2	3	25	75	100
23P3C3INT01	Internship /Industrial Activity (15 days)			1	-	-		-
Total			**30**	**23**	**22**	**190**	**510**	**700**

QUANTUM MECHANICS – II	II YEAR - THIRD SEMESTER

Subject Code	Subject Name	Category	L	T	P	Credits	Inst. Hours	Marks
23P3PHC06	**QUANTUM MECHANICS – II**	Core				4	6	75

Pre-Requisites
Knowledge of postulates of Quantum mechanics, properties of Hermitian operators, ladder operators, degeneracy, angular momentum techniques and commutation rules
Learning Objectives
➢ Formal development of the theory and the properties of angular momenta, both orbital and spin ➢ To familiarize the students to the crucial concepts of scattering theory such as partial wave analysis and Barn approximation. ➢ Time-dependent Perturbation theory and its application to study of interaction of an atom with the electromagnetic field ➢ To give the students a firm grounding in relativistic quantum mechanics, with emphasis on Dirac equation and related concepts ➢ To introduce the concept of covariance and the use of Feynman graphs for depicting different interactions

UNITS	Course Details
UNIT 1: SCATTERING THEORY	Scattering amplitude – Cross sections – Born approximation and its validity – Scattering by a screened coulomb potential – Yukawa potential – Partial wave analysis – Scattering length and Effective range theory for s wave – Optical theorem
UNIT II: PERTURBATION THEORY	Time dependent perturbation theory – Constant and harmonic perturbations – Fermi Golden rule – Transition probability Einstein's A and B Coefficients – Adiabatic approximation – Sudden approximation – Semi – classical treatment of an atom with electromagnetic radiation – Selection rules for dipole radiation

UNIT III: Relativistic QUANTUM MECHANICS	Klein – Gordon Equation –Probability density– Dirac Matrices – Dirac Equation – Plane Wave Solutions – Interpretation Of Negative Energy States – Antiparticles – Spin of Electron – Magnetic Moment Of An Electron Due To Spin
UNIT IV: DIRAC EQUATION	Covariant form of Dirac Equation – Properties of the gamma matrices – Traces – Relativistic invariance of Dirac equation – Probability Density – Current four vector – Bilinear covariant
UNIT V: CLASSICAL FIELDS AND SECOND QUANTIZATION	Classical fields – Euler Lagrange equation – Hamiltonian formulation – Noether's theorem – Quantization of real and complex scalar fields – Creation, Annihilation and Number operators – Fock states – Second Quantization of K-G field.
UNIT VI: PROFESSIONAL COMPONENTS	Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism, Walter Living Lectures
TEXT BOOKS	1. P. M. Mathews and K. Venkatesan, A Text book of Quantum Mechanics,2nd Edition, Tata McGraw-Hill, New Delhi, 2010. 2. G. Aruldhas, Quantum Mechanics, 2nd Edition, Prentice-Hall of India, NewDelhi,2009 3. L. I. Schiff, Quantum Mechanics, 3rd Edition, International Student Edition, McGraw-Hill Kogakusha, Tokyo, 1968 4. V. Devanathan, Quantum Mechanics, 1st Edition, Narosa Publishing House, New Delhi, 2005. 5. Nouredine Zettili, Quantum mechanics concepts and applications, 2nd Edition, Wiley, 2017
REFERENCE BOOKS	1. P. A. M. Dirac, The Principles of Quantum Mechanics, 4th Edition, Oxford University Press, London, 1973. 2. B. K. Agarwal & Hari Prakash, Quantum Mechanics, 7th reprint, PHI Learning Pvt. Ltd., New Delhi, 2009. 3. Deep Chandra Joshi, Quantum Electrodynamics and Particle Physics,1st edition,I.K.International Publishing house Pvt. Ltd., 2006 4. Ghatak and S. Lokanathan, Quantum Mechanics: Theory and Applications, 4th Edition, Macmillan India, New Delhi.

	5. E. Merzbacher, Quantum Mechanics, 2nd edition, John Wiley and Sons, New York, 1970
WEB SOURCES	1. https://ocw.mit.edu/courses/physics/8-05-quantum-physics-ii-fall-2013/lecture notes/MIT8_05F13_Chap_09.pdf 2. http://www.thphys.nuim.ie/Notes/MP463/MP463_Ch1.pdf 3. http://hep.itp.tuwien.ac.at/~kreuzer/qt08.pdf 4. https://www.cmi.ac.in/~govind/teaching/rel-qm-rc13/rel-qm-notes-gk.pdf 5. https://web.mit.edu/dikaiser/www/FdsAmSci.pdf

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Familiarize the concept of scattering theory such as partial wave analysis and Born approximation	K1
CO2	Give a firm grounding in relativistic quantum mechanics, with emphasis on Dirac equation and related concepts	K2
CO3	Discuss the relativistic quantum mechanical equations namely, Klein-Gordon and Dirac equations and the phenomena accounted by them like electron spin and magnetic moment	K1, K4
CO4	Introduce the concept of covariance and the use of Feynman graphs for depicting different interactions	K1, K3
CO5	Demonstrate an understanding of field quantization and the explanation of the scattering matrix.	K5
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate		

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** and program specific outcomes **(PSO)** in the 3-point scale of STRONG (3), MEDIUM (2) andLOW (1)**.**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	2	3	3	3	3	3	3	3
CO3	3	2	2	3	3	2	3	3	3	3

CO4	2	1	1	3	3	1	2	2	3	3
CO5	2	1	1	3	3	2	2	2	3	3

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	2	3	3	3	3	3	3	3
CO3	3	2	2	3	3	2	3	3	3	3
CO4	2	1	1	3	3	1	2	2	3	3
CO5	2	1	1	3	3	2	2	2	3	3

Paper 8 - SPECTROSCOPY		II YEAR - THIRD SEMESTER						
Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
23P3PHC07	**SPECTROSCOPY**	Core				4	6	75

Pre-Requisites
Thorough understanding of electromagnetic spectrum, mathematical abilities, knowledge of molecules, their structure, bond nature, physical and chemical behaviour
Learning Objectives
➢ To comprehend the theory behind different spectroscopic methods ➢ To know the working principles along with an overview of construction of different types of spectrometers involved ➢ To explore various applications of these techniques in R &D. ➢ Apply spectroscopic techniques for the qualitative and quantitative analysis of various chemical compounds. ➢ Understand this important analytical tool

UNITS	**Course Details**
UNIT I: **MICROWAVE SPECTROSCOPY**	Rotational spectra of diatomic molecules - Rigid Rotor (Diatomic Molecules)-reduced mass – rotational constant - Effect of isotopic substitution - Non rigid rotator – centrifugal distortion constant- Intensity of Spectral Lines- Polyatomic molecules – linear – symmetric asymmetric top molecules Instrumentation techniques – block diagram -Information Derived from Rotational Spectra- Stark effect.
UNIT II: **INFRA-RED SPECTROSCOPY**	Vibrations of simple harmonic oscillator – zero-point energy- Anharmonic oscillator – fundamentals, overtones and combinations- Diatomic Vibrating Rotator- PR branch – PQR branch- Fundamental modes of Vibrational of H_2O -Introduction to application of vibration spectra. IR Spectrophotometer Instrumentation (Double Beam Spectrometer) – Fourier Transform Infrared Spectroscopy - Interpretation of vibrational spectra–remote analysis of atmospheric gases like N_2O using FTIR by National Remote

