VIVEKANANDHA

COLLEGE OF ARTS AND SCIENCES FOR WOMEN

(Autonomous)

ELAYAMPALAYAM, TIRUCHENGODE (Tk.), NAMAKKAL (Dt.)

An ISO 9001: 2015 Certified Institution

(Affiliated to Periyar University, Approved by AICTE & Re-accredited with 'A+' Grade by NAAC) (Recognized under section 2(f) and 12(B) Under Act 1956)

AUTONOMOUS

PG AND RESEARCH

DEPARTMENT OF PHYSICS

B.Sc., Physics

OBE Syllabus

(2023-24 Onwards)

(Revised - 2024 -2025)

VIVEKANANDHA EDUCATIONAL INSTITUTIONS

Angammal Educational Trust

Elayampalayam, Tiruchengode (Tk.), Namakkal (DT).

About the College

Vivekanandha College of Arts and Sciences for Women (Autonomous) was established and hailed into Women's Educational Service in the Year 1995. Angammal Educational Trust Chaired by the great Educationalist 'Vidhya Rathna' Prof. Dr. M.KARUNANITHI, B.Pharm., M.S., Ph.D., D.Litt., sponsors this college and other institutions under the name of the greatSaint Vivekanandha. Our institutions are situated on either side of Tiruchengode -Namakkal Main Road at Elayampalayam, 6 k.m. away from Tiruchengode. This is biggest women's college in India with more than 7500 girl students and more than 18 departments. The strength of the college was just 65 at the time of its establishment. With the dedication, work, sacrifice and long vision of the chairman, this institution has grown into a Himalaya stage. As a result of which UGC, New Delhi, awarded 2f and 12b, extended Autonomous status for second cycle. The National Assessment and Accreditation Council reaccredited with grade 'A+' for its successful performance. As an Autonomous Institution, academic professionals of the college framed Curriculum and Syllabi in consultation with all its stakeholders to cater the needs of the young women to fulfil the women empowerment and present Industrial needs to the local benefits. The students are empowering with confidence and required skills to face the society.

Quality Policy

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

Our Vision

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

Our Mission

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

About the Department

The Department of physics were established in the year 2000 & 2003 with UG & PG courses. In the years 2009, 2011 & 2016, research programme (M.Phil and Ph.D) we started in the Department of Physics which are affiliated to Periyar University, Salem. The

department have an excellent academic record, research activities, Publications and have bagged several categories of ranks and the gold medals in Periyar University examinations. The Department of physics have been elevated as DST - FIST sponsored department in 2022 by the approval of Ministry of Science & technology and the Department of Science and technology, government of India.

Preamble

Physics is one of the basic and fundamental sciences. The curriculum for the graduate programme in Physics is revised as per the UGC guidelines on Learning Outcome based Course Framework. The learner-centric courses let the student progressively develop a deeper understanding of various aspects of physics.

The new curriculum offer courses in the core areas of mechanics, acoustics, optics and spectroscopy, electricity and magnetism, atomic and nuclear physics, solid state, electronics and other fields. The courses will train students with sound theoretical and experimental knowledge that suits the need of academics and industry. In addition to the theoretical course work, the students also learn physics laboratory methods for different branches of physics, specialized measurement techniques, analysis of observational data, including error estimation and etc. The students will have deeper understanding of laws of nature through the subjects like classical mechanics, quantum mechanics, statistical physics etc. The problem solving ability of students will be enhanced. The students can apply principles in physics to real life problems. The courses like integrated electronics and microprocessors will enhance the logical skills as well as employability skills. The numerical methods and mathematical physics provide analytical thinking and provides a better platform for higher level physics for research.

The restructured courses with well-defined objectives and learning outcomes, provide guidance to prospective students in choosing the elective courses to broaden their skills not only in the field of physics but also in interdisciplinary areas. The elective modules of the framework offer students choice to gain knowledge and expertise in specialized domains of physics like astrophysics, medical physics, etc.

REGULATIONS

SCOPE OF THE COURSE

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

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

SALIENT FEATURES

- Course is specially designed for a higher level Career Placement.
- Special Guest lecturers from Industrialists will be arranged.
- Exclusively caters to students interested in pursuing higher studies.
- Special Industry Orientations and Training are parts of the Degree Course.
- Project work is included in the syllabus to enhance conceptual, analytical & deductive skills.

OBJECTIVES OF THE COURSE

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

ELIGIBILITY FOR ADMISSION

Candidates seeking admission to the first year Degree course (B.Sc. Physics) shall be required to have passed Higher Secondary Examination with Physics as one of the Subjects conducted by the Government of Tamil Nadu.

DURATION OF THE COURSE

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

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

Each subject will have six hours of lecture per week apart from practical training at the end of each semester.

CONTINUOUS INTERNAL ASSESSMENT

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

1.	Average of three Test	-	15 Marks
2.	Assignment	-	5 Marks
3.	Attendance	-	5 Marks
4.	Total	=	25 Marks

The distribution of attendance marks is given as follows,

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

QUESTION PAPER PATTERN

Question Paper Pattern for the Examinations

Time: 3 Hours Maximum Marks: 75

Part A: Answer all the following Questions (10 x 1 = 10 Marks)

(choose the best answer)

Part B: Answer all questions (5 x 7 = 35 Marks)

(Either or type)

Part C: Answer any three of the following questions (3 x 10 = 30 Marks)

PASSING MINIMUM

In the University Examinations, the passing minimum shall be 40 % out of 75 Marks for theory (30 marks) and 40% out of 60 marks for practical (24 Marks).

GROUP PROJECT

- Maximum 3 Students
- 3 Credits
- Total of 100 Marks

Internal Marks: Maximum 25 Marks

(Marks to be awarded by the supervisor, based on the consistence progress of the research work, skill, basic understanding of the problem, regular attendance in the lab, presentation, discussion etc.)

External Marks: Maximum 75 Marks

- 50 – Marks – For the duly completed project report
- 25 – Marks – For the presentation by the student in the Viva-Voce exam

ELIGIBILITY FOR EXAMINATION

A candidate will be permitted to appear for the University Examination only on earning 75 % of attendance and only when her conduct has been satisfactory. It shall be open to grant exemption to a candidate for valid reasons subject to conditions prescribed.

CLASSIFICATION OF SUCCESSFUL CANDIDATES

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

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

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

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

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

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

- **Extra credits are given for extra skills and courses qualified in MOOC/NPTEL (2 CREDITS)**

COMMENCEMENT OF THESE REGULATIONS

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

COURSE PATTERN & CREDIT DISTRIBUTION

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN

(AUTONOMOUS)

SYLLABUS FRAME WORK 2023 – 2024 Onwards

SEMESTER - I

SEM	PART	SUBJECT CODE	TITLE OF THE SUBJECT	Hrs.		CREDIT	MARKS		
				Lect.	Lab		CIA	EA	TOTAL
I	I	23U1LT01	FOUNDATION TAMIL - I	6	-	3	25	75	100
	II	23U1LE01	ENGLISH - I	4	-	3	25	75	100
	III	23U1PHC01	**Core - I :** Properties of Matter and Sound	5	-	3	25	75	100
		23U1PHCP01	**Core Practical - I :** Properties of Matter	-	3	3	40	60	100
		23U1MAGE04	**Allied - I :** Allied Mathematics - I	4	-	3	25	75	100
		23U1MAGEP1	**Allied Practical - I :** Allied mathematics Practical - I	-	2	2	40	60	100
		23U1PHS01	**SEC-I :** Introductory Physics	2	-	2	25	75	100
	IV	23U1ENAC01	Soft Skill for Effective communication	2	-	2	25	75	100
		23U1VE01	**Value Education :** Yoga	2	-	2	25	75	100
TOTAL				25	5	23	255	645	900

SEMESTER - II

SEM	PART	SUBJECT CODE	TITLE OF THE SUBJECT	Hrs.		CREDIT	MARKS		
				Lect.	Lab		CIA	EA	TOTAL
II	I	23U2LT02	FOUNDATION TAMIL - II	6	-	3	25	75	100
	II	23U2LE02	ENGLISH - II	4	-	3	25	75	100
	III	23U2PHC02	**Core - II :** Heat, Thermodynamics and Statistical Physics	5	-	4	25	75	100
		23U2PHCP02	**Core Practical -II :** Heat, Oscillations, Waves & Sound	-	3	2	40	60	100
		23U1MAGE06	**Allied - II :** Allied Mathematics - II	4	-	3	25	75	100
		23U1MAGEP2	**Allied Practical - II :**	-	2	2	40	60	100
		23U2PHS02	**SEC - II :** Energy Physics	2	-	2	25	75	100
	IV	23U2EVS01	**EVS :** Environmental Studies	2	-	2	25	75	100
		23U2ENAC02	Soft Skill for Office Automation	2	-	2	25	75	100
		TOTAL		25	5	23	255	645	900

