SRI VIDYA MANDIR ARTS & SCIENCE COLLEGE

(Autonomous)

[An Autonomous College Affiliated to Periyar University, Salem, Tamil Nadu]
[Accredited by NAAC with 'A' Grade with CGPA of 3.27]
[Recognized 2(f) & 12(B) Status under UGC Act of 1956]
Katteri – 636 902, Uthangarai (Tk), Krishnagiri (Dt) Tamil Nadu, India

Website: www.svmcugi.com **E-mail:**principalsvmc@gmail.com

DEGREE OF BACHELOR OF SCIENCE IN PHYSICS

CHOICE BASED CREDIT SYSTEM (CBCS)

REGULATIONS AND SYLLABUS FOR

B.Sc. PHYSICS PROGRAMME

(SEMESTER PATTERN)

(For Students Admitted in the College from the Academic Year 2023 – 2024 Onwards)

REGULATIONS AND SYLLABUS FOR B.Sc PHYSICS PROGRAMME

(For Students Admitted in the College from the Academic Year 2023 – 2024 Onwards)

1. VISION OF THE DEPARTMENT

The Vision is to enable the students to compete on par with other professionals and to nurture their scientific and creative thinking by providing high quality education to face global challenges in the emerging ICT propelled "Knowledge Era"

2. MISSION OF THE DEPARTMENT

To redeem the rural students from the age-old ignorance and to isolate from the stream of modern developments, dedicate to provide free access to the rural students to enroll as students of physics and to enlighten them on the career options available in the field of science, technology, and other professions.

3. DEFINITIONS

(i) Programme: Programme means a course of study leading to the award of the degree in a Discipline

(ii) Course: Course refers to the subject offered under the Degree Programme

4. AIMS OF THE PROGRAMME

- Enabling students with a broad understanding of the universe's physical principles.
- To assist students to develop critical thinking and quantitative reasoning skills.
- Assisting them to think about scientific issues and experiments in a creative and critical way.
- To train students for their careers in Physics, Physical Sciences, College teaching, industrial jobs, or other sectors of our society.
- Develop students with an independent researcher of reputation.
- To be familiar with important classical experiments and be able to make both written and oral presentationsphysics problems to acquire basic laboratory, library, and computation skill
- To Mould students with fundamental competencies that are knowledge-based, performance/skills-based, and highest potential.
- Enable students to prepare for different research/teaching qualifications and competitive examinations, such as ISRO, UPSC, BARC, TRB, and TNPSC.

5. PROGRAMME OUTCOMES (POs)

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; analyse 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, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, 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 analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate 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.
PO11	**Self-directed learning:** Ability to work independently, identifies appropriate resources required for a project, and manages a project through to completion.
PO12	**Multicultural competence:** Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.
PO13	**Moral and ethical awareness/reasoning:** Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.
PO14	**Leadership readiness/qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.
PO15	**Lifelong learning:** Ability to acquire knowledge and skills, including 'learning how to learn', that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.

6. PROGRAMME SPECIFIC OUTCOME (PSOs)

PSO1	**Placement:** To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, and beliefs and apply diverse frames of reference to decisions and actions.
PSO2	**Entrepreneur:** To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate start-ups and high potential organizations
PSO3	**Research and Development:** Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development.
PSO4	**Contribution to Business World:** To produce employable, ethical and innovative professionals to sustain in the dynamic business world.
PSO5	**Contribution to the Society:** To contribute to the development of the society by collaborating with stakeholders for mutual benefit

7. 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 thereto 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 Autonomous College affiliated to Periyar University after a course of study of three academic years.

8. DURATION OF THE PROGRAMME

The Programme for the Degree of Bachelor of Science (B.Sc.) in Physics shall consist of three academic years divided into six semesters. Each Semester consists of 90 working days.

9. FEATURES OF CHOICE BASED CREDIT SYSTEM

Under Choice Based Credit System (CBCS), a set of Courses consisting of Core Courses, Elective Courses, Skill Enhancement Courses, Non-Major Elective Courses and Ability Enhancement Compulsory Courses are offered.

10. SYLLABUS

The syllabus of the B.Sc. Physics Degree Programme is divided into the following Courses:

i. Language Courses
ii. Core Courses
iii. Elective Courses
iv. Allied Courses
v. Skill Enhancement Courses (SEC- Discipline/ Subject Specific)
vi. Skill Enhancement Courses (NME - Non-Major Elective)
vii. Ability Enhancement Compulsory Courses

11. PROGRAMME OF STUDY

The Programme of study for the Degree shall be in the Branch – Physics (Choice Based Credit System) with internal assessment comprised of instructions in the following subjects according to the syllabi and books prescribed from time to time.

12. CREDIT

Weightage given to each course of study is termed as Credit.

13. CREDIT SYSTEM

The weightage of credits are spread over to four different semesters during the period of study and the cumulative credit point average shall be awarded based on the credits earned by the student. A total of 144 Credits are prescribed for the B.Sc. Physics Degree Programme.

14. DISTRIBUTION OF MARKS AND CREDITS

The distribution of marks and credits for the B.Sc. Physics Degree Programme is as follows:

Sl. No.	Part	Course	Marks	Credits	
1.	I	Language – Tamil	400	12	**12**
2.	II	Language – English	400	12	**12**
3.	III	Core – Theory/Practical	1600	54	**87**
		Allied– Theory/Practical	800	20	
		Major Elective Courses	300	9	
		Project	100	4	
4.	IV	Foundation Course	100	2	**33**
		Skill Enhancement Courses (Discipline/ Subject Specific)	500	10	
		Skill Enhancement Courses (Non-Major Elective)	200	4	
		Ability Enhancement Compulsory Courses	400	8	
		Environmental Studies	100	2	
		Value Education	100	2	
		Internship/Industrial Visit/Field visit	-	2	
		Extension Activity	-	1	
		Professional Competency Skills	100	2	
Total			**5100**	**144**	**144**

15. EXAMINATIONS

The examinations consist of Continuous Internal Assessment (CIA) and end of semester examinations (ESE). The ESE shall be of Three Hours duration for each theory course at the end of every semester. The candidate failing in any course(s) will be permitted to appear for each failed course(s) in the subsequent examination. The end of semester practical examinations shall be of Three Hours for the each practical course conducted at the end of every even semester.

To maintain uniformity, particularly for interdepartmental transfer of credits, there shall be a uniform pattern of examination to be adopted by all the teachers offering courses. There shall be three tests, one seminar and one assignment for CIA and ESE during each semester. The distribution of marks for CIA and ESE shall be 25 marks and 75 marks, respectively. Further, the distribution of CIA will be 15 marks for test, 5 marks for assignment and 5 marks for attendance. The average of the highest two test marks out of the three CIA tests will be taken for CIA.

16. COMPONENTS OF CONTINUOUS INTERNAL ASSESSMENT (CIA)

<table>
<tr><th colspan="2">Components</th><th>Marks</th><th>Total Marks</th></tr>
<tr><td colspan="4">Theory</td></tr>
<tr><td>CIA I</td><td>75</td><td rowspan="2">(75+75 = 150/10)
15</td><td rowspan="4">25</td></tr>
<tr><td>CIA II</td><td>75</td></tr>
<tr><td colspan="2">Assignment/ Seminar</td><td>05</td></tr>
<tr><td colspan="2">Attendance</td><td>05</td></tr>
<tr><td colspan="4">Practical</td></tr>
<tr><td colspan="2">Record Submission</td><td>10</td><td rowspan="3">25</td></tr>
<tr><td colspan="2">Model Exam</td><td>10</td></tr>
<tr><td colspan="2">Attendance</td><td>05</td></tr>
</table>

17. QUESTION PAPER PATTERN

Bloom's Taxonomy Based Assessment Pattern

(**K1** – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze; **K5** – Evaluate)

(i) Theory Examinations (CIA I & CIA II = 25 Marks and ESE = 75 Marks)

Knowledge Level	Section	Marks	Description	Total Marks
K1	A (Answer ALL) Q1–Q15	15 × 1 = 15	Multiple Choice Questions (MCQ) (Three questions from each unit)	15
K2	B (Answer any THREE out of FIVE) Q16–Q20	5 × 3 = 15	Short Answers (One question from each unit)	15
K3 & K4	C (Either or Pattern) Q20–Q25	5 × 9 = 45	Descriptive/Detailed Answers (Two questions from each unit)	45
Total Marks				**75**

Passing Minimum (CIA) 40% = 10 Marks

Passing Minimum (ESE) 40% = 30 Marks

40 Marks

(ii) Practical Examinations (CIA = 25 Marks and ESE = 75 Marks)

Knowledge Level	Components	Marks	Total
K3	Experiments	65	75
K4	Record Work	10	
K5			

Passing Minimum (CIA) 40% = 10 Marks

Passing Minimum (ESE) 40% = 30 Marks

40 Marks

Allocation of Marks for Semester Practical Examinations:

Record	10 Marks
Formula	5 Marks
Formula Description	5 Marks
Circuit Diagrams/Diagrams	10 Marks
Observation – Tabulation and Records	15 Marks
Calculations	15 Marks
Presentation	5 Marks
Result	10 Marks
Total	**75 Marks**

The candidate shall be declared to have passed the examination if the candidates secure not less than 30 marks out of 75 marks in the semester examination in each theory course and 10 marks out of 25 marks in the CIA and in total not less than 40 marks.

Candidate who does not obtain the required minimum marks for a pass in a Course/Practical shall be declared Re-Appear (RA) and the candidate has to appear and pass the same at a subsequent appearance.

18. MAXIMUM DURATION FOR THE COMPLETION OF THE B.Sc. PHYSICS PROGRAMME

The maximum duration for completion of the B.Sc. Physics Programme shall not exceed twelve semesters.

19. COMMENCEMENT OF THIS REGULATION

This regulation and syllabus shall take effect from the academic year 2023–2024 for students who are admitted to the first year of the Programme during the academic year 2023 – 2024 and thereafter.

20. GRADING

Once the marks of the cumulative CIA and ESE are available, they will be added. The marks thus obtained will then begraded as per details given below:

Marks and Grades:

The following table gives the marks grade points, letter grades and classification toindicate the performance of the candidate.

Range of Marks	Grade Points	Letter Grade	Description
90–100	9.0–10.0	O	Outstanding
80–89	8.0–8.9	D+	Excellent
75–79	7.5–7.9	D	Distinction
70–74	7.0–7.4	A+	Very Good
60–69	6.0–6.9	A	Good
50–59	5.0–5.9	B	Average
40–49	4.0–4.9	C	Satisfactory
00–39	0.0	U	Re-appear
ABSENT	0.0	AAA	ABSENT

Ci = Credits earned for course i in any semester

Gi = Grade Point obtained for course i in any semester

n = Semester in which such course were credited

For a semester:

GRADE POINT AVERAGE [GPA] = $\Sigma i\ Ci\ Gi\ /\ \Sigma i\ Ci$

$$GPA = \frac{\text{Sum of the multiplication of grade points by the credits of the courses}}{\text{Sum of the credits of the courses in a semester}}$$

For the entire Programme:

CUMULATIVE GRADE POINT AVERAGE [CGPA] = ΣnΣiCniGni / ΣnΣiCni

$$GPA = \frac{\text{Sum of the multiplication of grade points by the credits of the entire programme}}{\text{Sum of the credits of the courses of the entire programme}}$$

21. CLASSIFICATION OF SUCCESSFUL CANDIDATES

A candidate who passes all the examinations and securing following CGPA and Grades shall be declared as follows:

CGPA	GRADE	CLASSIFICATION OF FINAL RESULT
9.5–10.0	O+	First Class – Exemplary
9.0 and above but below 9.5	O	
8.5 and above but below 9.0	D++	First Class with Distinction
8.0 and above but below 8.5	D+	
7.5 and above but below 8.0	D	
7.0 and above but below 7.5	A++	First Class
6.5 and above but below 7.0	A+	
6.0 and above but below 6.5	A	
5.5 and above but below 6.0	B+	Second Class
5.0 and above but below 5.5	B	
4.5 and above but below 5.0	C+	Third Class
4.0 and above but below 4.5	C	

22. RANKING

A candidate who qualifies for the B.Sc. Physics, passing all the Examinations in the first attempt within the minimum period prescribed for the Programme from the date of admission to the Programme and secures first, second or third class shall be eligible for ranking and such ranking will be confined to 10% of the total number of candidates qualified in that particular

subject to a maximum of 10 ranks.

23. CONFERMENT OF THE DEGREE

No candidate shall be eligible for conferment of the Degree unless he/she has undergone the prescribed Programme of study for a period of not less than six Semesters in an Institution approved by and affiliated to the Periyar University and earns has passed the Examinations as have been prescribed.

24.TRANSITORY PROVISION

Candidates who have undergone the Programme of Study prior to the Academic Year 2023–2024 will be permitted to take the Examinations under those Regulations for aperiod of six years i.e. up to and inclusive of the Examination of April 2030.Thereafter, they will be permitted to take the Examination only under the Regulations in force at that time.

