GOVERNMENT ARTS COLLEGE (AUTONOMOUS)
COIMBATORE-641 018

B.Sc. PHYSICS

(Effective from the Academic year 2021-2022)

POSTGRADUATE AND RESEARCH DEPARTMENT OF PHYSICS

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Preamble

The world has advanced considerably throughout the decades and the need for higher education has been on the rise. The role of higher education in social and spatial mobility has attracted considerable attention. It provides opportunities for lifelong learning, allowing people to upgrade their knowledge and skills from time to time based in societal needs.

Over the past decades the higher education system of our country has undergone substantial structural and functional changes resulting in both quantitative and qualitative development of the beneficiaries. Such changes have gained momentum with the introduction of Choice Based Credit System (CBCS) which further expects learning outcome-based curriculum in order to maximize the benefits of the newly designed curriculum. The learning outcome-based curriculum will definitely help the teachers of the discipline to visualize the curriculum more specifically in terms of the learning outcomes expected from the students at the end of the instructional process. It is pertinent to mention here that the purpose of education is to develop an integrated personality of the individual and the educational system provides all knowledge and skills to the learner for this.

Tamil Nadu State Council for Higher Education (TANSCHE) has formed the State Integrated Boards of Studies, which, with great diligence and expertise has devised the mandatory areas that have to be covered for three-year under graduation and two-year post-graduation courses to realize the facilitation of the mobility of faculty and students from one university to another and to easily solve the problem of equivalence among courses. Great care has been taken so that these areas would take 75% of the course content and the remaining 25% can be decided by the individual institutions. The areas that must be covered by the student that are mandatory for earning the degree to have due value has been worked out so that the student will gain enough depth of knowledge in the subject concerned. 25% percent of the syllabus should be designed by the institutions, and the areas covered under this also must have a weightage of 25%. This gives the autonomous institution seamless liberty on every Board of Studies (BOS) to innovate and experiment, and more importantly, it is here that the institution devises appropriate strategies by which (i) to make creative and critical applications of what has been learnt in the mandatory components, and (ii) to meaningfully connect the learners to the career demands and expectations. It is essential that the theoretical subject knowledge of the students must be translated in to practical hands-on experience.

One of the significant reforms in the undergraduate education is to introduce the Learning Outcomes-based Curriculum Framework (LOCF) which makes it student-centric, interactive and outcome-oriented with well-defined aims, objectives and goals to achieve. LOCF also aims at ensuring uniform education standard and content delivery across the country which will help the students to ensure similar quality of education irrespective of the institute and location. With initiatives of University Grants Commission (UGC) for nation-wide adoption and implementation of the LOCF for bachelor's programmes in colleges, universities and HEIs in general. A Core Expert Committee (CEC) was constituted to formulate the modalities for developing the LOCF in various subjects being taught in the undergraduate courses in sciences, humanities, commerce and professional courses. The CEC also constituted the Subject Expert Committees (SEC) in various subjects to prepare detailed guidelines for the LOCF in subjects concerned.

The key components of the planning and development of LOCF are given in terms of clear and unambiguous description of the Graduate Attributes (GA), Qualification Descriptors (QD), Program Learning Outcomes (PLO) and Course Learning Outcomes (CLO) to be achieved at the end of the successful completion of each undergraduate program to be offered by HEIs. In undergraduate

education in Information Technology, the programme of study leading to the degree of B.Sc. in Information Technology is discussed herewith.

The Qualification Descriptors (QD), Program Learning Outcomes (PLO) and the Course Learning Outcomes (CLO) were also finalized keeping the broad requirement of the programme in view. The LOCF also gives general guidelines for the Teaching Learning Process (TLP) corresponding to each component of theory, experiment, tutorials, projects and industrial / field visits to be followed in order to achieve the stated outcomes for each component. Finally, some suggestions for using various methods in the assessment and evaluation of learning levels of students are also made. It is a student centric framework where they are expected to learn fundamentals of Information Technology along with the latest trends and techniques like Artificial Intelligence, Internet of Things, and Machine Intelligence along with advanced skillsets that include Mobile Application Development, Object Oriented Programming among many other courses.

1. Introduction

Outcome based education empowers students to choose their desired subject. Focusing on results outcome-based education (OBE) generates a transparent expectation of the top results. Teachers can structure their classes according to the student's wishes by reading transparently what needs to be done.

The learning outcome-based curriculum framework in Physics should also allow for the flexibility and innovation in the program design of the UG education, and its syllabi development, teaching learning process and the assessment procedures of the learning outcomes. The process of learningis defined by the following steps which should form the basis of final assessment of the achievement at the end of the program.