SEMESTER - III

SEM	PART	SUBJECT CODE	TITLE OF THE SUBJECT	Hrs.		CREDIT	MARKS		
				Lect.	Lab		CIA	EA	TOTAL
III	I	23U3LT03	TAMIL - III	6	-	3	25	75	100
	II	23U3LE03	ENGLISH - III	5	-	3	25	75	100
	III	23U3PHC03	**Core - III :** General Mechanics and Classical Mechanics	5	-	4	25	75	100
		23U3PHCP03	**Core Practical - III :** Electricity and C Programming	-	3	2	40	60	100
		23U3CHGE03	**Allied :** Chemistry for Physical Science - I	4	-	3	25	75	100
		23U3CHGEP1	**Allied Practical :** Chemistry Practical for Physical and Biological Science - I	-	3	2	40	60	100
		23U3PHS03	**SEC - III :** Computational Physics	2	-	2	25	75	100
	IV	23U3PHN01	**NMEC-I :** Physics For Everyday Life	2	-	2	25	75	100
		TOTAL		24	6	21	230	570	800

SEMESTER - IV

SEM	PART	SUBJECT CODE	TITLE OF THE SUBJECT	Hrs.		CREDIT	MARKS		
				Lect.	Lab		CIA	EA	TOTAL
IV	I	23U4LT04	TAMIL - IV	6	-	3	25	75	100
	II	23U4LE04	ENGLISH - IV	5	-	3	25	75	100
	III	23U4PHC04	**Core - IV :** Optics and Spectroscopy	5	-	4	25	75	100
		23U4PHCP04	**Core Practical - IV :** Light	-	3	2	40	60	100
		23U4CHGE04	**Allied :** Chemistry for Physical Science - II	4	-	3	25	75	100
		23U4CHGEP2	**Allied Practical :** Chemistry Practical for Physical and Biological Science – II	-	3	2	40	60	100
		23U4PHS04	**SEC - IV :** Communication Electronics	2	-	2	25	75	100
		23U4PHIN01	Internship/ Industrial Visit/ Field Visit	-	-	1	-	-	-
	IV	23U4PH	**NMEC – II :** Indian Knowledge System	2	-	2	25	75	100
		TOTAL		24	6	22	230	570	800

SEMESTER - V

SEM	PART	SUBJECT CODE	TITLE OF THE SUBJECT	Hrs.		CREDIT	MARKS		
				Lect.	Lab		CIA	EA	TOTAL
V	III	23U5PHC05	**Core - V :** Atomic Physics	6	-	5	25	75	100
		23U5PHC06	**Core - VI :** Quantum Mechanics and Relativity	6	-	5	25	75	100
		23U5PHC07	**Core - VII :** Electricity and Magnetism	5		5	25	75	100
		23U5PHCP05	**Core Practical – V :** Spectroscopy and Electricity	-	3	2	40	60	100
		23U5PHDE01	**DSE - I :** Basic Electronics	4	-	3	25	75	100
		23U5PHDE02	**DSE - II :** Medical Instrumentation	4	-	3	25	75	100
	IV	23U5PH	**SBEC-1 :** Professional Ethics	2	-	2	25	75	100
		TOTAL		27	3	25	190	510	700

SEMESTER - VI

SEM	PART	SUBJECT CODE	TITLE OF THE SUBJECT	Hrs.		CREDIT	MARKS		
				Lect.	Lab		CIA	EA	TOTAL
VI	III	23U6PHC08	**Core - VIII :** Nuclear Physics	6	-	5	25	75	100
		23U6PHC09	**Core - IX :** Solid State Physics	6	-	5	25	75	100
		23U6PHC10	**Core X :** Digital Electronics and Microprocessor	5		5	25	75	100
		23U6PHCP06	**Core Practical - VI :** Electronics	-	3	2	40	60	100
		23U6PHDE03	**DSE - III :** Nano Science and Nano Technology	4	-	3	25	75	100
		23U6PHPR01	**Core – IX :** Group Project	2	2	3	25	75	100
	IV	23U6PH	**SBEC-2 :** Academic Writing and Academic portfolio	2	-	2	25	75	100
	V	23U6PHEX01	Extension Activity	-	-	1	-	-	-
			TOTAL	25	5	26	190	510	700
			Grand Total	150	30	140	1350	3450	4800

LIST OF CORE PAPERS

S.No	Course Code	Course Title
1.	23U1PHC01	Properties of Matter and Sound
2.	23U2PHC02	Heat, Thermodynamics and Statistical Physics
3.	23U3PHC03	General Mechanics and Classical Mechanics
4.	23U4PHC04	Optics and Spectroscopy
5.	23U5PHC05	Atomic Physics
6.	23U5PHC06	Quantum Mechanics and Relativity
7.	23U5PHC07	Electricity and Magnetism
8.	23U6PHC08	Nuclear Physics
9.	23U6PHC09	Solid State Physics
10.	23U6PHC10	Digital Electronics and Microprocessor

LIST OF SKIL ENHANCEMENT COURSE

S.No	Course Code	Course Title
1.	23U1PHS01	FOUNDATION COURSE : Introductory Physics
2.	23U2PHS02	Energy Physics
3.	23U3PHS03	Computational Physics
4.	23U4PHS04	Communication Electronics
5.	23U3PHS05	Digital Photography
6.	23U2PHS06	Lasers and Fiber Optics

LIST OF DISCIPLINE SPECIFIC ELECTIVES

S.No	Course Code	Course Title
1.	23U5PHDE01	Basic Electronics
2.	23U5PHDE02	Medical Instrumentation
3.	23U6PHDE03	Nano Science and Nano Technology
4.	23U5PHDE04	Mathematical Physics
5.	23U5PHDE05	Advanced Mathematical Physics
6.	23U6PHDE06	Materials Science

LIST OF CORE PRACTICALS

S.No	Course Code	Course Title
1	23U1PHCP01	Properties of Matter
2	23U2PHCP02	Heat, Oscillations, Waves & Sound
3	23U3PHCP03	Electricity and C Programming
4	23U4PHCP04	Light
5	23U5PHCP05	Spectroscopy and Electricity
6	23U6PHCP06	Electronics

LIST OF NON- MAJOR ELECTIVE COURSE

S.No	Course Code	Course Title
1	23U3PHN01	Physics for Everyday Life
2	23U3PHN02	Astrophysics
3	23U4PHN03	Medical Physics
4	23U4PHN04	Home Electrical Installation
5	23U4PHN05	Physics of Music

LIST OF ALLIED PHYSICS

S.No	Code	Course Title
1	23U1PHGE01/ 23U3PHGE01	Allied Physics – I
2	23U2PHGE02/ 23U4PHGE02	Allied Physics - II

LIST OF ALLIED PHYSICS PRACTICALS

S.No	Code	Course Title
1	23U1PHGEP01/ 23U3PHGEP01	Allied Physics Practical – I
2	23U2PHGEP02/ 23U4PHGEP02	Allied Physics Practical - II

REGULATIONS ON LEARNING OUTCOMES-BASED (LOCB)CURRICULUM FRAMEWORK FOR UNDERGRADUATE EDUCATION	
Programme	**B.Sc., Physics**
Programme Code	**23UPH**
Duration	**3 years [UG]**
Programme Outcomes: (These are mere guidelines. Faculty can create POs based on their curriculum or adopt from UGC or the University for their Programme)	**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 the analytic thought to a body of knowledge; analyse and evaluate the proofs, arguments, claims, beliefs on the basis of empirical evidences; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach. **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. **PO 11 Self-directed learning**: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion. **PO 12 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. **PO 13: 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. **PO 14: 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. **PO 15: 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.

Programme Specific Outcomes: **(These are mere guidelines. Faculty can create POs based on their curriculum or adopt from UGC or University for their Programme)**	**PSO1: Placement:** To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, and beliefs and apply diverse frames of reference to decisions and actions. **PSO 2**: **Entrepreneur:** To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate 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. **PSO 5**: **Contribution to the Society:** To contribute to the development of the society by collaborating with stakeholders for mutual benefit

SEMESTER – I

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U1PHC01	Title	Semester	I
Hrs/Week	5	CORE – I : **PROPERTIES OF MATTER AND SOUND**	Credits	3

COURSE	**FIRST SEMESTER – CORE**
COURSE TITLE	**PROPERTIES OF MATTER AND SOUND**
COURSE OBJECTIVES	• Study of the properties of matter leads to information which is of practical value to both the physicist and the engineers. • It gives us information about the internal forces which act between the constituent parts of the substance. • Students who undergo this course are successfully bound to get a better insight and understanding of the subject.