SRI VIDYA MANDIR ARTS & SCIENCE COLLEGE

(Autonomous)

Bachelor of Science (B.Sc.) in Physics

Course Pattern and Syllabus – CBCS

(For Students Admitted in the College from the Academic Year 2023 - 2024 Onwards)

Sl. No.	Part	Nature of Course	Course Code	Name of the Course	Hours/ Week	Credits	Marks		
							CIA	ESE	Total
SEMESTER I									
1	I	Language – I	23UTA1F01	Tamil – I	6	3	25	75	100
2	II	Language – I	23UEN1F01	English – I	4	3	25	75	100
3	III	Core Course – I	23UPH1C01	Properties of Matter and Sound	5	3	25	75	100
4		Core Practical – I	23UPH1P01	Practical – I	3	3	40	60	100
5		Allied – I	23UMA1A01	Allied Mathematics – I	4	3	25	75	100
6		Allied Practical – I	23UMA1P01	Allied Mathematics – I (Practical)	2	2	25	75	100
7	IV	Skill Enhancement Course SEC- 1[NME]			2	2	25	75	100
8		Foundation Course	23UPH1F01	Introductory Physics	2	2	25	75	100
9		Ability Enhancement Compulsory Course (AECC) Soft Skill –I			2	2	25	75	100
Total					**30**	**23**	**240**	**660**	**900**
SEMESTER II									
10	I	Language – II	23UTA2F02	Tamil – II	6	3	25	75	100
11	II	Language – II	23UEN2F02	English – II	4	3	25	75	100
12	III	Core Course –II	23UPH2C02	Heat, Thermodynamics and Statistical Mechanics	5	3	25	75	100
13		Core Practical – II	23UPH2P02	Practical – II	3	3	40	60	100

14		Allied – II	23UMA2A02	Allied Mathematics – II	4	3	25	75	100
15		Allied Practical – II	23UMA2P02	Allied Mathematics – II (Practical)	2	2	25	75	100
16	IV	Skill Enhancement Course SEC - 2 [NME]			2	2	25	75	100
17		Skill Enhancement Course SEC- 3 [Discipline/Subject Specific – Numerical Methods and C Programming]			2	2	25	75	100
18		Ability Enhancement Compulsory (AECC) Soft Skill –II			2	2	25	75	100
Total					**30**	**23**	**240**	**660**	**900**
SEMESTER III									
19	I	Language – III	23UTA3F03	Tamil – III	6	3	25	75	100
20	II	Language – III	23UEN3E03	English – III	4	3	25	75	100
21	III	Core Course – III	23UPH3C03	Classical Mechanics	4	3	25	75	100
22		Core Practical – II	23UPH3P03	Practical – III	3	3	40	60	100
23		Allied Chemistry – I	23UCH3A01	Allied Chemistry– I (Theory)	4	3	25	75	100
24		Allied Chemistry Practical–II	23UCH3AP01	Allied Chemistry Practical– I	2	2	25	75	100
25	IV	Skill Enhancement Course SEC - 4 [Discipline/Subject Specific – Entrepreneurial Based – Home Electrical Installation]			2	2	25	75	100
26		Skill Enhancement Course SEC -5 [Discipline/Subject Specific – Medical Instrumentation]			2	2	25	75	100
27		Ability Enhancement Compulsory (AECC) Soft Skill –I			2	2	25	75	100
28		Environmental Studies (EVS)			1	-	-	-	-
Total					**30**	**23**	**240**	**660**	**900**

SEMESTER IV									
29	I	Language – IV	23UTA4F04	Tamil – IV	6	3	25	75	100
30	II	Language – IV	23UEN4F04	English –IV	4	3	25	75	100
31	III	Core Course –IV	23UPH4C04	Optics And Spectroscopy	4	3	25	75	100
32		Core Practical – IV	23UPH4P04	Practical – IV	3	3	40	60	100
33		Allied Chemistry - II	23UCH4A02	Allied Chemistry– II	4	3	25	75	100
34		Allied Chemistry Practical – II	23UCH4AP02	Allied Chemistry Practical – I	2	2	25	75	100
35	IV	Skill Enhancement Course SEC - 6 [Discipline/Subject Specific – Mathematical Physics]			2	2	25	75	100
36		Skill Enhancement Course SEC – 7 [Discipline/Subject Specific – Electronic Devices]			2	2	25	75	100
37		Ability Enhancement Compulsory (AECC) Soft Skill – 4			2	2	25	75	100
38		Environmental Studies (EVS)			1	2	25	75	100
Total					**30**	**25**	**265**	**735**	**1000**
SEMESTER V									
39	III	Core Course –V	23UPH5C05	Atomic Physics and Lasers	5	4	25	75	100
40		Core Course –VI	23UPH5C06	Relativity & Quantum Mechanics	5	4	25	75	100
41		Core Course –VII	23UPH5C07	Electricity and Magnetism	5	4	25	75	100
42		Core Course Practical – V	23UPH5P05	Practical -V	3	3	40	60	100
43	**IV**	Skill Enhancement Course SEC - 8 [Discipline/Subject Specific – Advanced Mathematical Physics]			5	3	25	75	100
43		Skill Enhancement Course SEC – 9 [Discipline/Subject Specific –Nanoscience and Nano Technology]			5	3	25	75	100

45		Value Education			2	2	25	75	100
46		Internship/Industrial Visit/Field Visit			-	2	-	-	-
Total					**30**	**25**	**190**	**510**	**700**
SEMESTER VI									
47	III	Core Course – VIII	23UPH6C08	Nuclear and Particle Physics	5	4	25	75	100
48		Core Course –IX	23UPH6C09	Solid State Physics	5	4	25	75	100
49		Core Course –X	23UPH6C10	Digital Electronics & Microprocessor 8085	5	4	25	75	100
50		Core Course Practical–VI	23UPH6P06	Practical – VI	3	3	40	60	100
51		Project	23UPH6PR01	Project	5	4	-	-	100
52 53	IV	Skill Enhancement Course SEC – 10 [Discipline/Subject Specific – Communication Systems]			5	3	25	75	100
54		Extension Activity			-	1	-	-	-
55		Professional Competency Skills			2	2	25	75	100
Total					**30**	**25**	**165**	**435**	**700**
Grand Total					**180**	**144**	**1340**	**3660**	**5100**

Note:

CBCS – Choice Based Credit system

CIA – Continuous Internal Assessment

ESE – End of Semester Examinations

SKILL ENHANCEMENT COURSE [DISCIPLINE/ SPECIFIC ELECTIVES]

S.NO	COURSE CODE	COURSE
1.	23UPHSEC01	Numerical Methods and Programming in C
2.	23UPHSEC02	Medical Instrumentation
3.	23UPHSEC03	Energy Physics
4.	23UPHSEC04	Material Science
5.	23UPHSEC05	Mathematical Physics
6.	23UPHSEC06	Advanced Mathematical Physics
7.	23UPHSEC07	Electronic Devices
8.	23UPHSEC08	Communication systems
9.	23UPHSEC09	Lasers and Fiber Optics
10.	23UPHSEC10	Nanoscience and Nano Technology

SKILL ENHANCEMENT COURSE [ENTREPRENEURIAL BASED]

	COURSE CODE	COURSE
1.	23UPHSEC11	Home Electrical Installation
2.	23UPHSEC12	Digital Photography

SKILL ENHANCEMENT COURSE (NME)

	COURSE CODE	COURSE
1.	23UPHNME01	Physics for Everyday life
2.	23UPHNME02	Astro Physics
3.	23UPHNME03	Medical Physics
4.	23UPHNME04	Physics of Music

PROFESSIONAL COMPETENCY SKILLS

1. Quantitative Aptitude for competitive Examinations

EXTENSION ACTIVITY/ FIELD VISIT IS MANDATORY

A visit to a factory, farm, or museum is mandatory for purposes of first hand observation

LIST OF EXTENSION ACTIVITIES

1. National Cade Corps (NCC)
2. National Service Scheme (NSS)
3. Youth Red Cross (YRC)
4. Physical Education (PYE)
5. Eco Club (ECC)
6. Red Ribbon Club (RRC)
7. Women Empowerment Cell (WEC)

PROGRAMME SYLLABUS

Program: B.Sc. Physics			
Core Course – I	**Course Code:** 23UPH1C01	**Course Title:** Properties of Matter and Sound	
Semester	**Hours/Week**	**Credits**	**Total Marks**
I	5	3	100

Course Objectives

1. Study of the properties of matter leads to information which is of practical value to both the physicist and the engineers.
2. It gives us information about the internal forces which act between the constituent parts of the substance.
3. Students who undergo this course are successfully bound to get a better insight and understanding of the subject.

UNIT–I: ELASTICITY

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

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 – Hanging bridge.

UNIT– III: FLUID DYNAMICS

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

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

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 – NTD, ultrasonic imaging.

BOOKS FOR STUDY:

1. D.S. Mathur, Elements of Properties of Matter, S.Chand & Co (2010).
2. BrijLal & N. Subrahmanyam, Properties of Matter, S.Chand & Co (2003).
3. D.R. Khanna & R.S. Bedi, Textbook of Sound, Atma Ram & sons (1969).
4. BrijLal and N. Subramanyam, A Text Book of Sound, Second revised edition, Vikas Publishing House (1995).
5. R. Murugesan, Properties of Matter, S.Chand& Co (2012).

BOOKS FOR REFERENCE:

1. C.J. Smith, General Properties of Matter, Orient Longman Publishers (1960).
2. H.R. Gulati, Fundamental of General Properties of Matter, Fifth edition, R. Chand & Co (1977).

3. A.P French, Vibration and Waves, MIT Introductory Physics, Arnold-Heinemann India (1973)
.

WEBLINKS

1.https://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work
2. http://hyperphysics.phy-astr.gsu.edu/hbase/permot2.html
3. https://www.youtube.com/watch?v=gT8Nth9NWPM
4. https://www.youtube.com/watch?v=m4u-SuaSu1s&t=3s
5. https://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work
6. https://learningtechnologyofficial.com/category/fluid-mechanics-lab/
7.http://www.sound-physics.com/
8. http://nptel.ac.in/courses/112104026/

Course Outcomes (COs)

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

COURSE OUTCOMES	**CO1**	Relate elastic behavior in terms of three modulii of elasticity and working of torsion pendulum.
	CO2	Able to appreciate concept of bending of beams and analyze the expression, quantify and understand nature of materials.
	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.
	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
	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

Mapping of Cos with POs

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3-point scale of STRONG (**S**), MEDIUM (**M**) and LOW (**L**).

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	S	M	M	S	M	S
CO2	M	S	S	S	M	M	S	M	S	S
CO3	S	M	S	M	S	S	M	S	S	S
CO4	S	S	S	S	S	M	S	M	M	M
CO5	M	M	S	S	M	S	S	S	S	M

Program: B.Sc. Physics				
FOUNDATION COURSE	**Course Code:** 23UPH1F01		**Course Title:** Introductory Physics	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	2	75	2	100

Course Objectives

1. To help students get an over view of Physics before learning their core courses.
2. To serve as a bridge between the school curriculum and the degree programme.

UNIT-I:

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:

Different types of forces – Gravitational, electrostatic, magnetic, electromagnetic, nuclear – Mechanical forces like, centripetal, centrifugal, friction, tension, cohesive and adhesive forces.

UNIT-III:

Different forms of energy– Conservation laws of momentum, energy – Types of collisions –Angular momentum– Alternate energy sources – Real life examples.

UNIT-IV:

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:

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.

REFERENCE BOOKS

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

WEBLINKS

1. http://hyperphysics.phy-astr.gsu.edu/hbase/permot2.html
2. https://science.nasa.gov/ems/
3. https://eesc.columbia.edu/courses/ees/climate/lectures/radiation_hays/

Course Outcomes (COs)

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

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

Mapping of Cos with POs

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3-point scale of STRONG (**S**), MEDIUM (**M**) and LOW (**L**).

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10

CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

Program: B.Sc. Physics				
Core Course Practical-I	**Course Code:**21UPH2P01		**Course Title**: Core Course Practical- I	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	3	45	3	100

Course Objectives

Apply various physics concepts to understand Properties of Matter, set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results

LIST OF 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 modulusby cantilever – load depression graph.
12. Determination of Young's modulus by cantilever – oscillation method
13. Determination of Young's modulus by Koenig's method – (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. Determinationradius of capillary tube by mercury pellet method.
22. Determinationof g using compound pendulum.

BOOKS FORSTUDY ANDREFERENCE:

1. S. Balasubramanian, R. Ranganathan, M.N. Srinivasan, A Text book of Physics Practical, 2nd Revised Edition, S. Chand & Sons (2017).
2. C.C. Ouseph, U.J. Rao, V. Vijayendiran, Practical Physics, 1st Edition, Viswanathan.S Printers and Publishers Private Ltd. (2015).
3. P.R. SasiKumar, Practical Physics, PHI (2014).
4. S.P. Singh, Advanced Practical Physics, Pragathi Prakasam (2017).
5. C.L Arora, Practical Physics, S. Chand& Co(2010).
6. GeetaSanon, B.Sc Practical Physics, 1st Edition, Chand & Co., New Delhi (2007).
7. K.A. Navas, Electronics Lab Manual, Volume I, PHI, 5th Edition (2015).

Course Outcomes (COs)

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

CO Number	CO Statement
CO1	Perform experiments on material to identify the strength the given objects
CO2	Deal with liquids based on their Surface tension
CO3	Learn the relation between frequency, length and tension of a stretched string under vibration

CO4	Acquire knowledge of Hookes law
CO5	Analyse the elasticity of the given materials
CO6	Examine the performance of stress and strain of the given objects

Mapping of Cos with POs

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3 point scale of STRONG (**S**), MEDIUM (**M**) and LOW (**L**).

