MAHENDRA ARTS & SCIENCE COLLEGE

(AUTONOMOUS)

(Affiliated to Periyar University, Salem)

[Accredited by NAAC with "A++" Grade & Recognized u/s 2(f) and 12(B) of the UGC act1956]

KALIPPATTI – 637501.

BACHELOR OF SCIENCE

SYLLABUS FOR B.Sc. PHYSICS

OUTCOME BASED EDUCATION WITH CHOICE BASED CREDIT SYSTEM

FOR THE STUDENTS ADMITTED FROM
THE ACADEMIC YEAR 2023 – 2024 ONWARDS

MAHENDRA ARTS & SCIENCE COLLEGE
(Autonomous)
(Affiliated to Periyar University)

DEPARTMENT OF PHYSICS

REGULATIONS FOR B.Sc. PHYSICS PROGRAMME

OUTCOME BASED EDUCATION WITH CHOICE BASED CREDIT SYSTEM
(Effective from the Academic Year 2023-2024)

I. PREAMBLE

The Department of Physics offers programs in conventional Physics to a broad range of students through creative learning and teaching methodology (CLM) which enables them to integrate this knowledge into their normal thought processes. Also, the department provides a forward-looking curriculum to undergraduate Physics majors, involving not only conventional Physics topics but also state-of-the-art instruction through Theory and Practical experimental techniques. On the other hand, computational and theoretical Physics with computers for data acquisition and analysis, as well as active involvement in higher studies and professional research.

II. GRADUATES ATTRIBUTES
- **In-depth knowledge and understanding of major concepts:** Understanding of theoretical principles and experimental findings in different sub-areas available in respective disciplines.
- **Creative and Critical thinking:** The capability of using creative and critical thinking in respective areas.
- **Analytical ability:** The ability to analyze issues and problems in all the disciplines.
- **Problem-solving skills:** The capability towards solving problems.
- **Entrepreneur skills:** The inclusion of leadership, business management, time management skills.
- **Communication skills:** The ability to transfer complicated/technical information in a precise manner.
- **Mutual and multidisciplinary competence:** The ability of teamwork in interdisciplinary fields.
- **Digital literacy:** The capability of utilizing modern digital tools to carry out the simulation process.

- **Moral and ethical awareness:** Ability to adopt moral ethics.
- **Social responsibility:** Creating socially responsible citizens.

III. PROGRAMME EDUCATIONAL OBJECTIVES

- ❖ Ability to identify problem solving skills in the field of theoretical and experimental Physics.
- ❖ To pursue higher education and research in reputed institute at National and International level.
- ❖ Ability to engage in life-long learning and be able to demonstrate knowledge of contemporary issues.
- ❖ To enrich the knowledge of students on current scenario in Physics.
- ❖ To work as entrepreneurs and technologist with strong ethics and practical skills.
- ❖ Ability to communicate scientific observations effectively in oral and written form.

IV. PROGRAM OUTCOMES

- ❖ **PO1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study.
- ❖ **PO2: Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.
- ❖ **PO3: Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyze and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.
- ❖ **PO4: Problem solving Capacity:** To extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.
- ❖ **PO5: Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples,

and addressing opposing viewpoints.
- ❖ **PO6: Research-related skills**: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesizing and articulating; Ability to recognize cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data, establish hypotheses, predict cause-and- effect relationships; ability to plan, execute and report the results of an experiment or investigation.
- ❖ **PO7: Cooperation/Team work:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.
- ❖ **PO8: Scientific reasoning**: Ability to analyze interprets and draws conclusions from quantitative/qualitative data; and critically evaluates ideas, evidence and experiences from an open-minded and reasoned perspective.
- ❖ **PO9: Reflective thinking**: Critical sensibility to lived experiences, with self-awareness and reflexivity of both self and society.
- ❖ **PO10: Information/digital literacy:** Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.

V. PROGRAMME SPECIFIC OUTCOMES

On successful completion of Bachelor of Physics programme, the student should be able to:
- ❖ **PSO1: Disciplinary Knowledge:** Understand the fundamental principles, concepts, and theories related to physics and computer science. Also, exhibit proficiency in performing experiments in the laboratory.
- ❖ **PSO2: Critical Thinking:** Analyze complex problems, evaluate information, synthesize information, apply theoretical concepts to practical situations, identify assumptions and biases, make informed decisions and communicate effectively.
- ❖ **PSO3: Problem Solving:** Employ theoretical concepts and critical reasoning ability with physical, mathematical and technical skills to solve problems, acquire data, analyze their physical significance and explore new design possibilities.
- ❖ **PSO4: Analytical & Scientific Reasoning:** Apply scientific methods, collect and analyze data, test hypotheses, evaluate

evidence, apply statistical techniques and use computational models.

- ❖ **PSO5: Research related skills:** Formulate research questions, conduct literature reviews, design and execute research studies, communicate research findings and collaborate in research projects.

VI. REGULATIONS

These regulations shall take effect from the academic year 2023-2024, i.e., for students who are to be admitted to the first year of the course during the academic year 2023-24 and thereafter.

1. Eligibility for Admission

Candidates seeking admission to the first year of the Bachelor of Science – Physics shall be required to have passed the Higher Secondary examination with Mathematics, Physics and Chemistry conducted by the Government of Tamil Nadu or an Examination accepted as equivalent there to by the Syndicate subject to the conditions as may be prescribed there to are permitted to and qualify for B.Sc., (Physics) degree examinations of this University after a course of study of three academic years.

2. Duration of the Programme

The candidates shall complete all the courses of the programme in Three years from the date of admission. The programme of study shall consist of six semesters and a total period of three years with a minimum of 140 credits. The programme of study will comprise the course according to the syllabus.

3. Programme of Study

The programme of study for the B.Sc. Physics has been divided into the following five categories:

Part-I	: Tamil / Other Languages.
Part-II	: English Language.
Part-III	: Core Courses, Elective Courses, & Project with viva-voce.
Part-IV	: Foundation Course, Skill Enhancement Courses (Non- Major Elective Course), Skill Enhancement Courses (Discipline Specific), Enhancement Compulsory Courses and Internship.
Part-V	: Value added Courses, Extension Activity, etc.

4. Extension Activity:

Every student shall participate compulsorily for period of not less than two years (5 semesters) in any one of the following programmes. NSS/Sports/Other Extra-curricular and Co-curricular activities (Club/IIC/EDC). The student's performance shall be examined by the staff in- charge of extension activities along with the Head of the respective department and a senior member of the Department on the following parameters.

The marks shall be sent to the Controller of Examinations before the commencement of the final semester examinations.

20% of marks for Regularity of attendance.

60% of marks for Active Participation in classes/camps/ games/special Camps/programmes in the college/District/State/ University activities.

10% of marks for Exemplary awards/Certificates/Prizes.

10% of marks for other social components such as Blood donations, Fine arts, etc.

The above activities shall be conducted outside the regular working hours of the college. The mark sheet shall carry the gradation relevant to the marks awarded to the candidates.

A - Exemplary - 80 and above B - Very good - 70-79

C - Good - 60-69 D - Fair - 50-59

E - Satisfactory - 40 – 49

This grading shall be incorporated in the mark sheet to be issued at the end of the semester. (Handicapped students who are unable to participate in any of the above activities shall be required to take a test in the theoretical aspects of any one of the above fields and be graded and certified accordingly).

5. Examinations:

The programme of study shall be based on semester pattern with Internal Assessment under Choice Based Credit System.

The examinations for all the papers consist of both Internal (Continuous Internal Assessment - CIA) and External (End Semester) theory examinations. The theory examinations shall be conducted for three hours duration at the end of each semester. The candidates failing in any subjects(s) will be permitted to reappear for the same in the subsequent semester examinations.

VII. STRUCTURE OF THE PROGRAMME

SEMESTER: I

Part	Course Category	Title of the Course	Course Code	Hrs/Week L	Hrs/Week P	No. of Credit	Max. Mark Int.	Max. Mark Ext.	Max. Mark Total
I	LANGUAGE COURSE - I	TAMIL - I	M23UFTA01	6	-	3	25	75	100
		HINDI - I	M23UFHI01						
		FRENCH - I	M23UFFR01						
II	LANGUAGE COURSE - II	ENGLISH - I	M23UFEN01	6	-	3	25	75	100
III	CORE COURSE – I	PROPERTIES OF MATTER & SOUND	M23UPH01	4	-	4	25	75	100
III	GENERIC ELECTIVE-I	MATHEMATICS – I	M23UMAA01	4	-	4	25	75	100
III	CORE PRACTICAL- I	PROPERTIES OF MATTER	M23UPHP01	-	3	3	40	60	100
III	GENERIC ELECTIVE PRACTICAL-I	MATHEMATICS PRACTICAL – I*	M23UMAAP01	-	3	-	-	-	-
IV	SEC (NME – I)	PHYSICS FOR EVERYDAY LIFE	M23UPHN01	2	-	2	25	75	100
IV	SEC-I FOUNDATION COURSE	INTRODUCTORY PHYSICS	M23UPHS01	2	-	2	25	75	100
			Total	**24**	**6**	**21**	**190**	**510**	**700**

* Examination will be held at the end of the semester

SEMESTER: II

Part	Course Category	Title of the Course	Course Code	Hrs/Week L	Hrs/Week P	No. of Credit	Max. Mark Int	Max. Mark Ext	Max. Mark Total
I	LANGUAGE COURSE - I	TAMIL - II	M23UFTA02	6	-	3	25	75	100
		HINDI - II	M23UFHI02						
		FRENCH - II	M23UFFR02						
II	LANGUAGE COURSE - II	ENGLISH - II	M23UFEN02	6	-	3	25	75	100
III	CORE COURSE–II	HEAT, THERMODYNAMIC SAND STATISTICAL MECHANICS	M23UPH02	4	-	4	25	75	100
III	GENERIC ELECTIVE-I	MATHEMATICS - II	M23UMAA02	4	-	4	25	75	100
III	CORE PRACTICAL-II	HEAT, OSCILLATIONS, WAVES & SOUND	M23UPHAP02	-	3	3	40	60	100
III	GENERIC ELECTIVE PRACTICAL-I	MATHEMATICS PRACTICAL - I	M23UMAAP02	-	3	3	40	60	100
IV	SEC (NME – II)	ASTROPHYSICS	M23UPHN02	2	-	2	25	75	100
IV	SEC - II	INSTRUMENTATION	M23UPHS02	2	-	2	25	75	100
			Total	**24**	**6**	**24**	**230**	**570**	**800**

SEMESTER: III

Part	Course Category	Title of the Course	Course Code	Hrs/ Week L	Hrs/ Week P	No. of Credit	Max. Mark Int	Max. Mark Ext	Max. Mark Total
I	LANGUAGE COURSE - I	TAMIL – III	M23UFTA03	6	-	3	25	75	100
		HINDI – III	M23UFHI03						
		FRENCH -III	M23UFFR03						
II	LANGUAGE COURSE - II	ENGLISH - III	M23UFEN03	6	-	3	25	75	100
III	CORE COURSE–III	GENERAL MECHANICS AND CLASSICAL MECHANICS	M23UPH03	4	-	4	25	75	100
III	GENERIC ELECTIVE-II	CHEMISTRY - I	M23UCHA01	4	-	4	25	75	100
III	CORE PRACTICAL - III	ELECTRICITY EXPERIMENTS	M23UPHP03	-	3	3	40	60	100
III	GENERIC ELECTIVE PRACTICAL - II	CHEMISTRY PRACTICAL – I *	M23UCHAP01	-	3	-	-	-	-
IV	SEC - III	ENTREPRENEURIAL BASED	M23UPHS03	2	-	2	25	75	100
IV	SEC – IV	COMPUTATIONAL METHODS AND PROGRAMMING IN C	M23UPHS04	2	-	2	25	75	100
			Total	24	6	21	190	510	700

* Examination will be held at the end of the semester.

SEMESTER: IV

Part	Course Category	Title of the Course	Course Code	Hrs/Week L	P	No. of Credit	Max. Mark Int	Ext	Total
I	LANGUAGE COURSE - I	TAMIL - IV	M23UFTA04	6	-	3	25	75	100
		HINDI - IV	M23UFHI04						
		FRENCH - IV	M23UFFR04						
II	LANGUAGE COURSE - II	ENGLISH - IV	M23UFEN04	6	-	3	25	75	100
III	CORE COURSE–IV	OPTICS & SPECTROSCOPY	M23UPH04	4	-	4	25	75	100
III	GENERIC ELECTIVE-II	CHEMISTRY - II	M23UCHA02	4	-	4	25	75	100
III	CORE PRACTICAL -IV	LIGHT EXPERIMENTS	M23UPHP04	-	3	3	40	60	100
III	GENERIC ELECTIVE PRACTICAL - II	CHEMISTRY PRACTICAL - I	M23UCHAP02	-	3	3	40	60	100
IV	SEC-V	ELECTRONIC DEVICES	M23UPHS05	2	-	2	25	75	100
IV	ECC	ENVIRONMENMTAL STUDIES (EVS)	M23UES01	2	-	2	25	75	100
			Total	**24**	**6**	**24**	**230**	**570**	**800**

SEMESTER: V

Part	Course Category	Title of the Course	Course Code	Hrs/Week L	Hrs/Week P	No. of Credit	Int.	Ext.	Total
III	CORE COURSE – V	ATOMIC PHYSICS AND LASER	M23UPH05	5	-	4	25	75	100
III	CORE COURSE –VI	RELATIVITY AND QUANTUM MECHANICS	M23UPH06	5	-	4	25	75	100
III	CORE COURSE –VII	ELECTRICITY AND MAGNETISM	M23UPH07	5	-	4	25	75	100
III	DISCIPLINE SPECIFIC ELECTIVE –I	ENERGY PHYSICS	M23UPHDSE1	5	-	3	25	75	100
III	DISCIPLINE SPECIFIC ELECTIVE –I	NANO PHYSICS	M23UPHDSE2						
III	DISCIPLINE SPECIFIC ELECTIVE –I	OPTOELECTRONICS	M23UPHDSE3						
III	DISCIPLINE SPECIFIC ELECTIVE –II	MATERIAL SCIENCE	M23UPHDSE4	5	-	3	25	75	100
III	DISCIPLINE SPECIFIC ELECTIVE –II	MEDICAL PHYSICS	M23UPHDSE5						
III	DISCIPLINE SPECIFIC ELECTIVE –II	LASER PHYSICS	M23UPHDSE6						
III	CORE PRACTICAL-V	GENERAL EXPERIMENTS	M23UPHP05	-	3	3	40	60	100
IV	INTERNSHIP	INTERNSHIP/ INDUSTRIAL VISIT/ FIELD VISIT**	M23UPHIS01	-	-	2	40	60	100
V	ECC	VALUE EDUCATION	M23UVE01	2	-	2	25	75	100
			Total	**27**	**3**	**25**	**230**	**570**	**800**

** The students should undergo compulsory two weeks internship programs during the IV Semester vacation. The students should submit the report at the end of the V semester.