UNITS	COURSE DETAILS
UNIT-I	**ELASTICITY :** Introduction, Stress - Strain Hooke's law – Stress-Strain diagram – Elastic constants – Factors affecting elasticity - 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–Torsion of a body - Torsional pendulum (with and without masses)
UNIT-II	**BENDING OF BEAMS :** Beam - 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– Experimental determination of Young's modulus by non-uniform bending using scale and telescope method - Experiment to determine Young's modulus by Koenig's method – Uniform bending – Expression for elevation – Experiment to determine Young's modulus using microscope
UNIT-III	**FLUID DYNAMICS :** *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 - Drop weight method of determining surface tension and interfacial surface tension. *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 – Stoke's method for the Coefficient of a highly viscous liquid - Comparison of viscosities by Oswald's viscometer - 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 and Properties of ultrasonic waves – Piezoelectric crystal method – Magnetostriction effect – Application of ultrasonic waves.
Text books	1. D.S.Mathur, 2010, Elements of Properties of Matter, S.Chand & Co. 2. BrijLal & N. Subrahmanyam, 2003, Properties of Matter, S.Chand & Co 3. D.R.Khanna & R.S.Bedi, 1969, Textbook of Sound, AtmaRam & sons 4. BrijLal and N.Subrahmanyam, 1995, A Text Book of Sound, Second revised edition,Vikas Publishing House. 5. R.Murugesan,2012, Properties of Matter, S.Chand & Co.
Reference Books	1. C.J. Smith, 1960, General Properties of Matter, Orient Longman Publishers 2. H.R. Gulati, 1977, Fundamental of General Properties of Matter, Fifth edition, R. Chand & Co. 3. A.P French, 1973, Vibration and Waves, MIT Introductory Physics, Arnold-Heinmann India.
Web links	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 OUT COMES :

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

COURSE OUT COMES	**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 WITH PROGRAM OUT COMES :

Map course out comes **(CO)** for each course with program out comes **(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	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

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U1PHCP01	Title	Semester	I
Hrs/Week	3	CORE PRACTICALS – I : **PROPERTIES OF MATTER**	Credits	3

COURSE	**FIRST SEMESTER - CORE**
COURSE TITLE	**CORE PRACTICALS**
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

PROPERTIES OF MATTER (Any Eight of the below list)

1. Determination of rigidity modulus without mass using Torsional pendulum.
2. Determination of Young's modulus by Non-uniform bending using optic lever.
3. Determination of Young's modulus by uniform bending using Microscope.
4. Determination of Young's modulus by Koenig's method – Non-Uniform pending.
5. Determination of Young's modulus by non-uniform bending using Microscope.
6. Determination of rigidity modulus with masses using Torsional pendulum.
7. Determination of Young's modulus by non-uniform bending – Scale & Telescope.
8. Determination of Young's modulus by cantilever using Microscope.
9. Determination of Young's modulus by cantilever – Dynamic method.
10. Determination of Young's modulus by Koenig's method – Uniform pending.
11. Determination of rigidity modulus by static torsion.
12. Determination of Young's modulus by uniform bending using optic lever.
13. Determination of surface tension & interfacial surface tension by drop weight method.
14. Determination of viscosity by Poiseullie's flow method.
15. Determination of rigidity modulus using scale and telescope.
16. Determination of Surface tension of a liquid – Capillary rise method.
17. Determination of moment of inertia using Bifilar pendulum.
18. Viscosity of a highly viscous liquid – Stoke's method.

BOOK FOR REFERNCES:

1. Practical Physics – C. C. Ouseph, U. J. Rao, V. Vjiayendran, 1st Edition, (2015).
2. Advanced Practical Physics, S.P Singh, and Pragati Prakashan, 17th Edition, Vol – I, II.
3. P. R. Sasi Kumar, Practical Physics – PHI, (2011).

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U2PHC02	Title	Semester	II
Hrs/Week	5	CORE – II : **HEAT, THERMODYNAMICS AND STATISTICAL PHYSICS**	Credits	3

COURSE	**SECOND SEMESTER - CORE**
COURSE TITLE	**HEAT, THERMODYNAMICS AND STATISTICAL PHYSICS**
COURSE OBJECTIVES	The course focuses to understand a basic in conversion of temperature in Celsius, Kelvin and Fahrenheit scales. Practical exhibition and explanation of transmission of heat in good and bad conductor. Relate the laws of thermodynamics, entropy in everyday life and explore the knowledge of statistical mechanics and its relation

UNITS	COURSE DETAILS
UNIT-I	**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 **LOW TEMPERATURE PHYSICS :** Joule-Kelvin effect – porous plug experiment – Joule-Thomson effect –Boyle temperature – temperature of inversion – liquefaction of gas by Linde's Process – adiabatic 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 ofthermal 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, Kedharnaath 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.
Web links	1. https://youtu.be/M_5KYncYNyc 2. https://www.youtube.com/watch?v=4M72kQulGKk&vl=en

COURSE OUT COMES :

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

COURSE OUT COMES	**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 the relationship 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 WITH PROGRAM OUT COMES :

Map course out comes **(CO)** for each course with program out comes **(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	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

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U2PHCP02	Title	Semester	II
Hrs/Week	3	CORE PRACTICALS – II : **HEAT, OSCILLATIONS, WAVES & SOUND**	Credits	2

COURSE	**SECOND SEMESTER - CORE**
COURSETITLE	**CORE PRACTICALS**
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

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

1. Determination of specific heat by Newton's law of cooling method.
2. Determination of thermal conductivity of good conductor by Forbe's method.
3. Determination of thermal conductivity of bad conductor by Lee's disc method.
4. Emissive power of a surface using spherical calorimeter.
5. Determination of g using compound pendulum.
6. Determination of specific heat capacity of solid.
7. Determination of specific heat of liquid by Joule's electrical heating method.
8. Determination of Latent heat of a vaporization of a liquid.
9. Determination of Stefan's constant.
10. Verification of Stefan's-Boltzmans law.
11. Determination of thermal conductivity of rubber tube.
12. Velocity of sound through a wire using Sonometer.
13. Determination of velocity of sound using Kunds tube.
14. Determination of frequency of a tuning fork using Sonometer.
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.

BOOK FOR REFERNCES :

1. Practical Physics – C. C. Ouseph, U. J. Rao, V. Vjiayendran, 1st Edition, (2015).
2. Advanced Practical Physics, S.P Singh, and Pragati Prakashan, 17th Edition, Vol – I, II.
3. P. R. Sasi Kumar, Practical Physics – PHI, (2011).

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U3PHC03	Title	Semester	III
Hrs/Week	5	CORE – III : **GENERAL MECHANICS AND CLASSICAL MECHANICS**	Credits	4

COURSE	**THIRD SEMESTER - CORE**
COURSE TITLE	**GENERAL MECHANICS AND CLASSICAL MECHANICS**
COURSE OBJECTIVES	This course allows the students: To have a basic understanding of the laws and principles of mechanics; To apply the concepts of forces existing in the system; To understand the forces of physics in everyday life; To visualize conservation laws; To apply Lagrangian equation to solve complex problems.

UNITS	**COURSE DETAILS**
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 – torque due to internal forces – torque due to gravity – angular momentum about center of mass.
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.DuraiPandian, Laxmi DuraiPandian, 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.
Reference books	1. Goldstein Herbert, 1980, Classical Mechanics. U.S.A: Addison and Wesely. 2. Halliday, David & Robert, Resnick, 1995, Physics Vol.I. New Age, International, Chennai. 3. Halliday, David Robert Resnick and Walker Jearl, 2001, Fundamentals of Physics, John Wiley, New Delhi
Web 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

COURSE OUT COMES :

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

COURSE OUT COMES	**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' Alemberts principle

MAPPING WITH PROGRAM OUT COMES :

Map course out comes **(CO)** for each course with program out comes **(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	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

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U3PHCP03	Title	Semester	III
Hrs/Week	3	CORE PRACTICALS – III : **ELECTRICITY AND C PROGRAMMING**	Credits	2

COURSE	**THIRD SEMESTER - CORE**
COURSE TITLE	**CORE PRACTICALS**
COURSE OBJECTIVES	Construct circuits to learn about the concept of electricity, current, resistance in the path of current, different parameters that affect a circuit. Set up experiments, observe, analyse and assimilate the concept

ELECTRICITY AND C PROGRAMMING (Any Eight of the below list)

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 e.m.f of thermo couple using potentiometer
10. Determination of figure of merit of BG or spot galvanometer.
11. Conversion of Centigrade into Fahrenheit.
12. Solving quadratic equation.
13. Finding the largest and smallest number in a data array
14. Roots of algebraic equations – Newton-Raphson method.
15. Numerical integration – Trapezoidal rule.
16. Numerical integration – Simpson's rule.
17. Deflection magnetometer M and B_H Tan A and Tan B position.
18. Field along the axis of coil – Vibration Magnetometer.

BOOK FOR REFERNCES:

1. Practical Physics – C. C. Ouseph, U. J. Rao, V. Vjiayendran, 1st Edition, (2015).
2. Advanced Practical Physics, S.P Singh, and Pragati Prakashan, 17th Edition, Vol – I, II.
3. P. R. Sasi Kumar, Practical Physics – PHI, (2011).

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U4PHC04	Title	Semester	IV
Hrs/Week	5	CORE – IV : **OPTICS AND SPECTROSCOPY**	Credits	4

COURSE	**FOURTH SEMESTER - CORE**
COURSE TITLE	**OPTICS AND SPECTROSCOPY**
COURSE OBJECTIVES	• To provide an in-depth understanding of the basics of various phenomena in geometrical and wave optics; • To explain the behaviour of light in different mediums; • To understand the differences in the important phenomena namely interference, diffraction and Polarization and apply the knowledge in day to day life; • To understand the design of optical systems and methods to minims aberrations; • To solve problems in optics by selecting the appropriate equations and performing numerical or analytical calculations.