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	S	S
CO2	S	S	S	S	S
CO3	M	S	S	S	S
CO4	S	S	S	S	S
CO5	S	M	S	S	S

Program: B.Sc. Physics				
Core Course–II	**Course Code:** 23UPH2C02		**Course Title:** Heat, Thermodynamics and Statistical Physics	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	5	75	3	100

Course Objectives

1. The course focuses to understand a basic in conversion of temperature in Celsius, Kelvin and Fahrenheit scales.
2. Practical exhibition and explanation of transmission of heat in good and bad conductor.
3. Relate the laws of thermodynamics, entropy in everyday life and explore the knowledge of statistical mechanics and its relation.

UNIT-I: CALORIMETRY AND LOWTEMPERATUREPHYSICS:

CALORIMETRY: 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.

LOWTEMPERATUREPHYSICS: Joule-Kelvin effect – Porous plug experiment – Joule-Thomson effect –Boyle temperature – Temperature of inversion – Liquefaction of gas by Linde's Process –Adiabatic demagnetisation.

UNIT-II: THERMODYNAMICS - I

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: THERMODYNAMICS-II

Second law of thermodynamics –Entropy of an ideal gas – Entropy change in reversible and irreversible processes – T-S diagram – Thermodynamical 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

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

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, Kedarnath Publish & Co, Meerut
4. Brijlal and N. Subramanyam, 2001, Waves and Oscillations, Vikas Publishing House, New Delhi.
5. Ghosh, 1996, Text Book of Sound, S. Chand & Co.
6. R. Murugeshan & Kiruthiga Sivaprasath, Thermal Physics, 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 University Physics with Modern Physics 15th Edition, Pearson.

WEBLINKS

1. https://youtu.be/M_5KYncYNyc
2. https://www.youtube.com/watch?v=4M72kQulGKk&vl=en

Course Outcomes (COs)

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

COURSE OUTCOMES	**CO1**	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 therelationship between heat capacity, specific heat capacity. The study of Low temperature Physics sets the basis for the students to understand cryogenics, superconductivity, superfluidity and Condensed Matter Physics
	CO2	Derive the efficiency of Carnot's engine. Discuss the implications of the laws of Thermodynamics in diesel and petrol engines
	CO3	Able to analyze performance of thermodynamic systems viz efficiency by problems. Gets an insight into thermodynamic properties like enthalpy, entropy
	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 analyse them
	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

Mapping of Cos with POs

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3 point scale of STRONG (**S**), MEDIUM (**M**) and LOW (**L**).

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	S	M	S	S	S	M	M	S	M

Program:B.Sc.Physics				
Core Course Practical-II	**Course Code:** 23UPH2P02		**Course Title**: Core Practical- II	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	3	45	3	100

Course Objectives

Apply their knowledge gained about the concept of heat and sound waves, resonance, calculate frequency of ac mains set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results.

LIST OF EXPERIMENTS

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 vaporization of a liquid.
8. Determination of Stefan's constant for Black body radiation.
9. Verification of Stefan's-Boltzmann's 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.

BOOKS FOR STUDY AND REFERENCE:

1. S. Balasubramanian, R. Ranganathan, M.N. Srinivasan, A Text book of Physics Practical, 2nd Revised Edition, S. Chand & Sons (2017).
2. C.C. Ouseph, U.J. Rao, V. Vijayendiran, Practical Physics, 1st Edition, Viswanathan. S Printers and Publishers Private Ltd. (2015).
3. P.R. SasiKumar, Practical Physics, PHI (2014).
4. S.P. Singh, Advanced Practical Physics, Pragathi Prakasam (2017).
5. C.L Arora, Practical Physics, S. Chand& Co (2010).
6. GeetaSanon, B.Sc Practical Physics,1st Edition, Chand & Co., New Delhi (2007).
7. K.A .Navas, Electronics Lab Manual, Volume -I, PHI, 5th Edition (2015).

Course Outcomes (COs)

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

CO Number	CO Statement
CO1	Perform experiments to identify the conductivity of the given materials
CO2	Deal with liquids based on their specific heat by cooling
CO3	Learn the relation between frequency, length and tension of a stretched string under vibration
CO4	Acquire knowledge of Sonometer
CO5	Analyse the input and output characteristics of various electronic devices
CO6	Examine the performance of logic gates using IC's and discrete components and to measure the output

Mapping of Cos with POs

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3 point scale of STRONG (**S**), MEDIUM (**M**) and LOW (**L**).

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	S	S
CO2	S	S	S	S	S
CO3	M	S	S	S	S
CO4	S	S	S	S	S
CO5	S	M	S	S	S

Program: B.Sc. Physics				
Core Course–III	**Course Code:** 23UPH3C03		**Course Title:** Classical Mechanics	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
III	4	75	3	100

Course Objectives:

This course allows the students:

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

UNIT- I: 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: 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: 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: 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: 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 – Atwood's machine.

TEXT BOOKS

1. J.C. Upadhyaya, 2019, Classical Mechanics, Himalaya Publishing house, 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.

REFERNCE BOOKS

1. Goldstein Herbert, 1980, Classical Mechanics. U.S.A: Addison and Wesley.
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, New Delhi

WEBSITE LINKS

1. https://youtu.be/X4_K-XLUIB4
2. https://nptel.ac.in/courses/115103115
3. https://www.youtube.com/watch?v=p075LPq3Eas
4. https://www.youtube.com/watch?v=mH_pS6fruyg
5. https://onlinecourses.nptel.ac.in/noc22_me96/preview
6. https://www.youtube.com/watch?v=tdkFc88Fw-M
7. https://onlinecourses.nptel.ac.in/noc21_me70/preview

Course Outcomes (COs)

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

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

Mapping of Cos with POs

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3 point scale of STRONG (**S**), MEDIUM (**M**) and LOW (**L**).

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	S	S	M	S	S
CO2	S	S	S	M	S	M	S	S	S	M
CO3	S	S	S	S	S	S	M	S	M	S
CO4	M	S	S	S	M	S	S	M	S	S
CO5	S	S	M	S	S	M	S	S	S	M

Program: B.Sc. Physics				
Core Course Practical- III	**Course Code:** 23UPH3P03		**Course Title**: Core Course Practical - III	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
III	3	45	3	100

Course Objectives

1. Construct circuits to learn about the concept of electricity, current, resistance in the path of current, different parameters that affect a circuit.
2. Set up experiments, observe, analyse and assimilate the concept

LIST OF 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 usingBG.
14. Comparison of capacitance using BG.

BOOKS FOR STUDY AND REFERENCE:

1. S. Balasubramanian, R. Ranganathan, M.N. Srinivasan, A Text book of Physics Practical, 2nd Revised Edition, S. Chand & Sons (2017).
2. C. C. Ouseph, U.J. Rao, V. Vijayendiran, Practical Physics, 1st Edition, Viswanathan.S Printers and Publishers Private Ltd. (2015).
3. P. R. Sasi Kumar, Practical Physics, PHI (2014).
4. S. P. Singh, Advanced Practical Physics, Pragathi Prakasam (2017).
5. C. L Arora, Practical Physics, S. Chand & Co (2010).
6. Geeta Sanon, B.Sc Practical Physics, 1st Edition, Chand & Co., New Delhi (2007).
7. K. A. Navas, Electronics Lab Manual, Volume I, PHI, 5th Edition (2015).

Course Outcomes (COs)

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

CO Number	CO Statement
CO1	Perform experiments on material to identify the specific resistance of the material
CO2	Deal with earth's magnetic field using field along axis of current carrying coil
CO3	Learn the relation between low range and high range voltmeter using potentiometer
CO4	Acquire knowledge of resistance and specific resistance using Carey Foster Bridge
CO5	Analyse the emf produced in a materials using potentiometer
CO6	Comparing the capacitance using Ballistic Galvanometer

Mapping of Cos with POs

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3 point scale of STRONG (**S**), MEDIUM (**M**) and LOW (**L**).

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	S	S
CO2	S	S	S	S	S
CO3	M	S	S	S	S
CO4	S	S	S	S	S
CO5	S	M	S	S	S

Program:B.Sc.Physics				
Core Course–IV		**Course Code:** 23UPH4C04		**Course Title:** OPTICS AND SPECTROSCOPY
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
III	4	75	3	100

Course Objectives

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

UNIT – I: LENS AND PRISMS

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

Division of wave front, Fresnel's biprism – 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 D_1 and D_2 lines of sodium light, (iii) determination of a thickness of a mica sheet.

UNIT – III: DIFFRACTION

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

Optical activity – Optically active crystals –Polarizer and analyser–Double refraction – Optic axis, principal plane – Huygens's explanation of double refraction in uniaxial 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

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, II edition. 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, New Delhi.
6. V. Rajendran, 2012, Engineering Physics, Tata McGraw Hill.

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2. Sathyaprakash, 1990, Optics, VII edition, Ratan Prakashan Mandhir, New Delhi.
3. C.N. Banewell, 2006, Introduction to Molecular Spectroscopy, IV edition, TMH Publishing Co, New Delhi.
4. Ajoy Ghatak, 2009, Optics, 4th edition, PHI Pvt Ltd, New Delhi.
5. Singh & Agarwal,2002,Optics and Atomic Physics, 9thedition, Pragati Prakashan Meerut.
6. D. Halliday, R. Resnick and J. Walker, 2001, Fundamentals of Physics,6th edition, Willey, New York.
7. Jenkins A. Francis & White, 2011, Fundamentals of Optics, 4th edition, McGraw Hill Inc., New Delhi.

WEBLINKS

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2. https://www.youtube.com/watch?v=tL3rNc1G0qQ&list=RDCMUCzwo7UlGkb-8Pr6svxWo-LA&start_radio=1&t=2472
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4. https://www.youtube.com/watch?v=tL3rNc1G0qQ&list=RDCMUCzwo7UlGkb-8Pr6svxWo-LA&start_radio=1&t=2472
5. https://imagine.gsfc.nasa.gov/educators/gammarabursts/imagine/index.html
6. http://www.thephysicsmill.com/2014/03/23/sky-blue-lord-rayleigh-sir-raman-scattering/
7. http://www.thephysicsmill.com/2014/03/23/sky-blue-lord-rayleigh-sir-raman-scattering/

Program: B.Sc. Physics				
Core Course Practical –IV	**Course Code:** 23UPH4P04		**Course Title:** Core Course Practical–IV	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
IV	3	75	3	100

Course Objectives

Demonstrate various optical phenomena principles, working, apply with various materials and interpret the results.

LIST OF 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 Searlesgoniometer.
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.

BOOKS FOR STUDY AND REFERENCE:

1. S. Balasubramanian, R. Ranganathan, M.N. Srinivasan, A Text book of Physics Practical, 2nd Revised Edition, S. Chand & Sons (2017).
2. C. C. Ouseph, U.J. Rao, V. Vijayendiran, Practical Physics, 1st Edition, Viswanathan.S Printers and Publishers Private Ltd. (2015).
3. P. R. Sasi Kumar, Practical Physics, PHI (2014).
4. S. P. Singh, Advanced Practical Physics, Pragathi Prakasam (2017).
5. C. L Arora, Practical Physics, S. Chand & Co (2010).
6. Geeta Sanon, B.Sc Practical Physics, 1st Edition, Chand & Co., New Delhi (2007).
7. K. A. Navas, Electronics Lab Manual, Volume I, PHI, 5th Edition (2015).

Course Outcomes (COs)

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

CO Number	CO Statement
CO1	Perform experiments on prism using spectrometer
CO2	Deal with dispersive power of prism
CO3	Learn the resolving power of grating and power of telescope
CO4	Acquire knowledge of refractive index using lens
CO5	Analyse the resolving power of diffraction grating using Laser
CO6	Examine the wire using Laser

Mapping of Cos with POs

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3 point scale of STRONG (**S**), MEDIUM (**M**) and LOW (**L**).

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	S	S
CO2	S	S	S	S	S
CO3	M	S	S	S	S
CO4	S	S	S	S	S
CO5	S	M	S	S	S

Program:B.Sc.Physics				
Core Course–V		**Course Code:** 23UPH4P04		**Course Title:** ATOMIC PHYSICS AND LASERS
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
V	5	75	4	100

COURSE OBJECTIVES

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

UNIT – I: THE ELECTRON AND POSITIVE RAYS

E/m of electron by Dunnington'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: 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 photoelectric cells –Photomultiplier.

UNIT – III: ATOMIC STRUCTURE

Sommerfield'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 magneton - Stern and Gerlach experiment – Lande 'g' factor.

UNIT – IV: SPLITTING OF SPECTRAL LINES

Excitation, ionisation 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 D_1 and D_2lines of sodium – Paschen Back effect - Stark effect (Qualitative only).

UNIT- V: 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
5. Avadhahnulu, An Introduction to Lasers - Theory and Applications, M.N., S.Chand & Co., New Delhi, 2001.

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.

WEBLINKS

1. http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html
2. https://makingphysicsfun.files.wordpress.com/2015/01/photoelectric-effect.pptx
3. https://www.khanacademy.org/science/physics/quantum-physics/in-in-nuclei/v/types-of-decay
4. https://www.khanacademy.org/science/in-in-class-12th-physics-india/nuclei

Course Outcomes (COs)

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

COURSE OUTCOMES	**CO1**	Listthe properties of electrons and positive rays, define specific charge of positive rays, know different mass spectrographs.
	CO2	Outline photoelectric effect and the terms related to it, State laws of photoelectric emission, Explain experiments and applications of photo electric effect, Solve problems based on photoelectric equation.
	CO3	Explain different atom models, Describe different quantum numbers and different coupling schemes.
	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.
	CO5	Understand the condition for production of laser, Appreciate various properties and applications of lasers.