SEMESTER: VI

Part	Course Category	Title of the Course	Course Code	Hrs/Week L	Hrs/Week P	No. of Credit	Max. Mark Int.	Max. Mark Ext.	Max. Mark Total
III	CORE COURSE – VIII	NUCLEAR AND PARTICLE PHYSICS	M23UPH08	5	-	4	25	75	100
III	CORE COURSE – IX	SOLID STATE PHYSICS	M23UPH09	5	-	4	25	75	100
III	CORE COURSE – X	DIGITAL ELECTRONICS AND MICROPROCESSOR 8085	M23UPH10	5	-	4	25	75	100
III	DISCIPLINE SPECIFIC ELECTIVE -III	NANOSCIENCE AND NANOTECHNOLOGY	M23UPHDSE7	5	-	3	25	75	100
		NON DESTRUCTIVE TESTING	M23UPHDSE8						
		SPECTROPHYSICS	M23UPHDSE9						
III	CORE PRACTICAL-VI	ELECTRONICS EXPERIMENTS	M23UPHP06	-	3	3	40	60	100
III	PROJECT	VIVA VOCE	M23UPHPR1	5	-	4	-	-	100
IV	SEC – VI	PROFESSTIONAL COMPETENCY SKILLS	M23UPHPCS1	2	-	2	25	75	100
V	EXTENSION ACTIVITY	EXTENSION ACTIVITY	M23UEX01	-	-	1	-	-	-
				27	3	25	165	435	700

*The students will gain extra credits for successful completion of online
courses from SWAYAM / MOOC/ Approved Online Certification Course.

Summary of Credits, Hours and Mark Distribution

Part	Course Name	No. of Credits						Total Credits	Total Hours	No. of Courses	Total. Marks
		I	II	III	IV	V	VI				
I	Language Courses – I	3	3	3	3	-	-	12	24	04	400
II	Language Courses– II	3	3	3	3	-	-	12	24	04	400
III	Core courses	4	4	4	4	12	12	40	46	10	1000
	Core Practical	3	3	3	3	3	3	18	18	06	600
	Discipline Specific Elective Courses	-	-	-	-	6	3	09	15	03	300
	Core Project	-	-	-	-	-	4	04	05	01	100
	Generic Elective Courses	4	7	4	7	-	-	22	28	06	600
	Internship	-	-	-	-	2	-	02	-	01	100
IV	SEC	2	2	4	2	-	2	12	12	06	600
	SEC - NMEC	2	2	-	-	-	-	04	04	02	200
V	ECC	-	-	-	2	2	-	04	04	02	200
	Extension Activities	-	-	-	-	-	1	01	-	-	-
TOTAL		21	24	21	24	25	25	140	180	45	4500

*The students will gain one extra credit for successful completion of online courses from SWAYAM / MOOC / Approved Online Certification Course.

GENERIC ELECTIVE SUBJECTS FOR B.Sc. PHYSICS STUDENTS

Semester	Course Category	Subject	Course Code
I	GENERIC ELECTIVE -I	MATHEMATICS - I	M23UMAGE1
II	GENERIC ELECTIVE -I	MATHEMATICS - II	M23UMAGE2
III	GENERIC ELECTIVE -II	CHEMISTRY - I	M23UCHGE1
IV	GENERIC ELECTIVE -II	CHEMISTRY - II	M23UCHGE2

GENERIC ELECTIVESUBJECTS OFFERED FOR OTHER MAJOR STUDENTS

Semester	Course Category	Subject	Course Code
III	GENERIC ELECTIVE -I	PHYSICS - I	M23UPHGE1
IV	GENERIC ELECTIVE -II	PHYSICS - II	M23UPHGE2

DISCIPLINE SPECIFIC ELECTIVE SUBJECTS FOR B.Sc. PHYSICS STUDENTS

Semester	Course Category	Course Title	Course Code
V	Discipline Specific Elective – I	ENERGY PHYSICS	M23PHDSE1
		NANO PHYSICS	M23PHDSE2
		OPTOELECTRONICS	M23PHDSE3
	Discipline Specific Elective – II	MATERIAL SCIENCE	M23PHDSE4
		MEDICAL PHYSICS	M23PHDSE5
		LASER PHYSICS	M23PHDSE6
VI	Discipline Specific Elective – III	NANOSCIENCE AND NANOTECHNOLOGY	M23PHDSE7
		NON DESTRUCTIVE TESTING	M23PHDSE8
		SPECTROPHYSICS	M23PHDSE9

SKILL ENHANCEMENT COURSES

Semester	Course Category	Course Title	Course Code
I	SEC-I	FOUNDATION COURSE (INTRODUCTORY PHYSICS)	M23UPHS01
II	SEC-II	INSTRUMENTATION	M23UPHS02
III	SEC-III	ENTREPRENEURIAL BASED	M23UPHS03
	SEC-IV	COMPUTATIONAL METHODS AND PROGRAMMING IN C	M23UPHS04
IV	SEC-V	ELECTRONIC DEVICES	M23UPHS05
VI	SEC-VI	PROFESSTIONAL COMPETENCY SKILLS	M23UPHPCS1

ENHANCEMENT COMPULSORY COURSES

Semester	Course Category	Subject	Course Code
IV	ECC-I	ENVIRONMENTAL STUDIES	M23UES01
V	ECC-II	VALUE EDUCATION – YOGA	M23UVE01

SEC (NON - MAJOR ELECTIVE COURSESFOR OTHER MAJOR STUDENTS)

Semester	Course Category	Course Title	Course Code
I	NME – I	PHYSICS FOR EVERYDAY LIFE	M23UPHN01
II	NME - II	ASTROPHYSICS	M23UPHN02

VIII. SCHEME OF EXAMINATION

1. Question Paper Pattern for Theory Examination

Time: Three Hours   Maximum Marks: 75

Knowledge Level	Sections		Marks	Total Marks	Meaning of K's
K1	**Part – A** 10 Questions - Objectives type *1 Marks (No Choice)	Two Questions from each unit	10	75	K1- Memory Level K2 – Understanding Level K3 - Application Level K4 - Analytical Level
K1, K2	**Part – B** 5 Questions *2 Marks (No Choice)	One Question from each unit	10		
K2, K3	**Part – C** 5 Questions (either or type) * 5 Marks	Two Question from each unit	25		
K2, K3, K4	**Part – D** 3 out of 5 Questions *10 Marks	One Question from each unit	30		

2. Question Paper Pattern for Practical Examination

Time: Three Hours   Maximum Marks: 60

Open Elective with following Scheme

Practical   : 50 Marks
Record   : 10 Marks

Total   : 60 Marks
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3. Distribution of Marks:

The following are the distribution of marks for external and internal for End Semester Examinations and continuous internal assessment and passing minimum marks for Theory / Practical /Internship / Project courses of B.Sc. Physics programme.

ESE	CIA Total	EA Total	Total Marks Allotted	Passing Minimum for EA	Passing Minimum (ESE)
Theory	25	75	100	30	40
Practical	40	60	100	24	40
Project	40	60	100	24	40
Internship	40	60	100	24	40

The following are the distribution of marks for the Continuous Internal Assessment in Theory/Practical/Project courses of B.Sc. Physics programme.

THEORY

EVALUATION OF INTERNAL ASSESSMENT

Test   : 15 Marks

Assignment : 05 Marks

Attendance : 05 Marks

Total   : 25 Marks

PRACTICAL

EVALUATION OF INTERNAL ASSESSMENT

Test   : 20 Marks

Attendance : 10 Marks

Observation: 10 Marks

Total   : 40 Marks

INTERNSHIP/PROJECT

EVALUATION OF INTERNAL ASSESSMENT

Review 1   : 10 Marks

Review 2   : 10 Marks

Review 3   : 10 Marks

Pre-Viva   : 10 Marks

Total   : 40 Marks

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4. Passing Minimum:

The Candidates shall be declared to have passed the examination if he/she secures not less than 40 marks in total (CIA mark + Theory Exam mark) with minimum of 30 marks (out of 75 marks) in the End Semester Theory Examinations.

The Candidates shall be declared to have passed the examination if he/she secures not less than 40 marks in total (CIA mark + Practical / Internship / Project Exam mark) with minimum of 24 marks (out of 60 marks) in the End Semester Practical Examinations.

5. Submission of Record Note Books for Practical Examinations

Candidates appearing for practical examinations should submit a bonafide record note books prescribed for practical examinations. The candidates failed to submit the record book shall not be permitted to appear for the practical examinations.

5. Internship/Project Internship

Internship training (Minimum two weeks period) is mandatory for B.Sc. Physics programmes during the IV semester vacation period. The Internship training should be valued by an internal examiner; however the Viva-Voce examination should be conducted by the Internal and External examiner/Guide/Teacher concerned.

1. The Internship training Report may consist of minimum of 30 pages.
2. The candidate has to submit the Internship training Report 20 days before the commencement of the V Semester Examinations.

Project:

The following guidelines to be followed for the Project with Viva-voce:

1. The project should be valued for 60 marks by an external examiner; however the Viva-Voce examination should be conducted by both the external examiner appointed by the College and the internal examiner/supervisor/teacher concerned.
2. The Project Report may consist of minimum of 60 pages.
3. The candidate has to submit the Project Report 10 days before the commencement of the VI Semester Examinations.
4. A candidate who fails in the Project/Dissertation or is absent may resubmit the report, on the same topic, with necessary modification/correction/improvements in the subsequent Even Semester Examinations for evaluation and shall undergo viva-voce Examination.

IX. NOTE

a) SWAYAM / MOOC – Free Online Course

SWAYAM/MOOC is an instrument for self-actualization providing opportunities for a life-long learning. Here the student can choose from hundreds of courses, virtually every course taught at the college level, offered by the best teachers in India and elsewhere. The students can choose an online SWAYAM/MOOC course during their period of study which will earn an extra credit and it will be transferred to the academic records of the students.

b) Value Added Courses

      Students are provided with additional courses during their course of study right from the First year. Students are free to choose the courses. On successful completion of each course, the students will gain one extra credit.

Core - I	B.Sc. Physics	Credits: 4
Course Code: M23UPH01	PROPERTIES OF MATTER AND SOUND	Contact Hour per week: 5

OBJECTIVES:

To expose students to the fundamentals of properties of matter and sound and also it provides rich ideas about various properties of matter under different conditions.

COURSE OUTCOMES:

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

CO Number	Statement	Knowledge Level
CO1	Relate elastic behavior in terms of three modulii of elasticity and working of torsion pendulum.	K1
CO2	Able to appreciate concept of bending of beams and analyze the expression, quantify and understand nature of materials.	K2
CO3	Explain the surface tension and viscosity of fluid and support the interesting phenomena associated with liquid surface, soap films provide an analogue solution to many engineering problems.	K3
CO4	Analyze simple harmonic motions mathematically and apply them. Understand the concept of resonance and use it to evaluate the frequency of vibration. Set up experiment to evaluate frequency of ac mains	K3
CO5	Understand the concept of acoustics, importance of constructing buildings with good acoustics. Able to apply their knowledge of ultrasonics in real life, especially in medical field and assimilate different methods of production of ultrasonic waves	K4

UNIT-I: ELASTICITY: 15 Hours

Hooke's law – stress-strain diagram – elastic constants –Poisson's ratio – relation between elastic constants and Poisson's ratio – work done in

stretching and twisting a wire – twisting couple on a cylinder – rigidity modulus by static torsion– torsional pendulum (with and without masses).

UNIT-II: BENDING OF BEAMS: 15 Hours
Cantilever– expression for Bending moment – expression for depression at the loaded end of the cantilever– oscillations of a cantilever – expression for time period – experiment to find Young's modulus – non-uniform bending– experiment to determine Young's modulus by Koenig's method – uniform bending – expression for elevation – experiment to determine Young's modulus using microscope.

UNIT-III: FLUID DYNAMICS: 15 Hours
Surface tension: definition – molecular forces – excess pressure over curved surface – application to spherical and cylindrical drops and bubbles – determination of surface tension by Jaegar's method–variation of surface tension with temperature.
Viscosity: definition – streamline and turbulent flow – rate of flow of liquid in a capillary tube – Poiseuille's formula –corrections – terminal velocity and Stoke's formula– variation of viscosity with temperature.

UNIT-IV: WAVES AND OSCILLATIONS: 15 Hours
Simple Harmonic Motion (SHM) – differential equation of SHM – graphical representation of SHM – composition of two SHM in a straight line and at right angles – Lissajous's figures- free, damped, forced vibrations –resonance and Sharpness of resonance.
Laws of transverse vibration in strings – sonometer – determination of AC frequency using sonometer – determination of frequency using Melde's string apparatus.

UNIT-V: ACOUSTICS OF BUILDINGS AND ULTRASONICS: 15 Hours
Intensity of sound – decibel – loudness of sound –reverberation – Sabine's reverberation formula – acoustic intensity – factors affecting the acoustics of buildings.
Ultrasonic waves: production of ultrasonic waves – Piezoelectric crystal method – magnetostriction effect – application of ultrasonic waves.

TEXT BOOKS
1. D.S. Mathur, 2010, Elements of Properties of Matter, S. Chand & Co.
2. Brij Lal & N. Subrahmanyam, 2003, Properties of Matter, S. Chand & Co

3. D.R. Khanna & R.S. Bedi, 1969, Textbook of Sound, Atma Ram & sons
4. Brij Lal and N. Subrahmanyam, 1995, A Text Book of Sound, Second revised edition, Vikas Publishing House.
5. R. Murugesan, 2012, Properties of Matter, S. Chand & Co.

REFERENCEBOOKS
1. C.J. Smith, 1960, General Properties of Matter, Orient Longman Publishers
2. H.R. Gulati, 1977, Fundamental of General Properties of Matter, Fifth edition, R. Chand & Co.
3. A.P French, 1973, Vibration and Waves, MIT Introductory Physics, Arnold-Heinmann India.