UNITS	**COURSE DETAILS**
UNIT-I	**Geometrical Optics :** *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:** Definition, Condition, theory - 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.
Reference Books	1. Agarwal B.S, 2011,Optics, Kedernath Ramnath Publishers, Meerut. 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, 4thedition, PHIPvt 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., NewDelhi.
Web links	1. https://science.nasa.gov/ems/ 2. https://www.youtube.com/watch?v=tL3rNc1G0qQ&list=RDCMUCzwo7UlGkb-8Pr6svxWo-LA&start_radio=1&t=2472 3. https://science.nasa.gov/ems/ 3. https://www.youtube.com/watch?v=tL3rNc1G0qQ&list=RDCMUCzwo7UlGkb-8Pr6svxWo-LA&start_radio=1&t=2472 4. 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/ 5. http://www.thephysicsmill.com/2014/03/23/sky-blue-lord-rayleigh-sir-raman-scattering/

COURSE OUT COMES :

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

COURSE OUT COMES	**CO1**	Outline basic knowledge of methods of rectifying different defects in lenses, articulate technological applications of eyepieces
	CO2	Discuss the principle of superposition of wave, use these ideas to understand the wave nature of light through working of interferometer
	CO3	Extend the knowledge about nature of light through diffraction techniques; apply mathematical principles to analyse the optical instruments

	CO4	Interpret basic formulation of polarization and gain knowledge about polarimeter, appraise its usage in industries
	CO5	Relate the principles of optics to various fields of IR, Raman and UV spectroscopy and understand their instrumentation and application in industries

MAPPING WITH PROGRAM OUT COMES :

Map course out comes **(CO)** for each course with program out comes **(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	M	S	M	M	M	S	S	M	M
CO2	M	S	M	S	M	S	M	M	S	S
CO3	S	M	S	S	S	M	S	S	M	M
CO4	S	M	S	M	M	S	M	M	S	M
CO5	S	M	S	M	S	S	M	S	S	S

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U4PHCP04	Title	Semester	IV
Hrs/Week	3	CORE PRACTICALS - IV : **LIGHT**	Credits	2

COURSE	**FOURTH SEMESTER - CORE**
COURSETITLE	**CORE PRACTICALS**
COURSE OBJECTIVES	Demonstrate various optical phenomena principles, working, apply with various materials and interpret the results.

LIGHT (Any Eight of the below list)

1. Determination of refractive index of prism using spectrometer.
2. Determination of refractive index of liquid using hollow prism and spectrometer
3. Determination of dispersive power of a prism.
4. Determination of radius of curvature of lens by forming Newton's rings.
5. Determination of thickness of a wire using air wedge.
6. Determination of Cauchy's Constants.
7. Determination of resolving power of grating
8. Determination of resolving power of telescope
9. Comparison of intensities using Lummer Brodhum Photometer.
10. Determination of range of motion using Searles gonio meter.
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.
17. Rydberg's constant

BOOK FOR REFERNCES:

1. Practical Physics – C. C. Ouseph, U. J. Rao, V. Vjiayendran, 1st Edition, (2015).
2. Advanced Practical Physics, S.P Singh, and Pragati Prakashan, 17th Edition, Vol – I, II.
3. P. R. Sasi Kumar, Practical Physics – PHI, (2011).

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U5PHC05	Title	Semester	V
Hrs/Week	6	CORE - V : **ATOMIC PHYSICS**	Credits	5

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

UNITS	**COURSE DETAILS**
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 :** Law of 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 :** Bohr atom model and Sommerfield's 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 – Frank and Hertz experiment - 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 –Debye explanation 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	**X- RAYS :** Electromagnetic spectrum - Production of X-Rays - Absorption of X - Rays - Bragg's Law – Bragg's X-ray spectrometer - Powder crystal method and Laue method – Origin and analysis of continuous X - ray spectrum and characteristic X - ray spectrum – Mosley's law (Statement, Explanation and Importance) – Compton effect – Derivation of expression for change in wavelength - its experimental verification.
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.
Web links	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 OUT COMES :

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

COURSE OUT COMES	**CO1**	List the 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 WITH PROGRAM OUT COMES :

Map course out comes **(CO)** for each course with program out comes **(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	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

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U5PHC06	Title	Semester	V
Hrs/Week	6	CORE – VI : **QUANTUM MECHANICS AND RELATIVITY**	Credits	5

COURSE	**FIFTH SEMESTER – CORE**
COURSE TITLE	**QUANTUM MECHANICS AND RELATIVITY**
COURSE OBJECTIVES	To understand the theory of relativity, its postulates and the consequences. To learn the importance of transformation equations and also to differentiate between special and general theory of relativity. To interpret the wave theory of matter with various theoretical and experimental evidences. To derive and use Schrodinger's wave equation and also learn about various operators. To solve Schrodinger's wave equation for simple problems and analyse to understand the solutions.

UNITS	**COURSE DETAILS**
UNIT-I	**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-II	**OPERATORS AND SCHRÖDINGER EQUATION :** Postulates of quantum mechanics – Wave function and its interpretation – Schrödinger's equation – linear operators – Eigenvalue – 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-III	**SOLVING SCHRÖDINGER EQUATION FOR SIMPLE PROBLEMS :** *one-dimensional problems*: (i) particle in a box, (ii) barrier penetration problem – quantum mechanical tunneling, (iii) linear harmonic oscillator. *higher dimensional problems*: (i) Rigid rotator (qualitative), (ii) Hydrogen atom (qualitative).
UNIT-IV	**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-V	**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
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, 1stEdition, 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, AjoyGhatak 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. 11. Quantum Mechanics, Gupta, Kumar and Sharma. Jai Prakash Nath & Co Meerut
Web links	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 OUT COMES :

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

COURSE OUT COMES	**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 WITH PROGRAM OUT COMES :

Map course out comes **(CO)** for each course with program out comes **(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	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

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U5PHC07	Title	Semester	V
Hrs/Week	5	CORE – VII : **ELECTRICITY AND MAGNETISM**	Credits	5

COURSE	**FIFTH SEMESTER – CORE**
COURSE TITLE	**ELECTRICITY AND MAGNETISM**
COURSE OBJECTIVES	• To gain knowledge about the principle and working of electrical circuits. • Acquire basic knowledge about handling electrical circuits. • Know about types of electricity.

UNITS	**COURSE DETAILS**
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 thermos e.m.f.– measurement of thermos e.m.f. using potentiometer–Peltier effect and Peltier coefficient – Thomson effect and Thomson coefficient – relation between π and σ – thermoelectric diagrams and their uses.
UNIT-III	**MAGNETIC PROPERTIES OF MATERIALS :** Relation between three magnetic vectors B, H and M- Intensity of magnetization - Susceptibility – Permeability – Properties, 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.

COURSE OUT COMES :

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

COURSE OUT COMES	**CO1**	To study about introduction of electrostatics and itsapplications.
	CO2	To gain knowledge about effect of electric field and magnetic field.
	CO3	To study the relation between thermal energy and Electric current.
	CO4	To understand and analyzing the basics of Alternating current and its measurements
	CO5	To acquire knowledge about electrical measurements devicesand its uses.

MAPPING WITH PROGRAM OUT COMES :

Map course out comes **(CO)** for each course with program out comes **(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	M	S	S	M	S		M
CO2	S	S	S	M	S	M	S	S	S	S
CO3	S	S	M	M	S	S		M	S	M
CO4	M	S	S	S	S	M	S	S	M	S
CO5	S	S	S	M	S	S	S	M	S	S

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U5PHCP05	Title	Semester	V
Hrs/Week	3	CORE PRACTICALS –V : **SPECTROSCOPY AND ELECTRICITY**	Credits	2

COURSE	**FIFTH SEMESTER - CORE**
COURSETITLE	**CORE PRACTICALS**
COURSE OBJECTIVES	Demonstrate various optical phenomena principles, working, apply with various materials and interpret the results.
	SPECTROSCOPY AND ELECTRICITY (Any Eight of the below list)

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 □.
6. Thickness of a thin film of Bi-prism
7. Brewster's law – polarization
8. Double refraction (□e and □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. e/m Thomson method
20. Spectral response of photo conductor (LDR).
21. Potentiometer –Resistance and Specific resistance of the coil.
22. Carey Foster's bridge - Temperature coefficient of resistance of the coil.
23. Deflection Magnetometer – Determination of Magnetic moment of a bar magnet and $B_H$using circular coil carrying current.
24. Vibration magnetometer - Determination of B_H using circular coil carrying current– Tan B position.
25. B.G – Figure of Merit – Charge Sensitivity

BOOK FOR REFERNCES:

1. Practical Physics – C. C. Ouseph, U. J. Rao, V. Vjiayendran, 1st Edition, (2015).
2. Advanced Practical Physics, S.P Singh, and Pragati Prakashan, 17th Edition, Vol – I, II.
3. P. R. Sasi Kumar, Practical Physics – PHI, (2011).

