V.V.VANNIAPERUMAL COLLEGE FOR WOMEN
(Belonging to Virudhunagar Hindu Nadars)
An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai
Reaccredited with 'A++' Grade (4th Cycle) by NAAC
VIRUDHUNAGAR
Quality Education with Wisdom and Values

OUTCOME BASED EDUCATION WITH CHOICE BASED CREDIT SYSTEM REGULATIONS AND SYLLABUS
(with effect from Academic Year 2025 - 2026)

V.V.Vanniaperumal College for Women, Virudhunagar, established in 1962, offers 13 UG Programmes (Aided), 13 UG Programmes (SF), 13 PG Programmes, and 6 Ph.D. Programmes. The curricula for all these Programmes, except Ph.D. Programmes, have been framed as per the guidelines given by the University Grants Commission (UGC) & Tamil Nadu State Council for Higher Education (TANSCHE) under Choice Based Credit System (CBCS) and the guidelines for Outcome Based Education (OBE).

The Departments of Commerce, English, History, Mathematics, Biochemistry and Tamil upgraded as Research Centres offer Ph.D. Programmes as per the norms and regulations of Madurai Kamaraj University, Madurai and do not come under the purview of CBCS.

A. CHOICE BASED CREDIT SYSTEM (CBCS)

The CBCS provides an opportunity for the students to choose courses from the prescribed Courses. The CBCS is followed as per the guidelines formulated by the UGC. The performance of students is evaluated based on the uniform grading system. Computation of the Cumulative Grade Point Average (CGPA) is made to ensure uniformity in evaluation system.

List of Programmes in which CBCS/Elective Course System is implemented

UG PROGRAMMES

Arts & Humanities	:	History (E.M. & T.M.), English, Tamil
Physical & Life Sciences	:	Mathematics, Zoology, Chemistry, Physics, Biochemistry, Home Science - Nutrition and Dietetics, Costume Design and Fashion, Microbiology, Biotechnology, Computer Science, Information Technology, Data Science, Computer Applications and Computer Applications - Graphic Design
Commerce & Management	:	Commerce, Commerce (Computer Applications), Commerce (Professional Accounting), Business Administration

PG PROGRAMMES

Arts & Humanities	:	History, English, Tamil
Physical & Life Sciences	:	Mathematics, Physics, Chemistry, Biochemistry, Home Science - Nutrition and Dietetics, Biotechnology, Computer Science and Computer Applications (MCA) *
Commerce & Management	:	Commerce, Business Administration (MBA) *
		* AICTE approved Programmes

OUTLINE OF CHOICE BASED CREDIT SYSTEM - PG

1. Core Courses
2. Elective Courses
   - Discipline Specific Elective Courses (DSEC)
   - Generic Elective Courses
   - Non-Major Elective Courses (NMEC)
3. Skill Enhancement Courses
4. Self Study Course (Online)
5. Extension Activity
6. Extra Credit Courses (Optional)

List of Non Major Elective Courses (NME)
(2024-2025 onwards)

PG PROGRAMMES

Name of the Course	Semester	Course Code	Department
Introduction to Epigraphy	II	24PHIN21	History
Communication Strategies for Leadership Success	III	24PHIN31	
Functional English	II	24PENN21	English
English for Careers	III	24PENN31	
ஆளுமை மேம்பாடு	II	24PTAN21N	Tamil
தகவல் தொடர்பியல்	III	24PTAN31	
Accounting for Managers -1	II	24PCON21N	Commerce
Accounting for Managers -II	III	24PCON31	
Entrepreneurship Development	II	24PBAN21	Business Administration
Employability Skills	III	24PBAN31	
Mathematics for Life Sciences	II	24PMTN21	Mathematics
Statistics for Life and Social Sciences	III	24PMTN31	
Solid Waste Management	II	24PPHN21	Physics
Sewage and Waste Water Treatment and Reuse	III	24PPHN31	
Chemistry in Everyday Life	II	24PCHN21	Chemistry
Industrial Chemistry	III	24PCHN31	
Food Preservation	II	24PHSN21	Home Science - Nutrition and Dietetics
Nutrition and Health	III	24PHSN31	
Nutritional Biochemistry	II	24PBCN21	Biochemistry
Molecular Basis of Diseases and Therapeutic Strategies	III	24PBCN31	

Tissue engineering	II	24PBON21	Biotechnology
Gene manipulation Technology	III	24PBON31	
Web Programming	II	24PCSN21	Computer Science
Python Programming	III	24PCSN31	
Fundamentals of Web Design	II	24PCAN21N	Computer Applications
Fundamentals of Cyber Security	III	24PCAN31	

B. OUTCOME BASED EDUCATION (OBE) FRAMEWORK

The core philosophy of Outcome Based Education rests in employing a student - centric learning approach to measure the performance of students based on a set of pre- determined outcomes. The significant advantage of OBE is that it enables a revamp of the curriculum based on the learning outcomes, upgrade of academic resources, quality enhancement in research and integration of technology in the teaching-learning process. It also helps in bringing clarity among students as to what is expected of them after completion of the Programme in general and the Course in particular. The OBE directs the teachers to channelise their teaching methodologies and evaluation strategies to attain the Programme Educational Objectives (PEOs) and fulfill the Vision and Mission of the Institution.

Vision of the Institution

The founding vision of the Institution is to impart Quality Education to the rural womenfolk and to empower them with knowledge and leadership quality.

Mission of the Institution

The mission of the Institution is to impart liberal education committed to quality and excellence. Its quest is to mould learners into globally competent individuals instilling in them life-oriented skills, personal integrity, leadership qualities and service mindedness.

B.1 Programme Educational Objectives, Programme Outcomes and Programme Specific Outcomes

It is imperative for the Institution to set the Programme Educational Objectives (PEOs), Programme Outcomes (POs) and Course Outcomes (COs), consistent with its Vision and Mission statements. The PEOs and the POs should be driven by the Mission of the Institution and should provide distinctive paths to achieve the stated goals. The PEOs for each Programme have to fulfill the Vision and Mission of the Department offering the Programme.

Vision of the Department of Physics

To awaken the young minds and discover their talents by providing a skilful learning experience and to develop analytical and problem-solving skills and give them a wide range of career choice.

Mission of the Department of Physics

To impart theoretical and experimental knowledge in Physics as well as to infuse the spirit of inquiry and research for personal and professional development with ethical values.

B.1.1 Programme Educational Objectives (PEOs)

PEOs are broad statements that describe the career and professional achievements that the Programme is preparing the graduates to achieve within the first few years after graduation. PEOs are framed for each Programme and should be consistent with the Mission of the Institution.

Programme Educational Objectives (PEOs) of M.Sc. Physics Programme

The students will be able to

- apply obtained knowledge and wisdom in Physics to real life situations.
- think critically and practice recent methodologies for conducting research in the chosen field.
- incur values and skills for professional empowerment and social recognition.

Key Components of Mission Statement	**PEO1**	**PEO2**	**PEO3**
Mastery of the Subject	✓	✓	-
Research Skills	-	✓	✓
Professional Skills	✓	✓	✓
Ethical Values	✓	✓	✓

B.1.2 Programme Outcomes (POs)

POs shall be based on Graduate Attributes (GAs) of the Programme. The GAs are the attributes expected of a graduate from a Programme in terms of knowledge, skills, attitude and values. The Graduate Attributes include Disciplinary Knowledge, Communication Skills, Critical Thinking, Problem Solving, Analytical Reasoning, Research Related Skills, Co- operation/Team Work, Scientific Reasoning, Reflective Thinking, Information/Digital Literacy, Multicultural Competence, Moral and Ethical Awareness/Reasoning, Leadership Qualities and Lifelong Learning.

On successful completion of the Programme, the students will be able to

1. apply their in depth domain knowledge and practical skills in interdisciplinary fields for research-based endeavours, employment and entrepreneurship development. (*Disciplinary Knowledge)*
2. communicate proficiently and confidently with the ability to present complex ideas in a concise manner to assorted groups. (*Communication Skills*)
3. identify, formulate and solve problems in a consistent and systematic way with updated skills using modern tools and techniques. (*Scientific Reasoning and Problem Solving*)

4. analyze the data, synthesise the findings and provide valid conclusion by critical evaluation of theories, policies and practices for the betterment of society. (*Critical Thinking and Analytical Reasoning*)
5. explore and evaluate globally competent research methodologies to apply appropriately in interdisciplinary research; Develop and sustain the research capabilities to meet the emerging needs for the welfare of the society. (*Research Related Skills*)
6. use ICT to mould themselves for lifelong learning activities to face career challenges in the changing environment. (*Digital Literacy, Self - Directed and Lifelong Learning*)
7. self-manage and function efficiently as a member or a leader in diverse teams in a multicultural society for nation building. (*Co-operation/Team Work and Multicultural Competence*)
8. uphold the imbibed ethical and moral values in personal, professional and social life for sustainable environment. (*Moral and Ethical Awareness*)

B.1.3 ProgrammeSpecific Outcomes (PSOs)

Based on the Programme Outcomes, Programme Specific Outcomes are framed for each PG Programme**.** ProgrammeSpecific Outcomes denote what the students would be able to do at the time of graduation. They are Programme-specific and it is mandatory that each PO should be mapped to the respective PSO.

On successful completion of M.Sc. Physics Programme, the students will be able to

PO 1: *Disciplinary Knowledge*

PSO 1a: Apply their academic proficiency of concepts, theories, current and emerging development in the field of Physics to meet challenges in interdisciplinary research work, teaching and government/public sector.

PSO 1b: Execute Physics related experiments in a systematic manner, analyse and interpret the results using appropriate methods and report accurately the findings/conclusions of the experiments with relevant theories of Physics.

PO 2: *Communication Skills*

PSO 2: Communicate profoundly their acquired knowledge in the academic field of Physics through oral/written mode where assessment of their knowledge is needed and share their proficiency in diverse fields to assorted audience.

PO 3: *Scientific Reasoning and Problem Solving*

PSO 3: Develop problem solving skills that are required to solve different types of Physics related problems with well-defined solutions and tackle open ended problems that belong to disciplinary area bounded.

PO 4: *Critical Thinking and Analytical Reasoning*

PSO 4: Analyse theories/equations of physical concepts to realize their significance in emerging technical aspects, industrial applications and critically evaluate them to be beneficial for the advancement of society.

PO 5: *Research Related Skills*

PSO 5: Adapt recent developments to execute interdisciplinary research for the environmental safety in global and social context.

PO 6: *Digital Literacy, Self-directed and lifelong learning*

PSO 6a: Use programming/computational techniques to represent, evaluate and analyse physical concepts that helps to progress research effectively.

PSO 6b: Identify, access and manage wide range of online resources for self-directed lifelong learning in their field of interest to compete in the digital environment and have a successful career.