Mapping of Cos with POs

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3 point scale of STRONG (**S**), MEDIUM (**M**) and LOW (**L**).

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	S	S	M	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	M	S	S	S
CO4	M	S	S	S	S	M	S	M	M	M
CO5	S	M	S	S	M	S	S	M	M	S

Program:B.Sc.Physics				
Core Course –VI	**Course Code:** 23UPH4P04		**Course Title:** RELATIVITY AND QUANTUM MECHANICS	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
V	5	75	4	100

Course Objectives

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

UNIT – I: 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: 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: 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: 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: SOLVING SCHRODINGER EQUATION FOR SIMPLE PROBLEMS:

One-dimensional problems: (i) Particle in a box, (ii) Barrier penetration problem – Quantum mechanical tunnelling, (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., New Delhi, 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. **(**Quantum Mechanics, Gupta, Kumar and Sharma. Jai Prakash Nath & Co Meerut
7. 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. Physics of the Atom, Editor(s): M. R. Wehr, J. A. Richards, T. W. Adair, 4th Edition, Narosa, 2013.
7. Quantum Mechanics, V. Devanathan, Narosa Pub. House, Chennai, 2005.
8. Quantum Mechanics, V.K. Thangappan, New Age International, New Delhi.
9. A Text Book of Quantum Mechanics, Mathews &Venkatesan, Tata McGraw Hill, New Delhi.
10. Quantum Mechanics, Ghatak & Loganathan, Macmillan Publications.

WEBSITES

1. http://hyperphysics.phy-astr.gsu.edu/hbase/qapp.html
2. https://swayam.gov.in/nd2_arp19_ap83/preview
3. https://swayam.gov.in/nd1_noc20_ph05/preview
4. https://www.khanacademy.org/science/physics/special-relativity/minkowski-spacetime/v/introduction-to-special-relativity-and-minkowski-spacetime-diagrams

Course Outcomes (COs)

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

COURSE OUTCOMES	**CO1**	Understand various postulates of special theory of relativity.
	CO2	Appreciate the importance of transformation equations and also the general theory of relativity..
	CO3	Realise the wave nature of matter and understand its importance
	CO4	Derive Schrodinger equation and also realize the use of operators.
	CO5	Apply Schrödinger equation to simple problems.

Mapping of Cos with POs

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3 point scale of STRONG (**S**), MEDIUM (**M**) and LOW (**L**).

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	S	S	M	S	M	M	S	M	M	M
CO3	M	M	S	M	S	S	M	S	S	S
CO4	M	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	M	M	S	M	M	S

Program: B.Sc. Physics

Core Course – VII	Course Code: 23UPH4P04	Course Title: ELECTRICITY AND MAGNETISM		
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
V	5	75	3	100

Course Objectives

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

UNIT-I: 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: ELECTRICAL MEASUREMENTS AND THERMOELECTRICITY

Carey–Foster Bridge – Theory –Temperature coefficient of resistance –Potentiometer –Calibration of ammeter and high range voltmeter –Thermoelectricity – Laws of thermo e.m.f.–Measurement of thermo 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: 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: 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: 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)

WEBLINKS

1. https://www.askiitians.com/revision-notes/physics/current-electricity.html
2. https://www.askiitians.com/revision-notes/physics/electromagnetic-induction-and-alternating-current

Course Outcomes (COs)

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

CO Number	CO Statement
CO1	Define And Derive The Laws Of Electricity And Magnetism
CO2	Update The Knowledge Of Properties And Magnetism
CO3	Expertise The Skills To Manufacture Devices
CO4	Understand The Properties Of Electric And Magnetic Materials
CO5	Acquire Experimental Skills To Construct Technically Useful Devices.

Mapping of Cos with POs

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3 point scale of STRONG (**S**), MEDIUM (**M**) and LOW (**L**).

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	M	S	S	M	M	S
CO2	S	M	M	M	S	M	M	S	S	M
CO3	S	S	S	S	S	S	S	S	S	S

Program:B.Sc.Physics				
Core Course–V	**Course Code:** 23UPH4P05		**Course Title: Core Practical - V**	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
V	3	75	3	100

Course Objectives

Demonstrate various optical phenomena principles, working, apply with various materials and interpret the results.

LIST OF EXPERIMENTS

1. Diffraction grating Normal incidence.
2. Diffraction grating minimum deviation.
3. Diffraction at a wire.
4. Specific rotation of sugar solution.
5. Bi-prism – Determination of μ.
6. Thickness of a thin film of Bi-prism
7. Brewster's law – Polarization
8. Double refraction (μ_e and μ_o)
9. Y – by Corlus method.
10. Dispersive power of plane diffraction grating.
11. Diffraction a straight edge.
12. Kundt's tube – Velocity of sound, Adiabatic Young's modulus of the material of the rod.
13. Forbe's method – Thermal conductivity of a metal rod.
14. Spectrometer– Grating - Normal incidence - Wave length of Mercury spectral lines.
15. Spectrometer – Grating - Minimum deviation - Wave length of Mercury spectral lines.
16. Spectrometer – (i-d) curve.
17. Spectrometer – (i-i′) curve.
18. Spectrometer – Narrow angled prism.

19. Rydberg's constant
20. e/m Thomson method
21. h by photocell
22. Spectral response of photo conductor (LDR).
23. Potentiometer –Resistance and Specific resistance of the coil.
24. Potentiometer – E.M.F of a thermocouple.
25. Carey Foster's bridge - Temperature coefficient of resistance of the coil.
26. Deflection Magnetometer – Determination of Magnetic moment of a bar magnet and $B_H$using circular coil carrying current.
27. Vibration magnetometer - Determination of B_H using circular coil carrying current– Tan B position.
28. B.G – Figure of Merit – Charge Sensitivity

BOOKS FOR STUDY AND REFERENCE:

1. S. Balasubramanian, R. Ranganathan, M.N. Srinivasan, A Text book of Physics Practical, 2nd Revised Edition, S. Chand & Sons (2017).
2. C. C. Ouseph, U.J. Rao, V. Vijayendiran, Practical Physics, 1st Edition, Viswanathan.S Printers and Publishers Private Ltd. (2015).
3. P. R. Sasi Kumar, Practical Physics, PHI (2014).
4. S. P. Singh, Advanced Practical Physics, Pragathi Prakasam (2017).
5. C. L Arora, Practical Physics, S. Chand & Co (2010).
6. Geeta Sanon, B.Sc Practical Physics, 1st Edition, Chand & Co., New Delhi (2007).
7. K. A. Navas, Electronics Lab Manual, Volume I, PHI, 5th Edition (2015).

Course Outcomes (COs)

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

CO Number	CO Statement
CO1	Perform experiments on grating, prism and wire
CO2	Deal with thermal conductivity of metal rod using Forbes method
CO3	Learn the relation normal incidence and minimum deviation using grating
CO4	Acquire knowledge of i-d curve and i-i' curve using prism and spectrometer
CO5	Analyse the EMF of a thermocouple using potentiometer
CO6	Examine the magnetic moment of a bar magnet using deflection magnetometer

Mapping of Cos with POs

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3 point scale of STRONG (**S**), MEDIUM (**M**) and LOW (**L**).

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	S	S
CO2	S	S	S	S	S
CO3	M	S	S	S	S
CO4	S	S	S	S	S
CO5	S	M	S	S	S

Program: B.Sc. Physics				
Core Course–X	**Course Code:** 23UPH6C08		**Course Title:** NUCLEAR AND PARTICLE PHYSICS	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
VI	5	75	4	100

Course Objectives

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

UNIT – I: PROPERTIES OF NUCLEUS

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: RADIOACTIVITY

Radioactivity – Laws of radioactivity – Radioactive disintegration, decay constant, half-life, mean-life (only final formulae) **– U**nits of radioactivity–successive disintegration – Transient and secular equilibrium– Properties of alpha, beta and gamma rays – Geiger-Nuttal law –α-ray spectra – Gamow'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: PARTICLE DETECTORS AND ACCELERATORS

DETECTORS: Gas detectors –Ionization chamber – G-M counter – Scintillation counter – Photo multiplier tube (PMT) – Semiconductor detectors – Neutron detector.

ACCELERATORS: Linear accelerators – Cyclotron – Synchrotron – Betatron– Electron synchrotron – Proton synchrotron (Bevatron)

UNIT –IV: NUCLEAR REACTIONS

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: 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 McGraw Hill, 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. Quarks and Leptons, F. Halzen and A.D. Martin, Wiley India, New Delhi
8. Radiation detection and measurement, G.F. Knoll (John Wiley & Sons, 2000).
9. Theoretical Nuclear Physics, J.M. Blatt &V.F. Weisskopf (Dover Pub.Inc., 1991)
10. Physics and Engineering of Radiation Detection, Syed Naeem Ahmed (Academic Press, Elsevier, 2007).
11. Nuclear Physics, S. N. Ghoshal, S Chand & Co. Edition 2003
12. Elements of Nuclear Physics, M. L.Pandya & R. P. S. Yadav, KedarNath & Ram Nath

WEBLINKS

1. http://hyperphysics.phy-astr.gsu.edu/hbase/nuccon.html
2. https://www.kent.edu/physics/nuclear-physics-links
3. https://www2.lbl.gov/abc/links.html

Course Outcomes (COs)

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

COURSE OUTCOMES	**CO1**	Describe various models that explain about the nuclear structures
	CO2	Give reason for various kinds of radioactivity and also know laws governing them
	CO3	Know the principles and applications of various particle detectors and accelerators.
	CO4	Discuss the concepts used in nuclear reaction.
	CO5	Classify various elementary particles and study the effect of cosmic rays.

Mapping of Cos with POs

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3 point scale of STRONG (**S**), MEDIUM (**M**) and LOW (**L**).

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	S	S	M	S	S
CO2	S	S	M	S	M	M	S	M	M	M
CO3	M	M	S	M	S	M	M	S	S	S
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	M	M	S	M	M	S

Program: B.Sc. Physics

Core Course–XI	Course Code: 23UPH6C09	Course Title: SOLID STATE PHYSICS

Semester	Hours/Week	Total Hours	Credits	Total Marks
VI	5	75	3	100

COURSE OBJECTIVES

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

UNIT –I: 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: ELEMENTARY LATTICE DYNAMICS

Lattice vibrations and phonons: Linear monoatomic and diatomic chains. acoustical and optical phonons –qualitative description of the phonon spectrum in solids – Dulong and Petit's Law – Einstein and Debye theories of specific heat of solids – T^3 law (qualitative only)–Properties of metals – Classical free electron theory of metals (Drude-Lorentz) – Ohm's law – Electrical and thermal conductivities – Weidemann-Franz' law –Sommerfeld's quantum free electron theory (qualitative only) – Einstein's theory of specific heat capacity.

UNIT –III: MAGNETIC PROPERTIES OF SOLIDS

Permeability, susceptibility, relation between them – Classification of magnetic materials – Propertiesofdia, para,ferro, ferri and antiferro-magnetism–Langevin'stheory of diamagnetism – Langevin'stheory 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: 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 – Plasmon's,

UNIT –V: FERROELECTRIC & SUPERCONDUCTING 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.

Superconductivity: 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 McGraw Hill publishers (2014).
3. Solid State Physics , R L Singhal, Kedarnath Ram Nath& Co., Meerut (2003)
4. Elements of Solid State Physics, J.P. Srivastava, 2nd Edition, 2006, Prentice-Hall of India

5. Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill
6. Solid State Physics, N.W. Ashcroft and N.D. Mermin, 1976, Cengage Learning
7. Solid-state Physics, H. Ibach and H. Luth, 2009, Springer
8. Elementary Solid State Physics, 1/e M. Ali Omar, 1999, Pearson India
9. Solid State Physics, M.A. Wahab, 2011, Narosa Publishing House, ND

REFERENCES

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. Azaroff - Introduction to solids, TMH
5. S. O. Pillai - Solid State Physics, Narosa publication
6. A.J. Dekker - Solid State Physics, McMillan India Ltd.
7. Elements of Solid State Physics, J.P. Srivastava, 2nd Edition, 2006, Prentice-Hall of India

WEBLINKS

1. https://nptel.ac.in/courses/115105099/
2. https://nptel.ac.in/courses/115106061/

Course Outcomes (COs)

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

COURSE OUTCOMES	**CO1**	Classify the bonding & crystal structure also learns about the crystal structure analysis using X ray diffraction.
	CO2	Understand the lattice dynamics and thus learn the electrical and thermal properties of materials.
	CO3	Give reason for classifying magnetic material on the basis of their behaviour.
	CO4	Comprehend the dielectric behavior of materials.
	CO5	Appreciate the ferroelectric and super conducting properties of materials.

Mapping of Cos with POs

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3 point scale of STRONG (**S**), MEDIUM (**M**) and LOW (**L**).

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	S	S	M	S	S
CO2	M	S	M	S	M	M	S	M	M	M
CO3	S	M	S	M	S	M	M	S	S	S
CO4	S	S	S	S	M	S	S	M	M	M
CO5	S	M	M	S	S	M	S	M	M	S

Program:B.Sc.Physics				
Core Course - X	**Course Code:** 23UPH6C10		**Course Title:** DIGITAL ELECTRONICS AND MICROPROCESSOR 8085	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
VI	5	75	3	100

COURSE OBJECTIVES

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

UNIT-I:

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 (Karnaugh map: 2, 3, 4 variables).