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U6PHC08	Title	Semester	VI
Hrs/Week	6	CORE – VIII : **NUCLEAR PHYSICS**	Credits	5

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

UNITS	**COURSE DETAILS**
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	**RADIO ACTIVITY:** Radio activity – laws of radioactivity – radioactive disintegration, decay constant, half-life, mean-life (only final formulae) **–** units of radioactivity **–** successive disintegration – transient and secular equilibrium– properties of alpha, beta and gamma rays – Geiger-Nuttal law – α-ray spectra – Gammow's theory of α-decay (qualitative) – β -ray spectrum – neutrino theory of β-decay – nuclear isomerism – K-shell capture – internal conversion – non-conservation of parity in weak interactions.
UNIT-III	**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 – protonsynchrotron (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 – nuclearfusion – 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. Physics and Engineering of Radiation Detection, Syed Naeem Ahmed (Academic Press, Elsevier, 2007). 10. Nuclear Physics, S. N. Ghoshal, S Chand & Co. Edition 2003 11. Elements of Nuclear Physics, M. L.Pandya & R. P. S.Yadav, KedarNath & Ram Nath
Web links	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 OUT COMES :

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

COURSE OUT COMES	**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 WITH PROGRAM OUT COMES :

Map course out comes **(CO)** for each course with program out comes **(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	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

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U6PHC09	Title	Semester	VI
Hrs/Week	6	CORE – IX : **SOLID STATE PHYSICS**	Credits	5

COURSE	**SIXTH SEMESTER – CORE**
COURSE TITLE	**SOLID STATE PHYSICS**
COURSE OBJECTIVES	To understand constituents, properties and models of nucleus. To give reason for radioactivity and study their properties.To learn about the principles of various particle detectors and accelerators. To acquire knowledge on different types of nuclear reactions and their applications.To know the reason for cosmic rays and their effect on the surface of earth and also understand the classification of elementary particles.

UNITS	COURSE DETAILS
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.
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).
UNIT-III	**MAGNETIC PROPERTIES OF SOLIDS :** Permeability, susceptibility, relation between them – classification of magnetic materials – properties of dia, para, ferro, ferri and antiferromagnetism – Langevin's theory of diamagnetism – Langevin's theory of paramagnetism – Curie-Weiss law – Weiss theory of ferromagnetism (qualitative only) – Heisenberg's quantum theory of ferromagnetism – domains – discussion of B-H curve – hysteresis and energy loss – soft and hard magnets – magnetic alloys.
UNIT-IV	**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.

UNIT-V	**FERROELECTRIC & SUPERCONDUCTING PROPERTIES OF MATERIALS :** *ferroelectric effect*: Curie-Weiss Law – ferroelectric domains, P-E hysteresis loop. *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.
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. Solid State Physics, M.A. Wahab, 2011, Narosa Publishing House, ND
Reference Books	1. Puri & Babber – Solid State Physics – S.Chand & Co. New Delhi. 2. Kittel - Introduction to solid state physics, Wiley and Sons, 7th edition. 3. Raghavan - Materials science and Engineering, PHI 4. 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
Web links	1. https://nptel.ac.in/courses/115105099/ 2. https://nptel.ac.in/courses/115106061/

COURSE OUT COMES :

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

COURSE OUT COMES	**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.

MAPPING WITH PROGRAM OUT COMES :

Map course out comes **(CO)** for each course with program out comes **(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	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

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U6PHC10	Title	Semester	VI
Hrs/Week	5	CORE – X : **DIGITAL ELECTRONICS AND MICROPROCESSOR**	Credits	5

COURSE	**SIXTH SEMESTER – CORE**
COURSE TITLE	**DIGITAL ELECTRONICS AND MICROPROCESSOR**
COURSE OBJECTIVES	To learn all types of number systems, Boolean algebra and identities, digital circuits for addition and subtraction, flip-flops, registers, counters. To get the knowledge on fundamentals of 8085 architecture, instruction sets and simple programs.

UNITS	**COURSE DETAILS**
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).
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.
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), subtraction (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, NewDelhi. 2. Ronald J. Tocci. "Digital Systems-Principles and Applications" 6/e. PHI. New Delhi. 1999.(UNITS I to IV) 3. S.Salivahana& S. Arivazhagan-Digital circuits and design 4. 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 GlenSA

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 OUT COMES :

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

	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

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U6PHCP06	Title	Semester	VI
Hrs/Week	3	CORE PRACTICALS – VI **:** **ELECTRONICS**	Credits	2

COURSE	**SIXTH SEMESTER - CORE**
COURSE OBJECTIVES	To perform basic experiments on characteristics of electronic devices and then get into the applications such as amplifiers, oscillators, counters, multivibrators. Perform fundamental experiments on microprocessor and learn to write programs by themselves.

ELECTRONICS (Any Eight of the below list)

1. Zener diode – voltage regulations
2. Bride rectifier using diodes
3. Characteristics of a transistor – (CE mode)
4. Characteristics of a transistor – (CB mode).
5. RC coupled CE transistor amplifier - single stage.
6. Transistor Emitter follower.
7. Colpitt's oscillator -transistor.
8. Hartley oscillator - transistor.
9. Astable multivibrator - transistor.
10. Bistable multivibrator - transistor.
11. FET - characteristics.
12. FET - amplifier (common drain)
13. UJT -characteristics
14. AC circuits with L,C,R -Series resonance.
15. AC circuits with L,C,R - Parallel resonance.
16. Operational amplifier - inverting amplifier and summing.
17. Operational amplifier - non-inverting amplifier and summing.
18. Operational amplifier – differential amplifier
19. Operational amplifier - differentiator & integrator.
20. Operational amplifier - D/A converter by binary resistor method.
21. 5V, IC Regulated power supply.
22. Construction of seven segment display.
23. Half adder / Half subtractor using basic logic gate ICs
24. Microprocessor 8085 – addition (8 bit only)
25. Microprocessor 8085 – subtraction (8 bit only)
26. Microprocessor 8085 – multiplication (8 bit only)
27. Microprocessor 8085 – division (8 bit only)
28. Microprocessor 8085 – square (8 bit only)
29. Microprocessor 8085 – square root (8 bit only)
30. Microprocessor 8085 – largest/smallest of numbers (8 bit only)
31. Microprocessor 8085 – ascending/descending order

SKIL ENHANCEMENT COURSE
STUDENTS CAN CHOOSE ANY OF THESES SUBJECTS

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U1PHS01	Title	Semester	I
Hrs/Week	2	SEC : **FOUNDATION COURSE :** INTRODUCTORY PHYSICS	Credits	2

COURSE	**FIRST SEMESTER - FOUNDATION COURSE**
COURSE TITLE	**INTRODUCTORY PHYSICS**
COURSE OBJECTIVES	• To help students get an overview of Physics before learning their core courses. • To serve as a bridge between the school curriculum and the degree programme.

UNITS	**COURSE DETAILS**
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, Adhesive forces
UNIT-III	Different forms of energy – conservation laws of momentum and 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.
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.
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.
Web links	1. http://hyperphysics.phyastr.gsu.edu/hbase/permot 2. https://science.nasa.gov/ems/ 3. https://eesc.columbia.edu/courses/ees/climate/lectures/radiation_hays/

COURSE OUT COMES :

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

COURSE OUT COMES	**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 WITH PROGRAM OUT COMES :

Map course out comes **(CO)** for each course with program out comes **(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	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

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U2PHS02	Title	Semester	II
Hrs/Week	2	SEC : **ENERGY PHYSICS**	Credits	2

ENERGY PHYSICS	
Learning Objective: To get the understanding of the conventional and non-conventional energy sources, their conservation and storage systems.	
UNITS	**COURSE DETAILS**
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 : S**olar 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.
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.
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: I**mportance 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.
Text books	1. G.D.Rai, Non-Conventional Sources of Energy, Khanna Publishers, 2009, 4thEdn. 2. S P Sukhstme, J K Nayak, Solar Energy, Principles of Thermal Collection and Storage, McGraw Hill, 2008, 3rdEdn. 3. D P Kothari, K P Singal, Rakesh Rajan, PHI Learning Pvt Ltd, 2011, 2ndEdn.
Reference books	1. John Twidell & Tony Weir, Renewable Energy Resources, Taylor & Francis, 2005, 2ndEdn. 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.

COURSE OUT COMES :

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

COURSE OUT COMES	**CO1**	To know the basic concept of energy sources.
	CO2	To understand the principles of solar thermal energy and its various applications.
	CO3	To learn the principles of photovoltaic cells and its classification.
	CO4	To study about introduction of biomass energy and itsuses.
	CO5	To study the basic of energy consumption,conservation.