MAPPING WITH PROGRAM SPECIFIC OUTCOMES:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	S
CO2	M	S	S	S	M
CO3	S	M	S	M	S
CO4	S	S	S	S	S
CO5	M	M	S	S	M

S – Strong M - Medium

CORE PRACTICAL - I	B.Sc. Physics	Credits: 3
Course Code: M23UPHP01	PROPERTIES OF MATTER	Contact Hour per week: 3

COURSE OUTCOMES (COs):
On the successful completion of the course, the students will be able to

CO number	Statement	Knowledge Level
CO1	Apply and Analyze the concepts of properties of matter	K3 & K4

PROPERTIES OF MATTER EXPERIMENTS (Any EIGHT of Below Experiments)

1. Determination of rigidity modulus without mass using Torsional pendulum.
2. Determination of rigidity modulus with masses using Torsional pendulum.
3. Determination of moment of inertia of an irregular body.
4. Verification of parallel axes theorem on moment of inertia.
5. Verification of perpendicular axes theorem on moment of inertia.
6. Determination of moment of inertia and g using Bifilar pendulum.
7. Determination of Young's modulus by stretching of wire with known masses.
8. Verification of Hook's law by stretching of wire method.
9. Determination of Young's modulus by uniform bending – load depression graph.
10. Determination of Young's modulus by non-uniform bending – scale & telescope.
11. Determination of Young's modulus by cantilever – load depression graph.
12. Determination of Young's modulus by cantilever – oscillation method
13. Determination of Young's modulus by Koenig's method – (or unknown load)
14. Determination of rigidity modulus by static torsion.
15. Determination of Y, n and K by Searle's double bar method.
16. Determination of surface tension & interfacial surface tension by drop weight method.
17. Determination of co-efficient of viscosity by Stokes' method –

terminal velocity.
18. Determination of critical pressure for streamline flow.
19. Determination of Poisson's ratio of rubber tube.
20. Determination of viscosity by Poiseullie's flow method.
21. Determination radius of capillary tube by mercury pellet method.
22. Determination of g using compound pendulum.

SEC (NME – I)	B.Sc. Physics	Credits: 2
Course Code: M23UPHN01	PHYSICS FOR EVERYDAY LIFE	Contact Hour per week: 3

OBJECTIVES:

To Understand and describe how physics relates to our everyday lives and informs us as consumers and citizens. To demonstrate ability to collect, process, and analyze scientific data. To display critical thinking skills in applying physics knowledge in the experimental process.

COURSE OUTCOMES:

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

CO Number	Statement	Knowledge Level
CO1	Apply concept of vectors to understand concepts of Physics and solve problems	K1
CO2	Appreciate different forces present in Nature while learning about phenomena related to LASER.	K2
CO3	Quantify energy in different process and home appliances.	K3
CO4	Differentiate different types of SOLAR energy and understand their basis	K3
CO5	Relate various contributions of physics with their behavior and connect them with different physical parameters involved.	K4

UNIT-I   **6 Hours**

MECHANICAL OBJECTS: Spring Scales – Bouncing Balls –Roller Coasters –Bicycles –Rockets and Space Travel.

UNIT-II   **6 Hours**

OPTICAL INSTRUMENTS AND LASER: Vision Corrective Lenses – Polaroid Glasses – UV Protective Glass – Polaroid Camera – Colour Photography – Holography and Laser.

UNIT-III   **6 Hours**

PHYSICS OF HOME APPLIANCES: Bulb – Fan – Hair Drier – Television – Air Conditioners – Microwave Ovens – Vacuum Cleaners.

UNIT-IV   **6 Hours**
SOLAR ENERGY: Solar Constant – General Applications Of Solar Energy – Solar Water Heaters – Solar Photo – Voltaic Cells – General Applications of Solar Cells.

UNIT-V   **6 Hours**
INDIAN PHYSICIST AND THEIR CONTRIBUTIONS: C.V.Raman, Homi Jehangir Bhabha, Vikram Sarabhai, Subrahmanyan Chandrasekhar, Venkatraman Ramakrishnan, Dr. APJ Abdul Kalam and their contribution to science and technology.

TEXT BOOKS
1. The Physics in our Daily Lives, Umme Ammara, Gugucool Publishing, Hyderabad, 2019.
2. For the love of physics, Walter Lawin, Free Press, New York.

MAPPING WITH PROGRAM SPECIFIC OUTCOMES:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S
CO2	M	S	S	S	M
CO3	S	S	S	M	S
CO4	S	S	S	S	S
CO5	S	M	S	S	S

S – Strong M - Medium

SEC – I – Foundation Course	B.Sc. Physics	Credits: 2
Course Code: M23UPHSO1	INTRODUCTORY PHYSICS	Contact Hour per week: 3

OBJECTIVES:

To Identify and define physical quantities. Understand major laws of Physics. To Apply the laws of mechanics, hydrostatics, kinetic theory of gases, heat and work, electromagnetism, oscillatory motion and waves, electricity and magnetism, and optics for explaining physical phenomena and solving problems.

COURSE OUTCOMES:

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

CO number	Statement	Knowledge Level
CO1	Apply concept of vectors to understand concepts of Physics and solve problems	K1
CO2	Appreciate different forces present in Nature while learning about phenomena related to these different forces.	K2
CO3	Quantify energy in different process and relate momentum, velocity and energy	K3
CO4	Differentiate different types of motions they would encounter in various courses and understand their basis	K3
CO5	Relate various properties of matter with their behaviour and connect them with different physical parameters involved.	K4

UNIT-I   6 Hours

Vectors, scalars – examples for scalars and vectors from physical quantities – addition, subtraction of vectors – resolution and resultant of vectors – units and dimensions– standard physics constants.

UNIT-II   6 Hours

Different types of forces – gravitational, electrostatic, magnetic, electromagnetic, nuclear – mechanical forces like, centripetal, centrifugal, friction, tension, cohesive, adhesive forces.

UNIT-III   **6 Hours**
Different forms of energy– conservation lawsof momentum, energy – typesof collisions –angular momentum– alternate energy sources–real life examples.

UNIT-IV   **6 Hours**
Types of motion– linear, projectile, circular, angular, simple harmonic motions – satellite motion – banking of a curved roads – stream line and turbulent motions – wave motion – comparison of light and sound waves – free, forced, damped oscillations.

UNIT-V   **6 Hours**
Surface tension – shape of liquid drop – angle of contact – viscosity – lubricants – capillary flow – diffusion – real life examples– properties and types of materials in daily use- conductors, insulators – thermal and electric.

TEXT BOOKS
1. D.S. Mathur, 2010, Elements of Properties of Matter, S. Chand & Co
2. BrijLal & N. Subrahmanyam, 2003, Properties of Matter, S. Chand & Co.

REFERENCEBOOKS
1. H.R. Gulati, 1977, Fundamental of General Properties of Matter, Fifth edition, S. Chand & Co.

MAPPING WITH PROGRAM SPECIFIC OUTCOMES:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S
CO2	M	S	S	S	M
CO3	S	S	S	M	S
CO4	S	S	S	S	S
CO5	S	M	S	S	S

S –Strong   M - Medium

Core - II	B.Sc. Physics	Credits: 4
Course Code: M23UPH02	**HEAT, THERMODYNAMICS AND STATISTICAL MECHANICS**	Contact Hour per week: 5

OBJECTIVES:

To give the students fundamental ideas on conservation laws, rotational and vibrational motion of rigid bodies, Gravitational fields and some idea about fluid mechanics

COURSE OUTCOMES:

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

Co number	Statement	Knowledge Level
C01	Acquires knowledge on how to distinguish between temperature and heat. Introduce him/her to the field of thermometry and explain practical measurements of high temperature as well as low temperature physics. Student identifies the relationship between heat capacity, specific heat capacity. The study of Low temperature Physics sets the basis for the students to understand cryogenics, superconductivity, super fluidity and Condensed Matter Physics	K1
CO2	Derive the efficiency of Carnot's engine. Discuss the implications of the laws of Thermodynamics in diesel and petrol engines	K2
CO3	Able to analyze performance of thermodynamic systems viz efficiency by problems. Gets an insight into thermodynamic properties like enthalpy, entropy	K3
CO4	Study the process of thermal conductivity and apply it to good and bad conductors. Quantify different parameters related to heat, relate them with various physical parameters and analyze them	K3
CO5	Interpret classical statistics concepts such as phase space, ensemble, Maxwell -Boltzmann distribution law. Develop the statistical interpretation of Bose-Einstein and Fermi- Dirac. Apply to quantum particles such as photon and electron	K4

UNIT-I: CALORIMETRY: **15 Hours**

specific heat capacity – specific heat capacity of gases C_P & C_V– Meyer's relation – Joly's method for determination of C_V – Regnault's method for determination of C_P

Low Temperature Physics: Joule-Kelvin effect – porous plug experiment – Joule-Thomson effect –Boyle temperature – temperature of inversion – liquefaction of gas by Linde's Process – adiabatic demagnetization.

UNIT-II: THERMO DYNAMICS-I: **15 Hours**

zeroth law and first law of thermodynamics – P-V diagram – heat engine – efficiency of heat engine – Carnot's engine, construction, working and efficiency of petrol engine and diesel engines – comparison of engines.

UNIT-III: THERMO DYNAMICS-II: **15 Hours**

second law of thermodynamics –entropy of an ideal gas – entropy change in reversible and irreversible processes – T-S diagram –thermo dynamical scale of temperature – Maxwell's thermodynamical relations – Clasius-Clapeyron's equation (first latent heat equation) – third law of thermodynamics – unattainability of absolute zero – heat death.

UNIT-IV: HEAT TRANSFER: **15 Hours**

Modes of heat transfer: conduction, convection and radiation.

Conduction: thermal conductivity – determination of thermal conductivity of a good conductor by Forbe's method – determination of thermal conductivity of a bad conductor by Lee's disc method.

Radiation: black body radiation (Ferry's method) – distribution of energy in black body radiation – Wien's law and Rayleigh Jean's law – Planck's law of radiation – Stefan's law – deduction of Newton's law of cooling from Stefan's law.

UNIT-V: STATISTICAL MECHANICS: **15 Hours**

Definition of phase-space – micro and macro states – ensembles –different types of ensembles – classical and quantum Statistics – Maxwell-Boltzmann statistics – expression for distribution function – Bose-Einstein statistics – expression for distribution function – Fermi-Dirac statistics – expression for distribution function – comparison of three statistics.

TEXT BOOKS

1. Brijlal &N. Subramaniam, 2000, Heat and Thermodynamics, S. Chand& Co.
2. Narayanamoorthy & Krishna Rao, 1969, Heat, Triveni Publishers, Chennai.
3. V.R.Khanna&R.S.Bedi, 1998 1st Edition, Text book of Sound, KedharnaathPublish & Co, Meerut
4. Brijlal and N. Subramanyam, 2001, Waves and Oscillations,Vikas PublishingHouse, New Delhi.
5. Ghosh, 1996, Text Book of Sound, S. Chand & Co.

REFERENCE BOOKS

1. J.B. Rajam & C.L. Arora, 1976, Heat and Thermodynamics, 8th edition,S. Chand & Co. Ltd.
2. D.S. Mathur, Heat and Thermodynamics, Sultan Chand & Sons.
3. Gupta, Kumar, Sharma, 2013, Statistical Mechanics, 26th Edition, S. Chand& Co.
4. Resnick, Halliday & Walker, 2010, Fundamentals of Physics, 6th Edition.
5. Sears, Zemansky, Hugh D. Young, Roger A. Freedman, 2021 UniversityPhysics with Modern Physics 15th Edition, Pearson.

MAPPING WITH PROGRAM SPECIFIC OUTCOMES:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S
CO2	M	S	S	S	M
CO3	S	S	S	M	S
CO4	S	S	S	S	S
CO5	S	S	M	S	S

S –Strong M - Medium

CORE PRACTICAL - II	B.Sc. Physics	Credits: 3
Course Code: M23UPHP02	HEAT, OSCILLATIONS, WAVES & SOUND	Contact Hour per week: 3

COURSE OUTCOMES (COs):

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

CO number	Statement	Knowledge Level
CO1	Apply and Analyze the concepts of Heat, Oscillations Wave & Sound	K3 & K4

HEAT, OSCILLATIONS, WAVES & SOUND (Any Eight of the below list)

1. Determination of specific heat by cooling – graphical method.
2. Determination of thermal conductivity of good conductor by Searle's method.
3. Determination of thermal conductivity of bad conductor by Lee's disc method.
4. Determination of thermal conductivity of bad conductor by Charlaton's method.
5. Determination of specific heat capacity of solid.
6. Determination of specific heat of liquid by Joule's electrical heating method (applying radiation correction by Barton's correction/graphical method),
7. Determination of Latent heat of a Polarization of a liquid.
8. Determination of Stefan's constant for Black body radiation.
9. Verification of Stefan's-Boltzmans law.
10. Determination of thermal conductivity of rubber tube.
11. Helmholtz resonator.
12. Velocity of sound through a wire using Sonometer.
13. Determination of velocity of sound using Kunds tube.
14. Determination of frequency of an electrically maintained tuning fork
15. To verify the laws of transverse vibration using sonometer.
16. To verify the laws of transverse vibration using Melde's apparatus.
17. To compare the mass per unit length of two strings using Melde's apparatus.
18. Frequency of AC by using sonometer.

SEC (NME-II)	B.Sc. Physics	Credits: 2
Course Code: M23UPHN01	ASTROPHYSICS	Contact Hour per week: 3

OBJECTIVES:

To get Knowledge, understanding and use of the principles of physics and/or astronomy. To enhance to use reasoning and logic to define a problem in terms of principles of physics. To know the use of mathematics and computer applications to solve physics and/or astronomy problems.

COURSE OUTCOMES:

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

CO number	Statement	Knowledge Level
CO1	Apply concept of vectors to understand concepts of Astrophysics and solve problems	K1
CO2	Appreciate different forces present in Nature while learning about phenomena related to these different forces, Telescopes	K2
CO3	Quantify Solar system in different process, Cloud and Wave	K3
CO4	Differentiate different types of Galaxies.	K3
CO5	Relate various Activities in Astrophysics.	K4

UNIT-I   TELESCOPES: 6 Hours

Optical telescopes – magnifying power, brightness, resolving power and f/a ratio – types of reflecting and refracting telescopes – detectors and image processing – radio telescopes – Hubble space telescope.

UNIT-II   SOLAR SYSTEM   6 Hours

Bode's law of planetary distances – meteors, meteorites, comets, asteroids – Kuiper belt – Oort cloud – detection of gravitational waves – recent advances in astrophysics.

UNIT-III - ECLIPSES: 6 Hours

Types of eclipses – solar eclipse – total and partial solar eclipse – lunar eclipse – total and partial lunar eclipse – transits.