PO 7: *Co-operation/Team Work and Multi-Cultural Competence*

PSO 7: Get acquainted with cultural diversity and work as a proficient member in a globalised team, or as an individual for personal and professional development that leads to the progress of the nation.

PO 8: *Moral and Ethical Awareness*

PSO 8: Respect individuality, appreciate the accomplishment of people in every phase of life adhering to ethical standard and integrity in Physics community around the world to build a prosperous living environment.

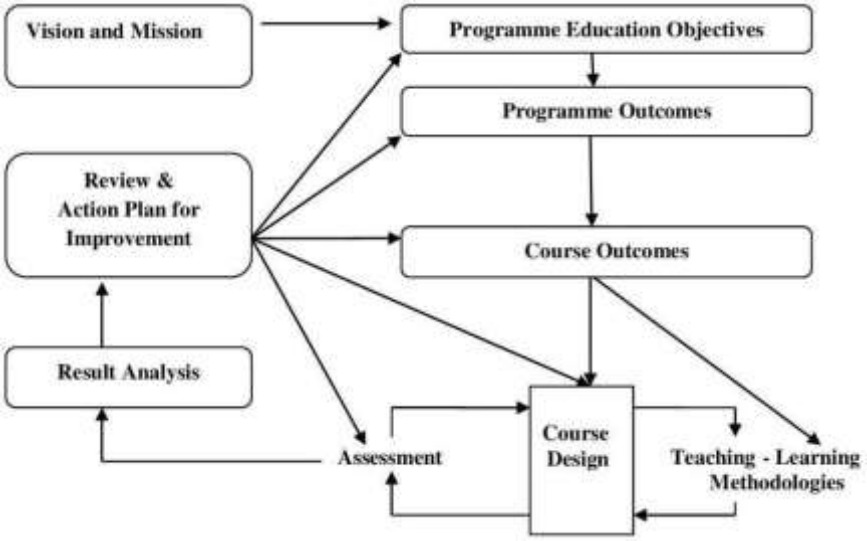
PO-PEO Mapping Matrix

Attainment of PEOs can be measured by a PO-PEO matrix. PEOs should evolve through constant feedback from alumnae, students, industry, management, *etc*. It is mandatory that each PEO should be mapped to at least one of the POs.

PEOs / POs/PSOs	**PEO1**	**PEO2**	**PEO3**
PO1/PSO1	✓	✓	✓
PO2/PSO2	✓	✓	✓
PO3/PSO3	✓	✓	-
PO4/PSO4	✓	✓	-
PO5/PSO5	✓	✓	✓
PO6/PSO6	✓	✓	✓
PO7/PSO7	-	✓	✓
PO8/PSO8	✓	✓	✓

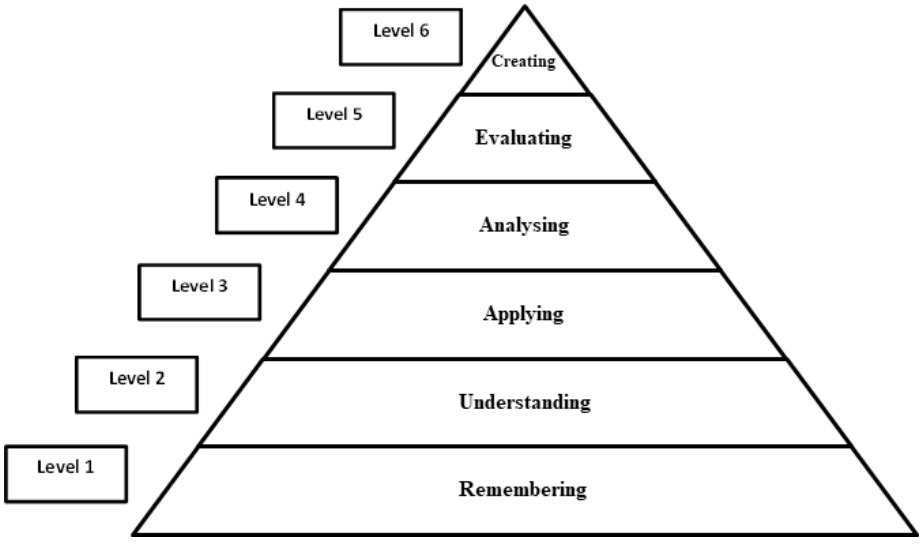
B.1.4 Course Outcomes (COs)

Course Outcomes are narrow statements restricted to the course contents given in five units. Course Outcomes describe what students would be capable of, after learning the contents of the Course. They reflect the level of knowledge gained, skills acquired and attributes developed by the students after learning of Course contents. COs are measurable, attainable and manageable in number. COs contribute to attain POs in such a way that each CO addresses at least one of the POs and also each PO is reasonably addressed by adequate number of COs.



It is important to determine the methods of assessment. A comprehensive assessment strategy may be outlined using the revised Bloom's Taxonomy levels.

BLOOM'S TAXONOMY



CO - PO Mapping of Courses

After framing the CO statements, the COs framed for each course is mapped with POs based on the relationship that exists between them. The COs which are not related toany of the POs is indicated with (-), signifying Nil. Measurement Mapping is based on Four Points Scale [High (H), Medium (M), Low (L) and Nil (-)]. For calculating weighted percentage of contribution of each Course in the attainment of the respective POs, the weights assigned for H, M and L are 3, 2 and 1 respectively.

CO-PO/PSO Mapping Table (Course Articulation Matrix)

PO/PSOs / COs	PO1/ PSO1	PO2/ PSO2	PO3/ PSO3	PO4/ PSO4	PO5/ PSO5	PO6/ PSO6	PO7/ PSO7	PO8/ PSO8
CO1								
CO2								
CO3								
CO4								
CO5								

ELIGIBILITY FOR ADMISSION

The candidate should have passed in B.Sc. Physics Degree from any recognized University.

DURATION OF THE PROGRAMME

The candidates shall undergo the prescribed Programme of study for a period of two academic years (four semesters).

MEDIUM OF INSTRUCTION

English

B.2 EVALUATION SCHEME

Components	Internal Assessment Marks	External Examination Marks	Total Marks
Theory	25	75	**100**

B.2.1 Core Courses, Elective Courses (Discipline Specific Elective Courses, Generic Elective Courses & Non Major Elective Courses

INTERNAL ASSESSMENT

Distribution of Marks

Theory

Mode of Evaluation		Marks
Periodic Test	:	20
Assignment	:	5
Total	**:**	**25**

Three Periodic Tests - Average of the best two will be considered

Two Assignments - Better of the two will be considered

Practical

Mode of Evaluation		**Marks**
Practical Test	:	30
Record Performance	:	10
Total	**:**	**40**

Practical Test - Average of the two Practical Tests will be considered
Performance - Attendance and Record

Question Pattern for Periodic Test **Duration: 2 Hours**

Section	**Q. No.**	**Types of Question**	**No. of Questions**	**No. of Questions to be answered**	**Marks for each Question**	**Total Marks**
A	1 - 5	Multiple Choice Questions	5	5	1	5
B	6-9	Internal Choice – Either… or Type	4	4	5	20
C	10 - 11	Internal Choice – Either…. or Type	2	2	10	20
					Total	**45***

*The total marks obtained in the Periodic Test will be calculated for 20 marks

Summative Examination
External Assessment
Distribution of Marks

Mode of Evaluation		**Marks**
Summative Examination	**:**	60
Seminar Presentation	**:**	15
Total	**:**	**75**

Summative Examination

Question Pattern **Duration: 3 Hours**

Section	**Q. No.**	**Types of Question**	**No. of Questions**	**No. of Questions to be answered**	**Marks for each Question**	**Total Marks**
A	1 - 5	Multiple Choice Questions	5	5	1	5
B	6 - 10	Internal Choice - Either ….or Type	5	5	5	25
C	11 - 13	Internal Choice - Either …or Type	3	3	10	30
					Total	**60**

B.2.2 Project

Individual Project is compulsory for II PG Students in IV Semester.

Distribution of Marks

Mode of Evaluation		**Marks**
Internal Assessment	**:**	40
External Assessment	**:**	60
Total	**:**	**100**

Internal Assessment:

Pre-submission Presentation - 10 Marks

Review Report - 20 Marks

One Open Online Course related to the Project - 10 Marks

External Assessment:

Project Report - 40 Marks

Viva Voce - 20 Marks

B. 2.3 Skill Enhancement Course - Professional Competency Skill

Types of Question – Multiple Choice Questions Only

INTERNAL ASSESSMENT

Distribution of Marks

Theory

Mode of Evaluation		**Marks**
Periodic Test	:	20
Assignment	:	5
Total	**:**	**25**

Three Periodic Tests - Average of the best two will be considered

Two Assignments - Better of the two will be considered

Question Pattern for Periodic Test **Duration: 2 Hours**

Section	**Q. No.**	**Types of Question**	**No. of Questions**	**No. of Questions to be answered**	**Marks for each Question**	**Total Marks**
A	1 - 5	Multiple Choice Questions	5	5	1	5
B	6-9	Internal Choice – Either… or Type	4	4	5	20
C	10 - 11	Internal Choice – Either…. or Type	2	2	10	20
	Total					**45***

*The total marks obtained in the Periodic Test will be calculated for 20 marks

Summative Examination
External Assessment

Distribution of Marks

Mode of Evaluation		Marks
Summative Examination	:	60
Seminar Presentation	:	15
Total	:	**75**

Summative Examination

Question Pattern **Duration: 3 Hours**

Section	Q. No.	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A	1 - 5	Multiple Choice Questions	5	5	1	5
B	6 - 10	Internal Choice - Either ….or Type	5	5	5	25
C	11 - 13	Internal Choice - Either …or Type	3	3	10	30
					Total	**60**

B. 2.4 Internship / Industrial Training

Internship / Industrial Training is mandatory for all the Students

- **Internship:** Students have to involve in a designated activity, working in an organization for maximum of 30 days (not less than 20 days) under the guidance of an identified mentor.
- **Industrial Training:** Students have to undertake in-plant training in industries individually or in group for maximum of 30 days (not less than 20 days)
- Internship / Industrial Training must be done during the second semester holidays

Distribution of Marks

Mode of Evaluation		Marks
Internal Assessment	:	75
External Assessment	:	25
Total	:	**100**

Internal Assessment

Mode of Evaluation		Marks
Onsite Learning/Survey	:	50
Report	:	25
Total		**75**

External Assessment

Mode of Evaluation		Marks
Viva-Voce	:	25
Total		**25**

B.2.5. Self Study - Online Course

Practice for CSIR NET-General Paper –Online
Internal Examination only

- Two Periodic Tests (Online) with Multiple Choice Questions will be conducted in III Semester.
- Model Examination will be conducted after two periodic tests.