UNIT-II:

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:

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:

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:

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.S Alivahana & S. Arivazhagan-Digital circuits and design
4. Microprocessor Architecture, Programming and Applications with the 8085 – Penram International Publishing, Mumbai.- Ramesh S. Gaonakar
5. Microcomputer Systems the 8086/8088 family – YU-Cheng Liu and Glen SA

REFERENCE BOOKS

1. Herbert Taub and Donald Schilling. “Digital Integrated Electronics” . McGraw Hill. 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
5. Microprocessors and Interfacing – Douglas V. Hall

6. Microprocessor and Digital Systems – Douglas V. Hall

WEBLINKS

1. https://youtu.be/-paFaxtTCkI
2. https://youtu.be/s1DSZEaCX_g

Course Outcomes (COs)

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

COURSE OUTCOMES	**CO1**	Classify the bonding & crystal structure also learn about the crystal structure analysis using X ray diffraction.
	CO2	Understand the lattice dynamics and thus learn the electrical and thermal properties of materials.
	CO3	Give reason for classifying magnetic material on the basis of their behaviour.
	CO4	Comprehend the dielectric behavior of materials.
	CO5	Appreciate the ferroelectric and super conducting properties of materials.

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CO1	S	M	S	S	S	S	S	M	S	S
CO2	M	S	M	S	M	M	S	M	M	M
CO3	S	M	S	M	S	M	M	S	S	S
CO4	S	S	S	S	M	S	S	M	M	M
CO5	S	M	M	S	S	M	S	M	M	S

Program:B.Sc.Physics				
Core–VI	**Course Code:** 23UPH6P06		**Course Title:** Core Practical - VI	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
VI	3	75	3	100

Course Objectives

Demonstrate various optical phenomena principles, working, apply with various materials and interpret the results.

LIST OF EXPERIMENTS

1. Zener diode – Voltage regulations
2. Bride rectifier using diodes
3. Clipping and clamping circuits using diodes.
4. Characteristics of a transistor –(CE mode)
5. Characteristics of a transistor –(CB mode).
6. RC coupled CE transistor amplifier - single stage.
7. Transistor Emitter follower.
8. Colpitt's oscillator -Transistor.
9. Hartley oscillator - Transistor.
10. Astable multivibrator - Transistor.
11. Bistable multivibrator - Transistor.
12. FET - Characteristics.
13. FET - Amplifier (common drain)
14. UJT -Characteristics
15. AC circuits with L,C,R -Series resonance.
16. AC circuits with L,C,R - Parallel resonance.
17. Operational amplifier - Inverting amplifier and summing.
18. Operational amplifier - Non-inverting amplifier and summing.
19. Operational amplifier – Differential amplifier

20. Operational amplifier - Differentiator & integrator.
21. Operational amplifier - D/A converter by binary resistor method.
22. 5V,IC Regulated power supply.
23. Construction of seven segment display.
24. Study of gate ICs – NOT,OR,AND, NOR,NAND, XOR, XNOR
25. Verification of De Morgan's theorem using ICs –NOT, OR,AND
26. NAND as universal building block.
27. NOR as universal building block.
28. Half adder / Half subtractor using basic logic gate ICs
29. Microprocessor 8085 – Addition (8 bit only)
30. Microprocessor 8085 – Subtraction (8 bit only)
31. Microprocessor 8085 – Multiplication (8 bit only)
32. Microprocessor 8085 – Division (8 bit only)
33. Microprocessor 8085 – Square (8 bit only)
34. Microprocessor 8085 – Square root (8 bit only)
35. Microprocessor 8085 – Largest/smallest of numbers (8 bit only)
36. Microprocessor 8085 –Ascending/descending order
37. Microprocessor 8085 – Fibonacci series

BOOKS FOR STUDY AND REFERENCE:

1. S. Balasubramanian, R. Ranganathan, M.N. Srinivasan, A Text book of Physics Practical, 2nd Revised Edition, S. Chand & Sons (2017).
2. C. C. Ouseph, U.J. Rao, V. Vijayendiran, Practical Physics, 1st Edition, Viswanathan.S Printers and Publishers Private Ltd. (2015).
3. P. R. Sasi Kumar, Practical Physics, PHI (2014).
4. S. P. Singh, Advanced Practical Physics, Pragathi Prakasam (2017).
5. C. L Arora, Practical Physics, S. Chand & Co (2010).
6. Geeta Sanon, B.Sc Practical Physics, 1st Edition, Chand & Co., New Delhi (2007).
7. K. A. Navas, Electronics Lab Manual, Volume I, PHI, 5th Edition (2015).

Course Outcomes (COs)

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

CO Number	CO Statement
CO1	Perform experiments Diodes, ICs, Resistors, FET, UJT and transistors
CO2	Deal with characteristics of FET and UJT
CO3	Learntherelationbetween inverting and non-inverting using Operational Amplifier
CO4	Acquire knowledge about logic gates using NOR, OR, AND, NAND gates
CO5	Analyse the Half adder and Half subtractor using logic gate ICs
CO6	Examine the performance of microprocessor 8085 by verifying addition, subtraction, multiplication, division, ascending and descending order

Mapping of Cos with POs

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3 point scale of STRONG (**S**), MEDIUM (**M**) and LOW (**L**).

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	S	S
CO2	S	S	S	S	S
CO3	M	S	S	S	S
CO4	S	S	S	S	S
CO5	S	M	S	S	S

DISCIPLINE SPECIFIC CORE ELECTIVES

DISCIPLINE SPECIFIC CORE ELECTIVES

STUDENTS CAN CHOOSE ANY OF THESES SUBJECTS IN SEM V AND VI

Program: B.Sc. Physics				
ELECTIVE	**Course Code:**		**Course Title:** Communication Physics	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
V & VI	5	75	3	100

Learning Objective:

To get a thorough knowledge on transmission and reception of radio waves, the different types of communication like fibre optic, radar, satellite, cellular.

UNIT-I: RADIO TRANSMISSION AND RECEPTION

Transmitter – Modulation types of modulation – Amplitude modulation – Limitations of amplitude modulation – Frequency modulation – Comparison of FM and AM – Demodulation- Essentials in demodulation – Receivers: AM radio receivers – Types of AM radio receivers – Stages of superheterodyne radio receiver, advantages – FM receiver – Difference between FM and AM receivers.

UNIT-II: FIBER OPTIC COMMUNICATION

Introduction – Basic principle of fiber optics – Advantages – Construction of optical fiber – Classification based on the refractive index profile – Classification based on the number of modes of propagation – Losses in optical fibers – Attenuation–Advantages of fiber optic communication

UNIT-III: RADAR COMMUNICATION

Introduction - Basic radar system –Radar range – Antenna scanning –Pulsed radar system – Search radar –Tracking radar – Moving target indicator Doppler effect-MTI principle – CW Doppler radar

UNIT-IV: SATELLITE COMMUNICATION

Introduction history of satellites – Satellite communication system – Satellite orbits – Basic components of satellite communication system – Commonly used frequency in satellite – Communication –Multiple access communication – Satellite communication in India

UNIT-V: MOBILE COMMUNICATION

Introduction – Concept of cell –Basic cellular mobile radio system – Cell phone – Facsimile – important features of fax machine – Application of facsimile – VSAT (very small aperture terminals) modem IPTV (internet protocol television) -Wi-Fi-4G (basic ideas)

TEXT BOOKS

1. V.K. Metha, Principles of Electronics, S. Chand & Co Ltd., 2013
2. Anokh Singh and Chopra A.K., Principles of communication Engineering, S.Chand & Co, 2013

REFERENCE BOOKS

1. J.S. Chitode, Digital Communications, 2020, Unicorn publications
2. Senior John. M, Optical Fiber Communications: Principles and Practice, 2009, Pearson Education.

Program: B.Sc. Physics				
ELECTIVE	**Course Code: 23UPH5E02**		**Course Title:** Energy Physics	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
V & VI	5	75	3	100

Learning Objective:

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

UNIT-I: INTRODUCTION TO ENERGY SOURCES

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

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

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

Introduction – Classification – Biomass conversion technologies –Photosynthesis – Fermentation -

biogas generation –Classification of biogas plants – Anaerobic digestion for biogas – Wood gasification – Advantages & disadvantages.

UNIT-V: ENERGY STORAGE

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, RakeshRajan, PHI Learning Pvt Ltd, 2011, 2nd Edn.

REFERENCE BOOKS

1. John Twidell & 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.

Program: B.Sc. Physics				
ELECTIVE	**Course Code:**		**Course Title:** Mathematical Physics	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
V & VI	5	75	3	100

Learning Objective:

To understand higher mathematical concepts which are applied to solve problems in Physics and similar situations.

UNIT-I: MATRICES

Types of matrices – Symmetric, Hermitian, unitary and orthogonal matrices– Characteristic equation of a matrix – Eigen values and Eigen vectors of a matrix – Cayley-Hamilton theorem – Inverse of matrix by Cayley-Hamilton theorem – Similarity transformations – Diagonalization of 2x2 real symmetric matrices.

UNIT-II: VECTOR CALCULUS

Vector differentiation – Directional derivatives –Definitions & Physical significance of gradient, divergence, curl – Laplace operators– Vector identities – Line, surface and volume integrals – Statement, proof and simple problems for Gauss's divergence theorem, Stoke's theorem, Green's theorem.

UNIT-III: ORTHOGONAL CURVILINEAR COORDINATES

Tangent basis vectors – Scale factors – Unit vectors in cylindrical and spherical coordinate systems –Gradient of a scalar –Divergence and curl of a vector – Laplacian in these coordinate systems.

UNIT-IV: FOURIER SERIES

Periodic functions – Dirichlet's conditions – General Fourier series – Even and odd functions and their Fourier expansions – Fourier cosine and sine – Half range series – Change of length of interval.

Fourier analysis of square wave, saw-tooth wave, half wave/full wave rectifier wave forms.

FOURIER TRANSFORMS: Fourier Integral theorem(Statement only)–Fourier, Fourier sine and Fourier cosine transforms,– Fourier transform of single pulse – Trigonometric, exponential and Gaussian functions – Inverse Fourier transform – Convolution theorem.

UNIT-V: APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS (PDE)

PDE for transverse vibrations in elastic strings (one dimensional wave equation) –One dimensional heat flow equation – Solutions to these PDE's by method of separation of variables – Problems based on boundary conditions and initial conditions.

TEXT BOOKS

1. Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India.
2. Mathematical Physics – P. K. Chattopadhyay, New Age International Publishers.
3. Mathematical Physics – B. D. Gupta.
4. Mathematical Physics – H. K. Das, S. Chand & Co, New Delhi.

REFERENCE BOOKS

1. Fourier Analysis by M.R. Spiegel, 2004, Tata McGraw-Hill.
2. Engineering Mathematics III- B, M. K. Venkataraman,
3. Applied Mathematics for Scientists and Engineers, Bruce R. Kusse & Erik A. Westwig, 2nd Ed, WILEY-VCH Verlag, 2006.
4. Vector space & Matrices – J. C. Jain, Narosa Publishing House Pvt. Ltd.

Program: B.Sc. Physics				
ELECTIVE	**Course Code:**		**Course Title:** Advanced Mathematical Physics	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
V & VI	5	75	3	100

Learning Objective

The fundamentals of matrices and vector calculus learnt in earlier course will enable students to learn advanced topics and theorems.

The special functions and applications of partial differential equations will be of use in research at a later stage.

UNIT-I: MATRICES

Introduction – Special types of matrices – Transpose – Conjugate– Conjugate transpose– Symmetric & anti symmetric – Hermitian and skew Hermitian – Orthogonal and unitary – Properties – Characteristic equation – Roots and characteristic vectors – Diagonalization– Cayley–Hamilton theorem –Simple problems

UNIT-II: VECTOR CALCULUS

∇-operator – Divergence – Second derivative of vector functions or fields –Laplacian operator – Curl of a vector – Line integral – Line Integral of a vector field around an infinitesimal rectangle – Curl of conservative field – Surface integral – Volume integral (without problem) – Gauss's divergence theorem and proof – Stroke's theorem and proof –Simple problems.

UNIT-III: SPECIAL FUNCTIONS

Definition –Beta function – Gamma function – Evaluation of Beta function – Other forms of Beta function – Evaluation of Gamma function – Other forms of Gamma function – Relation between Beta and Gamma functions – Simple problems.

UNIT-IV: FROBENIUS METHOD AND SPECIAL FUNCTIONS

Singular points of second order linear differential equations and importance –Singularities of Bessel's and Laguerre equations, Frobenius method and applications to differential equations: Legendre and Hermite differential equations – Legendre and Hermite polynomials – Rodrigues formula –Generating function – Orthogonality.