THE SUN: physical and orbital data – solar atmosphere – photosphere – chromosphere – solar corona – prominences – sunspots – 11year solar cycle – solar flares.

UNIT-IV - STELLAR EVOLUTION: 6 Hours
H-R diagram – birth & death of low mass, intermediate mass and massive stars – Chandrasekar limit – white dwarfs – neutron stars – pulsars – black holes – supernovae.

GALAXIES: classification of galaxies – galaxy clusters –interactions of galaxies, dark matter and super clusters – evolving universe.

UNIT-V - ACTIVITIES IN ASTROPHYSICS: 6 Hours
   (i).   Basic construction of telescope
   (ii). Develop models to demonstrate eclipses/planetary motion
   (iii). Night sky observation
   (iv). Conduct case study pertaining to any topic in this paper
   (v).   Visit to any one of the National ObservatoriesAny three activities to be done compulsorily.

TEXT BOOKS
   1. Baidyanath Basu, (2001). An introduction to Astrophysics, Second printing,Prentice – Hall of India (P) Ltd, New Delhi
   2. K.S.Krishnaswamy, (2002), Astrophysics – a modern perspective, New AgeInternational (P) Ltd, New Delhi.
   3. Shylaja, B.S. & Madhusudan, H.R.,(1999), Eclipse: A Celestial Shadow Play,Orient BlackSwan,

MAPPING WITH PROGRAM SPECIFIC OUTCOMES:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S
CO2	M	S	S	S	M
CO3	S	S	S	M	S
CO4	S	S	S	S	S
CO5	S	S	M	S	S

S – Strong M - Medium

SEC – II	B.Sc. Physics	Credits: 2
Course Code: M23UPHS02	INSTRUMENTATION	Contact Hour per week: 3

OBJECTIVES:

To impart knowledge of design, operation and use of various electrical and electronic instruments in real life applications and paraphrase their importance.

COURSE OUTCOMES:

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

CO number	Statement	Knowledge Level
CO1	Apply concept of Instrumentation to understand concepts of system and solve problems	K1
CO2	Appreciate different Sensors and Transducers.	K2
CO3	Quantify system in different digital instruments.	K3
CO4	Differentiate different Medical Instrumentation.	K3
CO5	Relate various gas analyzers and Pollution monitoring instruments.	K4

UNIT-I: 6 Hours
PERFORMANCE CHARACTERISTICS OF AN INSTRUMENTATION SYSTEM

Introduction – System configuration – Problem Analysis – Basic Characteristics of measuring devices – Calibration - Generalized measurement – Zero – order system – Second order system–Dead time element – Specification and testing of dynamic response.

UNIT-II: SENSORS AND TRANSDUCERS: 6 Hours

Basic principles of sensors – pressure sensor (Strain Gauge) – IR sensor - Characteristics of transducers – variable resistance transducer – variable capacitance transducer – Voltage and current transducer.

UNIT-III: DIGITAL INSTRUMENTS: 6 Hours

Introduction – Digital Multimeter – Digital panel meter – Digital frequency meter – Digital measurement of time – Universal counter – Digital tachometer – Digital PH meter.

UNIT-IV: MEDICAL INSTRUMENTATION: 6 Hours
ECG - EEG – Lead systems and recording methods –typical waveforms – X-ray machine – Digital Stethoscope – Computer tomography – MRI – Ultra sonography – Thermography – Pacemakers –Ventilators – Dialyzers.

UNIT-V: 6 Hours
GAS ANALYSERS AND POLLUTION MONITORING INSTRUMENTS:
Types of gas analysers – Oxygen, NO_2 and H_2S types – IR analyser – Air Pollution standards – Air Pollution detector – Dust and smoke detector – Radiation monitoring instruments –Area radiation dosimeter – personal radiation dosimeter – radiation warning alarm.

TEXT BOOKS
1. E.A. Doebelin, Measurement Systems-Applications and Design, Tata McGraw Hill (1990)
2. C.S Rangan, GR Sharma, V.S.V. Mani, Instrumentation Devices and Systems, Second Edition, Tata McGraw Hill, (2011)
3. R.S. Khandpur, Hand book of Analytical Instruments, Tata McGraw Hill (2003).

REFERENCE BOOKS
1. 1.D.Patranabis, Sensors and Transducers, Prentice Hallof India, (1999)
2. M. Arumugam, Bio-medical Instrumentation, Anuradha Agencies, (2002)
3. John G. Webster, Medical Instrumentation: Application and Design, John Wiley& Sons Inc (2009)
4. John P. Bentley Principles of Measurement Systems, Third Edition, Pearson Education, (2000)

MAPPING WITH PROGRAM SPECIFIC OUTCOMES:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S
CO2	M	S	S	S	M
CO3	S	S	S	M	S
CO4	S	S	S	S	S
CO5	S	S	M	S	S

S – Strong   M - Medium

Core - III	B.Sc. Physics	Credits: 4
Course Code: M23UPH03	GENERAL MECHANICS AND CLASSICAL MECHANICS	Contact Hour per week: 5

OBJECTIVES:

To have a basic understanding of the laws and principles of mechanics. To apply the concepts of forces existing in the system. To understand the forces of physics in everyday life. To visualize conservation laws. To apply Lagrangian equation to solve complex problems.

COURSE OUTCOMES:

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

CO number	Statement	Knowledge Level
CO1	Understand the Newton's Law of motion, understand general theory of relativity, Kepler's laws and Realize the basic principles behind planetary motion	K1
CO2	Acquire the knowledge on the conservation laws	K2
CO3	Apply conservation law and calculate energy of various systems, understand and differentiate conservative and non- conservative forces	K3
CO4	Gain knowledge on rigid body dynamics and solve problems based on this concept	K3
CO5	Appreciate Lagrangian system of mechanics, apply D'Alemberts principle	K4

UNIT-I   **15 Hours**
LAWS OF MOTION:

Newton's Laws–Forces–Equations of Motion–Frictional Force– Motion of a particle in a Uniform Gravitational Field – Types of Everyday Forces in Physics.

Gravitation: Classical Theory of Gravitation – Kepler's Laws, Newton's Law of Gravitation – Determination of G by Boy's Method – Earth - Moon System –Weightlessness – Earth Satellites – Parking Orbit – Earth Density– Mass of The Sun–Gravitational Potential – Velocity of Escape – Satellite Potential and Kinetic Energy – Einstein's Theory of Gravitation – Introduction –Principle of Equivalence – Experimental Tests of General

Theory of Relativity – Gravitational Red Shift – Bending of Light – Perihelion of Mercury..

UNIT-II - 15 Hours
CONSERVATION LAWS OF LINEAR AND ANGULAR MOMENTUM:

Conservation of Linear and Angular Momentum–Internal Forces and momentum Conservation – Center of Mass – Examples – General Elastic Collision of Particles of Different Masses – System with Variable Mass – Examples – Conservation of Angular Momentum – Torque due to Internal Forces – Torque due to Gravity – Angular Momentum about Center of Mass – Proton Scattering by Heavy Nucleus.

UNIT-III - 15 Hours
CONSERVATION LAWS OF ENERGY:

Introduction – Significance of Conservation Laws – Law of Conservation of Energy concepts of Work- Power – Energy – Conservative Forces – Potential Energy and Conservation of Energy in gravitational and Electric Field– Examples–Non- Conservative Forces– General Law of Conservation of Energy.

UNIT-IV - 15 Hours
RIGID BODY DYNAMICS:

Translational and Rotational Motion – Angular Momentum – Moment of Inertia – General Theorems of Moment of Inertia – Examples – Rotation About Fixed Axis– Kinetic Energy of Rotation–Examples– Body Rolling along a Plane Surface – Body Rolling Down an Inclined Plane – Gyroscopic Precision – Gyrostatic Applications.

UNIT-V 15 Hours
LAGRANGIAN MECHANICS:

Generalized Coordinates –Degrees of Freedom – Constraints – Principle of Virtual Work and D-Alembert's Principle – Lagrange's Equation from D-Alembert's Principle – Application –Simple Pendulum – At wood's Machine.

TEXT BOOKS
1. J.C. Upadhyaya, 2019, Classical Mechanics, Himalaya Publishinghouse, Mumbai.
2. P. Durai Pandian, Laxmi Durai Pandian, Muthamizh Jayapragasam, 2005, Mechanics, 6th revised edition, S. Chand & Co.
3. D.S. Mathur & P.S.Hemne, 2000, Mechanics, Revised Edition, S.Chand & Co.

4. Narayanamurthi. M & Nagarathnam.N, 1998, Dynamics. The National Publishing, Chennai.
5. Narayanamurthi. M and Nagarathnam. N, 1982, Statics, Hydrostatics and Hydrodynamics, The National Publishers, Chennai.

REFERENCE BOOKS
1. Goldstein Herbert, 1980, Classical Mechanics. U.S.A: Addison and Wesely.
2. Halliday, David & Robert, Resnick, 1995, Physics Vol.I. New Age, International, Chennai.
3. Halliday, David Robert Resnick and Walker Jearl, 2001, Fundamentals of Physics, John Wiley, NewDelhi

MAPPING WITH PROGRAM SPECIFIC OUTCOMES:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	S
CO2	S	S	S	M	S
CO3	S	S	S	S	S
CO4	M	S	S	S	M
CO5	S	S	M	S	S

S – Strong   M - Medium

CORE PRACTICAL - III	**B.Sc. Physics**	Credits: 3
Course Code: M23UPHP03	**ELECTRICITY EXPERIMENTS**	Contact Hour per week: 3

COURSE OUTCOMES (COs):

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

CO number	Statement	Knowledge Level
CO1	Apply and Analyze the concepts of Electricity experiments	K3 & K4

ELECTRICITY EXPERIMENTS (Any EIGHT of Below Experiments)

1. Calibration of low range and high range voltmeter using potentiometer.
2. Calibration of ammeter using potentiometer.
3. Measurement of low resistances using potentiometer.
4. Determination of field along the axis of a current carrying circular coil.
5. Determination of earth's magnetic field using field along axis of current carrying coil.
6. Determination of specific resistance of the material of the wire using PO box.
7. Determination of resistance and specific resistance using Carey Foster's bridge.
8. Determination of internal resistance of a cell using potentiometer.
9. Determination of specific conductance of an electrolyte.
10. Determination of e.m.f of thermo couple using potentiometer.
11. Determination of capacitance using Desauty's bridge and B.G./ Spot galvanometer/ head phone.
12. Determination of figure of merit of BG or spot galvanometer.
13. Comparison of EMF of two cells using BG.
14. Comparison of capacitance using BG.

SEC – IV	B.Sc. Physics	Credits: 2
Course Code: M23UPHS04	COMPUTATIONAL METHODS AND PROGRAMMING IN – C	Contact Hour per week: 3

OBJECTIVES:

This course will provide the necessary basic concepts of errors in computing and a few numerical methods for finding zeros of non- linear functions. To know the basics of the C- programming language.

COURSE OUTCOMES:

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

CO number	Statement	Knowledge Level
CO1	Apply concept of Error to understand concepts of system and solve problems	K1
CO2	Appreciate different C-programming language.	K2
CO3	Quantify system in different Iterative methods.	K3
CO4	Differentiate different Control statement.	K3
CO5	Relate various function and arrays.	K4

UNIT-I: ERRORSIN COMPUTING   6 Hours

Significant digits– Inherent Errors – Numerical Errors – Modelling Errors – Absolute and Relative Errors – Error Propagation – Conditioning and stability – Convergence of iterative process.

UNIT-II: ROOTS OF EQUATIONS   6 Hours

Algebraic, Polynomial, Transcendental equations – Methods of the solution – Iterative methods – Starting and stopping iterative process – Evaluation of polynomials – Bisection method – False Position method- Related problems.

UNIT-III: C-FUNDAMENTALS   6 Hours

Character set – Keywords - data types – variable types - constants – identifiers–keywords – operators and expressions – Input and Output functions.

UNIT-IV: CONTROL STATEMENTS   6 Hours

(Syntax and examples for each) If–else, Nested if-else, Switch–Case, Break, While Loop, for loop, Do-While statement, go to.

UNIT-V: FUNCTIONS AND ARRAYS   6 Hours

Declaration and definition of a function – accessing a function – passing parameters to a function. Defining an array–processing an array–single dimensional array – multidimensional array - simple programs (Addition, Subtraction, Multiplication of two matrices - Ascending and Descending order).

TEXT BOOKS

1. E. Balagurusamy, Numerical Methods, McGraw Hill Publishers, 2017.
2. S.S. Sastry, Introductory Methods of Numerical Analysis, Prentice Hall of India, 2012

REFERENCE BOOKS

1. E. Balagurusamy, Programming in ANSIC, McGraw Hill Publishers, 2019, 8th Edn.
2. Gottfried, Schaum's Outline of Programming with C, McGraw Hill Publishers, 1996.

MAPPING WITH PROGRAM SPECIFIC OUTCOMES:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S
CO2	M	S	S	S	M
CO3	S	S	S	M	S
CO4	S	S	S	S	S
CO5	S	S	M	S	S

S – Strong   M - Medium

Core - IV	B.Sc. Physics	Credits: 4
Course Code M23UPH04	OPTICS AND SPECTROSCOPY	Contact Hour per week: 5

OBJECTIVES:

To provide an in-depth understanding of the basics of various phenomena in geometrical and wave optics. To explain the behavior of light in different mediums. To understand the differences in the important phenomena namely interference, diffraction and Polarization and apply the knowledge in day to day life. To understand the design of optical systems and methods to minims aberrations. To solve problems in optics by selecting the appropriate equations and performing numerical or analytical calculations.

COURSE OUTCOMES:

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

CO number	Statement	Knowledge Level
CO1	Outline basic knowledge of methods of rectifying different defect sin lenses, articulate technological applications of eyepieces	K1
CO2	Discuss the principle of superposition of wave, use these ideas to understand the wave nature of light through working of interferometer	K2
CO3	Extend the knowledge about nature of light through diffraction techniques; apply mathematical principles to analyze the optical instruments	K3
CO4	Interpret basic formulation of polarization and gain knowledge about Polarimeter, appraise its usage in industries	K3
CO5	Relate the principles of optics to various fields of IR, Raman and UV spectroscopy and understand their instrumentation and application in industries	K4

UNIT-I: LENS AND PRISMS: 15 Hours

Fermat's Principle of Least Time–Postulates of Geometrical Optics – Thick and Thin Lenses – Focal Length, Critical Thickness, Power and Cardinal

Points of a Thick Lens – Narrow Angled Prisms.