Distribution of Marks

Mode of Evaluation		Marks
Periodic Test	:	25
Model Examination	:	75
Total	**:**	**100**

Two Periodic Tests - Better of the two will be considered

B.2.6. Extension Activities

Assessment by Internal Examiner only

Distribution of Marks

Mode of Evaluation		Marks
Attendance	:	5
Performance	:	10
Report	:	10
Total	**:**	**25***

*The marks obtained will be calculated for 100 marks

B.2.7 Transfer of credits earned through MOOC (UGC recognized Courses)

- Students can opt for minimum of
  - 12 weeks Courses for Core Courses
  - 8 weeks Courses for Elective Courses
  - 4 weeks Courses for Skill Enhancement Course
- The Online Courses opted by the students will be verified and approved by the Head of the Department and forwarded to the Controller of Examinations through the Principal.
- Students are required to register for the equivalent Online Courses through the Institution's SWAYAM-NPTEL Local Chapter after submitting a Permission letter to the Head of the Department.
- The Course should be completed before the beginning of that particular Semester in which the selected Course is offered.
- The student should submit the Course Completion Certificate immediately after receiving it, to the Department.

- The Head of the Department has to send the list of the students and their Course Completion Certificates to the Controller of Examinations through the Principal.
- The students who have submitted the Completion Certificate are exempted from appearing the Periodic Tests and Summative Examinations of the respective course but without any exemption for class attendance.
- Credits allotted for the particular Course in the Curriculum will be transferred after the completion of the Online Course
- Students can earn up to 10 credits within the mandatory credits requirements of the Degree Programme by completing UGC recognised Online Courses.

B.2.8. EXTRA CREDIT COURSES (OPTIONAL)

2.8.1 Extra Credit Course offered by the Department.

Assessment by Internal Examiner Only (To be conducted along with the III Periodic Test)

Distribution of Marks

Mode of Evaluation		**Marks**
Quiz (Multiple Choice Questions)	:	25
Model Examination	:	75
Total	**:**	**100**

Question Pattern for Model Examination

Section	**Types of Question**	**No. of Questions**	**No. of Questions to be answered**	**Marks for each Question**	**Total Marks**
A Q.No.(1-5)	Internal Choice-Either or Type	5	5	7	35
B Q.No.(6-9)	Internal Choice-Either or Type	4	4	10	40
				Total	**75**

2.8.2 Extra Credit Course offered by MOOC (Massive Open Online Course)

- The Courses shall be completed within the first III Semesters of the Programme.
- The allotment of credits is as follows **(Maximum of 15 credits)**

4 weeks Course - 1 credit

8 weeks Course - 2 credits

12 weeks Course - 3 credits

ELIGIBILITY FOR THE DEGREE

- The candidate will not be eligible for the Degree without completing the prescribed Courses of study and a minimum of 50% Pass marks in all the Courses.

- No Pass minimum for Internal Assessment for all the Courses
- Pass minimum for External Examination is 27 marks out of 60 marks for Core Courses, Discipline Specific Elective Courses and Non Major Elective Course.
- Pass minimum for Practice for SET/NET - General Paper is 50 Marks.

- ATTENDANCE

- The students who have attended the classes for 76 days (85%) and above are permitted to appear for the Summative Examinations without any condition.
- The students who have only 60-75 days (66% - 84%) of attendance are permitted to appear for the Summative Examinations after paying the required fine amount and fulfilling other conditions according to the respective cases.
- The students who have attended the classes for 59 days and less – upto 45 days (50% - 65%) can appear for the Summative Examinations only after getting special permission from the Principal.
- The students who have attended the classes for 44 days or less (<50%) cannot appear for the Summative Examinations and have to repeat the whole semester.
- For Certificate, Diploma, Advanced Diploma and Post Graduate Diploma Programmes, the students require 75% of attendance to appear for the Theory/Practical Examinations.

B.3 ASSESSMENT MANAGEMENT PLAN

An Assessment Management Plan that details the assessment strategy both at the Programme and the Course levels is prepared. The continuous assessment is implementedusing an assessment rubric to interpret and grade students.

B.3.1 Assessment Process for CO Attainment

Assessment is one or more processes carried out by the institution that identify, collect and prepare data to evaluate the achievement of Course Outcomes and Programme Outcomes. Course Outcome is evaluated based on the performance of students in the Continuous Internal Assessments and in End Semester Examination of a course. Target levels of attainment shall be fixed by the Course teacher and Heads of the respective departments.

Direct Assessment (Rubric based) - Conventional assessment tools such as Term Test, Assignment, Quiz and End Semester Summative Examination are used.

Indirect Assessment - Done through Course Exit Survey.

CO Assessment Rubrics

For the evaluation and assessment of COs and POs, rubrics are used. Internal assessment contributes 40% and End Semester assessment contributes 60% to the total attainment of a CO for the theory courses. For the practical courses, internal assessment contributes 50% and Semester

assessment contributes 50% to the total attainment of a CO. Once the Course Outcome is measured, the PO can be measured using a CO-PO matrix.

CO Attainment

Direct CO Attainment

Course Outcomes of all courses are assessed and the CO - wise marks obtained by all the students are recorded for all the assessment tools. The respective CO attainment level is evaluated based on set attainment rubrics.

Attainment Levels of COs

Assessment Methods	**Attainment Levels**	
Internal Assessment	Level 1	50% of students scoring more than average marks or set target marks in Internal Assessment tools
	Level 2	55% of students scoring more than average marks or set target marks in Internal Assessment tools
	Level 3	60% of students scoring more than average marks or set target marks in internal Assessment tools
End Semester Summative Examination	Level 1	50% of students scoring more than average marks or set target marks in End Semester Summative Examination
	Level 2	55% of students scoring more than average marks or set target marks in End Semester Summative Examination
	Level 3	60% of students scoring more than average marks or set target marks in End Semester Summative Examination

Target Setting for Assessment Method

For setting up the target of internal assessment tools, 55% of the maximum mark is fixed as target. For setting up the target of End Semester Examination, the average mark of the class shall be set as target.

Formula for Attainment for each CO

Attainment = Percentage of students who have scored more than the target marks

$$\text{Percentage of Attainment} = \frac{\text{Number of Students who Scored more than the Target}}{\text{Total Number of Students}} \times 100$$

Indirect CO Attainment

At the end of each Course, an exit survey is conducted to collect the opinion of the students on attainment of Course Outcomes. A questionnaire is designed to reflect the views of the students about the attainment of Course Outcomes.

Overall CO Attainment=75% of Direct CO Attainment + 25 % of Indirect CO Attainment

In each Course, the level of attainment of each CO is compared with the predefined targets. If the target is not reached, the Course teacher takes necessary steps for the improvement to reach the target.

For continuous improvement, if the target is reached, the Course teacher can set the target as a value greater than the CO attainment of the previous year.

B.3.2 Assessment Process for Overall PO Attainment

With the help of CO against PO mapping, the PO attainment is calculated. PO assessment is done by giving 75% weightage to direct assessment and 25% weightage to indirect assessment. Direct assessment is based on CO attainment, where 75% weightage is given to attainment through End Semester examination and 25% weightage is given to attainment through internal assessments. Indirect assessment is done through Graduate Exit Survey and participation of students in Co-curricular/Extra curricular activities.

PO Assessment Tools

Mode of Assessment	Assessment Tool	Description
Direct Attainment (Weightage -75%)	CO Assessment	This is computed from the calculated CO Attainment value for each Course
Indirect Attainment (Weightage - 25%)	Graduate Exit Survey 10%	At the end of the Programme, Graduate Exit Survey is collected from the graduates and it gives the opinion of the graduates on attainment of Programme Outcomes
	Co-curricular / Extra curricular activities 15%	For participation in Co-curricular/Extra Curricular activities during the period of their study.

Programme Articulation Matrix (PAM)

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Average Direct PO Attainment									
Direct PO Attainment in									

Indirect Attainment of POs for all Courses

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Graduate Exit Survey								
Indirect PO Attainment								

Attainments of POs for all Courses

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Direct Attainment(Weightage - 75%)								
Indirect Attainment(Weightage - 25%)								
Overall PO Attainment								

Overall PO Attainment= [75% of Direct PO Attainment +
25% of Indirect PO Attainment (Graduate Exit Survey
& Participation in Co- curricular and Extra curricular Activities)]

Expected Level of Attainment for each of the Programme Outcomes

POs	Level of Attainment
Attainment Value ≥70%	Excellent
60% ≤ Attainment Value < 70%	Very Good
50% ≤ Attainment Value < 60%	Good
40% ≤ Attainment Value < 50%	Satisfactory
Attainment Value <40%	Not Satisfactory

Level of PO Attainment

Graduation Batch	Overall PO Attainment (in percentage)	Whether Expected Level of PO is Achieved? (Yes/No)

B.3.3 Assessment Process for PEOs

The curriculum is designed so that all the courses contribute to the achievement of PEOs. The attainment of PEOs is measured after 3 years of completion of the Programme only through Indirect methods.

Target for PEO Attainment

Assessment Criteria	Target (UG)	Target (PG)
Record of Employment	15% of the class strength	30 % of the class strength
Progression to Higher Education	50% of the class strength	5 % of the class strength
Record of Entrepreneurship	2 % of the class strength	5 % of the class strength

Attainment of PEOs

Assessment Criteria & Tool	Weightage
Record of Employment	10
Progression to Higher Education	20
Record of Entrepreneurship	10
Feedback from Alumnae	30
Feedback from Parents	10
Feedback from Employers	20
Total Attainment	**100**

$$\text{Percentage of PEO Attainment from Employment} = \frac{\text{Number of Students who have got Employment}}{\text{Target}} \times 100$$

$$\text{Percentage of PEO Attainment from Higher Education} = \frac{\text{Number of Students who pursue Higher Education}}{\text{Target}} \times 100$$

$$\text{Percentage of PEO Attainment from Entrepreneurship} = \frac{\text{Number of Students who have become Entrepreneurs}}{\text{Target}} \times 100$$

Expected Level of Attainment for each of the Programme Educational Objectives

POs	Level of Attainment
Attainment Value ≥70%	Excellent
60% ≤ Attainment Value < 70%	Very Good
50% ≤ Attainment Value < 60%	Good
40% ≤ Attainment Value < 50%	Satisfactory
Attainment Value <40%	Not Satisfactory

Level of PEO Attainment

Graduation Batch	**Overall PEO Attainment (in percentage)**	**Whether Expected Level of PEO is Achieved? (Yes/No)**

C. PROCESS OF REDEFINING THE PROGRMME EDUCATIONAL OBJECTIVES

The college has always been involving the key stake holders in collecting information and suggestions with regard to curriculum development and curriculum revision. Based on the information collected, the objectives of the Programme are defined, refined and are inscribed in the form of PEOs. The level of attainment of PEOs defined earlier will be analysed and will identify the need for redefining PEOs. Based on identified changes in terms of curriculum, regulations and PEOs, the administrative system like Board of Studies, Academic Council and Governing Body may recommend appropriate actions. As per the Outcome Based Education Framework implemented from the Academic Year 2020 -2021, the following are the Programme Structure, the Programme Contents and the Course Contents of M.Sc. Physics Programme.