UNIT-V: PARTIAL DIFFERENTIAL EQUATIONS

Solutions to partial differential equations using separation of variables - Laplace's equation in problems of rectangular – Cylindrical and spherical symmetry – Conducting and dielectric sphere in an external uniform electric field – Wave equation and its solution for vibrational modes of a stretched string

TEXT BOOKS

1. Mathematical Physics, B.D. Gupta-Vikas Publishing House, 4 th Edition (2006)
2. Mathematical Physics, Satyaprakash (Sultan Chand)

REFERENCE BOOKS

1. Mathematical Methods or Physicists, G.B. Arfken, H.J. Weber, F.E. Harris (2013, 7th Edn., Elsevier)
2. Mathematical Physics–H. K. Dass, Dr. Rama Verma (S. Chand Publishing)
3. Advanced Engineering Mathematics, Erwin Kreyszig (Wiley India)
4. Mathematical Physics and Special Relativity, M. Das, P.K. Jena and B.K. Dash (Srikrishna Prakashan)

Program: B.Sc. Physics				
ELECTIVE	**Course Code:**		**Course Title:** NUMERICAL METHODS AND C- PROGRAMMING	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
V & VI	5	75	3	100

Learning Objective:

To understand the methods in numerical differentiation and integration and to develop the problem solving skills of the student.

To introduce and explain the basic structure, rules of compiling and execution of C programming.

UNIT-I: NUMERICAL SOLUTIONS

Determination of zeros of polynomials – Roots of linear and nonlinear algebraic and transcendental equations – Bisection and Newton-Raphson methods – Convergence and divergence of solutions.

UNIT-II: NUMERICAL DIFFERENTIATION, INTEGRATION AND CURVE FITTING

Newton's forward and backward interpolation – Lagrange's interpolation – Newton-Raphson method to find square root and cube roots – Principle of least squares – Fitting a straight line and exponential curve – Trapezoidal rule – Simpson's 1/3 and 1/8 rule

UNIT-III: ALGORITHM, FLOW CHART AND PROGRAM

Development of algorithm – Flow chart for solving simple problems– Average of set of numbers – Greatest, smallest – Conversion of Fahrenheit to Celsius and Celsius to Kelvin, miles to kilometer – Sorting set of numbers in ascending and descending order – Square matrix, addition, subtraction and multiplication of order (2x2) using arrays.

UNIT-IV: INTRODUCTION TO C

Importance of C – Basic structure of C programming – Constants, variables and data types – Character set, key words and identifiers – Declaration of variables and data types – Operators – Expressions: arithmetic, relational, logical, assignment – Increment and decrement – Conditional – Comma operators

UNIT-V: CONTROL STRUCTURE

Decision making with if, if-else, nested if – Switch –Go to – Break – Continue –While, do while, for statements – Arrays, one dimensional and two dimensional – Declaring arrays – Storing arrays in memory –Initializing arrays – Simple programs

TEXT BOOKS

1. Numerical methods, Singaravelu, Meenakshi Publication, 4thEdn., 1999.
2. Numerical methods, P. Kandasamy, K. Thilagavathy, K. Gunavathi, S.Chand, 2016
3. Programming in C, Balagurusamy, TMG, ND, 2012
4. Numerical Analysis, M.K. Venkatraman, NPH, 2013
5. Numerical Analysis, B.D. Gupta, Konark Publishers, New Delhi, 2013

REFERENCE BOOKS

1. Schaum's outline series, Theory and Problems of programming in C, C.Byron& S. Gottfried, Tata McGraw Hill 2003
2. Numerical methods and C Programming, Veerarajan, (2015).

Program: B.Sc. Physics				
ELECTIVE	**Course Code:**		**Course Title:** MATERIALS SCIENCE	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
V & VI	5	75	3	100

Learning Objective

To learn imperfections in 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.

UNIT-I: 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: 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 viscoelastic behavior of materials.

UNIT-III: PERMANENT DEFORMATION AND STRENGTHENING METHODS 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: 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: 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 publications2011

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. Askeland, Pradeep P. Phule, "The Science and Engineering of Materials", 5th Edition, Thomson Learning, First Indian Reprint, 2007.
4. William F. Smith, "Structure and Properties of Engineering Alloys", Mc-Graw-Hill Inc., U.S.A, 2nd edition, 1993.

Program: B.Sc. Physics				
ELECTIVE	Course Code:		Course Title: LASERS AND FIBER OPTICS	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
V & VI	5	75	3	100

Learning Objective:

The students will learn the fundamentals, types of lasers, laser instrumentation and their applications also the interconnect between optics with lasers.

UNIT-I: FUNDAMENTALS OF LASER

Basic principles: Spontaneous and stimulated emission – Einstein's coefficient – Pumping mechanism: optical, electrical and laser pumping – Population inversion – Two and three level laser system – Resonator configuration – Quality factor – Threshold condition – Concept of Q switching– Theory of mode locking– Cavity dumping.

UNIT-II: TYPES OF LASER

Solid state laser: Ruby laser, Nd: YAG laser, Nd: Glass laser– Semiconductor laser: Intrinsic semiconductor laser, doped semiconductorlaser, injection laser – Dye laser – Chemical laser: HCL laser, DF- CO_2, CO chemical laser. Gas laser: neutral atom gas laser (He-Ne laser), CO_2laser, Copper vapour laser.

UNIT-III: APPLICATIONS OF LASER

Application of laser in metrology – Optical communication – Material processing: Laser instrumentation of material processing, powder feeder, laser heating, laser welding, laser melting – Medical application – Laser instrumentation for surgeries–Laser in astronomy.

UNIT-IV: FIBEROPTICS

Basic components of optical fiber communication – Principles of light propagation through fiber –

Total internal reflection – Optical fiber – Coherent bundle – Numerical aperture and skew mode – Phase shift and attenuation during total internal reflection – Types of fiber: single mode and multi-mode fiber – Step index and graded index fiber – Fiber optic sensors – application of fiber optics.

UNIT-V: CHARACTERISTICS AND FABRICATION OF OPTICAL FIBER

Fiber characteristics: Mechanical and transmission characteristics – Absorption loss and scattering loss measurements – Dispersion – Connectors and splicers – Fiber termination – Optical Time Domain Reflectometer (OTDR) and its uses – Fiber material – Fiber fabrication – Fiber optic cables design.

TEXT BOOKS

1. B.B. Laud - Laser and Non-linear Optics, New Age International Publications Third Edition, New Delhi.
2. An Introduction to laser, theory and applications by Avadhunulu, M.N.S., Chand & Co, New Delhi.
3. J. Wilson and J.F.B. Hawkes. 'Introduction to Opto-Electronics', Pearson Education, 2018.

REFERENCE BOOKS

1. A. Sennaroglu,"Photonics and Laser Engineering: Principles, Devices and Applications" McGraw-Hill Education, 2010.
2. K.R. Nambiar, "Lasers: Principles, Types and Applications", New Age International, 2004.
3. Optic, Ajoy Ghatak, McGraw-Hill Education (India) Pvt, Ltd, 6th Edn., 2017.

Program: B.Sc. Physics				
ELECTIVE	**Course Code:**		**Course Title:** DIGITAL PHOTOGRAPHY	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
V & VI	5	75	3	100

Learning Objective:

To understand the principles of photography and image formation and the science and arts behind it.

To understand the essential components of conventional and digital cameras and also the different image processing techniques.

UNIT-I: PHOTOGRAPHY AND BASIC PRINCIPLE OF IMAGE FORMATION

Principle –Chemical route and digital route –Light, wavelengths, colours – Shadows – Light intensity and distance – Making light form images –Pin-hole images – Practical limitations to pin-hole images – Lens instead of pin-hole – Focal length and image size – Imaging of closer subjects.

UNIT-II: LENSES – CONTROLLING THE IMAGES

Photographic lens – Focal length and angle of view **(**problems**)** – Focusing movement – Aperture and f-numbers **(**problems**)** – Depth of field– Depth of focus – Image stabilization – Lenses for digital cameras – Lens and camera care

UNIT-III: CAMERA USING FILMS AND ITS TYPES

Camera and its essential components– Shutter – Aperture – Light measurement – Film housing – Camera types: view camera– View finder camera – Reflex camera– Single lens reflex (SLR) camera

UNIT-IV: DIGITAL CAMERAS PRINCIPLE AND TYPES

Principle of digital image capturing –Comparison of digital and analog picture information –

Megapixel – Grain, noise and pixel density – Optical and digital zooming – Image stabilizer – Bit depth – White balance – Colour modes – File formats (TIFF, RAW & JPEG) – Storage cards and types – Digital cameras: camera phones – Compact camera – Hybrid camera – Digital SLR.

UNIT-V: THE DIGITAL IMAGE – POST PRODUCTION

Hardware: computer and its peripherals – Software: saving digital file – Basic editing: navigating the image – Undo/redo/history – Crop – Rotate – Brightness & contrast – Colour balance – Hue/saturation – Dodge/burn – Cloning & retouching – Removing an element in an image – Advanced editing: Histogram/levels – Curves – Selection tools: magic wand – Printing digital images: Inkjet printer – Laser printer – Dye sub printer – Lambda/light jet printers.

TEXT BOOKS

1. Michel J. Langford , Anna Fox & Richard Sawdon Smith, Basic photography, 9th Edition, , 2010-NL, Focal press, London
2. Henry Carroll, Read this if you want to take great photographs of people, Laurence King Publishing.

REFERENCE BOOKS

1. Mark Galer, Digital Photography in Available Light essential skills, 2006, Focal press, London
2. Paul Harcourt Davies, The Photographer's Practical Handbook, 2005, UK PRESS

Program: B.Sc. Physics				
ELECTIVE	**Course Code:**		**Course Title:** NANOSCIENCE & NANO TECHNOLOGY	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
V & VI	5	75	3	100

Learning Objective:

This course aims to provide an overall understanding of Nanoscience and Nanotechnology and introduces different types of nanomaterials, their properties, fabrication methods, characterization techniques and a range of applications.

UNIT-I: NANOSCIENCE AND NANOTECHNOLOGY

Nanoscale–Nature and nanostructures – Nanostructures: 0D, 1D, 2D– Surface to volume ratio– Size effect – Excitons – Quantum confinement– Metal based nanoparticles (metal and metal oxide) – Nanocomposites (non-polymer based) – Carbon nanostructures – Fullerene –SWCNT and MWCNT

UNIT-II: PROPERTIES OF NANOMATERIALS

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: 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: 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: APPLICATIONS OF NANOMATERIALS

Medicine: drug delivery – Photodynamic therapy – Molecular motors –Energy: fuel cells – Rechargeable batteries – Super capacitors– Photovoltaic's, Sensors: Nanosensors based on optical and physical properties – Electrochemical sensors – Nano-biosensors. Nano-electronics: CNTFET – display screens – GMR read/write heads – Nanorobots –Applications of CNTs

TEXT BOOKS

1. K.K. Chattopadhyay and A.N. Banerjee, (2012), Introduction to Nanoscience and Nanotechnology, PHI Learning Pvt. Ltd.,
2. M.A. Shah, Tokeer Ahmad (2010), Principles of Nanoscience and Nanotechnology, Narosa Publishing House Pvt Ltd.
3. Mick Wilson, et al (2005) Nanotechnology, Overseas Press.

REFERENCE BOOKS

1. Richard Booker and Earl Boysen, (2005) Nanotechnology, Wiley Publishing Inc. USA
2. J.H. Fendler (2007) Nanoparticles and nano-structured films; Preparation, Characterization and Applications, John Wiley & Sons
3. B.S. Murty, et al (2012) Textbook of Nanoscience and Nanotechnology, Universities Press.

Program: B.Sc. Physics				
ELECTIVE	Course Code:		Course Title: MEDICAL INSTRUMENTATION	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
V & VI	5	75	3	100

Learning Objective:

This course aims to provide background of the Physics principles in medical instrumentation technologies through theoretical & practical learning.

UNIT-I: BIOMETRICS

Introduction to man-instrument system and its components –Problems encountered in measuring living systems – Transducers– Force, motion, pressure transducers.

AUDIOMETRY: Mechanism of hearing – Air and bone conduction – Threshold of hearing – Audiometer – Masking in audiometry – Pure tone and speech audiometer – Evoked response audiometry – Hearing aids

UNIT-II: BIOELECTRIC POTENTIALS AND ELECTRODES

Biomedical signals – Sources of bioelectric potentials – Resting, action and propagation of bioelectric potentials –Bio-potential electrodes – Skin surface, needle electrodes.

BIOMEDICAL RECORDERS: Electro-conduction system of heart – Electro cardiogram (ECG) – Einthoven's triangle — Electro encephalogram (EEG) –Brain waves – EEG instrumentation – Recording of evoked potentials – Electro-myogram (EMG)–Pulse oximeter.

UNIT-III: DIAGNOSTIC RADIOLOGY

Radiography – Primary radiological image – Contrast agents, filters– Beam restrictor, grid –Image quality

COMPUTED TOMOGRAPHY: Linear tomography – Computed tomography – Helical and multi slice –Image quality– Radiation dose.

RADIOISOTOPES AND NUCLEAR MEDICINE: Radioisotopes – Radiopharmaceuticals – Technetium generator – Gamma camera – Positron emission tomography – Disposal of radioactive waste.

UNIT-IV: ULTRASOUND IMAGING

Ultrasound transducer – Ultrasound imaging– Doppler ultrasound – Ultrasound image quality & bio-effects.

MAGNETIC RESONANCE IMAGING: Proton& external magnetic field – Precession – Radiofrequency and resonance – MRI signal – Relaxation time – MRI instrumentation – Imaging sequences – Bio-safety.