Lens: Lens Makers Formula (No Derivation) – Aberrations: Spherical Aberration, Chromatic Aberrations, Coma, and Astigmatism – Curvature of the Field – Distortion – Chromatic Aberrations Methods.

Prism: Dispersion, Deviation, Aberrations-Applications Rainbows and Halos, Constant Deviation Spectroscope.

Eyepieces: Advantage of an Eyepiece over a Simple Lens – Huygen's and Ramsden's Eyepieces, Construction and Working – Merits and Demerits of the Eyepiece.

Resolving power: Rayleigh's Criterion for Resolution – Limit of Resolution for the Eye – Resolving Power of (I) Prism (II) Grating (III) Telescope.

UNIT-II: INTERFERENCE: 15 Hours

Division of Wave Front, Fresnel's Bi prism – Fringes with White Light– Division of Amplitude: Interference in Thin Films due to, (i) reflected Light, (ii) Transmitted Light –Colours of Thin Films Applications –Air Wedge – Newton's Rings.

Interferometers: Michelson's Interferometer – Applications, (i) Determination of the Wavelength of a Monochromatic Source of Light, (ii) Determination of the Wavelength and Separation D1 and D2 Lines of Sodium Light, (iii) Determination of a Thickness of a Mica Sheet.

UNIT-III: DIFFRACTION: 15 Hours

Fresnel's assumptions – zone plate – action of zone plate for an incident spherical wave front– differences between a zone plate and a convex lens – Fresnel type of diffraction – diffraction pattern due to a straight edge – positions of maximum and minimum intensities – diffraction due to a narrow slit – Fraunhofer type of diffraction – Fraunhofer diffraction at a single slit – plane diffraction grating– experiment to determine wavelengths – width of principal maxima.

UNIT-IV: POLARISATION: 15 Hours

Optical Activity – Optically Active Crystals –Polarizer and Analyser – Double Refraction – Optic Axis, Principal Plane – Huygens's Explanation of Double Refraction in Uni axial Crystals – Polaroids and Applications – Circularly and Elliptically Polarized Light – Quarter Wave Plate–Half Wave Plate– Production and Detection of Circularly and Elliptically Polarized Lights – Fresnel's Explanation – Specific Rotation – Laurent Half Shade Polarimeter –Experiment to Determine Specific Rotatory Power.

UNIT-V: SPECTROSCOPY: 15 Hours

Infra-Red Spectroscopy Near Infra-Red and Far Infra-Red – Properties – Origin of IR spectra – IR Spectrophotometer – Applications Interpretation of

IR Spectra – CH, CO, CN Bending and Stretching Vibrational Modes Only – Scattering of Light – Raman Effect – Classical Theory – Quantum Theory – Mutual Exclusion Principle – Raman Spectrometer - Characteristics of Raman Lines – Applications – Ultraviolet and Visible Spectroscopy – Properties – Spectrophotometer.

TEXT BOOKS

1. Subramaniam. N & Brijlal, 2014, Optics, 25th edition, S. Chand & Co.
2. S.L. Gupta, V.Kumar & R.C. Sharma, 1997, Elements of Spectroscopy, 13th Edition, Pragati Prakashan, Meerut.
3. G. Aruldhass, 2000, Molecular Structure and Spectroscopy, IIedition. PHI Pvt Ltd, New Delhi.
4. P.R. Sasikumar, 2012, Photonics, PHI Pvt Ltd, New Delhi.
5. K. Rajagopal, 2008, Engineering Physics, PHI Pvt Ltd, NewDelhi.

REFERENCE BOOKS

1. Agarwal. B.S, 2011, Optics, Kedernath Ramnath Publishers, Meerut.
2. Sathyaprakash, 1990, Optics, VII edition, Ratan Prakashan Mandhir, NewDelhi.
3. C.N. Banewell, 2006, Introduction to Molecular Spectroscopy, IV edition, TMHPublishing Co, New Delhi.
4. Ajoy Ghatak, 2009, Optics, 4th edition, PHI Pvt Ltd, New Delhi.
5. Singh & Agarwal, 2002, Optics and Atomic Physics, 9th edition, PragatiPrakashan Meerut.

MAPPING WITH PROGRAM SPECIFIC OUTCOMES:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	M	M
CO2	M	S	M	S	M
CO3	S	M	S	S	S
CO4	S	M	S	M	M
CO5	S	M	S	M	S

S – Strong M - Medium

CORE PRACTICAL - IV	B.Sc. Physics	Credits: 3
Course Code M23UPHP04	LIGHT EXPERIMENTS	Contact Hour per week: 3

COURSE OUTCOMES (COs):

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

Co number	Statement	Knowledge Level
CO1	Apply and Analyze the concepts of Light experiments	K3 & K4

LIGHT EXPERIMENTS (Any EIGHT of Below Experiments)

1. Determination of refractive index of prism using spectrometer.
2. Determination of refractive index of liquid using hollow prism and spectrometer.
3. Determination of dispersive power of a prism.
4. Determination of radius of curvature of lens by forming Newton's rings.
5. Determination of thickness of a wire using air wedge.
6. Determination of Cauchy's Constants.
7. Determination of resolving power of grating.
8. Determination of resolving power of telescope.
9. Comparison of intensities using Lummer Brodhum Photometer.
10. Determination of range of motion using Searles goniometer.
11. Verification of Newton's formula for a lens separated by a distance.
12. Determination of refractive index of a given liquid by forming liquid lens.
13. Determination of refractive index using Laser.
14. Determination of wavelengths, particle size using Laser/Monochromatic source.
15. Determination of resolving power of Diffraction grating using Laser.
16. Determination of wire using Laser.

SEC – V	B.Sc. Physics	Credits: 2
Course Code M23UPHS05	ELECTRONIC DEVICES	Contact Hour per week: 3

OBJECTIVES:

To providing an overview of the principles, operation and applications of special diodes. To Introducing transistor and transistor biasing. To providing an overview of amplifiers, oscillators and their applications in different electronic fields. To make students acquire knowledge about Boolean algebra, logic circuits, designing counters and the basic concepts of memory and programmable logic device.

COURSE OUTCOMES:

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

CO number	Statement	Knowledge Level
CO1	Apply concept of Boolean algebra to understand concepts of system and solve problems	K1
CO2	Appreciate different Electronics devices.	K2
CO3	Quantify system in Special diodes.	K3
CO4	Differentiate different logic circuit.	K3
CO5	Relate various function programmable logic device.	K4

UNIT-I – SPECIAL DIODES: 6 Hours

Spectral response of human eye - Light Emitting Diode (LED) – advantages and its applications – photo transistor -- characteristics and applications–Tunnel diode and its characteristics – Tunnel diode as an Oscillator.

UNIT-II – SPECIAL TRANSISTORS: 6 Hours

JFET construction – JFET characteristics – parameters – Common source JFET amplifier UJT: construction - working – equivalent circuit - characteristics – Relaxation oscillator – SCR: Construction – working – equivalent circuit - V-I characteristics and their application.

UNIT-III – OPERATIONAL AMPLIFIERS: 6 Hours

Op-amp-characteristics – Inverting and non-inverting amplifier - CMRR – Frequency response – Slew rate – Differential Amplifier -

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Applications: Sign changer and scale changer – adder – subtractor – integrator – differentiator.

UNIT-IV - AMPLIFIERS: 6 Hours

Principle of Amplifier – Performance analysis of single – stage transistor amplifier - class A power amplifier- class B push pull power amplifier- Characteristics of Amplifier - Appliciaton.

UNIT-V - OSCILLATORS: 6 Hours

Principles of Oscillators- Types of Oscillators - Colpitt's oscillator – Hartley oscillator. Principle of multivibrator – Astable – monostable –bistable multivibrator using transistors – Applications.

TEXT BOOKS
1. Metha V.K. Principles of Electronics, NewDelhi, S.Chand & Co. Ltd., 2003.
2. Atul P. Godse, Deepali A. Godse, Electronic Circuits, Pune, TechnicalPublications, 2009.
3. B. L.Theraja, Basic electronics, S.Chand, NewDelhi, 2010.
4. DLeach, Albert Malvino, Digital Principles and Applications, Mc-graw Hill Inc.,US (1994).

REFERENCE BOOKS
1. Millman J. and Halkias C., Integrated Electronics, New Delhi, Tata McGrawHill, 2001.
2. Thomas L. Floyd, Electronic Devices, New Delhi, Kindersley (India) Pvt. Ltd.,2003
3. Charles A. Schuler, Roger L. Tokheim, Electronic Principles and Applications,New Delhi, Tata McGraw Hill Publishing Company Limited, 2008.
4. Arul Thalapathy M., Basic and Applied Electronics, Chennai, Comtek publisher,2005.

MAPPING WITH PROGRAM SPECIFIC OUTCOMES:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S
CO2	M	S	S	S	M
CO3	S	S	S	M	S
CO4	S	S	S	S	S
CO5	S	S	M	S	S

S – Strong M - Medium

Core - V	B.Sc. Physics	Credits: 4
Course Code M23UPH05	ATOMIC PHYSICS AND LASER	Contact Hour per week: 5

OBJECTIVES:

To study about electric charges, their properties through experiments. To gain knowledge on photoelectric effect. To solve problems based on Einstein's photoelectric equation. To make students understand the development of atom models, quantum numbers, coupling schemes and analysis of magnetic moments of an electrons. To gain knowledge on excitation and ionization potentials, splitting of spectral lines in magnetic and electric fields. To understand the principle, production and applications of lasers.

COURSE OUTCOMES:

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

CO number	Statement	Knowledge Level
CO1	List the properties of electrons and positive rays, define specific charge of positive rays, know different mass spectro graphs.	K1
CO2	Outline photoelectric effect and the terms related to it, State laws of photoelectric emission, Explain experiments and applications of photoelectric effect, Solve problems based on photoelectric equation.	K2
CO3	Explain different atom models, Describe different quantum numbers and different coupling schemes.	K3
CO4	Differentiate between excitation and ionization potentials, Explain Davis and Goucher's experiment, Apply selection rule, Analyse Paschen - Back effect, Compare Zeeman and Stark effect.	K3
CO5	Understand the condition for production of laser, Appreciate various properties and applications of lasers.	K4

UNIT-I   15 Hours
THE ELECTRON AND POSITIVE RAYS:
e/m of electron by Dunning ton's method – charge of electron by Millikan's oil drop method – properties of positive rays – e/m of positive rays by Thomson's parabola method (problems calculation of e/m ratio of positive rays) – mass spectrographs and uses – Bainbridge and Dempster's mass spectrographs.

UNIT-II   15 Hours
PHOTOELECTRIC EFFECT:
Photoelectric Emission – Leonard's Experiment – Richardson and Compton Experiment – Laws of Photoelectric Emission – Einstein's Photoelectric Equation (Problems using Einstein's Photoelectric Equation) – Experimental Verification by Millikan's Method – Photoelectric Cell – Photo Emissive Cell –Photovoltaic Cell – Photo Conducting Cell – Applications of Photo electric Cells–Photomultiplier.

UNIT-III   15 Hours
ATOMIC STRUCTURE:
Somerfield's relativistic atom model –vector atom model –various quantum numbers – L-S and J-J coupling – Pauli's exclusion principle – magnetic dipole moment of an electron due to orbital and spin motion – Bohr magnetron - Stern and Gerlach experiment – Lande's g' factor.

UNIT-IV   15 Hours
SPLITTING OF SPECTRALLINES:
Excitation, Ionization and Critical Potentials – Davis and Goucher's Method– Optical Spectra – Spectral Notation and Selection Rules – Fine Structure of Sodium D-Line – Zeeman Effect – Experimental Arrangement and Classical Theory of Normal Zeeman Effect – Larmor's Theorem –Quantum Theory of Normal Zeeman Effect –Anomalous Zeeman Effect–Explanation of Splitting of D1 and D2 lines of Sodium – Paschen Back Effect - Stark Effect (Qualitative Only).

UNIT-V   15 Hours
LASERS:
General Principles of Lasers – Properties of Lasers Action – Spontaneous and Stimulated Emission –Population Inversion– Optical Pumping – He-Ne Laser (Principle and Working) – Semiconductor Laser –Laser Applications–Holography.

TEXT BOOKS
1. R. Murugesan, Modern Physics, S. Chand & Co.(All units) (Units

I&II-Problems)
2. Brijlal & N.Subrahmanyam, Atomic & Nuclear Physics, S.Chand & Co. (All units)
3. J.B. Rajam, Modern Physics, S.Chand &Co.
4. Sehgal & Chopra, Modern Physics, Sultan Chand, New Delhi

REFERENCE BOOKS

1. Perspective of Modern Physics, Arthur Beiser, McGraw Hill.
2. Modern Physics, S. Ramamoorthy, National Publishing & Co.
3. Laser and Non –Linear Optics by B.B. Laud, Wiley Easter Ltd. New York, 1985.

MAPPING WITH PROGRAM OUTCOMES:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S
CO2	S	S	M	S	M
CO3	S	S	S	M	S
CO4	M	S	S	S	S
CO5	S	M	S	S	M

S – Strong   M - Medium

Core - VI	B.Sc. Physics	Credits: 4
Course Code M23UPH06	RELATIVITY AND QUANTUM MECHANICS	Contact Hour per week: 5

OBJECTIVES:

To understand the theory of relativity, its postulates and the consequences. To learn the importance of transformation equations and also to differentiate between special and general theory of relativity. To interpret the wave theory of matter with various theoretical and experimental evidences. To derive and use Schrodinger's wave equation and also learn about various operators. To solve Schrodinger's wave equation for simple problems and analyze to understand the solutions.

COURSE OUTCOMES:

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

CO number	Statement	Knowledge Level
CO1	Understand various postulates of special theory of relativity.	K1
CO2	Appreciate the importance of transformation equations and also the general theory of relativity.	K2
CO3	Realize the wave nature of matter and understand its importance	K3
CO4	Derive Schrodinger equation and also realize the use of operators.	K3
CO5	Apply Schrödinger equation to simple problems.	K4

UNIT-I   15 Hours
SPECIAL THEORY OF RELATIVITY:

Michelson – Morley Experiment – Frames of Reference – Galilean Relativity – Postulates of Special Theory of Relativity – Lorentz Transformation – Consequences – Time Dilation – Concept of Simultaneity – Doppler Effect– Length Contraction – Variation Of Mass with Velocity – Einstein's Mass-Energy Relation – Relativistic Momentum – Energy Relation.