	Sensing Centre (NRSC), India– other simple applications
UNIT III: **RAMAN SPECTROSCOPY**	Theory of Raman Scattering - Classical theory – molecular polarizability – polarizability ellipsoid - Quantum theory of Raman effect - rotational Raman spectra of linear molecule - symmetric top molecule – Stokes and anti-stokes line- SR branch -Raman activity of H_2O- Mutual exclusion principle- Instrumentation technique and block diagram - structure determination of planar and non-planar molecules using IR and Raman techniques - FT Raman spectroscopy- SERS
UNIT IV: **RESONANCE SPECTROSCOPY**	Nuclear and Electron spin- Interaction with magnetic field - Population of Energy levels - Larmor precession- Relaxation times NMR of Hydrogen nuclei - Instrumentation techniques of NMR spectroscopy – MRI Scan. Electron Spin Resonance: Basic principle –Total Hamiltonian (Direct Dipole-Dipole interaction and Fermi Contact Interaction) – Hyperfine Structure (Hydrogen atom) – ESR Spectra of Free radicals – g-factors – Instrumentation - Medical applications of ESR
UNIT V: **UV SPECTROSCOPY**	Origin of UV spectra - Laws of absorption – Lambert Bouguer law – Lambert Beer law - molar absorptivity – transmittance and absorbance - Color in organic compounds- Absorption by organic Molecule -Chromospheres -Effect of conjugation on chromospheres - Choice of Solvent and Solvent effect - Absorption by inorganic systems - Instrumentation - double beam UV-Spectrophotometer -Simple applications
UNIT VI: PROFESSIONAL COMPONENTS	Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism
TEXT BOOKS	1. C N Banwell and E M McCash, 1994, Fundamentals of Molecular Spectroscopy, 4th Edition, Tata McGraw–Hill, New Delhi. 2. G Aruldhas, 1994, Molecular Structure and Molecular Spectroscopy, Prentice–Hall of India, New Delhi. 3. D.N. Satyanarayana, 2001, *Vibrational Spectroscopy and Applications*, New Age International Publication. 4. B.K. Sharma, 2015, *Spectroscopy*, Goel Publishing House Meerut. 5. Kalsi.P.S, 2016, Spectroscopy of Organic Compounds (7th

	Edition), New Age International Publishers.
REFERENCE BOOKS	1. J L McHale, 2008, Molecular Spectroscopy, Pearson Education India, New Delhi. 2. J M Hollas, 2002, Basic Atomic and Molecular Spectroscopy, Royal Society of Chemistry, RSC, Cambridge. 3. B. P. Straughan and S. Walker, 1976, Spectroscopy Vol. I, Chapman and Hall, New York. 4. K. Chandra, 1989, Introductory Quantum Chemistry, Tata McGraw Hill, New Delhi. 5. Demtroder. W, Laser Spectroscopy: Basic concepts and Instrumentation, Springer Link.
WEB SOURCES	1. https://www.youtube.com/watch?v=0iQhirTf2PI 2. https://www.coursera.org/lecture/spectroscopy/introduction-3N5D5 3. https://www.coursera.org/lecture/spectroscopy/infrared-spectroscopy-8jEee 4. https://onlinecourses.nptel.ac.in/noc20_cy08/preview 5. https://www.coursera.org/lecture/spectroscopy/nmr-spectroscopy-introduction-XCWRu

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Understand fundamentals of rotational spectroscopy, view molecules as elastic rotors and interpret their behaviour. Able to quantify their nature and correlate them with their characteristic properties.	**K2**
CO2	Understand the working principles of spectroscopic instruments and theoretical background of IR spectroscopy. Able to correlate mathematical process of Fourier transformations with instrumentation. Able to interpret vibrational spectrum of small molecules.	**K2, K3**
CO3	Interpret structures and composition of molecules and use their knowledge of Raman Spectroscopy as an important analytical tool	**K5**
CO4	Use these resonance spectroscopic techniques for quantitative and qualitative estimation of a substances	**K4**
CO5	Learn the electronic transitions caused by absorption of radiation in the UV/Vis region of the electromagnetic	**K1, K5**

	spectrum and be able to analyze a simple UV spectrum.	

K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** and program specific outcomes **(PSO)** in the 3-point scale of STRONG (3), MEDIUM (2) andLOW (1)**.**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	3	3	2	3	3	3	3	3	2
CO2	2	2	2	3	3	3	3	3	3	2
CO3	3	2	3	3	3	3	3	3	3	3
CO4	3	2	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1	3	3	3	2	3	3	3	3	3	2
CO2	2	2	2	3	3	3	3	3	3	2
CO3	3	2	3	3	3	3	3	3	3	3
CO4	3	2	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3

Paper 10 - ELECTROMAGNETIC THEORY		II YEAR - THIRD SEMESTER						
Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
23P3PHC08	**ELECTROMAGNETIC THEORY**	Core				4	5	75

Pre-Requisites
Different coordinate systems, Laplace's equation, conducting & non-conducting medium, basic definitions in magnetism, propagation of electromagnetic waves, plasma
Learning Objectives
➢ To acquire knowledge about boundary conditions between two media and the technique of method of separation of variables ➢ To understand Biot – Savart's law and Ampere's circuital law ➢ To comprehend the physical ideas contained in Maxwell's equations, Coulomb & Lorentz gauges, conservation laws ➢ To assimilate the concepts of propagation, polarization, reflection and refraction of electromagnetic waves ➢ To grasp the concept of plasma as the fourth state of matter

UNITS	**Course Details**
UNIT I: ELECTROSTATICS	Boundary value problems and Laplace equation – Boundary conditions and uniqueness theorem – Laplace equation in three dimension – Solution in Cartesian and spherical polar coordinates Polarization and displacement vectors - Boundary conditions - Dielectric sphere in a uniform field – Molecular polarizability and electrical susceptibility – Electrostatic energy in the presence of dielectric.
UNIT II: MAGNETOSTATICS	Biot-Savart's Law - Ampere's law - Magnetic vector potential and magnetic field of a localized current distribution - Magnetic moment, force and torque on a current distribution in an external field - Magneto static energy - Magnetic induction and magnetic field in macroscopic media - Boundary conditions - Uniformly

	magnetized sphere.
UNIT III: MAXWELL EQUATIONS	Faraday's laws of Induction - Maxwell's displacement current - Maxwell's equations - Vector and scalar potentials - Gauge invariance - Wave equation and plane wave solution- Coulomb and Lorentz gauges - Energy and momentum of the field - Poynting's theorem - Lorentz force - Conservation laws for a system of charges and electromagnetic fields.
UNIT IV: WAVE PROPAGATION	Plane waves in non-conducting media - Linear and circular polarization, reflection and refraction at a plane interface - Waves in a conducting medium - Propagation of waves in a rectangular wave guide. Inhomogeneous wave equation and retarded potentials - Radiation from a localized source - Oscillating electric dipole
UNIT V: ELEMENTARY PLASMA PHYSICS	The Boltzmann Equation - Simplified magneto-hydrodynamic equations - Electron plasma oscillations - The Debye shielding problem - Plasma confinement in a magnetic field - Magneto-hydrodynamic waves - Alfven waves and magnetosonic waves.
UNIT VI: PROFESSIONAL COMPONENTS	Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism
TEXT BOOKS	1. D. J. Griffiths, 2002, *Introduction to Electrodynamics,* 3rd Edition, Prentice-Hall of India, New Delhi. 2. J. R. Reitz, F. J. Milford and R. W. Christy, 1986, *Foundations of Electromagnetic Theory,* 3rd edition, Narosa Publishing House, New Delhi. 3. J. D. Jackson, 1975, *Classical Electrodynamics,* Wiley Eastern Ltd. New Delhi. 4. J. A. Bittencourt, 1988, *Fundamentals of Plasma Physics,* Pergamon Press, Oxford. 5. Gupta, Kumar and Singh, Electrodynamics, S. Chand & Co., New Delhi
REFERENCE BOOKS	1. W. Panofsky and M. Phillips, 1962, *Classical Electricity and Magnetism,* Addison Wesley, London. 2. J. D. Kraus and D. A. Fleisch, 1999, *Electromagnetics with Applications,* 5th Edition, WCB