UNIT-V: PROJECT ASSIGNMENT

Clinical practice of one of the following: Electro cardiogram– Electro encephalogram, – Electro myogram– Electro oculogram– Computed tomography– Positron emission tomography– Ultrasound

TEXT BOOKS

1. Leslie Cromwell, Fred Weibell, Erich Pfieffer (2002) Biomedical Instrumentation & Measurements Prentice Hall of India, New Delhi.
2. R. S. Khandpur (2003)Handbook of Biomedical Instrumentation 2nd Edn. Tata McGraw Hill, New Delhi.
3. KuppusamyThayalan (2017), Basic Radiological Physics 2nd Edn. Jaypee Brothers Medical Publishers (P) Ltd, New Delhi.

REFERENCE BOOKS

1. John Webster (2004) Bioinstrumentation John Wiley and Sons, Singapore.
2. John Enderle, Susan Blanchard, Joseph Bronzino (2005) Introduction to Biomedical Engineering, 2nd ed. Elsevier, San Deigo

NON - MAJOR ELECTIVE

NON MAJOR ELECTIVES (NME)

Program: B.Sc. Physics				
NON MAJOR ELECTIVES (NME)	**Course Code:**		**Course Title:** PHYSICS FOR EVERYDAY LIFE	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
	3	75	3	100

Learning Objective: To know where all physics principles have been put to use in daily life and appreciate the concepts with a better understanding also to know about Indian scientists who have made significant contributions to Physics.

UNIT-I: MECHANICAL OBJECTS

Spring scales – Bouncing balls –Roller coasters – Bicycles –Rockets and space travel.

UNIT-II: OPTICAL INSTRUMENTS AND LASER

Vision corrective lenses – Polaroid glasses – UV protective glass – Polaroid camera – Colour photography – Holography and laser.

UNIT-III: PHYSICS OF HOME APPLIANCES

Bulb – Fan – Hair drier – Television – Air conditioners – Microwave ovens – Vacuum cleaners

UNIT-IV: SOLAR ENERGY

Solar constant – General applications of solar energy – Solar water heaters – Solar Photo – Voltaic cells – General applications of solar cells.

UNIT-V: 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, 2011.

Program: B.Sc. Physics				
NON MAJOR ELECTIVES (NME)	**Course Code:**		**Course Title:** ASTROPHYSICS	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
	2	75	2	100

Learning Objective:

This course intends to introduce principles of astrophysics describing the science of formation and evolution of stars and interpretation of various heavenly phenomena and provide an understanding of the physical nature of celestial bodies along with the instrumentation and techniques used in astronomical research

UNIT-I: **TELESCOPES**

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:**

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**

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

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:

(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 Observatories

Any 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 Age International (P) Ltd, New Delhi.
3. Shylaja, B.S. & Madhusudan, H.R.,(1999), Eclipse: A Celestial Shadow Play, Orient Black Swan,

Program: B.Sc. Physics				
NON MAJOR ELECTIVES (NME)	**Course Code:**		**Course Title:** PHYSICS OF MEDICAL INSTRUMENTS	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
	2	75	2	100

Learning Objective:

The students will be exposed to instruments like ECG, EEG, EMG, medical imaging, diagnostic specialties, operation theater and its safety which will kindle interest to specialize in instrument servicing.

UNIT-I: **BIO-POTENTIALS AND ELECTRODES**

Transport of ions through cell membrane- Resting and action potential - Characteristics of resting potential – Bio-electric potential – Design of medical instruments – Components of bio-medical instrumentation – Electrodes – Electrode potential – Metal microelectrode – Depth and needle electrodes – Types of surface electrode – The pH electrode.

UNIT-II: **BIO-POTENTIAL BASED INSTRUMENTATION**

Electrocardiography (ECG) – Origin of cardiac action potential - ECG lead configuration –Block diagram of ECG recording set up (qualitative) – Electroencephalography (EEG) – Origin of EEG – action and evoked potentials - Brain waves – Block diagram of modern EEG set up – Electromyography (EMG) – Block diagram of EMG recording setup.

UNIT-III: **OPERATION THEATRE AND SAFETY**

Diathermy – Block diagram of the electrosurgical diathermy– Shortwave, microwave, ultrasonic diathermy – Ventilators – Servo controlled systems

RADIATION SAFETY: Units of radiation - Pocket dosimeter – Pocket type radiation alarm – Thermo-Luminescence dosimeter.

UNIT-IV: MEDICAL IMAGING

Nuclear imaging technique –Computer tomography (CT) – Principle – Mathematical basis of image construction –Block diagram of CT scanner – Ultrasonic imaging systems – Construction of transducer – Display modes – MRI principle and instrumentation.

UNIT-V: DIAGNOSTICS AND SPECIALITIES

X-rays in radiography – Fluoroscopy – Comparison– Image intensifiers – Angiography – Applications of X-ray examination (problems).

LASER IN MEDICINE: Laser interactions with bio molecules – Advantages of laser surgery – Endoscopy – Types of endoscopes with their operation (qualitative).

TEXT BOOKS

1. Biomedical Instrumentation and measurement, Leslie Cromwell, PHI, 2015
2. Medical Instrumentation, M. Arumugam, Anuradha agencies, 1992
3. Medical Electronics, M.J. Kumar Doss, Prathibha Publishers, 1987
4. Medical Physics, John R. Cameron and James G. Skofronick, Thrift books, Atlanta, 1985
5. Electronic Instruments and Instrumentation Technology, M. M.M. Anand, PHI, 2015

Program: B.Sc. Physics				
NON MAJOR ELECTIVES (NME)	**Course Code:**		**Course Title:** HOME ELECTRICAL INSTALLATION	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
	2	75	2	100

Learning Objective:

The students will get knowledge on electrical instruments, installations and domestic wiring techniques with safety precautions and servicing.

UNIT-I: SIMPLE ELECTRICAL CIRCUITS

Charge, current, potential difference, resistance – Simple electrical circuits – DC ammeter, voltmeter, ohmmeter – Ohm's law – difference between DC and AC – Advantages of AC over DC – electromagnetic induction - Transformers – Inductors/chokes – Capacitors/condensers – Impedance – AC ammeter, voltmeter –Symbols and nomenclature

UNIT-II: TRANSMISSION OF ELECTRICITY

Production and transmission of electricity – Concept of power grid – Series and parallel connections – Technicalities of junctions and loops in circuits –Transmission losses (qualitative) – Roles of step-up and step-down transformers – Quality of connecting wires – Characteristics of single and multicore wires.

UNIT-III: ELECTRICAL WIRING

Different types of switches – Installation of two way switch – Role of sockets, plugs, sockets - Installation of meters – Basic switch board – Electrical bell – Indicator – Fixing of tube lights and fans – Heavy equipment like AC, fridge, washing machine, oven, geyser, jet pumps –Provisions for inverter – Gauge specifications of wires for various needs

UNIT-IV: POWER RATING AND POWER DELIVERED

Conversion of electrical energy in to different forms – Work done by electrical energy – Power rating of electrical appliances – Energy consumption – Electrical energy unit in kWh – Calculation of EB bill – Joule's heating – Useful energy and energy loss – Single and three phase connections – Measures to save electrical energy – Energy audit

UNIT-V: SAFETY MEASURES

Insulation for wires – Colour specification for mains, return and earth – Understanding of fuse and circuit breakers – Types of fuse: kit-kat, HRC, cartridge, MCB, ELCB – Purpose of earth line – Lighting arrestors – Short circuiting and over loading – Electrical safety – Tips to avoid electrical shock – First aid for electrical shock – Fire safety for electric current

TEXT BOOKS

1. Wiring a House: 5th Edition by Rex Cauldwell, (2014).
2. Black & Decker Advanced Home Wiring, 5th Edition: Backup Power - Panel Upgrades - AFCI Protection - "Smart" Thermostats, by Editors of Cool Springs Press, (2018).
3. Complete Beginners Guide to Rough in Electrical Wiring: by Kevin Ryan (2022).

Program: B.Sc. Physics				
NON MAJOR ELECTIVES (NME)	**Course Code:**		**Course Title:** PHYSICS OF MUSIC	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
	2	75	2	100

Learning Objective:

To apprise and train students on the role of Physics in music and get the knowledge on the musical notes and instruments.

UNIT-I: SCIENTIFIC STUDY OF MUSIC

Vibrations of atoms of matter– Vibrations coupling to air – Propagation of sound waves in air, other media, fluids & solids – Velocity, frequency, wavelength, time period, intensity: definition and unit fs – Classification of sound on frequency and velocity– Human & animal sound perception– Mechanism of ear and hearing – Psychoacoustics

UNIT-II: SIMPLE VIBRATING SYSTEMS

Simple harmonic motion – Tuning fork– Amplitude, phase, energy, energy loss/damping/ dissipation – Power – Travelling waves and standing waves– Laws of vibration in stretched strings– One-dimensional medium – Open and closed organ pipes – Over tones, harmonics – Quality of sound: pitch, timber, loudness – Octaves, musical notes

UNIT-III: MUSICAL TONE

Pure/simple tones – Sine/cosine waves– Well-defined frequencies, wavelengths, amplitudes & phases– Partial tones – Assembly of pure tones– Mix of different frequencies & amplitudes– complex tone – Superposition of simple tones – Complex waveform– Periodic complex waveform – Formants – Resonances– Sound envelope

UNIT-IV: PRODUCTION OF MUSICAL SOUNDS:

Human voice, mechanism of vocal sound production – larynx (sound box) – Stringed Instruments: plucked & bowed, guitar, mandolin, violin, piano, etc. – Wind instruments: whistles, flute, saxophone, pipe organ, bag pipes, etc – Percussion instruments: plates, membranes, drums, cymbals, xylophone etc. – Electronic instruments: keyboards, electric guitars, rhythm pads, etc. – Analog and digital sound synthesizers,–MIDI instrument– Computer generated music.

UNIT-V: RECORDING OF MUSIC & SOUND

Edison phonograph – Cylinder & disk records – Magnetic wire and tape recorders – Digital recording (e.g. to CD, DVD, etc.)– Analog transducers, condenser, dynamic microphones, loudspeaker – Complex sound fields – Near & far fields of acoustic– Spectral analysis techniques – Continuous & discrete Fourier transforms, digital signal processing – Digital filtering – Specifications of recording studios

TEXT BOOKS

1. Physics and Music: The Science of Musical Sound by Harvey White (2014)
2. Good Vibrations – The Physics of Music by Barry Parker, (2009)
3. The History of Musical Instruments by Curt Sachs, (2006)
4. Physics and Music: Essential Connections and Illuminating Excursions by Kinko Tsuji and Stefan C. Muller (2021)

ALLIED PHYSICS

(THEORY AND PRACTICALS)

Program: B.Sc. Mathematics				
Allied	Course Code: 23UPH1AP01		Course Title: ALLIED PHYSICS - I	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	4	75	3	100

Course Objectives

To impart basic principles of Physics that which would be helpful for students who have taken programmes other than Physics.

UNIT-I: WAVES, OSCILLATIONS AND ULTRASONICS

Simple harmonic motion (SHM) – Composition of two SHMs at right angles (periods in the ratio 1:1) – Lissajous figures – Uses – Laws of transverse vibrations of strings – Determination of AC frequency using sonometer (steel and brass wires) – Ultrasound – Production – Piezoelectric method – Application of ultrasonics: medical field – Lithotripsy, ultrasonography – Ultrasonoimaging- Ultrasonics in dentistry – Physiotheraphy, opthalmology – Advantages of noninvasive surgery – Ultrasonics in green chemistry.

UNIT-II: PROPERTIES OF MATTER

Elasticity: Elastic constants – Bending of beam – Theory of non- uniform bending – Determination of Young's modulus by non-uniform bending – Energy stored in a stretched wire – Torsion of a wire – Determination of rigidity modulus by torsional pendulum

Viscosity: Streamline and turbulent motion – Critical velocity – Coefficient of viscosity – Poiseuille's formula – Comparison of viscosities – Burette method,

Surface tension: definition – Molecular theory – Droplets formation–Shape, size and life time – COVID transmission through droplets, saliva – Drop weight method – Interfacial surface tension.

UNIT-III: HEAT AND THERMODYNAMICS

Joule-Kelvin effect – Joule-Thomson porous plug experiment – Theory – Temperature of inversion – Liquefaction of Oxygen– Linde's process of liquefaction of air– Liquid Oxygen for medical purpose–

Importance of cryocoolers – Thermodynamic system – Thermodynamic equilibrium – Laws of thermodynamics – Heat engine – Carnot's cycle – Efficiency – Entropy – Change of entropy in reversible and irreversible process.

UNIT-IV: ELECTRICITY AND MAGNETISM

Potentiometer – Principle – Measurement of thermo emf using potentiometer –Magnetic field due to a current carrying conductor – Biot-Savart's law – Field along the axis of the coil carrying current – Peak, average and RMS values of ac current and voltage – Power factor and current values in an AC circuit – Types of switches in household and factories– Smart wifi switches- Fuses and circuit breakers in houses.

UNIT-V: DIGITAL ELECTRONICS AND DIGITAL INDIA:

Logic gates, OR, AND, NOT, NAND, NOR , EXOR logic gates – Universal building blocks – Boolean algebra – De Morgan's theorem – Verification – Overview of Government initiatives: software technological parks under MeitY, NIELIT- Semiconductor laboratories under Dept. of Space – An introduction to Digital India

TEXT BOOKS

1. R. Murugesan (2001), Allied Physics, S. Chand & Co, New Delhi.
2. Brijlal and N. Subramanyam (1994), Waves and Oscillations, Vikas Publishing House, New Delhi.
3. Brijlal and N. Subramaniam (1994), Properties of Matter, S.Chand & Co., New Delhi.
4. J.B. Rajam and C.L. Arora (1976). Heat and Thermodynamics (8th edition), S. Chand & Co., New Delhi.
5. R. Murugesan (2005), Optics and Spectroscopy, S.Chand & Co, New Delhi.
6. A. Subramaniyam, Applied Electronics 2nd Edn., National Publishing Co.,Chennai.