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Quality Education with Wisdom and Values

MASTER OF SCIENCE- PHYSICS (7014)

Outcome Based Education with Choice Base Credit System

Programme Structure - Allotment of Hours and Credits

For those who join in the Academic Year 2024-2025

Components	Semester				Total Number of Hours (Credits)
	I	II	III	IV	
Core Course	6 (5)	6 (5)	6 (5)	6 (5)	24 (20)
Core Course	6 (5)	6 (5)	6 (5)	6 (5)	24 (20)
Core Course	-	-	6 (5)	-	6 (5)
Core Course Practical	6 (4)	6 (4)	6 (4)	-	18 (12)
Project	-	-	-	6 (5)	6(5)
Elective Course (DSEC)	6 (3)	4 (3)	3 (3)	-	13 (9)
Elective Course (Generic)	6 (3)	4 (3)	-	-	10 (6)
Elective Course(NME)	-	4 (2)	3 (2)	-	7 (4)
Elective Course- (Industry / Entrepreneurship)	-	-	-	6 (3)	6 (3)
Skill Enhancement Course/ Professional Competency Skill	-	-	-	6 (3)	6 (3)
Self Study Course	-	-	0 (1)	-	0 (1)
Internship/Industrial Activity	-	-	0 (2)	-	0 (2)
Extension Activity	-	-	-	0 (1)	0 (1)
Total	**30 (20)**	**30 (22)**	**30 (27)**	**30 (22)**	**120 (91)**
Extra Credit Course(Optional) - Offered by the Department	-	-	0(2)	-	0(2)
Extra Credit Course(Optional) - MOOC	-	-	-	-	Limited to a maximum of 15 credits

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MASTER OF PHYSICS
Programme Code-7014
PROGRAMME CONTENT
M.Sc. PHYSICS-SEMESTER I

S.No.	Components	Title of the Course	Course Code	Hours Per Week	Credits	Exam. Hours	Marks		
							Int.	Ext.	Total
1	Core Course-1	Classical Mechanics and Relativity	24PPHC11	6	5	3	25	75	100
2	Core Course-2	Mathematical Physics	24PPHC12	6	5	3	25	75	100
3	Core Course-3	Electronics and General Physics Lab-I	24PPHC11PN	6	4	6	40	60	100
4	Elective Course -1 (DSEC)	Energy Physics	24PPHE11	6	3	3	25	75	100
5	Elective Course-2 (Generic)	Linear and Digital ICs andApplications	24PPHE12	6	3	3	25	75	100
Total				**30**	**20**				**500**

DSEC-Discipline Specific Elective Course

M.Sc. PHYSICS-SEMESTER II

S.No.	Components	Title of the Course	Course Code	Hours Per Week	Credits	Exam. Hours	Marks		
							Int.	Ext.	Total
1	Core Course-4	Statistical Mechanics	24PPHC21	6	5	3	25	75	100
2	Core Course-5	Quantum Mechanics-I	24PPHC22	6	5	3	25	75	100
3	Core Course-6	Electronics and General Physics Lab-II	24PPHC21PN	6	4	6	40	60	100
4	Elective Course -3 (DSEC)	Solar Energy Utilization	24PPHE21	4	3	3	25	75	100
5	Elective Course -4 (Generic)	Physics of Nano Science and Technology	24PPHE22	4	3	3	25	75	100
6	Elective Course- 5 (NME)	Solid Waste Management	24PPHN21	4	2	3	25	75	100
Total				**30**	**22**				**600**

DSEC-Discipline Specific Elective Course ; NME – Non Major Elective

**** Internship will be carried out during the summer vacation of the first year and marks will be included in the Third Semester Marks Statement.**

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M.Sc. PHYSICS-SEMESTER III

S.No.	Components	Title of the Course	Course Code	Hours Per Week	Credits	Exam. Hours	Marks		
							Int.	Ext.	Total
1	Core Course-7	Quantum Mechanics -II	24PPHC31	6	5	3	25	75	100
2	Core Course-8	Condensed Matter Physics	24PPHC32	6	5	3	25	75	100
3	Core Course-9	Electromagnetic Theory	24PPHC33	6	5	3	25	75	100
4	Core Course-10	C Programming Lab for Numerical Methods	24PPHC31P	6	4	6	40	60	100
5	Elective Course -6 (DSEC)	Numerical Methods and Programming with C	24PPHE31	3	3	3	25	75	100
6	Elective Course-7 (NME)	Sewage and Waste Water Treatment and Reuse	24PPHN31	3	2	3	25	75	100
7	Self-Study Course	Practice for CSIR NET - General Paper - Online	24PGOL32	-	1	-	100	-	100
8	Internship / Industrial Activity	Internship	24PPHI31	-	2	-	75	25	100
Total				**30**	**27**				**800**
9	Extra Credit Course	Remote Sensing and GIS Applications	24PPHO31	-	2	3	100	-	100

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M.Sc. PHYSICS-SEMESTER IV

S.No.	Components	Title of the Course	Course Code	Hours per Week	Credits	Exam. Hours	Marks		
							Int.	Ext.	Total
1	Core Course-11	Nuclear and Particle Physics	24PPHC41	6	5	3	25	75	100
2	Core Course-12	Spectroscopy	24PPHC42	6	5	3	25	75	100
3	Core Course-13	Project	24PPHC43PR	6	5	-	40	60	100
4	Elective Course -8 (Industry/ Entrepreneurship)	Characterization of Materials	24PPHE41	6	3	3	25	75	100
5	Skill Enhancement Course/ Professional Competency Skill	Physics for Competitive Examinations	24PPHS41	6	3	3	25	75	100
6		Extension Activity		-	1	-	100	-	100
Total				**30**	**22**				**600**

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M. Sc. Physics

(2024-2025 onwards)

Semester I	**ELECTRONICS AND GENERAL PHYSICS LAB-I**	Hours/Week:6	
Core Course-3 Practical -1		Credits:4	
Course Code **24PPHC11PN**		Internal 40	External 60

COURSE OUTCOMES

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

CO1: understand the theoretical concepts of Physics and Electronics to formulate the experiment. [K2]

CO2: explain the procedure to carry out the experiment. [K2]

CO3: Sketch/write the circuit diagram, tabular column, model graph to calculate the required physical parameters [K3]

CO4: use the technical skills to efficiently handle the instruments, measure the required physical Parameters, obtain the result and complete the records. [K3]

CO5: analyze the accuracy of the obtained result and assess the experimental errors. [K4]

CORE PRACTICAL

(Any Twelve Experiments)

1. Determination of Young's modulus and Poisson's ratio by hyperbolic fringes.
2. Measurement of Band gap energy- Thermistor
3. Determination of Wavelength, Separation of wavelengths - Michelson Interferometer
4. Determination of Compressibility of a liquid using Ultrasonics
5. Measurement of wavelength of Diode Laser / He – Ne Laser using Diffraction grating.
6. Construction of relaxation oscillator using UJT
7. V- I Characteristics of different colours of LED.

8. Construction of square wave Triangular wave generator using IC 741
9. Construction of Wein's Bridge Oscillator using IC741.
10. Study of Binary to Gray and Gray to Binary code conversion.
11. Study of R-S, clocked R-S and D-Flip flop using NAND gates
12. Study of J-K, D and T flip flops using IC 7476/7473
13. Arithmetic operations using IC 7483- 4-bit binary addition and subtraction.
14. Determination of Mutual Inductance using Carey Foster's Bridge
15. Determination of specific rotatory power- Polarimeter.

TEXT BOOKS

1.S.L. Gupta, V.K. Kumar, (2018). Practical Physics, Pragati Prakasan.

2. K A. Navas, (2015). Electronic lab manual Volume I, PHI Learning Pvt. Ltd.

3. K A. Navas, (2018). Electronic lab manual Volume II, PHI Learning Pvt. Ltd.

REFERENCE BOOKS

1. S.P Singh, (2015). Advanced Practical Physics, Pragati Prakasan.
2. Ramakanth A Gaykwad, (2000). Op-Amps and Linear Integrated Circuit, Pearson Education, New Delhi.

Course code 24PPHC11PN	**PO1**		**PO2**	**PO3**	**PO4**	**PO5**	**PO6**		**PO7**	**PO8**
	PSO 1.a	**PSO 1.b**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO 6.a**	**PSO 6.b**	**PSO7**	**PSO8**
CO1	3	3	2	3	3	2	3	2	1	1
CO2	3	3	1	3	3	3	3	2	1	1
CO3	3	3	1	3	2	3	2	3	1	1
CO4	3	3	1	3	3	3	3	3	1	1
CO5	3	3	1	3	3	3	3	3	1	1

Strong (3) Medium (2) Low (1)

Mrs. P.Kanmani
Head of the Department

Dr .M. Reka devi
Course Designer

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M.Sc. Physics

(2024-2025 onwards)

Semester II	**ELECTRONICS AND GENERAL PHYSICS LAB–II**	Hours/Week: 6	
Core Course-6 Practical -2		Credits: 4	
Course Code **24PPHC21PN**		Internal 40	External 60

COURSE OUTCOMES

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

CO1: understand the basic law/principle behind the experiment. [K2]

CO2: explain the basic laws/principle to correlate the physical parameters involved in the experiment. [K2]

CO3: apply the learned concepts to execute the experiment scientifically and systematically. [K3]

CO4: use the relevant theories to calculate the required Physical parameters. [K3]

CO5: analyze the results obtained and interpret the results. [K4]

List of Experiments (Any Twelve)

1. Determination of Young's modulus and Poisson's ratio by Elliptical fringes - Cornu's Method
2. Measurement of Susceptibility of liquid - Quincke's method
3. Determination of Thickness of thin film. - Michelson Interferometer
4. Determination of Refractive index of liquids using diode Laser/ He – Ne Laser
5. Determination of Numerical Apertures and Acceptance angle of optical fibers using Laser Source.
6. Determination of refractive index of given liquid using Newton's ring method.
7. Determination of I-V Characteristics and efficiency of solar cell.
8. Op-Amp –Active filters: Low pass, High pass and Band pass filters (Second Order) Batter worth filter
9. Determination of dielectric constants of given liquids.

10. Construction of square wave generator using IC 555 – Study of VCO
11. Shift register and Ring counter and Johnson counter- IC 7476/IC 7474 Study of Modulus Counter
12. Determination of e/m - Millikan's method
13. Miscibility measurements using ultrasonic diffraction method
14. IC 7490 as scalar and seven segment display using IC7447
15. Solving simultaneous equations – IC 741 / IC LM324

TEXT BOOKS

1. S.L. Gupta, V.K. Kumar, (2018). Practical Physics, Pragati Prakasan.
2. K A. Navas, (2015). Electronic lab manual Volume I, PHI Learning Pvt. Ltd.
3. K A. Navas, (2018). Electronic lab manual Volume II, PHI Learning Pvt. Ltd.