MAPPING WITH PROGRAM OUT COMES :

Map course out comes **(CO)** for each course with program out comes **(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	M	S	S	S	M	S	S	S	S
CO2	S	S	S	S	M	S	S	S	S	S
CO3	S	S	M	S	S	S	S	M	S	S
CO4	M	S	S	S	S	M	S	S	S	S
CO5	S	S	S	M	S	S	S	M	S	S

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U3PHS03	Title	Semester	III
Hrs/Week	2	SEC : **COMPUTATIONAL PHYSICS**	Credits	2

COMPUTATIONAL PHYSICS	
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.	
UNITS	**COURSE DETAILS**
UNIT-I	**INTRODUCTION TO C LANGUAGE AND ITS FUNDAMENTALS :** Importance of C – Basic structure of C Programs – Programming style – Executing a C program. *Constant, Variables and Data types :* character sets – constants – keywords – identifiers – variables – data types – declaration of variables – assigning values to variables – defining symbolic constants. *Expressions:* Arithmetic, Relational, Logical, Increment/Decrement, conditional, Bit-wise, Comma Operators – Arithmetic expressions – Procedures and Associativity.
UNIT-II	**INPUT AND OUTPUT OPERATIONS :** Reading and writing character – formatted input and output – decision making: IF statement: Simple IF, IF... ELSE, Nesting of IF… ELSE and ELSE IF Ladder – Switch Statement – ?: operator – go to statement – while, do – while statement – For loop.
UNIT-III	**ARRAYS :** Introduction – One dimensional array – declaration of array – Initiating on two and multidimensional arrays – declaring and initializing string variables – reading strings from terminal – writing strings on the screen.
UNIT-IV	**USER DEFINED FUNCTIONS :** Need for user defined functions – A multifunction program – The form of C Functions - RETURN values and their Types - Calling a function - Call by Value - Call by Reference- Recursive functions.
UNIT-V	**NUMERICAL SOLUTIONS :** Roots of linear and nonlinear algebraic and transcendental equations – bisection and Newton - Raphson methods – convergence and divergence of solutions. **NUMERICAL DIFFERENTIATION** : Trapezoidal rule – Simpson's 1/3 and 1/8 rule. **NUMERICAL CURVE FITTING :** Principle of least squares – fitting a straight line and exponential curve. P*rograms :* Newton - Raphson methods : Trapezoidal rule – Simpson's 1/3 rule.
Text books	1. Numerical methods,Singaravelu, Meenakshi publication, 4th Edn., 1999. 2. Numerical methodsP.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.

COURSE OUT COMES :

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

COURSE OUT COMES	**CO1**	Understand the basic of normal equation.
	CO2	To get the knowledge about algebraic and transcendentalequation.
	CO3	To get the ability to solve the linear equations.
	CO4	Acquire the knowledge about types of interpolation.
	CO5	Analyze and understand the numerical integration.

MAPPING WITH PROGRAM OUT COMES :

Map course out comes **(CO)** for each course with program out comes **(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	M	S	S	S	S	M	S	S	S	S
CO2	S	S	M	S	S	S	S	S	M	S
CO3	S	S	S	S	M	S	S	S	S	M
CO4	S	S	S	M	S	S	M	S	S	S
CO5	S	M	S	S	S	S	S	S	M	S

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U4PHS04	Title	Semester	IV
Hrs/Week	2	SEC : **COMMUNICATION ELECTRONICS**	Credits	2

COMMUNICATION ELECTRONICS	
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	
UNITS	**COURSE DETAILS**
UNIT-I	**RADIO TRANSMISSION AND RECEPTION :** Transmitter – modulation types of modulation – amplitude modulation– frequency modulation – comparison of FM and AM – demodulation- receivers: AM radio receivers – types of AM radio receivers – stages of super heterodyne 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 fiberoptic 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 – cellphone – facsimile – important features of fax machine – application of facsimile – VSAT (very small aperture terminals) modem IPTV (internet protocol television) -Wi-Fi-5G (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.

COURSE OUT COMES :

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

COURSE OUT COMES	**CO1**	To explain the basics concepts of modulation of FM and PM
	CO2	To understand the fundaments of AM Transmitter and Receiver
	CO3	To explain the communication elements of modulators
	CO4	To Understand the characteristics of antennas and propagation of transmission.
	CO5	To compare the fundaments of communication systems

MAPPING WITH PROGRAM OUT COMES :

Map course out comes **(CO)** for each course with program out comes **(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	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

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U3PHS05	Title	Semester	-
Hrs/Week	2	SEC : **DIGITAL PHOTOGRAPHY**	Credits	2

DIGITAL PHOTOGRAPHY	
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.	
UNITS	**COURSE DETAILS**
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 – focusing movement – aperture and f-numbers – 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

COURSE OUT COMES :

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

COURSE OUT COMES	**CO1**	To study the basic knowledge about Photography
	CO2	Understand the basic principles and characteristics of Lenses
	CO3	To understand and explain the principles of camera using films
	CO4	To learn about digital cameras principle and types.
	CO5	Study the applications of digital image

MAPPING WITH PROGRAM OUT COMES :

Map course out comes **(CO)** for each course with program out comes **(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	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

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U2PHS06	Title	Semester	-
Hrs/Week	2	SEC : **LASERS AND FIBEROPTICS**	Credits	2

LASERS AND FIBEROPTICS	
Learning Objective: The students will learn the fundamentals, types of lasers, laser instrumentation and their applications also the interconnect between optics with lasers.	
UNITS	**COURSE DETAILS**
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 semiconductor laser, injection laser – dye laser – *chemical laser:* HCL laser, DF- CO_2, CO chemical 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	**FIBER OPTICS :** 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 – 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.
Text books	1. B.B. Laud - Laser and Non-linear Optics, New Age International Publications Third Edition, NewDelhi. 2. An Introduction to laser, theory and applications by Avadhunulu, M.N.S., Chand & Co, NewDelhi 3. J.Wilsonand J.F.B. Hawkes.'Introduction to OptoElectronics', 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, AjoyGhatak, McGraw-Hill Education (India) Pvt, Ltd, 6thEdn., 2017.

COURSE OUT COMES :

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

COURSE OUT COMES	**CO1**	To study the basic knowledge about energy levels ofatoms and molecules.
	CO2	Understand the basic principles and characteristics of lasers.
	CO3	To understand and explain the principles of solid state, gasand semiconductor lasers.
	CO4	To learn about gas and liquid laser source.
	CO5	Study the applications of laser.

MAPPING WITH PROGRAM OUT COMES :

Map course out comes **(CO)** for each course with program out comes **(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	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

DISCIPLINE SPECIFIC CORE ELECTIVES

STUDENTS CAN CHOOSE ANY OF THESES SUBJECTS

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U5PHDE01	Title	Semester	V
Hrs/Week	4	DSE : **BASIC ELECTRONICS**	Credits	3

UNITS	**BASIC ELECTRONICS**
UNIT-I	**SEMICONDUCTORS :** Introduction to Semiconductors - Energy band diagram of semiconductors - Intrinsic semiconductor - Extrinsic Semiconductor – n - type semiconductor - p-type semiconductor - Charge on n - type and p - type semiconductors – Principle, construction, working, I-V characteristics and applications: pn junction diode - Zener diode - LED - Photo diode – Schottky diode - Tunnel diode.
UNIT-II	**TRANSISTOR :** Transistor - Basic configurations - CB, CE and CC mode - Transistor action - Relation between α, β and γ - DC load line - DC bias and stabilization - Operating point - AC load line, transistor biasing - Fixed bias - Voltage divider bias – Transistor as a two part network - h parameter – Applications of transistors.
UNIT-III	**AMPLIFIERS AND OSCILLATORS** : Amplifiers: Amplifiers – Gain, Frequency response, decibel and band width of an amplifier - Classification of amplifiers - Single stage and Multi stage RC couples CE amplifier **OSCILLATORS :** Oscillators - Criteria for oscillation – Construction, Operation and Applications: Hartley Oscillator - Colpitt's Oscillator - Wien's Bridge Oscillator - Phase Shift Oscillator – Piezo - Electric Oscillator.
UNIT-IV	**SPECIAL SEMICONDUCTOR DEVICES :** Construction, working, characteristics, parameters and applications of FET – MOSFET - Comparison between FET and Transistor - UJT - UJT relaxation oscillator.
UNIT-V	**OPERATIONAL AMPLIFIERS AND ITS APPLICATIONS :** Op amp - Pin configuration - Characteristics of Op amp - Virtual ground - Off-set voltage - Common mode rejection ratio - Inverting amplifier - Non- inverting amplifier- Differential amplifier -– Application - op-amp as Adder - Subtractor – Integrator – Differentiator – Comparator – Multivirators - IC 741: Astable and Monostable.
Text books	1. V. K. Mehta, Principles of Electronics, Twelfth Edition, S.Chand Publishing Company, New Delhi, (2020). 2. B.L. Theraja, Basic Electronics (Solid state), Fifth Edition, S.Chand Publishing Company, New Delhi, (2005). 3. R.S.Sedha, A Text Book of Applied Electronics, Revised Multicolor Edition, S.Chand Publishing Company, New Delhi, (1990). 4. D.Roy Choudhury and Shail Bala Jain, Linear Integrated Circuits, Fifth Multicolor Edition, New Age International Publishers Pvt., Ltd., New Delhi, (2017).
Reference books	1. S.L.Gupta and V.Kumar, Thirty Fourth Edition, Hand book of Electronics, Pragati Prakashan, Meerut, (2013).