	McGraw-Hill, New York. 3. B. Chakraborty, 2002, *Principles of Electrodynamics,* Books and Allied, Kolkata. 4. P. Feynman, R. B. Leighton and M. Sands, 1998, *The Feynman Lectures on Physics*, Vols. 2, Narosa Publishing House, New Delhi. 5. Andrew Zangwill, 2013, Modern Electrodynamics, Cambridge University Press, USA.
WEB SOURCES	1. http://www.plasma.uu.se/CED/Book/index.html 2. http://www.thphys.nuim.ie/Notes/electromag/frame-notes.html 3. http://www.thphys.nuim.ie/Notes/em-topics/em-topics.html 4. http://dmoz.org/Science/Physics/Electromagnetism/Courses_and_Tutorials/ 5. https://www.cliffsnotes.com/study-guides/physics/electricity-and-magnetism/electrostatics

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Solve the differential equations using Laplace equation and to find solutions for boundary value problems	**K1, K5**
CO2	Use Biot-Savart's law and Ampere circuital law to find the magnetic induction & magnetic vector potential for various physical problems	**K2, K3**
CO3	Apply Maxwell's equations to describe how electromagnetic field behaves in different media	**K3**
CO4	Apply the concept of propagation of EM waves through wave guides in optical fiber communications and also in radar installations, calculate the transmission and reflection coefficients of electromagnetic waves	**K3, K4**
CO5	Investigate the interaction of ionized gases with self-consistent electric and magnetic fields	**K5**
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** and program specific outcomes **(PSO)** in the 3-point scale of STRONG (3), MEDIUM

(2) andLOW (1)**.**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	3	3	1	2	2	3	3	1	3
CO2	3	3	3	1	2	2	3	3	1	3
CO3	3	3	3	1	2	2	3	3	1	3
CO4	3	3	3	1	2	2	3	3	1	3
CO5	3	3	3	1	2	2	3	3	1	3

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1	3	3	3	1	2	2	3	3	1	3
CO2	3	3	3	1	2	2	3	3	1	3
CO3	3	3	3	1	2	2	3	3	1	3
CO4	3	3	3	1	2	2	3	3	1	3
CO5	3	3	3	1	2	2	3	3	1	3

Elective - MICROPROCESSOR 8085 AND MICROCONTROLLER 8051		II YEAR – THIRD SEMESTER						
Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
23P3PHDE03	**MICROPROCESSOR 8085 AND MICROCONTROLLER 8051**	ELECTIVE				3	4	75

Pre-Requisites
Knowledge of number systems and binary operations
Learning Objectives
➢ To provide an understanding of the architecture and functioning of microprocessor 8085A and to the methods of interfacing I/O devices and memory to microprocessor ➢ To introduce 8085A programming and applications and the architecture and instruction sets of microcontroller 8051

UNITS	**Course Details**
UNIT I: EVOLUTION AND ARCHITECTURE OF MICROPROCESSORS 8085	Evolution of Microprocessors - INTEL 8085 microprocessor - Pin configuration - Pins and their functions - Architecture - ALU - Flags - Registers. Instruction set - Addressing modes - Programming techniques – 8 bit Addition - 8 bit Subtraction - 16 bit Multiplication - 16 bit Division.
UNIT II: 8085 PERIPHERAL DEVICES AND THEIR INTERFACING	Memory mapped I/O scheme- I/O mapped I/O scheme - Memory and I/O interfacing - Programmable Peripheral Interface (PPI) INTEL 8255 - Data Transfers: Types of parallel and serial data transfer schemes - Direct Memory Access (DMA) controller INTEL 8257. Seven segment display interface - Interfacing of Digital to Analog converter and Analog to Digital converter - Stepper motor interface – Temperature measurement and control.
UNIT III: 8051 MICROCONTROLLER HARDWARE	Introduction – Features of 8051 – 8051 Microcontroller Hardware: Pin-out 8051, Central Processing Unit (CPU), internal RAM, Internal ROM, Register set of 8051 – Memory organization of 8051 – Input/ Output pins, Ports and Circuits – External data memory and program memory: External

	program memory, External data memory.
UNIT IV: 8051 INSTRUCTION SET AND ASSEMBLY LANGUAGE PROGRAMMING	Addressing modes – Data moving (Data transfer) instructions: Instructions to Access external data memory, external ROM / program memory, PUSH and POP instructions, Data exchange instructions – Logical instructions: byte and bit level logical operations, Rotate and swap operations – Arithmetic instructions: Flags, Incrementing and decrementing, Addition, Subtraction, Multiplication and division, Decimal arithmetic – Jump and CALL instructions: Jump and Call program range, Jump, Call and subroutines – Programming.
UNIT V: INTERRUPT PROGRAMMING AND INTERFACING TO EXTERNAL WORLD	8051 Interrupts – Interrupt vector table – Enabling and disabling an interrupt – Timer interrupts and programming – Programming external hardware interrupts – Serial communication interrupts and programming – Interrupt priority in the 8051 : Nested interrupts , Software triggering of interrupt. LED Interface Seven segment display interface- Interfacing of Digital to Analog converter and Analog to Digital converter - Stepper motor interface - Measurement of electrical quantities – Voltage and current) Measurement of physical quantities(Temperature an strain).
UNIT VI: PROFESSIONAL COMPONENTS	Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism
TEXT BOOKS	1. A. NagoorKani, Microprocessors & Microcontrollers, RBA Publications (2009). 2. A. P. Godse and D. A. Godse, Microprocessors, Technical Publications, Pune (2009). 3. Ramesh Gaonkar, Microprocessor Architecture, Programming and Applications with 8085, Penram International Publishing (2013). 4. B. Ram, Fundamentals of Microprocessors & Microcontrollers, DhanpatRai publications New Delhi (2016). 5. V. Vijayendran, 2005, Fundamentals of Microprocessor-8085", 3rd Edition S.Visvanathan Pvt, Ltd.

REFERENCE BOOKS	1. Douglas V. Hall, Microprocessors and Interfacing programming and Hardware, Tata Mc Graw Hill Publications (2008) 2. Muhammad Ali Mazidi, Janice GillispieMazidi, Rolin D. Mckinlay, The 8051 Microcontroller and Embedded Systems, Pearson Education (2008). 3. Barry B. Brey, 1995, The Intel Microprocessors 8086/8088, 80186, 80286, 80386 and 80486, 3rd Edition, Prentice-Hall of India, New Delhi. 4. J. Uffrenbeck, "The 8086/8088 Family-Design, Programming and Interfacing, Software, Hardware and Applications", Prentice-Hall of India, New Delhi. 5. W. A. Tribel, Avtar Singh, "The 8086/8088 Microprocessors: Programming, Interfacing, Software, Hardware and Applications", Prentice-Hall of India, New Delhi.