REFERENCE BOOKS

1. S.P Singh, (2015). Advanced Practical Physics, Pragati Prakasan.
2. Ramakanth A Gaykwad, (2000). Op-Amps and Linear Integrated Circuit, Pearson Education, New Delhi.

Course code 24PPHC21PN	**PO1**		**PO2**	**PO3**	**PO4**	**PO5**	**PO6**		**PO7**	**PO8**
	PSO 1a	**PSO 1b**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6a**	**PSO 6b**	**PSO 7**	**PSO 8**
CO1	3	3	2	1	1	1	1	2	1	1
CO2	3	3	2	2	2	1	1	2	1	1
CO3	2	3	2	2	2	1	1	2	2	2
CO4	2	3	2	3	3	1	2	3	2	2
CO5	2	3	2	3	3	2	2	3	2	2

Strong (3) Medium (2) Low (1)

Mrs.P.Kanmani
Head of the Department

Mrs.P.Kanmani
Course Designer

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M.Sc. Physics

(2024-2025 onwards)

Semester III	**QUANTUM MECHANICS –II**	**Hours/Week: 6**	
Core Course-7		**Credits: 5**	
Course Code 24PPHC31		**Internal 25**	**External 75**

COURSE OUTCOMES

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

CO1: explain the concepts of scattering by potential, perturbation, relativistic quantum mechanics, Dirac equation and field quantization. [K2]

CO2: apply the learned concepts to find scattering cross section & amplitude, perturbed energy levels and spin states of electron [K3]

CO3: apply the learned concepts to find various forms of Dirac equation and quantization of real as well as complex scalar fields. [K3]

CO4: analyze scattering probabilities, transition probability between perturbed levels and negative energy states. [K4]

CO5: study covariance of Dirac equation, Feynmen's theory and second quantization. [K4]

UNIT I

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 – Transformation from centre of mass to laboratory frame. (18 Hours)

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. (18 Hours)

UNIT III

RELATIVISTIC QUANTUM MECHANICS: Klein – Gordon Equation – Charge And Current Densities – Dirac Matrices – Dirac Equation – Plane Wave Solutions – Interpretation Of Negative Energy States – Antiparticles – Spin of Electron – Magnetic Moment Of An Electron Due To Spin (18 Hours)

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 – Feynman's theory of positron (Elementary ideas only without propagation formalism) (18 Hours)

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. (18 Hours)

TEXT BOOKS

1. Mathews P.M and Venkatesan K, (2017, A Text book of Quantum Mechanics,2nd Edition,Tata McGraw-Hill, New Delhi
2. Aruldhas G, (2008), Quantum Mechanics, 2nd Edition, Prentice-Hall of India, NewDelhi
3. Schiff L. I, (2017) Quantum Mechanics, 3rd Edition, International Student Edition, McGraw-Hill Kogakusha, Tokyo

REFERENCE BOOKS

1. Agarwal B.K & Hari Prakash, (2009), Quantum Mechanics, 7th reprint, PHI Learning Pvt. Ltd., New Delhi
2. Deep Chandra Joshi, (2006), Quantum Electrodynamics and Particle Physics,1stedition, I.K.International Publishing house Pvt. Ltd.
4. Merzbacher E,(1998), Quantum Mechanics, 2nd edition, John Wiley and Sons, New York

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 code 24PPHC31	**PO1**		**PO2**	**PO3**	**PO4**	**PO5**	**PO6**		**PO7**	**PO8**
	PSO 1.a	**PSO 1.b**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6.a**	**PSO 6.b**	**PSO 7**	**PSO 8**
CO1	3	-	3	2	1	2	-	1	-	2
CO2	3	1	2	3	2	1	-	2	-	2
CO3	3	1	2	3	2	1	1	2	-	2
CO4	3	1	1	3	3	1	2	2	1	1
CO5	3	1	1	3	3	1	2	2	1	1

Strong (3) Medium (2) Low (1)

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Head of the Department

Mrs.P.Kanmani
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M.Sc. Physics

(2024-2025 onwards)

Semester III	**CONDENSED MATTER PHYSICS**	**Hours/Week: 6**	
Core Course -8		**Credits: 5**	
Course Code 24PPHC32		**Internal 25**	**External 75**

COURSE OUTCOMES

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

CO1: explain crystal structure, lattice vibrations, band theory of solids, occurrence of magnetism and super conductivity in solids. [K2]

CO2: illustrate simple crystal structure, phonon properties, thermal and electronic properties of semiconductor crystals. [K3]

CO3: demonstrate magnon properties and superconducting transition in solids [K3]

CO4: analyze structural parameters, heat capacity and charge transportation in solids. [K4]

CO5: examine quantum theory of magnetism, thermal, electrical and electronic properties of solids in superconducting state. [K4]

UNIT I

CRYSTAL PHYSICS: Types of lattices - Miller indices – Symmetry elements and allowed rotations - Simple crystal structures – Atomic Packing Factor- Crystal diffraction - Bragg's law – Scattered Wave Amplitude - Reciprocal Lattice (sc, bcc, fcc). Structure and properties of liquid crystals. Diffraction Conditions - Laue equations - Brillouin zone - Structure factor - Atomic form factor - Inert gas crystals - Cohesive energy of ionic crystals - Madelung constant - Types of crystal binding (general ideas). (18 Hours)

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 - Debye's theory of lattice heat capacity - Thermal Conductivity - Umkalapp processes. (18 Hours)

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 . (18 Hours)

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. (18 Hours)

UNITV

SUPER CONDUCTIVITY: Occurrence - Effect of magnetic fields - Meissner effect – Critical field – Critical current - Entropy and heat capacity - Energy gap - Microwave and infrared properties - 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. (18 Hours)

TEXT BOOKS

1. Kittel C, (2012), Introduction to Solid State Physics, 8th Edition, Wiley, New York.
2. Pillai.S.O, (2022), Solid State Physics,10th Edition, New Age International Private Limited.

REFERENCE BOOKS

1. Blakemore J.S, (1985), Solid State Physics, 2nd Edition, W.B. Saunder, Philadelphia
2. Rosenburg H.M, (1993), The Solid State, 3rd Edition, Oxford University Press, Oxford.
3. Srivastava J.P,(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/

https://www.brainkart.com/article/Super-Conductors_6824/

Course code 24PPHC32	**PO1**		**PO2**	**PO3**	**PO4**	**PO5**	**PO6**		**PO7**	**PO8**
	PSO 1.a	**PSO 1.b**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6.a**	**PSO 6.b**	**PSO 7**	**PSO 8**
CO1	3	1	3	1	1	3	1	3	-	2
CO2	3	2	3	2	2	3	1	3	-	2
CO3	3	2	3	2	2	3	2	3	-	2
O4	3	2	3	3	3	3	2	3	2	2
CO5	3	2	3	3	3	3	2	3	2	2

Strong (3) Medium (2) Low (1)

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M.Sc. Physics

(2024-2025 onwards)

Semester III	**ELECTROMAGNETIC THEORY**	**Hours/Week: 6**	
Core Course -9		**Credits: 5**	
Course Code 24PPHC33		**Internal 25**	**External 75**

COURSE OUTCOMES

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

CO1: explain electrostatic fields, magneto static fields, Maxwell's equations, propagation of electromagnetic waves and magneto hydrodynamics. [K2]

CO2: illustrate boundary conditions in electrostatics, magneto statics, gauge invariance and plane wave equation. [K3]

CO3: demonstrate propagation of electromagnetic waves in different media and electron-plasmon oscillations. [K3]

CO4: analyze molecular polarization, electrical susceptibility, current distribution in magneto static fields and energy, momentum, conservation laws in electromagnetic fields. [K4]

CO5: examine retarded potentials, oscillating dipole, plasma confinement and magnetosonic waves. [K4]

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 – Examples of solutions for boundary value problems. Polarization and displacement vectors - Boundary conditions - Dielectric sphere in a uniform field – Molecular polarizability and electrical susceptibility – Electrostatic energy in the presence of dielectric – Multipole expansion. (18 Hours)

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.

(18 Hours)

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. (18 Hours)

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

(18 Hours)

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. (18 Hours)

TEXT BOOKS

UNIT I, II, III and IV

1. Griffiths D.J,(2015), Introduction to Electrodynamics,3rd Edition, Prentice-Hall of India, New Delhi.

UNIT V

2. Bittencourt J. A., (2004), Fundamentals of Plasma Physics, Pergamon Press, Oxford.

Gupta, Kumar and Singh, Electrodynamics, S.Chand & Co., New Delhi

REFERENCE BOOKS

1. Chakraborty B, (2002), Principles of Electrodynamics, Books and Allied, Kolkata.
2. Feynman P., Leighton R. B and Sands M, (1998), The Feynman Lectures on Physics, Vols. 2, Narosa Publishing House, New Delhi.
3. 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/

https://www.cliffsnotes.com/study-guides/physics/electricity-and-magnetism/electrostatics

Course code 24PPHC33	**PO1**		**PO2**	**PO3**	**PO4**	**PO5**	**PO6**		**PO7**	**PO8**
	PSO 1.a	**PSO 1.b**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6.a**	**PSO 6.b**	**PSO 7**	**PSO 8**
CO1	3	-	3	2	2	2	1	1	1	1
CO2	3	1	2	2	2	1	1	2	1	1
CO3	3	1	2	2	2	1	2	2	1	1
CO4	3	1	1	3	3	1	3	2	-	-
CO5	3	1	1	3	3	1	3	2	-	-

Strong (3) Medium (2) Low (1)

Mrs.P.Kanmani
Head of the Department

Mrs.P.Kanmani
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Quality Education with Wisdom and Values

M.Sc. Physics

(2024-2025 onwards)

Semester III	**C PROGRAMMING LAB FOR NUMERICAL METHODS**	**Hours/Week: 6**	
Core Course-10 Practical 3		**Credits: 4**	
Course Code 24PPHC31P		**Internal 40**	**External 60**

COURSE OUTCOMES

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

CO1: explain the syntax and logic of C language statements. [K2]

CO2: write the C program to solve the problems using numerical methods. [K2]

CO3: apply the learned concepts to execute the program and obtain the solutions of the problems. [K3]

CO4: use the relevant theories to find the solutions of problems. [K3]

CO5: compare the solutions obtained using C programs with theoretical solutions. [K4]

(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. Runge Kutta Fourth Order Method for solving first order Ordinary Differential Equations
14. Curve-fitting: Method of moments with Algorithm, Flow chart and output.
15. Curve-fitting: Exponential with Algorithm, Flow chart and output.

TEXT BOOKS

1. John M and Kurtis F, (2006), Numerical methods using Matlab –, Prentice Hall, New Jersey
2. Venkataraman M.K, (1996),Numerical methods in Science and Engineering, National Publishing Co. Madras
3. Rajaraman V, (1993), Computer Oriented Numerical Methods, 3rd Ed. (Prentice-Hall, New Delhi.
4. Jain M.K, Iyengar S.R and Jain R.K, (1995), Numerical Methods for Scientific and Engineering Computation, 3rd Ed. New Age International, New Delhi.