UNIT-II   15 Hours
TRANSFORMATION RELATIONS:

Transformation of velocity, mass, energy and momentum – four vector – invariance under transformation – Lorentz transformation and velocity

addition equations in terms of hyperbolic functions.

GENERAL THEORY OF RELATIVITY: Inertial and Gravitational mass – Principle of equivalence – Experimental evidences for General theory of Relativity.

UNIT-III   15 Hours
PHOTONS AND MATTER WAVES:
Difficulties of classical physics and origin of quantum theory –black body radiation – Planck's law – Einstein's photoelectric equation – Compton effect – pair production – De Broglie waves – phase velocity and group velocity – Davisson and Germer's experiment – uncertainty principle – consequences – illustration of Gamma ray microscope.

UNIT-IV   15 Hours
OPERATORS AND SCHRÖDINGER EQUATION:
Postulates of quantum mechanics – Wave function and its interpretation – Schrödinger's equation – linear operators – Eigen value – Hermitian operator – properties of Hermitian operator– observable – operators for position, linear Momentum, angular momentum components – Commutator algebra – commutator between these operators – expectation values of position and momentum – Ehrenfest theorem.

UNIT-V   15 Hours
SOLVING SCHRÖDINGER EQUATION FOR SIMPLE PROBLEMS:
One-dimensional problems: (i) particle in a box, (ii) barrier penetration problem – quantum mechanical tunneling, (iii) linear harmonic oscillator. Higher dimensional problems: (i) Rigid rotator (qualitative), (ii) Hydrogen atom (qualitative).

TEXT BOOKS
1. Special Theory of Relativity, S.P. Puri, Pearson Education, India, 2013.
2. Concepts of Modern Physics, A. Beiser, 6th Ed. McGraw- Hill, 2003.
3. Modern Physics, R. Murugeshan, Kiruthiga Sivaprasath, S. Chand &Co., 17th Revised Edition, 2014.
4. Quantum Mechanics, S.P. Singh, M.K. Bagde, S. Chand & Co., NewDelhi, 2000.
5. Quantum Mechanics in Physics and Chemistry with Applications to Biology, Rabi Majumdar, PHI, 2011.
6. Modern Physics, R. Murugesan, S.Chand& Co., New Delhi.
7. Quantum Mechanics, Gupta, Kumar and Sharma. Jai Prakash

Nath& Co Meerut

8. Quantum mechanics – Satyaprakash and Swati Saluja. KedarNath Ram Nath& Co.

REFERENCE BOOKS

1. Fundamentals of Modern Physics, Peter J.Nolan,1st Edition, 2014, by Physics
2. Quantum Mechanics, V. Murugan, Pearson Education, India, 2014.
3. Quantum Mechanics, Alastair I.M. Rae and Jim Napolitano, 6th Edition, CRC Press: Taylor & Francis, 2010.
4. Quantum Physics: A Fundamental Approach to Modern Physics, John S. Townsend, University Science Books, Sausalito, California, 2010.
5. Quantum Mechanics: Theory and Applications, Ajoy Ghatak and S. Lokanathan, Springer Science Business Media, Dordrecht, Netherlands, 2004.
6. Quantum Mechanics, V. Devanathan, Narosa Pub.House, Chennai,2005.
7. Quantum Mechanics, V.K. Thangappan, New Age International, New Delhi.

MAPPING WITH PROGRAM SPECIFIC OUTCOMES:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S
CO2	S	S	M	S	M
CO3	M	M	S	M	S
CO4	M	S	S	S	S
CO5	S	M	S	S	M

S – Strong   M - Medium

Core - VII	**B.Sc. Physics**	**Credits: 4**
Course Code M23UPH07	**ELECTRICITYAND MAGNETISM**	**Contact Hour per week: 5**

OBJECTIVES:

To acquire in-depth knowledge of measuring instruments involing electric and magnetic fields. To study various magnetic properties of materials and their applications. To give an idea of the fundamentals of electromagnetic induction and alternating currents. To know the successful completion of the course, students will be able to recognize basic principles and applications of electro meters. To formulate the electrical circuit problem into a mathematical problem using circuits, laws and theorems.

COURSE OUTCOMES:

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

CO number	Statement	Knowledge Level
CO1	Define and derive the laws of electricity and magnetism.	K1
CO2	Update the knowledge of properties and magnetism.	K2
CO3	Expertise the skills to manufacture devices.	K3
CO4	Understand the properties of electric and magnetic materials.	K3
CO5	Acquire experimental skills to construct technically useful devices.	K4

UNIT-I   15 Hours
CAPACITORS AND ELECTROMETERS:
Spherical Capacitors – Cylindrical capacitors – Parallel plate capacitor – Effect of dielectric - the force of attraction between plates of a charged parallel plate capacitor – Guard Ring capacitor – Mica capacitor–uses of capacitors-Quadrant electrometer – measurement of potential, ionization current and dielectric constant.

UNIT-II   15 Hours
ELECTRICAL MEASUREMENTS AND THERMO ELECTRICITY:
Carey – Foster Bridge – theory – temperature coefficient of resistance –

potentiometer – calibration of ammeter and high range voltmeter – thermoelectricity – laws of thermos e.m.f.– measurement of thermos e.m.f. using potentiometer – Peltier effect and Peltier coefficient–Thomson effect and Thomson coefficient – relation between π and σ – thermoelectric diagrams and their uses.

UNIT-III -   15 Hours
MAGNETIC PROPERTIES OF MATERIALS:
Relation between three magnetic vectors B, H and M- Intensity of magnetization- Susceptibility – Permeability – Properties, Electron theory and Langevin's theory of dia, Para and ferromagnetic materials - magnetic hysteresis – Experiment to draw B-H curve – Ballistic method – Energy loss - determination of susceptibility: Gouy's method.

UNIT-IV -   15 Hours
ELECTROMAGNETIC INDUCTION:
Magnetic induction due to a straight conductor carrying current – Moving coil ballistic galvanometer – damping correction – absolute capacity of a condenser using B.G – Ampere's circuital Law- Faradays Laws of electromagnetic induction – vector form - self – inductance by Anderson's Bridge method – Mutual inductance – Experimental determination - coefficient of coupling.

UNIT-V   15 Hours
ALTERNATING CURRENT:
Peak, average and RMS value of current and voltage– form factor – ac circuit containing resistance and inductance – ac circuit containing resistance and capacitance – series and parallel resonance circuits – Q-factor –power in an ac circuit containing LCR – Wattless current – choke coil - Transformer – construction, theory and uses – energy loss – skin effect.

TEXT BOOKS
1. Brijlal and Subrahmanyam, Electricity and Magnetism, S. Chand & Co,New Delhi (2016).
2. R. Murugesan, Electricity and Magnetism, S. Chand & Co, New Delhi(2016).

REFERENCE BOOKS
1. D.N. Vasudeva, Electricity and Magnetism, S. Chand & Co, New Delhi (2016).
2. K.K. Tewari, Electricity and Magnetism, S. Chand & Co, New Delhi (2016).

3. Fundamentals of Electricity and Magnetism – B.D. Duggal and C.L. Chhabra, Vishal Publishing Co (2004).

MAPPING WITH PROGRAM SPECIFIC OUTCOMES:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	M	M
CO2	S	M	M	M	S
CO3	S	S	S	S	S
CO4	M	S	S	S	S
CO5	S	M	S	S	M

S – Strong   M - Medium

DISCIPLINE SPECIFIC ELECTIVE – I	B.Sc. Physics	Credits: 3
Course Code M23UPHDSE1	ENERGY PHYSICS	Contact Hour per week: 5

OBJECTIVES:

To get the understanding of the conventional and non-conventional energy sources, their conservation and storage systems.

COURSE OUTCOMES:

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

Co number	Statement	Knowledge Level
CO1	Define the energy sources.	K1
CO2	Update the knowledge of solar energy.	K2
CO3	Expertise the skills to manufacture biomass energy.	K3
CO4	Understand the basics of energy storage.	K3
CO5	Acquire experimental skills to construct technically energy devices.	K4

UNIT-I: INTRODUCTION TO ENERGY SOURCES   15 Hours

Energy Consumption as a Measure of Prosperity – World Energy Future – Energy Sources and their Availability – Conventional Energy Sources– Non-Conventional and Renewable Energy Sources – Comparison – Merits and Demerits.

UNIT-II: SOLAR ENERGY   15 Hours

Solar Energy Introduction – Solar Constant – Solar Radiation at the Earth's Surface – Solar Radiation Geometry – Solar Radiation Measurements – Solar Radiation Data – Solar Energy Storage And Storage Systems– Solar Pond – Solar Cooker – Solar Water Heater – Solar Greenhouse – Types Of Greenhouses – Solar Cells.

UNIT-III: WIND ENERGY   15 Hours

Introduction – Nature of the Wind – Basic Principle of Wind Energy Conversion – Wind Energy Data and Energy Estimation – Basic Components of Wind Energy Conversion Systems (WECS) – Advantages and Disadvantages of WECS – Applications – Tidal Energy.

UNIT-IV: BIOMASS ENERGY   **15 Hours**

Introduction – Classification – Biomass Conversion Technologies – Photo synthesis – Fermentation-Biogas Generation – Classification of Biogas Plants – Anaerobic Digestion for Biogas – Wood Gasification – Advantages & Disadvantages.

UNIT-V: ENERGY STORAGE   **15 Hours**

Importance of Energy Storage – Batteries – Lead Acid Battery - Nickel-Cadmium Battery – Fuel Cells – Types of Fuel Cells – Advantages And Disadvantages of Fuel Cells – Applications of Fuel Cells - Hydrogen Storage.

TEXT BOOKS
1. G.D.Rai, Non-Conventional Sources of Energy, Khanna Publishers, 2009,4th Edn.
2. S.P. Sukhstme, J.K. Nayak, Solar Energy, Principles of Thermal Collection and Storage, McGraw Hill, 2008, 3rd Edn.
3. D.P. Kothari, K.P. Singal, Rakesh Rajan, PHI Learning Pvt Ltd, 2011, 2nd Edn.

REFERENCE BOOKS
1. John T widell & Tony Weir, Renewable Energy Resources, Taylor & Francis,2005, 2nd Edn.
2. S.A. Abbasi and Nasema Abbasi, Renewable Energy sources and their environmental impact, PHI Learning Pvt. Ltd, 2008.
3. M.P. Agarwal, Solar Energy, S. Chand & Co. Ltd. New Delhi,1982
4. H.C. Jain, Non-Conventional Sources of Energy, Sterling Publishers, 1986.

MAPPING WITH PROGRAM SPECIFIC OUTCOMES:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	M	M
CO2	S	M	M	M	S
CO3	S	S	S	S	S
CO4	M	S	S	S	S
CO5	S	M	S	S	M

S –Strong   M - Medium

DISCIPLINE SPECIFIC ELECTIVE – II	B.Sc. Physics	Credits: 3
Course Code M23UPHDSP4	MATERIALS SCIENCE	Contact Hour per week: 5

OBJECTIVES:

To learn imperfection sin crystals, deformation of materials and testing of materials. To get knowledge on behavior of a material, under the action of light and their applications. To know the applications of crystal defects.

COURSE OUTCOMES:

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

CO number	Statement	Knowledge Level
CO1	Define the energy sources.	K1
CO2	Update the knowledge of solar energy.	K2
CO3	Expertise the skills to manufacture biomass energy.	K3
CO4	Understand the basics of energy storage.	K3
CO5	Acquire experimental skills to construct technically energy devices.	K4

UNIT-I   **15 Hours**
CRYSTAL IMPERFECTIONS:

Introduction – Point Defects: Vacancies (Problems), Interstitials, Impurities, Electronic Defects – Equilibrium Concentration of Point Imperfections (Problems) – Application of Point Defects – Line Defects: Edge Dislocation (Problems), Screw Dislocation – Surface Defects: Extrinsic Defects – Intrinsic Defects: Grain Boundaries, Tilt & Twist Boundaries, Twin Boundaries, Stacking Faults – Volume Defects – Effect of Imperfections.

UNIT-II   **15 Hours**
MATERIAL DEFORMATION:

Introduction – Elastic Behavior of Materials – Atomic Model of Elastic Behavior - Modulus as a Parameter in Design – Rubber Like Elasticity – Inelastic Behavior of Materials – Relaxation Process – Visco elastic Behavior of Materials – Spring- Dash Pot Models of Visco elastic Behavior of Materials.

UNIT-III   15 Hours
PERMANENT DEFORMATION AND STRENGTHENINGMETHODS OF MATERIALS:

Introduction – Plastic Deformation: Tensile Stress – Strain Curve – Plastic Deformation by Slip – Creep: Mechanism of Creep – Creep Resistant Materials – Strengthening Methods: Strain Hardening, Grain Refinement – Solid Solution Strengthening – Precipitation Strengthening.

UNIT-IV   15 Hours
OPTICAL MATERIALS:

Introduction – Optical Absorption in Metals, Semiconductors and Insulators – NLO Materials and their Applications – Display Devices and Display Materials: Fluorescence and Phosphorescence – Light Emitting Diodes – Liquid Crystal Displays.

UNIT-V   15 Hours
MECHANICAL TESTING:

Destructive Testing: Tensile Test, Compression Test, Hardness Test – Nondestructive Testing (NDT): Radiographic Methods, Ultrasonic Methods – Thermal Methods of NDT: Thermography – Equipment Used for NDT: Metallurgical Microscope.

TEXT BOOKS
1. Material science and Engineering, Raghavan V, Prentice Hall of India, Sixth Edition, 2015
2. Materials science, V. Rajendran, McGraw Hill publications 2011.

REFERENCE BOOKS
1. William D.Callister, Jr. Material Science & Engineering An Introduction, 8th Edition, John Wiley & Sons, Inc., 2007
2. W.Bolton, "Engineering materials technology", 3rd Edition, Butterworth& Heinemann, 2001.
3. Donald R. Askel and, Pradep P. Phule, "The Science and Engine ring of Materials", 5th Edition, Thomson Learning, First Indian Reprint, 2007.