WEB SOURCES	1. https://www.tutorialspoint.com/microprocessor/microprocessor_8085_architecture.html 2. http://www.electronicsengineering.nbcafe.in/peripheral-mapped-io-interfacing/ 3. https://www.geeksforgeeks.org/programmable-peripheral-interface-8255/ 4. http://www.circuitstoday.com/8051-microcontroller 5. https://www.elprocus.com/8051-assembly-language-programming/

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Gain knowledge of architecture and working of 8085 microprocessor.	**K1**
CO2	Get knowledge of architecture and working of 8051 Microcontroller.	**K1**
CO3	Be able to write simple assembly language programs for 8085A microprocessor.	**K2, K3**
CO4	Able to write simple assembly language programs for 8051 Microcontroller.	**K3, K4**
CO5	Understand the different applications of microprocessor and	**K3,**

	microcontroller.	**K 5**
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate;		

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** and program specific outcomes **(PSO)** in the 3-point scale of STRONG (3), MEDIUM (2) **and** LOW (1)**.**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	2	3	3	3	3	1	1	1	1	1
CO2	2	1	1	1	1	1	1	1	1	1
CO3	3	3	3	3	3	1	1	1	1	1
CO4	3	3	3	3	3	1	1	1	1	1
CO5	3	3	3	3	3	1	1	1	1	1

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1	2	3	3	3	3	1	1	1	1	1
CO2	2	1	1	1	1	1	1	1	1	1
CO3	3	3	3	3	3	1	1	1	1	1
CO4	3	3	3	3	3	1	1	1	1	1
CO5	3	3	3	3	3	1	1	1	1	1

SCIENTIFIC RESEARCH PROCESS		II YEAR –THIRD SEMESTER						
Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
23P3PHS02	**SCIENTIFIC RESEARCH PROCESS**	**Skill Enhancement Course – III**				2	2	75

Pre-Requisites
Ability in scientific research process
Learning Objectives
➢ To give an introduction to students in the areas of **scientific research process**

UNIT – I : RESEARCH PROBLEM	Definition- Scientific Research- Meaning and importance of Research – Types of Research - Defining and formulating the research problem - Selecting the problem - Necessity of defining the problem.
UNIT – II : LITERATURE REVIEW	Importance of literature review in defining a problem – Literature review – reviews – web as a source
UNIT – III : DATA ANALYSIS	Data Preparation - Univariate analysis (frequency tables, bar charts, pie charts, percentages), Reference Management Software like Zotero/ Mendeley, Software for paper formatting like LaTeX/ MS Office, Software for detection of Plagiarism
UNIT – IV: SCIENTIFIC PRESENTATION	Preparing Research papers for journals, Seminars and Conferences - power point and poster presentation- Calculations of Impact factor of a journal, citation Index, ISBN & ISSN- web of science
UNIT - V : ETHICS OF RESEARCH	Ethical Issues – Ethical Committees – Commercialization – copy right - Plagiarism – Citation and Acknowledgement

TEXT BOOKS	**1.** Garg.B.L., Karadia, R., Agarwal,F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers **2.** Kothari, C.R.(2008). Research Methodology: Methods and Techniques. Second Edition. New Age International Publishers, New Delhi. **3.** Thesis and assignment writing – J.Anderson, B.H.Durston and M.Poole – Wiley Eastern, New Delhi (1977).
REFERENCE BOOKS	**1.** How to write a research paper – Ralph Berry, Pergamon Press, Oxford (1986). **2.** Form and style in thesis writing – W.G.Campbell, The University of Chicago Press (2016). **3.** A Handbook of Methodology of Research – Rajammal P.A.Devadas, R.M.M.Vidyalaya Press (1976).
WEB SOURCES	1. https://www.bu.edu/abroad/files/2016/06/CAS-NS291-Introduction-into-Scientific-Research.pdf 2. https://www.linkedin.com/pulse/e-commerce-our-daily-life-dash-technologies-inc 3. https://www.quora.com/What-are-the-most-important-electronic-devices-for-everyday-life

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Understand scientific research process	**K2**
CO2	To analyze research problem	**K4,K1**
CO3	Apply the data handling	**K3**
CO4	To remember the research process	**K1**
CO5	To apply the research presentation	**K3**
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate;		

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** and program specific outcomes **(PSO)** in the 3-point scale of STRONG (3), MEDIUM (2) and LOW (1)**.**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	3	1	3	2	3	2	2	2	2
CO2	3	3	1	3	2	3	2	2	2	2

CO3	3	2	1	2	1	2	1	1	3	2
CO4	3	2	1	2	1	2	1	1	3	2
CO5	3	2	1	2	1	2	1	1	3	2

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M	S	M	L	S	S
CO2	S	M	S	L	L	M	M
CO3	S	M	S	L	M	M	M
CO4	S	M	S	S	M	S	S
CO5	S	M	S	L	M	M	M

PRACTICAL III	II YEAR - THIRD SEMESTER

Subject Code	Subject Name	Category	L	T	P	Credits	Inst. Hours	Marks
23P3PHCP03	**PRACTICAL - III**	Core				4	6	75

Pre-Requisites
Fundamentals of digital principles
Learning Objectives
➢ To understand the theory and working of Microprocessor, Microcontroller and their applications ➢ To use microprocessor and Microcontroller in different applications

Course Details
Practical IV: MICROPROCESSOR 8085 AND MICROCONTROLLER 8051 (ANY TWELVE EXPERIMENTS) 1. 8-bit addition and subtraction 8085 2. 8-bit multiplication and division 8085 3. Picking up the smallest and largest number in an array. 4. Sum of a set of N data (8-bit number) 5. Ascending and descending order in given array 6. Multi-byte decimal addition and subtraction 7. 16- bit square root of a number and square of a number 8. 16-bit addition and subtraction 8085 9. 16-bit multiplication and division 8085 10. Interfacing of DC stepper motor 8085 11. Sum of simple series and Factorial of a given number. 12. ADC 0809 interface 13. Data transfer program

14. Interfacing of seven segment display 15. Addition and Subtraction of 8-bit numbers 8051 16. Multiplication and Division of 8-bit numbers 8051 17. Sum of a series of 8-bit numbers 8051 18. Stepper motor interfacing 19. ADC interfacing 20. Temperature controller and Measurements 21. Traffic light controller	
TEXT BOOKS	1. Douglas V. Hall, Microprocessors and Interfacing programming and Hardware, Tata Mc Graw Hill Publications (2008) 2. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. Mckinlay, The 8051 Microcontroller and Embedded Systems, Pearson Education (2008). 3. V. Vijayendran, 2005, Fundamentals of Microprocessor-8085", 3rd Edition S. Visvanathan Pvt, Ltd. 4. The 8085 Microprocessor, Architecture, Programming and Interfacing – K. Udaya Kumar, S. Uma Shankar, Pearson 5. Fundamentals of Microprocessors and Microcontrollers - B. Ram, Dhanpat Rai Publications
REFERENCE BOOKS	1. W. A. Tribel, Avtar Singh, "The 8086/8088 Microprocessors: Programming, Interfacing, Software, Hardware and Applications", Prentice-Hall of India, New Delhi. 2. Microprocessor and Its Application - S. Malarvizhi, Anuradha Agencies Publications 3. Microprocessor Architecture, Program And Its Application With 8085 - R.S. Gaonkar, New Age International (P) Ltd 4. Barry B. Brey, 1995, The Intel Microprocessors 8086/8088, 80186, 80286, 80386 and 80486, 3rd Edition, Prentice- Hall of India, New Delhi. 5. J. Uffrenbeck, "The 8086/8088 Family-Design, Programming and Interfacing, Software, Hardware and Applications", Prentice-Hall of India, New Delhi.