REFERENCE BOOKS

1. Resnick Halliday and Walker (2018). Fundamentals of Physics (11th edition), John Willey and Sons, Asia Pvt.Ltd., Singapore.
2. V.R. Khanna and R.S. Bedi (1998), Text book of Sound 1st Edn. Kedharnaath Publish & Co, Meerut.
3. N.S. Khare and S.S. Srivastava (1983), Electricity and Magnetism 10th Edn., AtmaRam & Sons, New Delhi.
4. D.R. Khannaand H.R. Gulati (1979). Optics, S. Chand &Co. Ltd., New Delhi.
5. V.K. Metha (2004).Principles of electronics 6th Edn. S. Chand and company.

WEBLINKS

1. https://youtu.be/M_5KYncYNyc
2. https://youtu.be/ljJLJgIvaHY
3. https://youtu.be/7mGqd9HQ_AU
4. https://youtu.be/h5jOAw57OXM
5. https://learningtechnologyofficial.com/category/fluid-mechanics-lab/
6. http://hyperphysics.phy-astr.gsu.edu/hbase/permot2.html
7. https://www.youtube.com/watch?v=gT8Nth9NWPM
8. https://www.youtube.com/watch?v=9mXOMzUruMQ&t=1s
9. https://www.youtube.com/watch?v=m4u-SuaSu1s&t=3s
10. https://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work

Course Outcomes (COs)

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

COURSE OUTCOMES	**CO1**	Explain types of motion and extend their knowledge in the study of various dynamic motions analyze and demonstrate mathematically. Relate theory with practical applications in medical field.
	CO2	Explain their knowledge of understanding about materials and their behaviors and apply it to various situations in laboratory and real life. Connect droplet theory with Corona transmission.
	CO3	Comprehend basic concept of thermodynamics concept of entropyand associated theorems able to interpret the process of flow temperature physics in the background of growth of this technology.
	CO4	Articulate the knowledge about electric current resistance, capacitance in terms of potential electric field and electric correlate the connection between electric field and magnetic field and analyze them mathematically verify circuits and apply the concepts to construct circuits and study them.
	CO5	Interpret the real life solutions using AND, OR, NOT basic logic gates and intend their ideas to universal building blocks. Infer operations using Boolean algebra and acquire elementary ideas of IC circuits. Acquire information about various Govt. programs/ institutions in this field.

Mapping of Cos with POs

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3 point scale of STRONG (**S**), MEDIUM (**M**) and LOW (**L**).

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

Program: B.Sc. Physics				
Allied Physics Practical -I	**Course Code: 23UPH1AP01**		**CourseTitle:** **ALLIED PHYSICS PRACTICALS – I**	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
	3	75	2	100

COURSE OBJECTIVES

Apply various physics concepts to understand Properties of Matter and waves, set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results

LIST OF EXPERIMENTS

ANY Seven only

1. Young's modulus by non-uniform bending using pin and microscope
2. Young's modulus by non-uniform bending using optic lever, scale and telescope
3. Rigidity modulus by static torsion method.
4. Rigidity modulus by torsional oscillations without mass
2. Surface tension and interfacial Surface tension – drop weight method
3. Comparison of viscosities of two liquids – Burette method
4. Specific heat capacity of a liquid – Half time correction
5. Verification of laws of transverse vibrations using sonometer
6. Calibration of low range voltmeter using potentiometer
7. Determination of thermo emf using potentiometer
8. Verification of truth tables of basic logic gates using ICs
9. Verification of De Morgan's theorems using logic gate ICs.
10. Use of NAND as universal building block.

Note : Use of digital balance permitted

BOOKS FOR STUDY AND REFERENCE:

1. S. Balasubramanian, R. Ranganathan, M.N. Srinivasan, A Text book of Physics Practical, 2nd Revised Edition, S. Chand & Sons (2017).
2. C.C. Ouseph, U.J. Rao, V. Vijayendiran, Practical Physics, 1st Edition, Viswanathan. S Printers and Publishers Private Ltd. (2015).
3. P.R. SasiKumar, Practical Physics, PHI (2014).
4. S.P. Singh, Advanced Practical Physics, Pragathi Prakasam (2017).
5. C.L Arora, Practical Physics, S. Chand & Co(2010).
6. GeetaSanon, B.Sc Practical Physics,1st Edition, Chand &Co., New Delhi (2007).
7. K.A. Navas, Electronics Lab Manual, Volume-I, PHI, 5th Edition (2015).

Course Outcomes (COs)

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

CO Number	CO Statement
CO1	Perform experiments on material to identify the strength the given objects
CO2	Deal with liquids based on their Surface tension
CO3	Learn the relation between frequency, length and tension of a stretched string under vibration
CO4	Analyse the input and output characteristics of various electronic Devices
CO5	Examine the performance of logic gates using IC's and discrete Components and to measure the output

Mapping of Cos with POs

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3 point scale of STRONG (**S**), MEDIUM (**M**) and LOW (**L**).

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	M	S	S
CO2	M	M	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

Program: B.Sc. Physics				
Allied Physics - II	Course Code: 23UPH2A02		CourseTitle: ALLIED PHYSICS – II	
Semester	Hours/Week	Total Hours	Credits	Total Marks
	4	75	3	100

COURSE OBJECTIVES

To understand the basic concepts of optics, modern Physics, concepts of relativity and quantum physics, semiconductor physics, and electronics.

UNIT-I: OPTICS

Interference – Interference in thin films –Colors of thin films – Air wedge – Determination of diameter of a thin wire by air wedge – Diffraction – Diffraction of light vs sound – Normal incidence – Experimental determination of wavelength using diffraction grating (no theory) – Polarization – Polarization by double reflection – Brewster's law – Optical activity – Application in sugar industries

UNIT-II: ATOMIC PHYSICS

Atom models – Bohr atom model – Mass number – Atomic number – Nucleons – Vector atom model – Various quantum numbers – Pauli's exclusion principle – Electronic configuration – Periodic classification of elements – Bohr magneton – Stark effect –Zeeman effect (elementary ideas only) – Photo electric effect – Einstein's photoelectric equation – Applications of photoelectric effect: solar cells, solar panels, optoelectric devices.

UNIT-III: NUCLEAR PHYSICS

Nuclear models – Liquid drop model – Magic numbers – Shell model – Nuclear energy – Mass defect – Binding energy – Radioactivity – Uses – Half life – Mean life - Radio isotopes and uses – Controlled and uncontrolled chain reaction – Nuclear fission – Energy released in fission – Chain

reaction – Critical reaction – Critical size- atom bomb – Nuclear reactor – Breeder reactor – Importance of commissioning PFBR in our country – Heavy water disposal, safety of reactors: seismic and floods –Introduction to DAE, IAEA – Nuclear fusion – Thermonuclear reactions – Differences between fission and fusion.

UNIT-IV: INTRODUCTION TO RELATIVITY AND GRAVITATIONAL WAVES

Frame of reference – Postulates of special theory of relativity – Galilean transformation equations – Lorentz transformation equations – Derivation – Length contraction – Time dilation – Twin paradox – Mass-energy equivalence –Introduction on gravitational waves, LIGO, ICTS opportunities at International Centre for Theoretical Sciences

UNIT-V: SEMICONDUCTOR PHYSICS

P-N junction diode – Forward and reverse biasing – Characteristic of diode – Zener diode – Characteristic of zener diode – Voltage regulator – Full wave bridge rectifier – Construction and working – Advantages (no mathematical treatment) – USB cell phone charger –Introduction to e-vehicles and EV charging stations

TEXT BOOKS

1. R. Murugesan (2005), Allied Physics, S.Chand & Co, New Delhi.
2. K. Thangaraj and D. Jayaraman (2004), Allied Physics, Popular Book Depot, Chennai.
3. Brijlal and N. Subramanyam (2002), Text book of Optics, S. Chand & Co, New Delhi.
4. R. Murugesan (2005), Modern Physics, S. Chand & Co, New Delhi.
5. A. Subramaniyam Applied Electronics, 2nd Edn., National Publishing Co.,Chennai.

REFERENCE BOOKS

1. Resnick Halliday and Walker (2018), Fundamentals of Physics, 11th Edn., John Willey and Sons, Asia Pvt. Ltd., Singapore.
2. D.R. Khanna and H.R. Gulati (1979).Optics, S.Chand & Co.Ltd., New Delhi.
3. A. Beiser (1997), Concepts of Modern Physics, Tata McGraw Hill Publication, New Delhi.
4. Thomas L. Floyd (2017), Digital Fundamentals, 11th Edn., Universal Book Stall, New Delhi.
5. V.K. Metha (2004), Principles of electronics, 6thEdn. ,S. Chand and Company, New Delhi.

WEBLINKS

1. https://www.berkshire.com/learning-center/delta-p-facemask/https://www.youtube.com/watch?v=QrhxU47gtj4https://www.youtube.com/watch?time_continue=318&v=D38BjgUdL5U&feature=emb_logo
2. https://www.youtube.com/watch?v=JrRrp5F-Qu4
3. https://www.validyne.com/blog/leak-test-using-pressure-transducers/
4. https://www.atoptics.co.uk/atoptics/blsky.htm -
5. https://www.metoffice.gov.uk/weather/learn-about/weather/optical-effects

Course Outcomes (COs)

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

COURSEOUTCOMES	**CO1**	Explain the concepts of interference diffraction using principles of superposition of waves and rephrase the concept of polarization based on wave patterns
	CO2	Outline the basic foundation of different atom models and variousexperiments establishing quantum concepts. Relate the importance of interpreting improving theoretical models based on observation. Appreciate interdisciplinary nature of science and in solar energy related applications.
	CO3	Summarize the properties of nuclei, nuclear forces structure of atomic nucleus and nuclear models. Solve problems on delay rate half-life and mean-life. Interpret nuclear processes like fission and fusion. Understand the importance of nuclear energy, safety measures carried and get our Govt.agencies like DAE guiding the country in the nuclear field.
	CO4	To describe the basic concepts of relativity like equivalence principle, inertial frames and Lorentz transformation. Extend their knowledge on concepts of relativity and vice versa. Relate this with current research in this field and get an overview of research projects of National and International importance, like LIGO, ICTS, and opportunities available.
	CO5	Summarize the working of semiconductor devices like junction diode, Zener diode, transistors and practical devices we daily use like USB chargers and EV charging stations.

Mapping of Cos with POs

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3 point scale of STRONG (**S**), MEDIUM (**M**) and LOW (**L**).

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	S	S	S
CO2	M	S	S	S	M	S	S	S	S	M
CO3	M	S	S	S	S	M	S	S	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	M	S	S	S	S	S	S	S	S	S

Program: B.Sc. Physics				
Allied Physics Practical -II	**Course Code: 23UPH2AP02**		**CourseTitle:** **ALLIED PHYSICS PRACTICALS – II**	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
	3	75	2	100

Course Objectives

Apply various Physics concepts to understand concepts of Light, electricity and magnetism and waves, set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results.

LIST OF EXPERIMENTS

Any Eight

1. Radius of curvature of lens by forming Newton's rings
2. Thickness of a wire using air wedge
3. Wavelength of mercury lines using spectrometer and grating
4. Refractive index of material of the lens by minimum deviation
5. Refractive index of liquid using liquid prism
6. Determination of AC frequency using sonometer
7. Specific resistance of a wire using PO box
8. Thermal conductivity of poor conductor using Lee's disc
9. Determination of figure of merit table galvanometer
10. Determination of Earth's magnetic field using field along the axis of a coil
11. Characterisation of Zener diode
12. Construction of Zener/IC regulated power supply
13. Construction of AND, OR, NOT gates using diodes and transistor
14. NOR gate as a universal building block

BOOKS FOR STUDY AND REFERENCE:

1. S. Balasubramanian, R. Ranganathan, M.N. Srinivasan, A Text book of Physics Practical, 2nd Revised Edition, S. Chand & Sons (2017).
2. C.C. Ouseph, U.J. Rao, V. Vijayendiran, Practical Physics, 1st Edition, Viswanathan.S Printers and Publishers Private Ltd. (2015).
3. P.R. SasiKumar, Practical Physics, PHI (2014).
4. S.P. Singh, Advanced Practical Physics, Pragathi Prakasam (2017).
5. C.L Arora, Practical Physics, S. Chand & Co (2010).
6. GeetaSanon, B.Sc Practical Physics, 1st Edition, Chand & Co., New Delhi (2007).
7. K.A. Navas, Electronics Lab Manual, Volume-I, PHI, 5th Edition (2015).

Course Outcomes (COs)

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

CO Number	CO Statement
CO1	Perform experiments to identify the curvature of the lens and thickness of wire using newton ring and air wedge
CO2	Deal with prism and grating to find its refractive index and wavelength
CO3	Learn the relation between frequency, length and tension of a stretched string under vibration
CO4	Analyse the construction and characteristics of Zener diode
CO5	Examine the performance of logic gates using IC's and discrete Components and to measure the output

Mapping of Cos with POs

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3 point scale of STRONG (**S**), MEDIUM (**M**) and LOW (**L**).

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	M	S	S
CO2	M	M	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S