REFERENCE BOOKS

1. Conte S.D. and Boor C, (1981), Elementary Numerical Analysis, An Algorithmic Approach, 3rd Ed., International Ed. (McGraw-Hill).
2. Gerald B.F and Wheately P.O, (1994), Applied Numerical Analysis, 5th Edition, Addison Wesley, Reading, MA.
3. Carnahan B, Luther H.A and Wikes J.O, (1969), Applied Numerical Methods (Wiley, New York.

Course code 24PPHC31P	**PO1**		**PO2**	**PO3**	**PO4**	**PO5**	**PO6**		**PO7**	**PO8**
	PSO 1.a	**PSO 1.b**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6.a**	**PSO 6.b**	**PSO 7**	**PSO 8**
CO1	3	3	2	3	2	3	3	2	1	2
CO2	1	3	2	3	2	3	3	2	1	2
CO3	-	3	2	3	2	3	3	2	2	2
CO4	1	3	2	3	2	3	3	2	2	2
CO5	-	3	2	3	3	3	3	2	2	2

Strong (3) Medium (2) Low (1)

Mrs.P.Kanmani
Head of the Department

Mrs.P.Kanmani
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M.Sc. Physics

(2024-2025 onwards)

Semester III	**NUMERICAL METHODS AND PROGRAMMING WITH C**	**Hours/Week: 3**	
Elective Course-6		**Credits: 3**	
Course Code 24PPHE31		**Internal 25**	**External 75**

COURSE OUTCOMES

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

CO1: explain the numerical methods of finding roots of equations, solving simultaneous equations, interpolation, differentiation, integration, solving differential equations and statements in C language. [K2]

CO2: apply the numerical methods to solve problems in roots of equations, simultaneous equations, interpolation and write C programs for the respective numerical methods [K3]

CO3: apply the numerical methods to solve problems in differentiation, integration, differential equations and write C programs for respective numerical methods. [K3]

CO4: analyze roots of equations, solutions of simultaneous equation, interpolated values obtained using numerical methods and C programs. [K4]

CO5: analyze solutions of differentiation, integration, differential equations problems obtained using numerical methods and C programs. [K4]

UNIT I

SOLUTIONS OF EQUATIONS & LINEAR SYSTEM 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.

(9 Hours)

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 – Direct method - Power method and Jacobi Method to find the Eigen values and Eigen vectors. (9 Hours)

UNIT III

INTERPOLATION AND CURVE FITTING: Interpolation with equally spaced points - Newton forward and backward interpolation - Interpolation with unevenly spaced points - Lagrange interpolation – Curve fitting – Method of least squares – Exponential – Method of Moments - Fitting a polynomial. (9 Hours)

UNIT IV

DIFFERENTIATION, INTEGRATION AND SOLUTION OF DIFFERENTIAL EQUATIONS: Numerical differentiation – Numerical integration – Trapezoidal rule – Simpson's rule – Error estimates – Gauss-Legendre, Gauss-Laguerre, Gauss-Hermite and Gauss-Chebyshev quadrature – solution of ordinary differential equations – Euler and RungaKutta methods**.**

(9 Hours)

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.

(9 Hours)

TEXT BOOKS

1. Rajaraman V, (2019), Computer oriented Numerical Methods, 3rd Edition. PHI, New Delhi
2. Venkataraman, M.K, (1999). Numerical Methods in Science and Engineering, The National Publishing Company.
3. Arumugam S, Thangapandi Issac A, Somasundaram A, (2015) Numerical Methods, Scitech Publications (India) Pvt.Ltd.

REFERENCE BOOKS

1. Conte S. D and Boor C, (1981), Elementary Numerical analysis-an algorithmic approach, 3rd Edition, McGraw Hill,)
2. Gerald B.F, and Wheatley P.O, (2007), Applied Numerical analysis, 5th Edition, Addison-Wesley
3. Kuo S.S, (1996), Numerical Methods and Computers, Addison-Wesley.

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 code 24PPHE31	PO1		PO2	PO3	PO4	PO5	PO6		PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6.a	PSO 6.b	PSO 7	PSO 8
CO1	3	3	2	3	1	2	2	2	-	2
CO2	3	3	2	3	1	2	2	2	-	1
CO3	3	3	2	3	2	2	3	2	-	1
CO4	3	3	2	3	2	3	3	2	1	-
CO5	3	3	2	3	2	3	3	2	1	-

Strong (3) Medium (2) Low (1)

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M. Sc. Physics

(2024-2025 onwards)

Semester III	**SEWAGE AND WASTE WATER TREATMENT AND REUSE**	**Hours/Week: 3**	
Elective Course- 7 (NME)		**Credits:2**	
Course Code 24PPHN31		**Internal 25**	**External 75**

COURSE OUTCOMES

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

CO1: understand the significance of waste water recovery, reuse of waste water and methods of recovery and reuse of waste water. [K1]

CO2: explain the issues related to waste water, recovery methods and disinfection techniques of waste water treatment. [K2]

CO3: explain physical and chemical disinfectant techniques of waste water treatment. [K2]

CO4: apply learned concepts for waste water treatment and reuse of waste water. [K3]

CO5: analyze the status of sewage and waste water management in the nearby areas. [K4]

UNIT I

SOURCES OF WASTE WATER AND SIGNIFICANCE OF RECOVERY & REUSE: Sources of waste water (domestic, industrial and agricultural) – environmental issues – health issues- water scarcity issues- areas of application (9 Hours)

UNIT II

RECOVERY OF WASTE WATER: Methods of recovery: Flocculation - Sedimentation - sedimentation with coagulation - Filtration - sand filters - pressure filters - horizontal filters - vector control measures in industries - chemical and biological methods of vector eradication (9 Hours)

UNIT III

DISINFECTION: Introduction to disinfection and sterilization: Disinfectant - UV radiation - Chlorination - Antisepsis - Sterilant - Aseptic and sterile -Bacteriostatic and Bactericidal - factors affecting disinfection. (9 Hours)

UNIT IV

CHEMICAL DISINFECTION: Introduction - Theory of Chemical Disinfection - Chlorination Other Chemical Methods - Chemical Disinfection Treatments Requiring - Electricity - Coagulation/Flocculation Agents as Pretreatment - DisinfectionBy-Products(DBPs) (9 Hours)

UNIT V

PHYSICAL DISINFECTION: Introduction - Ultraviolet Radiation - Solar Disinfection - Heat Treatment - Filtration Methods - Distillation - Electrochemical Oxidation Water Disinfection by Microwave Heating. (9 Hours)

TEXT BOOKS

1. Anirudhha Balachandra, (2013), Drinking water and disinfection technique,CRC press
2. Shashi Bushan, Jain (2015), Design of Water and Wastewater Treatment Systems (CV- 424/434)
3. Material prepared by Department of Physics (Self Finance)

REFERENCE BOOKS

1. Frank. R Spellman , (2020), Handbook of Water and Wastewater Treatment Plant Operations, CRC Press
2. Mritunjay Chaubey, (2021),Wastewater Treatment Technologies, , Wiley
3. Metcalf and Eddy, (2002), Wastewater Engineering, 4th ed., McGraw Hill Higher Edu.
4. Lancaster, (2010), Green Chemistry: An Introductory Text, 2nd edition, RSC publishing.

WEB SOURCES

1.https://www.google.co.in/books/edition/Drinking_Water_DisinfectionTechniques/HVbNBQAAQBAJ?hl=en

2.https://www.meripustak.com/Integrated-Solid-Waste-Management-Engineering-Principles-And-Management-Issues-125648?

Course code 24PPHN31	PO1		PO2	PO3	PO4	PO5	PO6		PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6.a	PSO 6.b	PSO 7	PSO 8
CO1	3	-	3	-	-	1	-	2	2	2
CO2	3	-	3	-	-	1	-	2	2	2
CO3	3	2	2	2	1	2	-	2	2	2
CO4	3	2	2	2	1	2	-	2	2	2
CO5	3	2	2	2	1	3	1	2	2	2

Strong (3) Medium (2) Low (1)

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Head of the Department

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M.Sc. Physics

(2024-2025 onwards)

Semester III	**REMOTE SENSING AND GIS APPLICATIONS**	**Hours/Week: -**
Extra Credit Course		**Credits: 2**
Course Code 24PPHO31		**Internal 100**

COURSE OUTCOMES

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

CO1: explain the concepts of photogrammetry, principles of aerial, satellite remote sensing and basic concepts of GIS.

CO2: illustrate energy interactions with earth surface features, spectral properties of water bodies and different types of data representation in GIS

CO3: apply knowledge of GIS software and able to work with GIS software in various Application fields.

CO4: analyze spatial and non-spatial data features in GIS and understand the map projections and coordinates systems.

CO5: compute the heights of objects and develop models for GIS spatial Analysis.

UNIT I

INTRODUCTION TO PHOTOGRAMMETRY: Principles and types of aerial photographs, geometry of vertical and aerial photograph, Scale and Height measurement on single and vertical aerial photograph, Height measurement based on relief displacement, Fundamentals of Stereoscopy, fiducial points, parallax measurement using fiducial line.

UNIT II

REMOTE SENSING: Basic concepts and foundation of Remote Sensing elements, Data information, Remote sensing data collection, Remote sensing advantages and Limitations, Remote sensing process. Electromagnetic spectrum, Energy interaction with atmosphere and with earth surface features (soil, water, and vegetation) Indian Satellites and Sensors characteristics, Map and Image false color composite, introduction to digital data, elements of visual interpretations techniques.

UNIT III

GEOGRAPHIC INFORMATION SYSTEMS: Introduction to GIS, Components of GIS, Geospatial data: Spatial Data – Attribute Data- Joining Spatial and Attribute Data, GIS Operations: Spatial Data input- Attribute Data Management-Data Display-Data Exploration-Data Analysis. COORDINATE SYSTEMS: Geographic Coordinate system; Approximation of Earth, Datum: Map Projections; Types of Map Projections-Map Projection Parameters-Commonly used Map Projections – Projected Coordinate Systems

UNIT IV

VECTOR DATA MODEL: Representation of simple features- Topology and its importance: coverage and its data structure, shape file:, data models for composite features Object Based Vector Data Model; Classes and their Relationships: The geobased data model: Geometric representation of Spatial feature and data structure: Topology rules.

UNIT V

RASTER DATA MODEL: Elements of Raster data model: Types of Raster data: Raster data structure: Data conversion, Integration of Raster and Vector data. Data Input: Metadata: Conversion of Existing data, Creating new data, Remote sensing data, Field data, Digitizing, Scanning, on screen digitizing, importance of source map, Data Editing.