SEMESTER IV

SEMESTER - IV								
Subject Code		**Subject Title**	**Hrs**	**Credit**	**Exam**	**Int. Marks**	**Ent. Marks**	**Total Mark**
23P4PHC09	Core – IX	Nuclear and Particle Physics	6	4	3	25	75	100
23P4PHC10	Core - X	Condensed Matter Physics	5	4	3	25	75	100
23P4PHC11	Core - XI	Computational techniques for Physics	5	4	3	25	75	100
23P4PHCP04	Core Practical - IV	Practical – IV	6	4	4	40	60	100
23P4PHPR01	Core - XII	Project with Viva-Voce	4	4	-	25	75	100
23P4PHDE04	Soft Skill – II Ability Enhancement Compulsory Course	Robotics, AI in Physics	2	2	3	25	75	100
23P4PH ED1	EDC	Applied polymer Chemistry	2	2	3	25	75	100
		Extension Activity	-	1	-	-	-	-
Total			**30**	**25**	**19**	**190**	**510**	**700**

CONDENSED MATTER PHYSICS	II YEAR - FOURTH SEMESTER

Subject Code	Subject Name	Category	L	T	P	Credits	Inst. Hours	Marks
23P4PHC10	**CONDENSED MATTER PHYSICS**	Core				4	5	75

Pre-Requisites
Basic knowledge of atomic physics, quantum mechanics and statistical mechanics.
Learning Objectives
➢ To describe various crystal structures, symmetry and to differentiate different types of bonding. ➢ To construct reciprocal space, understand the lattice dynamics and apply it to concept of specific heat. ➢ To critically assess various theories of electrons in solids and their impact in distinguishing solids. ➢ Outline different types of magnetic materials and explain the underlying phenomena. ➢ Elucidation of concepts of superconductivity, the underlying theories – relate to current areas of research.

UNITS	Course Details
UNIT I: CRYSTAL PHYSICS	**Basic Concepts :** Types of lattices - Miller indices - Simple crystal structures – Atomic Packing Factor-– Symmetry elements and allowed rotations –Reciprocal Lattice (SC, BCC, FCC). Brillouin zone - Structure factor - Atomic form factor **Crystal diffraction:** Bragg's law – Scattered Wave Amplitude Structure and Diffraction Conditions - Laue equations - Inert gas crystals - Cohesive energy of ionic crystals
UNIT II: LATTICE DYNAMICS	Lattice with two atoms per primitive cell - First Brillouin zone - Group and phase velocities - Quantization of lattice vibrations - Phonon momentum - Inelastic scattering by phonons - Thermal Conductivity - Debye's theory of lattice heat capacity - Umkalapp processes.

UNIT III: THEORY OF METALS AND SEMICONDUCTORS	Free electron gas in three dimensions - Electronic heat capacity - Wiedemann-Franz law - Band theory of metals and semiconductors - Bloch theorem - Kronig-Penney model - Semiconductors - Intrinsic carrier concentration – Temperature Dependence - Mobility - Impurity conductivity – Impurity states - Hall effect - Fermi surfaces and construction - Experimental methods in Fermi surface studies - de Hass-van Alphen effect .
UNIT IV: MAGNETISM	Diamagnetism - Quantum theory of paramagnetism - Rare earth ion - Hund's rule - Quenching of orbital angular momentum - Adiabatic demagnetization - Quantum theory of ferromagnetism - Curie point - Exchange integral - Heisenberg's interpretation of Weiss field - Ferromagnetic domains - Bloch wall - Spin waves - Quantization - Magnons - Thermal excitation of magnons - Curie temperature and susceptibility of ferrimagnets - Theory of antiferomagnetism - Neel temperature.
UNIT V: SUPERCONDUCTIVITY	**Experimental facts:** Occurrence - Effect of magnetic fields - Meissner effect – Critical field – Critical current - Entropy and heat capacity - Energy gap -Type I and II Superconductors. **Theoretical Explanation:** Thermodynamics of super conducting transition - London equation - Coherence length – Isotope effect - Cooper pairs – Bardeen Cooper Schrieffer (BCS) Theory – BCS to Bose – Einstein Condensation (BEC) regime- Nature of paring and condensation of Fermions. Single particle tunneling - Josephson tunneling - DC and AC Josephson effects - High temperature Superconductors – SQUIDS.
UNIT VI: PROFESSIONAL COMPONENTS	Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism
TEXT BOOKS	1. C. Kittel, 1996, *Introduction to Solid State Physics,* 7th Edition, Wiley, New York. 2. Rita John, Solid State Physics, Tata Mc-Graw Hill Publication. 3. A. J. Dekker, *Solid State Physics*, Macmillan India, New Delhi. 4. M. Ali Omar, 1974, *Elementary Solid State Physics – Principlesand Applications,* Addison - Wesley 5. H. P. Myers, 1998, *Introductory Solid State Physics,* 2ndEdition,Viva Book, New Delhi.
REFERENCE BOOKS	1. J. S. Blakemore, 1974 , *Solid state Physics,* 2nd Edition, W.B. Saunder, Philadelphia 2. H. M. Rosenburg, 1993, *The Solid State,* 3rd Edition, Oxford University Press, Oxford.

	3. J. M. Ziman, 1971, Principles *of the Theory of Solids*, Cambridge University Press, London. 4. C. Ross-Innes and E. H. Rhoderick, 1976, *Introduction to Superconductivity,* Pergamon, Oxford. 5. J. P. Srivastava, 2001, *Elements of Solid State Physics,* Prentice-Hall of India, New Delhi.
WEB SOURCES	1. http://www.physics.uiuc.edu/research/electronicstructure/389/389-cal.html 2. http://www.cmmp.ucl.ac.uk/%7Eaph/Teaching/3C25/index.html 3. https://www.britannica.com/science/crystal 4. https://www.nationalgeographic.org/encyclopedia/magnetism/ 5. https://www.brainkart.com/article/Super-Conductors_6824/

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Student will be able to list out the crystal systems, symmetries allowed in a system and also the diffraction techniques to find the crystal structure	**K1**
CO2	Students will be able to visualize the idea of reciprocal spaces, Brillouin Zone and their extension to band theory of solids.	**K1, K2**
CO3	Student will be able to comprehend the heat conduction in solids	**K3**
CO4	Student will be able to generalize the electronic nature of solids from band theories.	**K3, K4**
CO5	Student can compare and contrast the various types of magnetism and conceptualize the idea of superconductivity.	**K5**
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** and program specific outcomes **(PSO)** in the 3-point scale of STRONG (3), MEDIUM (2) andLOW (1)**.**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	2	3	2	2	2	2	2	2	2
CO2	3	2	3	2	3	2	3	3	2	3
CO3	3	3	3	2	3	2	3	3	2	3
CO4	2	2	2	2	2	2	2	2	2	3
CO5	2	2	2	2	2	2	2	2	2	3

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	3	2	3	2	2	2	2	2	2	2
CO2	3	2	3	2	3	2	3	3	2	3
CO3	3	3	3	2	3	2	3	3	2	3
CO4	2	2	2	2	2	2	2	2	2	3
CO5	2	2	2	2	2	2	2	2	2	3

NUCLEAR AND PARTICLE PHYSICS		II YEAR - FOURTH SEMESTER						
Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
23P4PHC09	**NUCLEAR AND PARTICLE PHYSICS**	Core				4	6	75

Pre-Requisites
Knowledge of basic structure of atom and nucleus.
Learning Objectives
➢ Introduces students to the different models of the nucleus in a chronological order ➢ Imparts an in-depth knowledge on the nuclear force, experiments to study it and the types of nuclear reactions and their principles ➢ Provides students with details of nuclear decay with relevant theories ➢ Exposes students to the Standard Model of Elementary Particles and Higgs boson

UNITS	**Course Details**
UNIT I: **NUCLEAR MODELS**	Liquid drop model – Weizacker mass formula – Isobaric mass parabola –Mirror Pair - Bohr Wheeler theory of fission – shell model – spin-orbit coupling – magic numbers – angular momenta and parity of ground states – magnetic moment – Schmidt model – electric Quadrapole moment - Bohr and Mottelson collective model – rotational and vibrational bands.
UNIT II: **NUCLEAR FORCES**	Nucleon – nucleon interaction – Tensor forces – properties of nuclear forces – ground state of deuteron – Exchange Forces - Meson theory of nuclear forces – Yukawa potential – nucleon-nucleon scattering – effective range theory – spin dependence of nuclear forces - charge independence and charge symmetry – isospin formalism.
UNIT III: **NUCLEAR REACTIONS**	Kinds of nuclear reactions – Reaction kinematics – Q-value – Partial wave analysis of scattering and reaction cross section – scattering length – Compound nuclear reactions – Reciprocity theorem – Resonances – Breit Wigner one level formula – Direct reactions - Nuclear Chain reaction – four factor formula.
UNIT IV: **NUCLEAR**	Beta decay – Continuous Beta spectrum – Fermi theory of beta decay - Comparative Half-life –Fermi Kurie Plot – mass of neutrino