	2. D. Chattopadhyay, P.C.Rakshit, B.Saha and N.N.Purkait, Foundations of Electronics, Third Edition, New Age International Publishers Pvt., Ltd., New Delhi, (2014). 3. S.L.Kakani and K.C.Bhandari, Electronics: Theory and Applications, Fourth Edition, New Age International Publishers Pvt., Ltd., New Delhi, (2011). 4. Jacob Millman, Christos C.Halkias and Satyabrata Jit, Electronic Devices and Circuits, Fourth Edition, Mcgraw-Hill Education India Pvt., Ltd., New Delhi, (2015). 5. Albert Malvino and David J.Bates, Electronic Principles, Seventh Edition, Mcgraw-Hill Education India Pvt., Ltd., New Delhi, (2017).

COURSE OUT COMES :

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

COURSE OUT COMES	**CO1**	To study the basic ideas about the Semiconductor anddevices.
	CO2	To learn about the construction and operation of transistorand JFET.
	CO3	To acquire knowledge about construction and operations of various type of Amplifier and oscillators.
	CO4	To study about the Construction, working, characteristics of Semiconductor devices.
	CO5	To learn about Linear ICs and Operational Amplifiers.

MAPPING WITH PROGRAM OUT COMES :

Map course out comes **(CO)** for each course with program out comes **(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	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

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U5PHDE02	Title	Semester	V
Hrs/Week	4	DSE : **MEDICAL INSTRUMENTATION**	Credits	3

MEDICAL INSTRUMENTATION	
Learning Objective: This course aims to provide background of the Physics principles in medical instrumentation technologies through theoretical & practical learning.	
UNITS	**COURSE DETAILS**
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 : I**inear tomography – computed tomography – helical and multi slice – image quality – radiation dose. **RADIOISOTOPES AND NUCLEAR MEDICINE : R**adioisotopes – 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 : P**roton & external magnetic field – precession – radiofrequency and resonance – MRI signal – relaxation time – MRI instrumentation – imaging sequences – biosafety
UNIT-V	**PROJECT ASSIGNMENT : C**linical 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. Kuppusamy Thayalan (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 3. William Hendee, Geoffrey Ibbott, Eric Hendee (2005) Radiation therapy Physics 3rd ed. Wiley-Liss, New Jersey

COURSE OUT COMES :

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

COURSE OUT COMES	**CO1**	To study the various electrode in medicine.
	CO2	To Understand the principles of various medicineinstruments.
	CO3	To apply the aid devices for medicine instruments.
	CO4	To Understand the medical equipments in medical fields.
	CO5	To measure the ultrasonic and X-ray in Medicine.

MAPPING WITH PROGRAM OUT COMES :

Map course out comes **(CO)** for each course with program out comes **(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	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

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U5PHDE03	Title	Semester	VI
Hrs/Week	4	DSE : **NANOSCIENCE AND NANO TECHNOLOGY**	Credits	3

NANOSCIENCE AND NANO TECHNOLOGY	
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.	
UNITS	**COURSE DETAILS**
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 –superplastic 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.
UNIT-IV	**CHARACTERIZATION TECHNIQUES :** 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. sensors: nanosensors based on optical and physical properties – electrochemical sensors – nanobiosensors. nanoelectronics: 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) Nano particles 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.

COURSE OUT COMES :

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

COURSE OUT COMES	**CO1**	Apply principles of basic science concepts in understanding, analysis and prediction of matter at Nano scale.
	CO2	To introduce interdisciplinary subjects/concepts/ideas for interdisciplinary application of nano materials
	CO3	To introduce advanced ideas and techniques required in emergent area of nanotechnology.
	CO4	To develop human resource with specialization in theoretical and experimental techniques required for career in academia and Nano technology driven industry.
	CO5	Engage in lifelong learning and adapt to changing professional and societal needs.

MAPPING WITH PROGRAM OUT COMES :

Map course out comes **(CO)** for each course with program out comes **(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	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

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U5PHDE04	Title	Semester	-
Hrs/Week	4	DSE : **MATHEMATICAL PHYSICS**	Credits	3

MATHEMATICAL PHYSICS	
Learning Objective: To understand higher mathematical concepts which are applied to solve problems in Physics and similar situations	
UNITS	**COURSE DETAILS**
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 CO-ORDINATES :** 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.

COURSE OUT COMES :

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

COURSE OUT COMES	**CO1**	Understand use of matrices and explain the meaning of complete orthonormal matrices set of basis vectors, and transformations and be able to apply them
	CO2	Able to understand analytic functions, Vector differentiation, Physical significance of gradient, divergence, curl, Laplace operators**.**
	CO3	Analyze characteristics of matrices and its different types, and the process of diagonalization
	CO4	Identify various properties responsible for their behavior
	CO5	To find the solutions for physical problems using partial differential equations. Apply problems based on boundary conditions and initial conditions.

MAPPING WITH PROGRAM OUT COMES :

Map course out comes **(CO)** for each course with program out comes **(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	M	S	S	S	S	M	S	S	S	S
CO2	S	S	M	S	S	S	S	S	M	S
CO3	S	S	S	S	M	S	S	S	S	M
CO4	S	S	S	M	S	S	M	S	S	S
CO5	S	M	S	S	S	S	S	S	M	S

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U5PHDE05	Title	Semester	-
Hrs/Week	4	DSE : **ADVANCED MATHEMATICAL PHYSICS**	Credits	3

ADVANCED MATHEMATICAL PHYSICS	
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.	
UNITS	**COURSE DETAILS**
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 : S**ingular points of second order linear differential equations and importance – singularities of Bessels 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	3. Mathematical Physics, B.D. Gupta-Vikas Publishing House, 4 th Edition (2006) 4. 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)

COURSE OUT COMES :

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

COURSE OUT COMES	**CO1**	Understand use of matrices and explain the meaning of complete orthonormal matrices set of basis vectors, and transformations and be able to apply them
	CO2	Able to understand analytic functions, Vector differentiation, Physical significance of gradient, divergence, curl, Laplace operators**.**
	CO3	Analyze characteristics of matrices and its different types, and the process of diagonalization
	CO4	Identify various properties responsible for their behavior
	CO5	To find the solutions for physical problems using partial differential equations. Apply problems based on boundary conditions and initial conditions.

MAPPING WITH PROGRAM OUT COMES :

Map course out comes **(CO)** for each course with program out comes **(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	M	S	M	S	S	S	S
CO2	S	M	M	S	S	S	M	S	M	S
CO3	S	S	S	S	M	S	S	M	S	S
CO4	M	S	S	M	S	S	M	S	S	S
CO5	S	M	S	S	M	S	S	S	M	S

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U5PHDE06	Title	Semester	-
Hrs/Week	4	DSE : **MATERIALS SCIENCE**	Credits	3

MATERIALS SCIENCE	
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.	
UNITS	**COURSE DETAILS**
UNIT-I	**CRYSTAL IMPERFECTIONS :** Introduction – point defects: vacancies, interstitials, impurities, electronic defects – equilibrium concentration of point imperfections –application of point defects –line defects: edge dislocation**,** screw dislocation – surface defects: extrinsic defects – intrinsic defects: grain boundaries, tilt & twist boundaries, twin boundaries, stacking faults.
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 – viscoelastic 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.
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 publications 2011
Reference books	1. William D. Callister, Jr., Material Science & Engineering – An Introduction, 8th Edition, John Wiley & Sons, Inc., 2007 2. W. Bolton, "Engineering materials technology", 3rd Edition, Butterworth & Heinemann, 2001. 3. Donald R. 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.

COURSE OUT COMES :

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

COURSE OUT COMES	**CO1**	Acquire knowledge on crystal imperfections materials
	CO2	Be able to understand the processing and applications of elastic behavior
	CO3	Understand the testing methods for evaluating the mechanical properties of ceramic materials
	CO4	.Understand the conducting, semiconducting, insulators behavior of materials
	CO5	Students will get to know the different classes of materials used in engineering applications and would be able to choose the right materials for specific applications

MAPPING WITH PROGRAM OUT COMES :

Map course out comes **(CO)** for each course with program out comes **(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	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

NON - MAJOR ELECTIVES (NME)

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U3PHN01	Title	Semester	III
Hrs/Week	2	NME : **PHYSICS FOR EVERYDAY LIFE**	Credits	2

PHYSICS FOR EVERYDAY LIFE	
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	
UNITS	**COURSE DETAILS**
UNIT I: UNITS AND MEASUREMENTS	Current - Alternating current - Direct current - Voltage - Resistance - Ohms law - Galvanometer – Voltmeter – Ammeter - Multimeter
UNIT II: GENERATION OF ELECTRICITY	Sources of generation of electricity - Hydro power method - Thermal power method - Nuclear power generation - solar cells - wind mill - Generators
UNIT III: STORAGE AND CONSERVATION OF ELECTRICITY	Batteries - Non-rechargeable battery - Rechargeable battery - Lithium-ion battery - Nickel - Cadmium Primary cells - Polymer battery - applications of battery
UNIT IV: ELECTRONIC COMPONENTS	Resistors - Capacitors - Diode – Tester – Switch - LED - Fuse - Transformer - Transistors - Integrated chips
UNIT V: ELECTRICAL APPLIANCES	Main box – Metal circuit breakers (MCB) – Switch board – Iron box – Fan – Electrical Oven – Water heaters - Air conditioners – Refrigerators – washing machines
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. 3. S.S. Kamble – Electronics and Mathematics Data book – Allied publishers Ltd, 1997. 4. William David Cooper, Electronic Instrumentation and Measurement Technique, Second Edition, Prentice-Hall, 1978. 5. Electronics in Every Day Life, William Charles Vergara, Dover Publications, 1983. 6. A Text Book of Electrical Technology, Theraja. A.L. Theraja. B.K, S.Chand & Co., (2010).