MAPPING WITH PROGRAM SPECIFIC OUTCOMES:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	S	S
CO2	M	S	M	S	M
CO3	S	M	S	M	S
CO4	S	M	S	S	S
CO5	M	S	M	S	M

S – Strong   M - Medium

CORE PRACTICAL - V	B.Sc. Physics	Credits: 3
Course Code M23UPH05	GENERAL EXPERIMENTS	Contact Hour per week: 3

COURSE OUTCOMES (COs):

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

Co number	Statement	Knowledge Level
CO1	Apply and Analyze the concepts of General experiments	K3 & K4

GENERAL EXPERIMENTS (Any TEN of Below Experiments)

1. Diffraction at a wire and straight edge.
2. Specific rotation of a sugar solution.
3. Brewster's law-polarization.
4. Biprism – determination of refractive index.
5. Dispersive power of plane diffraction grating.
6. Y- by Corlus Method.
7. e/m Thomson Method.
8. Kundt's tube – Velocity of sound, Adiabatic Young's modulus of the material of the rod.
9. Forbe's method – Thermal conductivity of a metal rod.
10. Spectrometer – Grating – Normal incidence – Wavelength of Mercury spectral lines.
11. Spectrometer – Grating – Minimum deviation – Wave length of Mercury spectral lines.
12. Spectrometer – (i-d) curve.
13. Spectrometer – (i-i′) curve.
14. Spectrometer – Narrow angled prism.
15. Rydberg's constant
16. Spectral response of photo conductor (LDR).
17. Potentiometer – Resistance and Specific resistance of the coil.
18. Potentiometer – E.M.F of a thermo couple.
19. Carey-Foster's bridge - Temperature coefficient of resistance of the coil.
20. Deflection Magnetometer – Determination of Magnetic moment of a bar magnet and BH using circular coil carrying current.
21. Vibration magnetometer – Determination of BH using circular coil carrying current– Tan B position.
22. B.G–Figure of Merit –Charge Sensitivity

Core - VIII	B.Sc. Physics	Credits: 4
Course Code M23UPH08	NUCLEAR AND PARTICLE PHYSICS	Contact Hour per week: 5

OBJECTIVES:

To understand constituents, properties and models of nucleus. To give reason for radioactivity and study their properties. To learn about the principles of various particle detectors and accelerators. To acquire knowledge on different types of nuclear reactions and their applications. To know the reason for cosmic rays and their effect on the surface of earth and also understand the classification of elementary particles.

COURSE OUTCOMES:

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

Co number	Statement	Knowledge Level
CO1	Describe various models that explain about the nuclear structures	K1
CO2	Give reason for various kinds of radioactivity and also know laws governing them	K2
CO3	Know the principles and applications of various particle detectors and accelerators.	K3
CO4	Discuss the concepts used in nuclear reaction.	K3
CO5	Classify various elementary particles and study the effect of cosmic rays.	K4

UNIT-I - PROPERTIES OF NUCLEUS   15 Hours

constituents of nucleus – isotopes, isobars, isotones – nuclear size, mass, density, charge, spin, angular momentum, magnetic dipole moment, electric quadrupole moment (qualitative)– binding energy – mass defect – packing fraction – nuclear stability – binding energy per nucleon graph – properties of nuclear force – meson theory of nuclear forces – Yukawa potential.

Nuclear Models: liquid drop model – Weizacker's semi-empirical mass formula – shell model – magic numbers.

UNIT-II - RADIO ACTIVITY   15 Hours

radio activity – laws of radioactivity – radioactive disintegration, decay constant, half-life, mean-life (only final formulae) **–** units of

radioactivity–successive disintegration – transient and secular equilibrium–properties of alpha, beta and gamma rays – Geiger-Nuttal law– α-ray spectra – Gammow's theory of α-decay (qualitative) –β-ray spectrum – neutrino theory of β-decay – nuclear isomerism – K-shell capture – internal conversion – non-conservation of parity in weak interactions.

UNIT-III -   15 Hours
PARTICLE DETECTORS AND ACCELERATORS DETECTORS:
Gas Detectors– Ionization Chamber – GM Counter– Scintillation Counter– Photo Multiplier Tube (Pmt) –Semiconductor Detectors – Neutron Detector.
Accelerators: Linear Accelerators – Cyclotron – Synchrotron – Betatron – Electron Synchrotron – Proton synchrotron (Betatron)

UNIT-IV - NUCLEAR REACTIONS   15 Hours
Types of Nuclear Reactions –Conservation Laws in Nuclear Reaction – Q-Value–Threshold Energy – Nuclear Fission – Energy Released In Fission– Chain Reaction – Critical Mass – Nuclear Reactor – Nuclear Fusion – Sources Of Stellar Energy – Proton-Proton Cycle – Carbon-Nitrogen Cycle – Thermonuclear Reactions – Controlled Thermonuclear Reactions.

UNIT-V   15 Hours
COSMIC RAYS AND ELEMENTARY PARTICLES COSMIC RAYS:
Discovery of Cosmic Rays – Primary and Secondary Cosmic Rays – Cascade Theory of Cosmic Ray Showers – Altitude and Latitude Effects –Discovery of Positron – Pair Production – Annihilation of Matter – Van-Allen Radiation Belts – Big-Bang Theory – Future of The Universe (Elementary ideas only).
Elementary Particles: particles and antiparticles – classification of elementary particles – types of fundamental interactions – quantum numbers of elementary particles – conservation laws and symmetry – quarks and types – quark model (elementary ideas only).

TEXT BOOKS
1. R. Murugeshan & Kiruthiga Sivaprasath, Modern Physics, S.Chand & Co.(2013)
2. Brijlal & N.Subramaniyan, Atomic and Nuclear Physics S.Chand&Co
3. J.B. Rajam, Modern Physics, S. Chand & Co. Publishing Co.
4. D.C. Tayal, Nuclear Physics, Himalayan Publishing House
5. Atomic and Nuclear Physics, Brijlal & N.Subramaniyan, S. Chand & Co

REFERENCE BOOKS

1. Basic ideas and concepts in Nuclear Physics, K.Heyde,3rd Edn., Institute of Physics Pub.
2. Introductory nuclear Physics by Kenneth S. Krane (Wiley India Pvt.Ltd., 2008)
3. Concepts of nuclear physics by Bernard L. Cohen. (Tata McgrawHill, 1998).
4. Introduction to the physics of nuclei & particles, R.A. Dunlap. (Thomson Asia, 2004).
5. Introduction to High Energy Physics, D.H. Perkins, Cambridge Univ. Press
6. Introduction to Elementary Particles, D. Griffith, John Wiley & Son
7. Radiation detection and measurement, G.F. Knoll (John Wiley & Sons,2000).

MAPPING WITH PROGRAM SPECIFIC OUTCOMES:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	S	S
CO2	S	S	M	S	M
CO3	M	M	S	M	S
CO4	S	S	S	S	S
CO5	S	M	S	S	M

S – Strong   M - Medium

Core - IX	B.Sc. Physics	Credits: 4
Course Code M23UPH09	SOLID STATE PHYSICS	Contact Hour per week: 5

OBJECTIVES:

To understand constituents, properties and models of nucleus. To give reason for radioactivity and study their properties. To learn about the principles of various particle detectors and accelerators. To acquire knowledge on different types of nuclear reactions and their applications. To know the reason for cosmic rays and their effect on the surface of earth and also understand the classification of elementary particles.

COURSE OUTCOMES:

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

CO number	Statement	Knowledge Level
CO1	Classify the bonding & crystal structure also learn about the crystal structure analysis using X ray diffraction.	K1
CO2	Understand the lattice dynamics and thus learn the electrical and thermal properties of materials.	K2
CO3	Give reason for classifying magnetic material on the basis of their behavior.	K3
CO4	Comprehend the dielectric behavior of materials.	K3
CO5	Appreciate the Ferro electric and superconducting properties of materials.	K4

UNIT-I   15 Hours
BONDING IN SOLIDS, CRYSTAL STRUCTURE:

Types of Bonding –Ionic Bonding – Bond Energy of NaCl Molecule – Covalent Bonding – Metallic Bonding – Hydrogen Bonding – Van-Der- Waals Bonding – Crystal Lattice – Lattice Translational Vectors – Lattice with Basis – Unit Cell – Bravais' Lattices – Miller Indices – Procedure for finding them– Packing of BCC and FCC Structures– Structures of NaCl and Diamond Crystals – Reciprocal Lattice – Reciprocal Lattice Vectors – Properties– Reciprocal Lattices to SC, BCC and FCC Structures – Brillouin Zones – X-Rays – Bragg's Law (Simple Problems) – Experimental Methods: Laue

Method, Powder Method and Rotating Crystal Method.

UNIT-II -   **15 Hours**
ELEMENTARY LATTICE DYNAMICS:

Lattice Vibrations and Phonons: Linear Mono atomic and Diatomic Chains. Acoustical and Optical Phonons –Qualitative description of the Phonon Spectrum in Solids– Du long and Petit's Law– Einstein and Debye Theories of specific Heat of Solids – T3 Law (Qualitative Only)–Properties of Metals – Classical Free Electron Theory of Metals (Drude - Lorentz) – Ohm's Law – Electrical and Thermal Conductivities – Weide Mann-Franz' Law – Somerfield's Quantum Free Electron Theory (Qualitative Only) – Einstein's Theory of Specific Heat Capacity.

UNIT-III -   **15 Hours**
MAGNETIC PROPERTIES OF SOLIDS:

Permeability, Susceptibility, Relation Between them – Classification of Magnetic Materials – Properties of Dia, Para, Ferro, Ferri and Anti ferro magnetism – Langevin's theory of Diamagnetism – Langevin's Theory of Paramagnetism – Curie- Weiss Law – Weiss Theory of Ferromagnetism (Qualitative Only) – Heisenberg's Quantum Theory of Ferromagnetism – Domains –Discussion of B-H Curve– Hysteresis and Energy Loss – Soft and Hard Magnets – Magnetic Alloys.

UNIT-IV -   **15 Hours**
DIELECTRIC PROPERTIES OF MATERIALS:

Polarization and Electric Susceptibility – Local Electric Field of an Atom – Dielectric Constant and Polarisability – Polarization Processes: Electronic Polarization – Calculation of Polarisability – Ionic, Orientational and Space Charge Polarization –Internal Field – Clausius - Mosotti Relation – Frequency Dependence of Dielectric Constant – Dielectric Loss – Effect of Temperature on Dielectric Constant – Dielectric Breakdown and its types– Classical Theory of Electric Polarisability – Normal and Anomalous Dispersion – Cauchy and Sellmeir Relations – Langevin – Debye Equation – Complex Dielectric Constant -Optical Phenomena Application – Plasma Oscillations – Plasma Frequency – Plasmons.

UNIT-V   **15 Hours**
FERROELECTRIC & SUPER CONDUCTING PROPERTIES OF MATERIALS:

Ferroelectric Effect: Curie-Weiss Law – Ferroelectric Domains, P-E Hysteresis Loop – Elementary Band Theory: Kronig- Penny Model– Band Gap (No Derivation) – Conductor, Semiconductor (P And N Type) and Insulator – Conductivity of Semiconductor – Mobility – Hall Effect –

Measurement of Conductivity (Four Probe Method) - Hall Coefficient.

Super conductivity: experimental results –critical temperature –critical magnetic field – Meissner effect –type-I and type-II superconductors – London's equation and penetration depth – isotope effect– idea of BCS theory (no derivation).

TEXT BOOKS
1. Introduction to Solid State Physics, Kittel, Willey Eastern Ltd (2003).
2. Solid state Physics, Rita John, 1st edition, Tata Mc Graw Hill publishers (2014).
3. Solid State Physics, RL Singhal , Kedarnath RamNath & Co, Meerut (2003)
4. Introduction to Solids, Leonid V.Azaroff, 2004, Tata Mc-Graw Hill
5. Solid State Physics, N.W.Ashcroft and N.D.Mermin,1976, Cengage Learning

REFERENCE BOOKS
1. Puri & Babber– Solid State Physics – S. Chand & Co. New Delhi.
2. Kittel – Introduction to solid state physics, Wiley and Sons, 7th edition.
3. Raghavan – Materials science and Engineering, PHI
4. S.O. Pillai – Solid State Physics, Narosa publication
5. A.J. Dekker- Solid State Physics, Mc Millan India Ltd.

MAPPING WITH PROGRAM SPECIFIC OUTCOMES:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	S	S
CO2	M	S	M	S	M
CO3	S	M	S	M	S
CO4	S	S	S	S	M
CO5	S	M	M	S	S

S – Strong   M - Medium

Core - X	B.Sc. Physics	Credits: 4
Course Code M23UPH10	DIGITAL ELECTRONICS AND MICROPROCESSOR 8085	Contact Hour per week: 5

OBJECTIVES:

To learn all types of number systems, Boolean algebra and identities, digital circuits for addition and subtraction, flip-flops, registers, counters. To get the knowledge on fundamentals of 8085 architecture, instruction sets and simple programs.

COURSE OUTCOMES:

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

CO number	Statement	Knowledge Level
CO1	Classify the Number system and their inter correction	K1
CO2	Understand function of encoder and decoder	K2
CO3	Classifying Fip flop on the basis of their behavior.	K3
CO4	To study about microprocessor 8085.	K3
CO5	Appreciate the input and output interfaces.	K4

UNIT-I   15 Hours

Decimal, Binary, Octal, Hexadecimal Numbers Systems and their Conversions – Codes: BCD, Gray and Excess-3 Codes – Code Conversions –Complements (1's, 2's, 9's And 10's) – Binary Addition, Binary Subtraction using 1's & 2's Complement Methods–Boolean Laws– De-Morgan's Theorem –Basic Logic Gates -Universal Logic Gates (NAND & NOR) – Standard Representation of Logic Functions (SOP & POS) – Minimization Techniques (KarnaughMap:2,3,4 Variables).

UNIT-II -   15 Hours

Adders, Half & Full Adder – Subtractors, Half & Full Subtractor – Parallel Binary Adder – Magnitude Comparator – Multiplexers (4:1) & Demultiplexers (1:4), Encoder (8-Line- To- 3- Line) And Decoder (3-Line-To-8-Line), BCD to Seven Segment Decoder.

UNIT-III -   **15 Hours**

Flip-Flops: S-R Flip-Flop , J-K Flip-Flop, T and D Type Flip- Flops, Master- Slave Flip-Flop, Truth Tables, Registers:- Serial in Serial Out And Parallel in And Parallel Out – Counters Asynchronous:-Mod-8, Mod-10, Synchronous - 4- Bit &Ring Counter–General Memory Operations, ROM, RAM (Static and Dynamic), PROM, EPROM, EEPROM, EAROM. IC – Logic Families: RTL, DTL, TTL Logic, CMOS NAND & NOR Gates, CMOS Inverter, Programmable Logic Devices – Programmable Logic Array (PLA), Programmable Array Logic (PAL).