DECAY	– allowed and forbidden decay — neutrino physics – Helicity - Parity violation - Gamma decay – multipole radiations – Angular Correlation - internal conversion – nuclear isomerism – angular momentum and parity selection rules.
UNIT V: **ELEMENTARY PARTICLES**	Classification of Elementary Particles – Types of Interaction and conservation laws – Families of elementary particles – Isospin – Quantum Numbers – Strangeness – Hypercharge and Quarks –SU (2) and SU (3) groups-Gell Mann matrices– Gell Mann Okuba Mass formula-Quark Model. Standard model of particle physics – Higgs boson.
UNIT VI: PROFESSIONAL COMPONENTS	Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism
TEXT BOOKS	1. D. C. Tayal – Nuclear Physics – Himalaya Publishing House (2011) 2. K. S. Krane – Introductory Nuclear Physics – John Wiley & Sons (2008) 3. R. Roy and P. Nigam – Nuclear Physics – New Age Publishers (1996) 4. S. B. Patel – Nuclear Physics – An introduction – New Age International Pvt Ltd Publishers (2011) 5. S. Glasstone – Source Book of Atomic Energy – Van Nostrand Reinhold Inc.,U.S.- 3rd Revised edition (1968)
REFERENCE BOOKS	1. L. J. Tassie – The Physics of elementary particles – Prentice Hall Press (1973) 2. H. A. Enge – Introduction to Nuclear Physics – Addison Wesley, Publishing Company. Inc. Reading. New York, (1974). 3. Kaplan – Nuclear Physics – 1989 – 2nd Ed. – Narosa (2002) 4. Bernard L Cohen – Concepts of Nuclear Physics – McGraw Hill Education (India) Private Limited; 1 edition (2001) 5. B.L. Cohen, 1971, Concepts of Nuclear Physics, TMCH, New Delhi.
WEB SOURCES	1. http://bubl.ac.uk/link/n/nuclearphysics.html 2. http://www.phys.unsw.edu.au/PHYS3050/pdf/Nuclear_Models.pdfhttp://www.scholarpedia.org/article/Nuclear_Forces 3. https://www.nuclear-power.net/nuclear-power/nuclear-reactions/ 4. http://labman.phys.utk.edu/phys222core/modules/m12/nuclear_models.html 5. https://www.ndeed.org/EducationResources/HighSchool/Radi

	ography/radioactivedecay.html

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Gain knowledge about the concepts of helicity, parity, angular correlation and internal conversion.	K1, K5
CO2	Demonstrate knowledge of fundamental aspects of the structure of the nucleus, radioactive decay, nuclear reactions and the interaction of radiation and matter.	K2, K3
CO3	Use the different nuclear models to explain different nuclear phenomena and the concept of resonances through Briet-Weigner single level formula	K3
CO4	Analyze data from nuclear scattering experiments to identify different properties of the nuclear force.	K3, K4
CO5	Summarize and identify allowed and forbidden nuclear reactions based on conservation laws of the elementary particles.	K5
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** and program specific outcomes **(PSO)** in the 3-point scale of STRONG (3), MEDIUM (2) andLOW (1)**.**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	3	2	2	2	2	2	2	2	2
CO2	3	3	2	2	1	2	1	2	2	2
CO3	3	3	1	2	1	2	1	1	2	2
CO4	3	3	2	3	2	3	2	2	3	3
CO5	3	3	2	3	2	3	2	3	3	3

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1	3	3	2	2	2	2	2	2	2	2
CO2	3	3	2	2	1	2	1	2	2	2
CO3	3	3	1	2	1	2	1	1	2	2
CO4	3	3	2	3	2	3	2	2	3	3
CO5	3	3	2	3	2	3	2	3	3	3

NUMERICAL METHODS AND COMPUTER PROGRAMMING	II YEAR - FOURTH SEMESTER

Subject Code	Subject Name	Category	L	T	P	Credits	Inst. Hours	Marks
23P4PHC11	**COMPUTATIONAL TECHNIQUES FOR PHYSICS**	Core				4	5	75

Pre-Requisites
Prior knowledge on computer and basic mathematics
Learning Objectives
➢ To make students to understand different numerical approaches to solve a problem. ➢ To understand the basics of programming

UNITS	Course Details
UNIT I: SOLUTIONS OF EQUATIONS	Zeros or Roots of an equation - Non-linear algebraic equation and transcendental equations - Zeros of polynomials –Roots of polynomials, nonlinear algebraic equations and transcendental equations using Bisection and Newton-Raphson methods – Convergence of solutions in Bisection and Newton-Raphson methods – Limitations of Bisection and Newton-Raphson methods.
UNIT II: LINEAR SYSTEM OF EQUATIONS	Simultaneous linear equations and their matrix representation– Inverse of a Matrix – Solution of simultaneous equations by Matrix inversion method and its limitations – Gaussian elimination method – Gauss Jordan method – Inverse of a matrix by Gauss elimination method - Eigen values and eigenvectors of matrices –Jacobi Method to find the Eigen values and Eigen vectors.
UNIT III: INTERPOLATION AND CURVE FITTING	Interpolation with equally spaced points - Newton forward and backward interpolation - Interpolation with unevenly spaced points -Newton's divided difference interpolation - Lagrange interpolation – least square approximation- Curve fitting – Method of least squares – Fitting a polynomial.
UNIT IV: DIFFERENTIATION, INTEGRATION	Numerical differentiation – Numerical integration – Trapezoidal rule – Simpson's rule – Error estimates – Gauss-Legendre, Gauss-Laguerre, Gauss-Hermite and Gauss-

AND SOLUTION OF DIFFERENTIAL EQUATIONS	Chebyshev quadrature – solution of ordinary differential equations – Euler and RungaKutta methods.
UNIT V: PROGRAMMING WITH C	Flow-charts – Integer and floating point arithmetic expressions – Built-in functions – Executable and non-executable statements – Subroutines and functions – Programs for the following computational methods: (a) Zeros of polynomials by the bisection method, (b) Zeros of polynomials/non-linear equations by the Newton-Raphson method, (c) Newton's forward and backward interpolation, Lagrange Interpolation, (d) Trapezoidal and Simpson's Rules, (e) Solution of first order differential equations by Euler's method.