TEXT BOOKS

1. John R,(2013),Remote Sensing of the environment-An earth resource perspective- 2nd Edition, Pearson Education.
2. Kang–Tsung Chang, (2017), Introduction to geographic information system-, Tata McGraw- Hill Education Private Limited.

REFERENCE BOOKS

1. Anji Reddy M, (2001) Remote Sensing and Geographical Information systems, JNTU Hyderabad B.S. Publications.
2. Peter A Burragh and Rachael A, (2004), Principals of Geo physical Information System. Mc Donnell, Oxford Publishers

NPTEL WEB COURSE: http://nptel.ac.in/downloads/105108077/

NPTEL VIDEO COURSE: http://nptel.ac.in/downloads/105108077/#

Mrs.P.Kanmani
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M.Sc. Physics

(2024-2025 onwards)

Semester III	**PRACTICE FOR CSIR NET – GENERAL PAPER**	**Hours/Week: -**
Self-Study Course		**Credits: 1**
Course Code 24PGOL32		**Internal 100**

COURSE OUTCOMES

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

CO1: explain various concepts related to numbers, quantitative comparison, monetary problems and logical reasoning. [K2]

CO2: apply the analytical skills and logical reasoning in solving problems related to competitive examinations. [K3]

CO3: solve typical problems, geometrical type problems, daily life problems in a effective manner. [K3]

CO4: analyze the techniques used in solving complicated real life problems. [K4]

CO5: examine the data using logical reasoning and observational ability. [K4]

UNIT I

Typical Problems- Series formation

Numerical Ability- Numbers

UNIT II

Geometrical Type Problems-Mensuration and quantitative comparison

UNIT III

Typical Problems- Moving locomotive problem

Numerical Ability- Distance and Directions

UNIT IV

Daily Life Problems

Finding the X – Average - Monetary problems

UNIT V

Logical Reasoning

Data interpretation – Observational ability – Logical puzzles

BOOKS FOR STUDY:

Christy Varghese. (2016). *CSR – NET, General aptitude –A new outlook,* Lilly publishing house, Changanacherry, Kerala.

REFERENCE BOOKS

1. Pradip Kumar Ray, *General Aptitude Theory ,CSIR NET, Previous question and answer with explanation and hint to solve,* Notion Press, India
2. Ram Mohan Pandey. (2021). *CSIR-UGC-NET General Aptitude Theory and Practice*, Pathfinder Publication, a unit of Pathfinder Academy Pvt. Ltd., India.

Unit	Chapter	Section/Page Number
1	4	142-162
	5	163-192
2	12	272-294
3	3	132-141
	7	206-220
4	8	221-230
	9	231-239
	10	240-249
5	13	295-309
	14	310-323
	15	324-332

Course code 24PGOL32	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	2	-	2	-	-
CO2	3	3	3	3	-	2	-	-
CO3	3	3	3	3	-	3	-	-
CO4	3	2	3	3	-	3	-	-
CO5	3	2	3	3	-	3	-	-

Strong (3) Medium (2) Low (1)

Dr. M. C. Maheshwari
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Dr. T. Anitha
Course Designer

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M.Sc. Physics

(2024-2025 onwards)

Semester III	**INTERNSHIP**	**Hours/Week: -**	
Internship		**Credits: 2**	
Course Code 24PPHI31		**Internal 75**	**External 25**

COURSE OUTCOMES

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

CO1: apply the theoretical knowledge and skills to work as an efficient member during training period. [K3]

CO2: describe the working principle, the use of advanced tools and techniques encountered during training .[K3]

CO3: communicate effectively the knowledge and technical skills gained through report preparation and presentation. [K3]

CO4: analyze the results obtained for the given training and make strategies to optimize the results. [K4]

CO5: develop interpersonal and team skills, confidence of working in industry, awareness about the working environment and self-learning capability. [K5]

Guidelines/ Regulations:

- Each student must go for Internship training in a reputed Industry/Company/ Organization / Educational Institution.
- Students should produce the Completion Certificate after the Completion of Internship period.
- A report of 15 – 20 pages must be submitted by each student after the completion of the Internship period.
- External Viva-voce examination will be conducted.

Course code 24PPHI31	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	3	-	2	1	1	2	3	3
CO2	3	2	1	-	-	2	-	-
CO3	2	3	2	-	-	-	-	2
CO4	3	-	3	3	3	2	2	2
CO5	3	2	3	3	3	3	3	3

Strong (3) Medium (2) Low (1)

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M. Sc. Physics

(2024-2025 onwards)

Semester IV	**NUCLEAR AND PARTICLE PHYSICS**	**Hours/Week: 6**	
Core Course 11		**Credits:5**	
Course Code 24PPHC41		**Internal 25**	**External 75**

COURSE OUTCOMES

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

CO1: understand nuclear models, various nuclear reactions, nuclear decay modes, nuclear forces, fundamental elementary particles. [K2]

CO2: apply different nuclear models, nuclear forces and various nuclear reactions to Identify different properties of the nucleus. [K3]

CO3 : use nuclear detectors, consequences of decay and elementary particles to the nuclear reactions based on conservation laws of the nucleus. [K3]

CO4 : analyze the fundamental aspects of the structure of the nucleus, nuclear forces nuclear reactions and the interaction of radiation and matter.[K4]

CO5 : examine the different decay process and conservation laws of elementary particles in nuclear system.[K4]

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. (18 Hours)

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. (18 Hours)

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.

(18 Hours)

UNITIV

NUCLEAR DECAY: Beta decay – Continuous Beta spectrum – Fermi theory of beta decay - Comparative Half-life –Fermi Kurie Plot – mass of neutrino – 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.

(18 Hours)

UNITV

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.

(18 Hours)

TEXT BOOKS

1. Tayal.D.C.,(2022), Nuclear Physics,Himalaya Publishing House .

Unit I, Unit II , Unit IV, Unit V

2. Patel.S. B.,(2021),Nuclear Physics:An introduction,New Age International Pvt Publishers. Unit III

REFERENCE BOOK

Kuila S. P.,(2015),Concepts of Nuclear Physics, New Central Book Agency.

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/Radiography/radioactivedecay.html

Course code 24PPHC41	**PO1**		**PO2**	**PO3**	**PO4**	**PO5**	**PO6**		**PO7**	**PO8**
	PSO 1.a	**PSO 1.b**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6.a**	**PSO 6.b**	**PSO 7**	**PSO 8**
CO1	3	-	3	2	-	2	1	1	-	1
CO2	3	-	3	2	-	2	1	1	-	1
CO3	3	1	3	3	2	2	2	3	-	1
CO4	3	1	1	3	3	3	2	3	1	-
CO5	3	1	1	3	3	3	2	3	1	-

Strong (3) Medium (2) Low (1)

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Semester IV	**SPECTROSCOPY**	**Hours/Week: 6**	
Core Course 12		**Credits: 5**	
Course Code 24PPHC42		**Internal 25**	**External 75**

COURSE OUTCOMES

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

CO1: understand the working principles of various spectroscopic instruments and theoretical background of different spectroscopic techniques. [K2]

CO2: apply the physics principles to understand the instrumentation techniques in rotational, vibrational &raman spectroscopic methods and figure out the structural and compositional information of molecules. [K3]

CO3: illustrate the electronic, nuclear magnetic resonance & NMR spectroscopy methods and applications of ESR. [K3]

CO4: analyze the parameters obtained through rotational, Vibrational and Raman spectroscopic techniques. [K4]

CO5: investigate the parameters obtained through NMR and UV spectroscopic analysis. [K4].

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 - Hyperfine structure and quadrupole moment of linear molecules - Instrumentation techniques – block diagram - Information Derived from Rotational Spectra- Stark effect- Problems. (18 Hours)

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 vibration of H_2O and CO_2-Introduction to application of vibrational spectra- IR Spectrophotometer Instrumentation (Double Beam Spectrometer) – Fourier Transform Infrared Spectroscopy - Interpretation of vibrational spectra– remote analysis of atmospheric gases like N2O using FTIR by National Remote Sensing Centre (NRSC), India– other simple applications (18 Hours)

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 and CO_2 -Mutual exclusion principle- determination of N_2O structure -Instrumentation technique and block diagram -structure determination of planar and non-planar molecules using IR and Raman techniques - FT Raman spectroscopy- SERS. (18 Hours)

UNIT IV

RESONANCE SPECTROSCOPY: Nuclear and Electron spin-Interaction with magnetic field - Population of Energy levels - Larmor precession- Relaxation times - Double resonance- Chemical shift and its measurement - NMR of Hydrogen nuclei - Indirect Spin -Spin Interaction – interpretation of simple organic molecules - Instrumentation techniques of NMR spectroscopy – NMR in Chemical industries- 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.

(18 Hours)

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 -Chromophores -Effect of conjugation on chromophores - Choice of Solvent and Solvent effect - Absorption by inorganic systems - Instrumentation - double beam UV-Spectrophotometer -Simple applications. (18 Hours)

TEXT BOOKS

1. Banwell .C. N and Cash .E. M, (2017), Fundamentals of Molecular Spectroscopy, 4th Edition, Tata McGraw–Hill, New Delhi.

   Unit I, Unit II, Unit III

2. Aruldhas .G, (2007), Molecular Structure and Molecular Spectroscopy, Prentice–Hall of India, New Delhi.

   Unit IV, Unit V.

REFERENCE BOOKS

1. McHale. J. L, (2008), Molecular Spectroscopy, Pearson Education India, New Delhi.
2. Hollas.J. M,(2002), Basic Atomic and Molecular Spectroscopy, Royal Society of Chemistry, RSC, Cambridge.

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- CWRu

Course code 24PPHC42	**PO1**		**PO2**	**PO3**	**PO4**	**PO5**	**PO6**		**PO7**	**PO8**
	PSO 1.a	**PSO 1.b**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6.a**	**PSO 6.b**	**PSO 7**	**PSO 8**
CO1	3	1	3	2	2	3	1	2	-	1
CO2	3	1	3	2	2	3	1	2	-	1
CO3	3	2	3	3	3	3	1	3	1	1
CO4	3	2	1	3	3	3	1	3	1	1
CO5	3	2	1	3	3	3	1	3	1	1

Strong (3) Medium (2) Low (1)

Mrs.P.Kanmani
Head of the Department

Dr.M.Reka devi
Course Designer

V.V.VANNIAPERUMAL COLLEGE FOR WOMEN
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VIRUDHUNAGAR
Quality Education with Wisdom and Values

M.Sc. Physics

(2024-2025 onwards)

Semester IV	**PROJECT**	**Hours/Week: 6**	
Core Course-13		**Credits: 5**	
Course Code 24PPHC43PR		**Internal 40**	**External 60**

COURSE OUTCOMES

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

CO1 : identify the research problem through literature review. [K2]

CO2 : apply inter disciplinary knowledge to carry out project work upholding research ethics. [K3]

CO3 : communicate the findings of the work carried through report and presentation. [K3]

CO4 : conclude the findings with the existing results. [K4]

CO5 : develop the project work to fulfill the needs of society. [K5]

- Project will be done by the final year students in the fourth semester under the guidance of respective guides.
- For projects internal marks will be awarded by the respective guide and external marks will be awarded in the external examinations held at the end of the semester.
- Project should be done Individually.
- The report of the project must be in the prescribed form. It should be typed neatly in MS word (12 pt, Times New Roman, 1.5 spacing)
- The format of the project report should have the following components.
  - ❖ First page should contain:

Title of the project report

Name of the candidate

Register number

Name of the supervisor

Address of the institution

Month & year of submission

- ❖ Contents
- ❖ Certificate by supervisor
- ❖ Declaration by candidate
- ❖ Acknowledgement
- ❖ Chapter 1 – Preliminaries
- ❖ Other chapters
- ❖ References

- The project report should be written in 30 - 40 pages.
- Four copies of the project report with binding should be submitted.