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U3PHN02	Title	Semester	III
Hrs/Week	2	NME : **ASTROPHYSICS**	Credits	2

ASTROPHYSICS	
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	
UNITS	**COURSE DETAILS**
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 BlackSwan,

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U4PHN03	Title	Semester	IV
Hrs/Week	2	NME : **MEDICAL PHYSICS**	Credits	2

PHYSICS OF MEDICAL INSTRUMENTS	
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.	
UNITS	**COURSE DETAILS**
UNIT-I	**BIO-POTENTIALS AND ELECTRODES : T**ransport 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 : L**aser interactions with biomolecules – 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

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U4PHN04	Title	Semester	IV
Hrs/Week	2	NME : **HOME ELECTRICAL INSTALLATION**	Credits	2

HOME ELECTRICAL INSTALLATION	
Learning Objective: The students will get knowledge on electrical instruments, installations and domestic wiring techniques with safety precautions and servicing.	
UNITS	**COURSE DETAILS**
UNIT-I	**SIMPLE ELECTRICAL CIRCUITS : C**harge, 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 Cauld well, (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).

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U4PHN05	Title	Semester	IV
Hrs/Week	2	NME : **PHYSICS OF MUSIC**	Credits	2

PHYSICS OF MUSIC	
Learning Objective: To apprise and train students on the role of Physics in music and get the knowledge on the musical notes and instruments.	
UNITS	**COURSE DETAILS**
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. Müller(2021)

ALLIED PHYSICS

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U1PHGE01/ 23U3PHGE01	Title	Semester	I / III
Hrs/Week	4	**ALLIED PHYSICS – I**	Credits	3

COURSE	**ALLIED PAPER**
COURSE TITLE	**ALLIED PHYSICS – I**
COURSE OBJECTIVES	To impart basic principles of Physics that which would be helpful for students who have taken programmes other than Physics.

UNITS	COURSE DETAILS
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.
UNIT-II	**PROPERTIES OF MATTER :** *Elasticity :* Stress – Strain – Young's modulus – Behaviour of wire under progressive tension –Bending of beams – Expression for the bending moment – Measurement of Young's modulus by bending of a beam – Non-uniform bending and Uniform bending. *Viscosity :* Streamline flow and Turbulent flow – critical velocity - Poiseuille's formula – Determination of coefficient of viscosity of a liquid (Variable pressure head). *Surface Tension :* Drop weight method of determining the surface tension of a Liquid – Experiment to determine the interfacial tension.
UNIT-III	**HEAT CONDUCTION :** Coefficient of Thermal Conductivity – Determination of Thermal Conductivity of a bad Conductor by Lee's disc method - Joule-Kelvin effect – Joule-Thomson porous plug experiment. **THERMODYNAMICS :** Thermodynamic system – thermodynamic equilibrium - Laws of thermodynamics – Reversible and irreversible process – Heat engine – Carnot's theorem. Radiation : Black body – Stefan's law – Newton's law of cooling – Newton's law of cooling from Stefan's law – Experimental determination of Stefan's constant – Wien's displacement law – Jean's law – Planck's law.
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 : L**ogic gates, OR, AND, NOT, NAND, NOR, EXOR logic gates – universal building blocks – Boolean algebra - Solving Boolean expressions – De Morgan's theorem – verification – Binary, Decimal, Octal , Hexadecimal and Inter conversion.

Text books	1. R.Murugesan (2001), Allied Physics,S. Chand & Co, NewDelhi. 2. Brijlal and N.Subramanyam (1994), Waves and Oscillations, Vikas Publishing House, NewDelhi. 3. Brijlal and N.Subramaniam (1994), Properties of Matter, S.Chand & Co., NewDelhi. 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, NewDelhi. 6. A.Subramaniyam, Applied Electronics 2ndEdn., National Publishing Co., Chennai.
Reference books	1. Resnick Halliday and Walker (2018). Fundamentals of Physics (11thedition), JohnWilley and Sons, Asia Pvt. Ltd., Singapore. 2. V.R.Khanna and R.S.Bedi (1998), Textbook of Sound 1stEdn. Kedharnaath Publish & Co, Meerut. 3. N.S.Khare and S.S.Srivastava (1983), Electricity and Magnetism 10thEdn., AtmaRam & Sons, New Delhi. 4. D.R.Khanna and 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.htmlhttps://www.youtube.com/watch?v=gT8Nth9NWPMhttps://www.youtube.com/watch?v=9mXOMzUruMQ&t=1shttps://www.youtube.com/watch?v=m4u-SuaSu1s&t=3shttps://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work

COURSE OUT COMES :

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

COURSE OUT COMES	**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 entropy and 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 WITH PROGRAM OUT COMES:

Map course out comes **(CO)** for each course with program out comes **(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

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U1PHGEP01/ 23U3PHGEP01	Title	Semester	I / III
Hrs/Week	3	**ALLIED PRACTICAL – I**	Credits	2

COURSE	**ODD SEMESTER - ALLIED PRACTICAL**
COURSE TITLE	**ALLIED PRACTICAL – I**
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

ANY EIGHT

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
6. Surface tension and interfacial Surface tension – drop weight method
7. Comparison of viscosities of two liquids – burette method
8. Specific heat capacity of a liquid – half time correction
9. Verification of laws of transverse vibrations using sonometer
10. Calibration of low range voltmeter using potentiometer
11. Determination of thermo emf using potentiometer
12. Verification of truth tables of basic logic gates using ICs
13. Verification of De Morgan's theorems using logic gate ICs.
14. Use of NAND as universal building block.

Note : Use of digital balance permitted

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U2PHGE02/ 23U4PHGE02	Title	Semester	II / IV
Hrs/Week	4	**ALLIED PHYSICS –II**	Credits	3

COURSE	**ALLIED PAPER**
COURSETITLE	**ALLIED PHYSICS –II**
COURSE OBJECTIVES	To understand the basic concepts of optics, modern Physics, concepts of relativity and quantum physics, semiconductor physics, and electronics.

UNITS	COURSE DETAILS
UNIT-I	**GEOMETRICAL OPTICS :** Spherical aberration of a thin lens – Methods of reducing - spherical aberration – Coma – Aplanatic surface – Astigmatism – Curvature of the field – Distortion. **INTERFERENCE :** Introduction – Air wedge – Newton's rings – Colours of thin films. **DIFFRACTION :** Plane diffraction Grating – Theory of plane transmission Grating. **POLARIZATION :** Double refraction- half wave and quarter wave plate – Production and detection of plane, elliptically and circularly polarized light.
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 :** Introduction – Nucleus – Classification of Nuclei – Nuclear Size – Charge – Mass and Spin – nuclear energy – mass defect – binding energy - magic numbers – *Nuclear models :* Liquid drop model - shell model - radioactivity – uses – half life – mean life - radio isotopes and uses –controlled and uncontrolled chain reaction – nuclear fusion – thermonuclear reactions – differences between fission and fusion – energy released in fission – chain reaction – critical reaction – critical size- atom bomb – nuclear reactor – breeder reactor.
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, NewDelhi. 2. K.Thangaraj and D.Jayaraman (2004), Allied Physics, Popular Book Depot, Chennai. 3. Brijlal and N.Subramanyam (2002), Textbook of Optics, S.Chand & Co, NewDelhi. 4. R.Murugesan (2005), ModernPhysics,S.Chand&Co,NewDelhi. 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, NewDelhi. 4. Thomas L. Floyd (2017), Digital Fundamentals, 11th Edn., Universal Book Stall, NewDelhi. 5. V.K.Metha (2004), Principles of electronics, 6th Edn., 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

COURSE OUT COMES :

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

COURSE OUT COMES	**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 various experiments 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, nuclearforces 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 WITH PROGRAM OUT COMES:

Map course out comes **(CO)** for each course with program out comes **(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

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	23U2PHGEP02/ 23U4PHGEP02	Title	Semester	II / IV
Hrs/Week	2	**ALLIED PRACTICAL – II**	Credits	2

COURSE	**EVEN SEMESTER - ALLIED PRACTICAL**
COURSETITLE	**ALLIED PRACTICAL – II**
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

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 resistanceof 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 Zerner/IC regulated power supply
13. Construction of AND, OR, NOT gates using diodes and transistor
14. NOR gate as a universal building block