UNIT VI: PROFESSIONAL COMPONENTS	Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism
TEXT BOOKS	1. V. Rajaraman, 1993, Computer oriented Numerical Methods, 3rd Edition. PHI, New Delhi 2. M. K .Jain, S. R. Iyengar and R. K. Jain, 1995, Numerical Methods for Scientific and Engineering Computation, 3rd Edition, New Age Intl., New Delhi 3. S. S. Sastry, Introductory Methods of Numerical analysis, PHI, New Delhi 4. F. Scheid, 1998, Numerical Analysis, 2nd Edition, Schaum's series, McGraw Hill, New York 5. W. H. Press, S. A. Teukolsky, W. T. Vetterling and B. P. Flannery, 1992, Numerical Recipes in FORTRAN, 2nd Edition, Cambridge Univ. Press
REFERENCE BOOKS	1. S. D. Conte and C. de Boor, 1981, Elementary Numerical analysis-an algorithmic approach, 3rd Edition, McGraw Hill,) 2. B. F. Gerald, and P. O. Wheatley, 1994, Applied Numerical analysis, 5th Edition, Addison-Wesley, MA. 3. B. Carnagan, H. A. Luther and J. O. Wilkes, 1969, Applied Numerical Methods, Wiley, New York. 4. S. S. Kuo, 1996, Numerical Methods and Computers, Addison-Wesley. 5. V. Rajaraman, Programming in FORTRAN / Programming in C, PHI, New Delhi

WEB SOURCES	1. https://www.scribd.com/doc/202122350/Computer-Oriented-Numerical-Methods-by-V-RajaRaman 2. https://www.scirp.org/(S(lz5mqp453edsnp55rrgjct55))/reference/referencespapers.aspx?referenceid=1682874 3. https://nptel.ac.in/course/122106033/ 4. https://nptel.ac.in/course/103106074/ 5. https://onlinecourses.nptel.ac.in/noc20_ma33/preview

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Recall the transcendental equations and analyze the different root finding methods. Understand the basic concept involved in root finding procedure such as Newton Raphson and Bisection methods, their limitations.	**K1, K2**
CO2	Relate Simultaneous linear equations and their matrix representation Distinguish between various methods in solving simultaneous linear equations.	**K5**
CO3	Understand, how interpolation will be used in various realms of physics and Apply to some simple problems Analyze the newton forward and backward interpolation	**K2, K3**
CO4	Recollect and apply methods in numerical differentiation and integration. Assess the trapezoidal and Simson's method of numerical integration.	**K3, K4**
CO5	Understand the basics of C-programming and conditional statements.	**K2**
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate;		

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)**
and program specific outcomes **(PSO)** in the 3-point scale of
STRONG (3),
MEDIUM (2) andLOW (1)

	PO1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**
CO1	3	2	3	1	1	2	3	2	2	3
CO2	3	2	3	1	1	2	3	2	2	3
CO3	3	2	3	1	1	2	3	2	2	3
CO4	3	2	3	1	1	2	3	2	2	3

CO5	3	2	3	1	1	2	3	2	2	3
	PSO1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**	**PSO 7**	**PSO 8**	**PSO 9**	**PSO10**
CO1	3	2	3	1	1	2	3	2	2	3
CO2	3	2	3	1	1	2	3	2	2	3
CO3	3	2	3	1	1	2	3	2	2	3
CO4	3	2	3	1	1	2	3	2	2	3
CO5	3	2	3	1	1	2	3	2	2	3

ROBOTICS AND ARTIFICIAL INTELLIGENCE IN PHYSICS	II YEAR –FOURTH SEMESTER

Subject Code	Subject Name	Category	L	T	P	Credits	Inst. Hours	Marks
23P4PHDE04	**ROBOTICS AND ARTIFICIAL INTELLIGENCE IN PHYSICS**	**Elective VI**				2	2	75

Pre-Requisites
Ability in robotics, artificial intelligence
Learning Objectives
➢ To give an introduction to students in the areas of robotics, artificial intelligence

Unit I BASICS OF ROBOTICS	Robot – Definition of Robot – Industrial Robot – Laws of Robotics – Motivating Factors – Advantages and Disadvantages of Robots – Characteristics & Components of an Industrial Robot — Comparison of the Human and Robot Manipulator – Robot Wrist and End of Arm Tools – Robot Terminology – Robotic Joints.
UNIT II CLASSIFICATION OF ROBOTS	Classification on the Basis of Coordinate System, Power Source and Method of Control - Robot Selection – Robot Work cell – Robotics and Machine Vision – Robotic Accidents , Safety, Maintenance and Installation – Robotic Sensors – Types of Sensors in Robots – Exteroceptors – Tactile Sensors – Proximity Sensors – Range Sensors – Machine Vision Sensors – Velocity Sensors – Proprioceptors
Unit III ARTIFICIAL INTELLIGENCE	Introduction to Artificial Intelligence (AI) – Need for AI – Applications domains of AI – tools – Challenges and Future of AI –Fundamentals of Machine Learning and Deep Learning
UNIT IV MACHINE LEARNING ALGORITHMS	Machine Learning algorithms to find associations across Biological Data, Cellular Image Classification and Identification of Genetic Variations – AI in Bio Physics Research – AI in drug Design – AI in next generation Sequencing – AI in Protein Structure – AI in Protein Folding Analysis

Unit V BASICS OF CYBER SECURITY	Cyber Security - Security Environment – Threats – Cyber Crime – Vulnerabilities in Software – Open Access Data – Open Source Software

TEXT BOOKS	1. Industrial Automation and Robotics – A. K. Gupta, S. K. Arora and J. R. Westcott, Mercury Learning and Information LLC, 2017 2. Arduino Cookbook – Michael Margolis, O' Reilly Media, Inc., 2011 3. Artificial Intelligence: A modern approach – Stuart Russell and Peter Norvig, Prentice Hall, 3rd Edition, 2009
REFERENCE BOOKS	4. Principles of Information Security – Michael E Whitman and Herbert J Mattord, Vikas Publishing House, 4th Edition, 2011 5. Ethical Hacking: A Beginners Guide to Learning the World of Ethical Hacking – LakshayEshan, Shockwave Publishing, 2018 6. Quantum Computation and Quantum Information – Michael A. Nielsen and Isaac L. Chuang, Cambridge University Press, 2000
WEB SOURCES	https://nptel.ac.in/courses/106105166/ **http://www.theory.caltech.edu/people/preskill/ph229/**

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Understand & acquire basics of robotics	**K1**
CO2	Understand & acquire basics of robotics/ robotic sensors	**K2**
CO3	Understand artificial intelligence	**K2**
CO4	Understand Machine Learning Algorithms	**K2**
CO5	Remembering the basics of cyber security	**K1**
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate;		

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** and program specific outcomes **(PSO)** in the 3-point scale of STRONG (3),MEDIUM (2) and LOW (1)**.**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	3	1	3	2	3	2	2	2	2
CO2	3	3	1	3	2	3	2	2	2	2

CO3	3	2	1	2	1	2	1	1	3	2
CO4	3	2	1	2	1	2	1	1	3	2
CO5	3	2	1	2	1	2	1	1	3	2

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	S	M	S	M	L	S	S
CO2	S	M	S	L	L	M	M
CO3	S	M	S	L	M	M	M
CO4	S	M	S	S	M	S	S
CO5	S	M	S	L	M	M	M

Practical – IV		II YEAR - FOURTH SEMESTER						
Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**Credits**	**Inst. Hours**	**Marks**
23P3PHPC04	**Practical – IV**	Core				3	6	75

Pre-Requisites
Basic knowledge in differential equation and linear algebra Basic knowledge of operating system and computer fundamentals.
Learning Objectives
➢ The aim and objective of the course on Computational Practical is to familiarize the of M.Sc. students with the numerical methods used in computation and programming using any high level language such as C/FORTRAN ➢ To equip the computational skill using various mathematical tools. ➢ To apply the software tools to explore the concepts of physical science. ➢ To approach the real time activities using physics and mathematical formulations.