Evaluation :

Internal Assessment: 40 Marks

External Examination: 60 Marks

Internal Assessment:

Pre-submission Presentation: 10 Marks

Review Report: 20 Marks

One Open Online Course related to the Project: 10 Marks

External Examination:

Project Report: 40 Marks

Viva Voce: 20 Marks

- Internal Viva-voce Presentation in the presence of all faculty members in the department is compulsory
- External Viva-voce will be conducted by the External Examiner.

Course code 24PPHC43PR	**PO1**		**PO2**	**PO3**	**PO4**	**PO5**	**PO6**		**PO7**	**PO8**
	PSO 1.a	**PSO 1.b**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6.a**	**PSO 6.b**	**PSO 7**	**PSO 8**
CO1	2	3	3	2	2	3	3	2	-	2
CO2	2	3	3	2	2	3	3	2	-	2
CO3	2	3	3	3	3	3	3	3	1	3
CO4	2	3	2	3	3	3	3	3	2	3
CO5	2	3	2	3	3	3	3	3	2	3

Strong (3) Medium (2) Low (1)

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Dr.M.Reka devi
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M.Sc. Physics
(2024-2025 onwards)

Semester IV	**Characterization of Materials**	**Hours/Week: 6**	
Elective Course -8		**Credits: 3**	
Course Code 24PPHE41		**Internal 25**	**External 75**

COURSE OUTCOMES

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

CO1: understand the XRD,TGA, DTA, DSC, TMA thermal analysis techniques and microscopic instrumentation techniques [K2].

CO2: use XRD,TGA, DTA and DSC and different microscopic techniques to characterize the materials [K3].

CO3: use hall measurement, four –probe resistivity measurement, C-V, I-V electrochemical, Photoluminescence, electroluminescence and various experimental techniques to characterize the materials[K3].

CO4: evaluate the desired physical, chemical parameters of different materials [K4].

CO5: analyze the properties of the materials with different spectroscopic techniques and their applications [K4].

UNIT I

X-RAY AND SPECTROSCOPIC METHODS: Principles and instrumentation for UV-Vis-IR, FTIR spectroscopy, Raman spectroscopy–Rutherford Back Scattering (RBS) analysis-application - Powder diffraction - Powder diffractometer -interpretation of diffraction patterns - indexing - phase identification - residual stress analysis - Particle size, texture studies - X-ray fluorescence spectroscopy uses. (18 Hours)

UNIT II

MICROSCOPIC METHODS: Optical Microscopy: optical microscopy techniques – Bright field optical microscopy – Dark field optical microscopy – Dispersion staining microscopy - phase contrast microscopy –differential interference contrast

microscopy - fluorescence microscopy - confocal microscopy - - digital holographic microscopy - oil immersion objectives - quantitative metallography - image analyzer.

(18 Hours)

UNIT III

ELECTRON MICROSCOPY AND SCANNING PROBE MICROSCOPY: SEM, EDAX, EPMA, TEM: working principle and Instrumentation – sample preparation – Data collection, processing and analysis- Scanning tunneling microscopy (STEM) - Atomic force microscopy (AFM) - Scanning new field optical microscopy. (18 Hours)

UNIT IV

ELECTRICAL METHODS AND OPTICAL CHARACTERISATION: Two probe and four probe methods- van der Pauw method – Hall probe and measurement – scattering mechanism – C-V characteristics – Schottky barrier capacitance – impurity concentration – electrochemical C-V profiling – limitations. Photoluminescence – light – matter interaction – instrumentation – electroluminescence – instrumentation – Applications.

(18 Hours)

UNIT V

THERMAL ANALYSIS: Introduction – thermogravimetric analysis (TGA) – instrumentation – determination of weight loss and decomposition products – differential thermal analysis (DTA)- cooling curves – differential scanning calorimetry (DSC) – instrumentation – specific heat capacity measurements – determination of thermomechanical parameters. (18 Hours)

TEXT BOOKS

1. Stradling.R. A. and Klipstain .P. C.. (1990),Growth and Characterization of semiconductors. Adam Hilger, Bristol.
2. Belk.J.A, (1979),Electron microscopy and microanalysis of crystalline materials. Applied Science Publishers, London.
3. Materials Prepared by Department of Physics (Self Finance)

REFERENCE BOOKS

1. Cullity, B.D., and Stock, R.S., (2001),"Elements of X-Ray Diffraction", Prentice-Hall,
2. Murphy, Douglas B, (2001).Fundamentals of Light Microscopy and Electronic Imaging, Wiley-Liss, Inc. USA.
3. Tyagi, A.K., Roy, Mainak, Kulshreshtha, S.K., and Banerjee, S., ,(2009).Advanced Techniques for Materials Characterization, Materials Science Foundations (monograph series), Vol 49 – 51.

WEB SOURCES

1.https://cac.annauniv.edu/uddetails/udpg_2015/77.%20Mat%20Sci(AC).pdf

2.http://www.digimat.in/nptel/courses/video/113106034/L11.html

3.https://nptel.ac.in/courses/104106122 4.https://nptel.ac.in/courses/118104008

5.https://www.sciencedirect.com/journal/materials-characterization

Course code 24PPHE41	PO1		PO2	PO3	PO4	PO5	PO6		PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6.a	PSO 6.b	PSO 7	PSO 8
CO1	3	3	3	3	1	3	3	2	1	-
CO2	3	3	3	3	2	3	3	2	1	-
CO3	3	3	3	3	3	3	3	3	1	-
CO4	3	3	1	3	3	3	3	3	1	1
CO5	3	3	1	3	3	3	3	3	1	1

Strong (3) Medium (2) Low (1)

Mrs.P.Kanmani
Head of the Department

Dr.M.Reka devi
Course Designer

M.Sc. Physics
(2024-2025 onwards)

Semester IV	**PHYSICS FOR COMPETITIVE EXAMINATIONS**	**Hours/Week: 6**	
SEC– Professional Competency Skill		**Credits: 3**	
Course Code 24PPHS41		**Internal 25**	**External 75**

COURSE OUTCOME

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

CO1: explain core concepts in different areas of Physical sciences. [K1]

CO2: use mathematical tools (calculus, vectors, differential equations) to solve physics problems. [K2]

CO3: identify the relevant physics principles and apply them to solve problems. [K2]

CO4: apply data analysis, error analysis and experimental techniques to solve problems. [K3]

CO5: evaluate the results and analyze how physics principles relate to real-world phenomena and technologies [K4].

UNIT I

Classical Mechanics and Mathematical Methods of Physics: Newton's laws- Dynamical systems-Phase space dynamics, stability analysis-Central force motions- Generalized coordinates-Lagrangian and Hamiltonian formalism and equations of motion- Special functions (Hermite, Bessel, and Legendre functions)-Elements of complex analysis-analytic functions-Taylor & Laurent series-poles, residues and evaluation of integrals. (18 Hours)

UNIT II

Statistical Physics and Electromagnetic Theory: Free energy and its connection with thermodynamic quantities- Classical and quantum statistics- Ideal Bose and Fermi gases-Principle of detailed balance-Blackbody radiation and Planck's distribution law-Laplace and Poisson equations- boundary value problems- Magnetostatics- Electromagnetic induction- Maxwell's equations in free space and linear isotropic media- boundary conditions on the fields at interfaces. (18 Hours)

UNIT III

Quantum Mechanics and Numerical methods : Eigenvalue problems - Tunneling through a barrier-Wave-function in coordinate and momentum representations- Timeindependent perturbation theory and applications-Time dependent perturbation theory and Fermi's golden rule-selection rules- spin-statistics connection- Elements of computational techniques:root of functions-interpolation-extrapolation-integration by trapezoid and Simpson's rule-Solution of first order differential equation using RungeKutta method-Finite difference methods. (18 Hours)

UNIT IV

Atomic Physics and Condensed Matter Physics: Quantum states of an electron in an atom. Electron spin-Spectrum of helium and alkali atom-Relativistic corrections for energy levels of hydrogen atom-hyperfine structure and isotopic shift-width of spectrum lines-LS & JJ couplings-Zeeman, Paschen-Bach & Stark effects-Electron spin resonance-Nuclear magnetic resonance-chemical shift-Frank-Condon principle-Defects and dislocations-Ordered phases of matter: translational and orientational order-kinds of liquid crystalline order-Quasi crystals.

(18 Hours)

UNIT V

Electronics and Nuclear and Particle Physics: Operational amplifiers and their applications- Digital techniques and applications (registers, counters, comparators and similar circuits)- A/D and D/A converters-Classification of fundamental forces-Elementary particles and their quantum numbers (charge, spin, parity, isospin, strangeness, etc.)-Gellmann-Nishijima formula- Quark model-baryons and mesons. C, P, and T invariance-Application of symmetry arguments to particle reactions- Parity non-conservation in weak interaction-Relativistic kinematics. (18 Hours)

TEXT BOOKS

1. Dr. Surekha Tomar, (2023),CSIR-UGC NET/JRF/SET Physical Sciences,
2. Nageshwara Rao.R,(2018),CSIR-UGC NET/SET(JRF & LS)PHYSICAL SCIENCES, Khanna Publisers.
3. Materials Prepared by Department of Physics (SF)

REFERENCE BOOKS

1. Sunil Kushwaha, (2010)," UGC CSIR JRF/Net Physical Sciences, Danika Publishing Company.
2. NTA CSIR NET Physics PYQ, GATE & SET Physics,(2024),IFAS Publications.

Course code 24PPHS41	PO1		PO2	PO3	PO4	PO5	PO6		PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6.a	PSO 6.b	PSO 7	PSO 8
CO1	3	-	-	3	3	3	-	3	1	1
CO2	3	-	-	3	3	3	-	3	1	1
CO3	3	1	-	3	3	3	-	3	-	1
CO4	3	2	1	3	3	3	2	3	-	1
CO5	3	2	2	3	3	3	2	3	-	1

Strong (3) Medium (2) Low (1)

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