UNIT-IV -   **15 Hours**

8085 Microprocessor: Introduction To Microprocessor – INTEL 8085 Architecture – Register Organization– Pin Configuration Of 8085, Interrupts And Its Priority – Program Status Word (PSW)– Instruction Set of 8085 – Addressing Modes Of 8085 – Assembly Language Programming Using 8085 – Programmes For Addition (8-Bit & 16-Bit), Subtraction (8-Bit & 16-Bit), Multiplication (8-Bit), Division (8- Bit) – Largest And Smallest Number In An Array – BCD To ASCII And ASCII To BCD.

UNIT-V   **15 Hours**

I/O Interfaces: Serial Communication Interface (8251-USART) – Programmable Peripheral Interface (8255-PPI) – Programmable Interval Timers (8253) – Keyboard and Display (8279), DMA Controller (8237).

TEXT BOOKS
1. M.Morris Mano, "Digital Design" 3rd Edition, PHI, New Delhi.
2. Ronald J. Tocci. "Digital Systems-Principles and Applications" 6/e. PHI. New Delhi. 1999. (UNITS I to IV)
3. S.Salivahana & S.Arivazhagan- Digital circuits and design.
4. Microcomputer Systems the 8086/8088 family–YU-Cheng Liuand Glen SA

REFERENCE BOOKS
1. Herbert Taub and Donald Schilling. "Digital Integrated Electronics". McGrawHill. 1985.
2. S.K.Bose. "Digital Systems". 2/e. New Age International.1992.
3. D.K. Anvekar and B.S. Sonade. "Electronic Data Converters: Fundamentals &Applications". TMH.1994.
4. Malvino and Leach. "Digital Principles and Applications". TMG Hill Edition

MAPPING WITH PROGRAM SPECIFIC OUTCOMES:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	S	S
CO2	M	S	M	S	M
CO3	S	M	S	M	S
CO4	S	S	S	S	M
CO5	S	M	M	S	S

S – Strong   M – Medium

DISCIPLINE SPECIFIC ELECTIVE – III	B.Sc. Physics	Credits: 3
Course Code M23UPHDSE7	NANOSCIENCE AND NANOTHECHNOLOGY	Contact Hour per week: 5

OBJECTIVES:

To provide an overall understanding of Nano science and Nano technology. To introduces different types of nano materials, their properties, fabrication methods, characterization techniques and arrange of applications.

COURSE OUTCOMES:

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

CO Number	Statement	Knowledge Level
CO1	Classify the Nano materials	K1
CO2	Understand properties of Nano materials	K2
CO3	Classifying Fabrication methods.	K3
CO4	To study about characterization techniques.	K3
CO5	Appreciate the Application of Nano materials.	K4

UNIT-I   **15 Hours**

NANO SCIENCE AND NANO TECHNOLOGY:

Nano scale – Nature and Nano structures – Nano structures: 0D, 1D, 2D – Surface to Volume Ratio – Size Effect – Excitons – Quantum Confinement–Metal Based Nano particles (Metal And Metal Oxide) – Nano composites (Non-Polymer Based) – Carbon Nanostructures – Fullerene – SWCNT And MWCNT.

UNIT-II -   **15 Hours**

PROPERTIES OF NANO MATERIALS:

Introduction – Mechanical Behavior – Elastic Properties – Hardness And Strength – Ductility And Toughness – Super plastic Behavior – Optical Properties – Surface Plasmon Resonance – Electrical Properties – Dielectric Materials And Properties – Magnetic Properties – Super Paramagnetism – Electrochemical Properties – Properties of Cnts.

UNIT-III -   15 Hours
FABRICATION METHODS AND VACUUM TECHNIQUES:

Top-Down and Bottom-Up Approaches – Electrochemical Method – Chemical & Physical Vapour Depositions (CVD & PVD)– Plasma Arc Discharge – Sputtering – Thermal Evaporation – Pulsed Laser Deposition – Ball Milling – Lithography: Photolithography – E-Beam Lithography – Sol- Gel Methods – Synthesis Of CNT.

UNIT-IV   15 Hours
CHARACTERIZATION TECHNIQUES:

Scanning Probe Microscopy – Scanning Tunneling Microscopy – Atomic Force Microscopy – Scanning Electron Microscopy – Transmission Electron Microscopy – Powder XRD Method: Determination of Structure and Grain Size Analysis – UV-Visible and Photoluminescence Spectroscopy.

UNIT-V   15 Hours
APPLICATIONS OF NANO MATERIALS:

Medicine: Drug Delivery – Photo dynamic Therapy – Molecular Motors – Energy: Fuel Cells –Rechargeable Batteries – Super capacitors – Photo voltaics Sensors: Nano sensors based on Optical and Physical Properties – Electrochemical Sensors – Nano biosensors. Nano electronics: CNTFET– Display Screens – GMR Read/Write Heads – Nano robots –Applications of CNTs.

TEXT BOOKS
1. K.K. Chatto padhyay and A.N. Banerjee, (2012), Introduction to Nano science and Nanotechnology, PHI Learning Pvt. Ltd.,
2. M.A. Shah, Tokeer Ahmad (2010), Principles of Nano science and Nano technology, Narosa Publishing House Pvt Ltd
3. Mick Wilson, etal (2005) Nano technology, Overseas Press.

REFERENCE BOOKS
1. Richard Booker and Earl Boysen, (2005) Nano technology, Wiley Publishing Inc. USA
2. J.H. Fendler (2007) Nano particles and nano structured films; Preparation, Characterization and Applications, John Wiley & Sons
3. B.S. Murty, et al (2012) Text book of Nanoscience and Nano technology, Universities Press.

MAPPING WITH PROGRAM SPECIFIC OUTCOMES:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	S	S
CO2	M	S	M	S	M
CO3	S	M	S	M	S
CO4	S	S	S	S	M
CO5	S	M	M	S	S

S – Strong   M – Medium

CORE PRACTICAL - VI	B.Sc. Physics	Credits: 3
Course Code M23UPH06	ELECTRONICS EXPERIMENTS	Contact Hour per week: 3

COURSE OUTCOMES (COs):

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

Co number	Statement	Knowledge Level
CO1	Apply and Analyze the concepts of General experiments	K3 & K4

ELECTRONICS EXPERIMENTS (Any TEN of Below Experiments)

1. Zener diode – voltage regulations.
2. Bridge rectifier using diodes.
3. Clipping and clamping circuits using diodes.
4. Characteristics of a transistor – (CE mode).
5. RC coupled CE transistor amplifier - single stage.
6. Transistor Emitter follower.
7. Colpitt's oscillator - transistor.
8. Hartley oscillator - transistor.
9. Astable multivibrator - transistor
10. FET - characteristics.
11. UJT - characteristics
12. AC circuits with L, C, R -Series resonance.
13. Operational amplifier – inverting amplifier and summing.
14. Operational amplifier – differentiator & integrator.
15. 5V, IC Regulated power supply.
16. Study of gate ICs – NOT, OR, AND, NOR, NAND, XOR, XNOR.
17. Verification of De-Morgan's theorem using ICs –NOT, OR, AND.
18. NAND and NOR as universal building block.
19. Half adder and half subtractor using basic logic gate ICs.
20. Microprocessor 8085 – addition and subtraction (8bit only).
21. Microprocessor 8085 – largest and smallest of numbers (8bit only).

GENERIC ELECTIVE - I	B.Sc Maths/Chemistry	Credits: 4
Course Code	GENERIC ELECTIVE - PHYSICS - I	Contact Hour per week: 5

OBJECTIVES:
To recall laws of impact and classification of modulus. To calculate thermal conductivity of a bad conductor. To calibrate voltmeter & ammeter

COURSE OUTCOMES (COs):
On the successful completion of the course, the students will be able to

CO Number	Statement	Knowledge Level
CO1	Recall laws of Physics under various platforms.	K1
CO2	Classification of mechanical behavior.	K2
CO3	Calculate thermal behavior of the materials.	K3
CO4	Calibrate various instruments.	K3
CO5	To Study about interferometer.	K4

UNIT- I: Mechanics **15 Hrs**
Projectile - range up and down an inclined plane - impulse and impact - laws of impact coefficient of restitution - direct impact between two spheres - compound pendulum- theory - determination of acceleration due to gravity.

UNIT-II: Properties of Matter **15 Hrs**
Bending of beams - expressions for bending moment - expression for the depression of the free end of the cantilever - uniform and non-uniform bending - theory and experiment - torsion - expression for couple per unit twist - torsion pendulum - theory - rigidity modulus by static torsion. Surface tension and interfacial surface tension drop weight method.

UNIT-III: Heat **15 Hrs**
Specific heats: Determination of Cp and Cv - Van-der waal's equation - critical constants and their determination - expressions for critical constants - thermal conductivity of a bad conductor - Lee's disc method Joule - Thomson effect - porous plug experiment - theory - inversion temperature - Boyle temperature -

liquefaction of Helium.

UNIT-IV: Optics   15 Hrs
Small angled prism - formation of two thin prisms to produce dispersion without deviation and deviation without dispersion - constant deviation spectroscope. Interference - air wedge - thickness of a wire - Jamin's Interferometer.

UNIT-V: Electricity   15 Hrs
Carey Foster's bridge - Theory - Measurement of resistance Potentiometer- Low range voltmeter and Ammeter calibration -Theory of moving coil Ballistic Galvanometer - Determination of current and voltage sensitivities.

TEXT BOOKS:
1. R. Murugeshan, Allied Physics I & II, S. Chand & Co, New Delhi (2006),
2. D.S. Mathur, Elements of properties of matter and acoustics S. Chand & Company Ltd., New Delhi, (2010)
3. R. Murugeshan, Properties of matter and acoustics, S. Chand & Co, New Delhi, (2012).
4. Brijal & Dr. N. Subramanyan and P.S. Hemne, Heat and Thermodynamics, S. Chand & Co, New Delhi, (2004).

REFERENCE BOOKS:
1. R. Murugeshan, Electricity, S. Chand & Co, New Delhi, (2010).
2. R. Murugeshan and Kiruthiga Sivaprasath, Modern Physics, S. Chand & Co, New Delhi, (2016).
3. N. Subramaniyam, Brijlal and M.N. Avadhanulu, A textbook of Optics S. Chand & Co, New Delhi, (2012).
4. D.S. Mathur, Heat and Thermodynamics, S. Chand Co, New Delhi, (2014).

MAPPING WITH PROGRAM SPECIFIC OUTCOMES:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	S	S
CO2	M	S	M	S	M
CO3	S	M	S	M	S
CO4	S	S	S	S	M
CO5	S	M	M	S	S

S – Strong   M – Medium

GENERIC ELECTIVE - II	B.Sc Maths/Chemistry	Credits: 4
Course Code	GENERIC ELECTIVE - PHYSICS - II	Contact Hour per week: 5

OBJECTIVES:
To remind vector atom model and classification of nuclear models. To illustrate transistors. To analyze digital electronics

COURSE OUTCOMES (COs):
On the successful completion of the course, the students will be able to

CO Number	Statement	Knowledge Level
CO1	Classify the Number system and their inter correction.	K1
CO2	Understand function of IR Spectrum.	K2
CO3	Classifying Nuclear Models on the basis of their behavior.	K3
CO4	To study about Vector Atom Model.	K3
CO5	Appreciate the Transistor and Amplifiers interfaces.	K4

UNIT- I: Atomic Physics   15 Hrs
Vector atom model - Spatial quantization - spinning electron - Quantum numbers associated with vector atom model - Coupling schemes - LS and jj coupling - Pauli's exclusion principle - periodic classifications of elements example of electron configuration - Stern and Gerlach experiment.

UNIT- II: Nuclear Physics   15 Hrs
Nuclear models - liquid drop model - Semi empirical mass formula - merits and demerits - shell model - evidences. Nuclear radiation detectors - Ionisation chamber - Geiger Muller Counter - Wilson cloud chamber. Particle accelerator - Betatron.

UNIT- III: Spectroscopy   15 Hrs
Basic theory of IR spectrum - single beam experiment - applications - Theory of Raman spectroscopy - vibrational spectrum - applications - electronic spectra - Basic theory of NMR and ESR.

UNIT- IV: Basic Electronics   15 Hrs
Semiconductor physics - construction and characteristics of

FET, UJT - Multivibrator - Astable - Monostable - Bistable - basic circuits. Operational amplifier - differentiator and integrator.

UNIT- V: Digital Electronics   15 Hrs

Binary, Hexadecimal numbers and their inter conversion - Laws of Boolean algebra - De Morgan's theorems - NAND and NOR as universal blocks - simplification of Boolean expression.

TEXT BOOKS:
1. R. Murugesan, Modern Physics, S. Chand & Co, (2005).
2. Malvino & Leach, Digital Principles and application, TMH, (2005).

REFERENCE BOOKS:
1. V.K. Metha, Principles of Electronics, S. Chand & Co (2005).
2. J.B. Rajam, Modern Physics, S. Chand & Co, (2004).
3. Gupta & Kamar, Hand book of Electronics, Pragathi Prakashan (2006).

MAPPING WITH PROGRAM OUTCOMES:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	S	S
CO2	M	S	M	S	M
CO3	S	M	S	M	S
CO4	S	S	S	S	M
CO5	S	M	M	S	S

S – Strong   M – Medium

GENERIC ELECTIVE PRACTICAL - I	B.Sc Maths/Chemistry	Credits: 3
Course Code	PHYSICS - I	Contact Hour per week: 3

COURSE OUTCOMES (COs):

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

Co number	Statement	Knowledge Level
CO1	Apply and Analyze the concepts of Electricity experiments	K3 & K4

LIST OF EXPERIMENTS (Any Twelve of Below Experiments)

1. Young's modulus (q) – non–uniform bending – scale and telescope method.
2. Young's modulus (q) – uniform bending – scale and telescope method.
3. Static Torsion – Rigidity modulus of a rod
4. Torsion Pendulum – Rigidity modulus of a wire.
5. Surface tension and interfacial surface tension of a liquid –drop weight method.
6. Sonometer – frequency of a tuning fork
7. Sonometer – AC frequency
8. Air Wedge – thickness of a wire.
9. Newton's rings –determination of wavelength of light
10. Spectrometer –Refractive index of a solid prism.
11. Spectrometer – grating –normal incidence – Determination of wavelength of mercury lamp.
12. Verification of De Morgan's theorems.
13. Specific heat capacity of a liquid –half time correction.
14. Potentiometer – calibration of ammeter.
15. Potentiometer – calibration of low range voltmeter.
16. Construction of low range power pack using two diodes.
17. Characteristics of zener diode.
18. Verification of truth tables of AND, OR & NOT gates using ICs.