Course Details
(Any Twelve Experiments)
1. Lagrange interpolation with Algorithm, Flow chart and output.
2. Newton forward interpolation with Algorithm, Flow chart and output.
3. Newton backward interpolation with Algorithm, Flow chart and output.
4. Curve-fitting: Least squares fitting with Algorithm, Flow chart and output.
5. Numerical integration by the trapezoidal rule with Algorithm, Flow chart and output.
6. Numerical integration by Simpson's rule with Algorithm, Flow chart and output.
7. Numerical solution of ordinary first-order differential equations by the Euler method with Algorithm, Flow chart and output.
8. Numerical solution of ordinary first-order differential equations by the Runge- Kutta method with Algorithm, Flow chart and output.
9. Finding Roots of a Polynomial - Bisection Method –
10. Finding Roots of a Polynomial - Newton Raphson Method –
11. Solution of Simultaneous Linear Equation by Gauss elimination method.
12. Solution of Ordinary Differential Equation by Euler
13. RungeKutta Fourth Order Method for solving first order Ordinary

	Differential Equations
14.	Newton's cotes formula
15.	Trapezoidal rule
16.	Simpson's 1/3 rule
17.	Simpson's 3/8 rule
18.	Boole's rule
19.	Gaussian quadrature method (2 point and 3 point formula)
20.	Giraffe's root square method for solving algebraic equation

TEXT BOOKS	1. Numerical methods using Matlab – John Mathews & Kurtis Fink, Prentice Hall, New Jersey 2006 2. Numerical methods in Science and Engineering - M.K. Venkataraman, National Publishing Co. Madras, 1996 3. V. Rajaraman, 1993, Computer Oriented Numerical Methods, 3rd Ed. (Prentice-Hall, New Delhi. 4. M.K. Jain, S.R. Iyengar and R.K. Jain, 1995, Numerical Methods for Scientific and Engineering Computation, 3rd Ed. New Age International, New Delhi. 5. S.S. Sastry, Introductory Methods of Numerical Analysis, PHI, New Delhi.
REFERENCE BOOKS	1. S.D. Conte and C. de Boor, 1981, Elementary Numerical Analysis, An Algorithmic Approach, 3rd Ed., International Ed. (McGraw-Hill). 2. B.F. Gerald and P.O. Wheately, 1994, Applied Numerical Analysis, 5th Edition, Addison Wesley, Reading, MA. 3. B. Carnahan, H.A. Luther and J.O. Wikes, 1969, Applied Numerical Methods (Wiley, New York. 4. S.S. Kuo, 1996, Numerical Methods and Computers, Addison - Wesley, London. 5. V. Rajaraman,Programming in FORTRAN/ Programming in C, PHI, New Delhi.

COURSE OUTCOMES:

At the end of the course the student will be able to:

CO1	Program with the C Program/ FORTRAN with the C or any other high level language	K1
CO2	Use various numerical methods in describing/solving physics problems.	K4
CO3	Solve problem, critical thinking and analytical reasoning as applied to scientific problems.	K5
CO4	To enhance the problem-solving aptitudes of students using	K5

	various numerical methods.	
CO5	To apply various mathematical entities, facilitate to visualise any complicate tasks.	K3
CO6	Process, analyze and plot data from various physical phenomena and interpret their meaning	K4
CO7	Identify modern programming methods and describe the extent and limitations of computational methods in physics	K1
CO8	Work out numerical differentiation and integration whenever routine are not applicable.	K5
CO9	Apply various interpolation methods and finite difference concepts.	K4
CO10	Understand and apply numerical methods to find out solution of algebraic equation using different methods under different conditions, and numerical solution of system of algebraic equation.	K1, K4
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)**

and program specific outcomes **(PSO)** in the 3-point scale of STRONG (3), MEDIUM (2) **and** LOW (1)**.**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	2	2	2	3	3	2	2	2	3	3
CO2	2	2	3	3	3	2	2	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3
CO4	3	2	3	3	3	3	2	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3
CO6	2	2	2	3	3	2	2	2	3	3
CO7	2	2	3	3	3	2	2	3	3	3
CO8	3	3	3	3	3	3	3	3	3	3
CO9	3	3	3	3	3	3	3	3	3	3
CO10	3	3	3	3	3	3	3	3	3	3

	PSO 1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO 9**	**PSO 10**
CO1	2	2	2	3	3	2	2	2	3	3
CO2	2	2	3	3	3	2	2	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3

CO4	3	2	3	3	3	3	2	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3
CO6	2	2	2	3	3	2	2	2	3	3
CO7	2	2	3	3	3	2	2	3	3	3
CO8	3	3	3	3	3	3	3	3	3	3
CO9	3	3	3	3	3	3	3	3	3	3
CO10	3	3	3	3	3	3	3	3	3	3

EDC : SOLAR ENERGY	II YEAR - FOURTH SEMESTER

Subject Code	Subject Name	Category	L	T	P	Credits	Inst. Hours	Marks
23P4PHED1	**EDC : SOLAR ENERGY**	Core				4	5	75

Pre-Requisites
Basic knowledge of atomic physics, quantum mechanics and statistical mechanics.
Learning Objectives
➢ Energy resources around us. ➢ Threatening to our energy resources. ➢ How to conserve energy.

UNITS	Course Details
UNIT I: INTRODUCTION TO ENERGY SOURCES	Classification of Energy sources - Worlds reserve of commercial energy sources and their availability - Geothermal energy - wind energy - Ocean thermal energy conversion - Energy from waves and tides (basic ideas) - Merits and Demerits.
UNIT II: SOLAR THERMAL ENERGY	Introduction about thermal properties - Renewable energy sources - Solar energy - Solar water heater - Solar Pumping - Solar furnace - Solar space heating and cooling - Solar thermal technologies - Solar cooker – Solar Pond - Merits and Demerits of solar energy.
UNIT III: SOLAR CELL	Introduction about semiconductor - Photo voltaic effect - Performance of solar cell - Solar cell Parameter - Solar cell characteristics and efficiency – Choice of materials for solar cell - Basic requirements for obtaining an effective solar cell - Power generation by using solar cell.
UNIT IV: BIOMASS ENERGY FUNDAMENTALS	Biomass energy - Classification - Photosynthesis - Biogas Generation - Introduction basic process and energetic, Advantages - Biomass conversion technology – Wet and dry process - Gobar gas and its Applications - Advantages and Disadvantages of

	biomass energy.
UNIT V: ENERGY STORAGE	Introduction - Liquid media storage - Solid media storage - Ground collector - Chemical storage- Capacitor, Electromagnets-Superconducting Magnet Energy Storage (SMES)systems
UNIT VI: PROFESSIONAL COMPONENTS	Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism
TEXT BOOKS	1. G.D. Rai, Non Conventional Energy Sources, 4th, 5th Edition, (2011). 2. G. G.D. Rai, Solar Energy Utilization, 5th Edition, (2011). 3. S.P. Sukhatme, Solar Energy, Tata McGraw Hill Publishing Company, 3rd Edition, (2005).
REFERENCE BOOKS	1. D.S. Chauhan, S.K. Srivastava, Non Conventional Energy Sources, Ed.V, first edition, (2004). 2. 2. Solar Energy, Fundamentals, Design, Modelling and Applications, G.N.Tiwari, Narosa Publications, (2004).
WEB SOURCES	https://www.renewableenergyworld.com/solar-energy/tech.html https://en.wikipedia.org/wiki/Solar_power

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Energy resources around us.	**K1**
CO2	Threatening to our energy resources.	**K1, K2**
CO3	How to conserve energy	**K3**
CO4	Student will be able to generalize bio medical storage systems	**K3, K4**
CO5	Student will be able to generalize energy storage systems.	**K5**
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** and program specific outcomes **(PSO)** in the 3-point scale of STRONG (3), medium (2) and low (1)**.**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	2	3	2	2	2	2	2	2	2
CO2	3	2	3	2	3	2	3	3	2	3
CO3	3	3	3	2	3	2	3	3	2	3
CO4	2	2	2	2	2	2	2	2	2	3
CO5	2	2	2	2	2	2	2	2	2	3

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1	3	2	3	2	2	2	2	2	2	2
CO2	3	2	3	2	3	2	3	3	2	3
CO3	3	3	3	2	3	2	3	3	2	3
CO4	2	2	2	2	2	2	2	2	2	3
CO5	2	2	2	2	2	2	2	2	2	3