- The accumulation of facts of nature and the ability to link the facts to observe and discover the laws of nature i.e., develop an understanding and knowledge of the basic Physics.
- The ability to use this knowledge to analyze new situations and learn skills and tools like mathematics, engineering and technology to find the solution, interpret the results and make predictions for the future developments.
- The ability to synthesize the acquired knowledge, understanding and experience for a better and improved comprehension of the physical problems in nature and to create new skills and tools for their possible solutions.

The conceptualization and formulation of the learning outcomes for an undergraduate program in Physics is aimed to achieve (i) and (ii) above while the (iii) could be planned for the PG and research programs in Physics in the Higher Education Institutions in India.

1.1 Course Structure – Types of Courses.

The following types of courses are offered under CBCS-LOCF:

a) Core Courses (CC). A core course is a compulsory discipline specific course. A student of Physics has to take such 15 Physics courses over six semesters.

b) Elective Courses (EC). An elective course is a course that is to be chosen from a specified set of courses. These courses are of two types, which may be very specific or specialized or advanced or supportive to the discipline/subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

i. **Discipline Specific Electives (DSE).** These are elective courses that provide advanced undergraduate training in specialised areas of Physics. A set of six semester-specific, courses of this kind are offered in the First through fourth semester of the Undergraduate programme, Physics.

ii**. Project.** An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a

course on his own with an advisory support by a teacher/faculty member is called dissertation/project. Such a course is compulsory in sixth semester.

iii. **Generic Electives (GE).** These courses, in disciplines other than Physics, are intended to broaden the training of a student in the Physics Undergraduate programme. A student of Physics will take one such course, offered by another department, in each of Semester V and VI.

c) Ability Enhancement Compulsory Course (AECC). Two such courses are to be taken, one in Semester I (Environmental Studies) and one in Semester II (Value Education– Gandhian Thoughts).

d) Skill Enhancement Course (SEC). A student is to take one such course each in Semester III through Semester VI.

2. Learning Outcomes-based approach to Curriculum Planning

2.1 Nature and extent of UG program in Physics:

The UG programs in Physics builds on the basic Physics taught at the +2 level in all the schools in the country. Ideally, the +2 senior secondary school education should aim and achieve a sound grounding in understanding the basic Physics with sufficient content of topics from modern Physics and contemporary areas of exciting developments in physical sciences to ignite the young minds. The curricula and syllabi should be framed and implemented in such a way that the basic connection between theory and experiment and its importance in understanding Physics should be apparent to the student. This is very critical in developing a scientific temperament and urge to innovate, create and discover in Physics. Unfortunately, the condition of our school system in most parts of the country lacks the facilities to achieve the above goal and it is incumbent upon the college/university system to fill the gaps in the knowledge creation of our young minds created by the lack of infrastructural and academic resources of our school system and strengthen their understanding in all the subjects through the UG programs specially in Physics and other science subjects.

The undergraduate program in Physics is presently being offered though the course designed for granting the following degree by various colleges and universities in India. The course is of three-year duration spread over six semesters after the higher secondary (+2) level Physics course:

B.Sc. Physics

2.2 Aims of UG program in Physics

The aims and objectives of our UG educational programs in sciences in general and Physics in particular should be structured to

a) create the facilities and environment in all the educational institutions to consolidate the knowledge acquired at +2 level and to motivate and inspire the students to create deep interest in Physics, to develop broad and balanced knowledge and understanding of physical concepts, principles and theories of Physics.
b) learn, design and perform experiments in the laboratories to demonstrate the concepts, principles and theories learned in the classrooms.

c) develop the ability to apply the knowledge acquired in the classroom and laboratories to specific problems in theoretical and experimental Physics.
d) expose the student to the vast scope of Physics as a theoretical and experimental science with applications in solving most of the problems in nature spanning from 10^{-15} m to 10^{26} m in space and 10^{-10} eV to 10^{25} eV in energy dimensions.
e) emphasize the discipline of Physics to be the most important branch of science for pursuing the interdisciplinary and multidisciplinary higher education and/or research in interdisciplinary and multidisciplinary areas.
f) to emphasize the importance of Physics as the most important discipline for sustaining the existing industries and establishing new ones to create job opportunities at all levels of employment.

In view of opening the new windows in higher education and research and opening job opportunities at all levels from technicians to innovator scientists and engineers, one undergraduate program is offered in our institution.

3. Graduate Attributes in Physics

Some of the characteristic attributes of a graduate in Physics are

3.1 Education and Training

a. Provide training of the highest academic quality in Physics in a challenging and supportive learning environment.
b. Develop a systematic understanding of both core areas and advanced topics in the study of Physics
c. Develop the ability to evaluate primary evidence critically; and the conceptual understanding to present arguments and solutions based on theory and research analyses
d. Promote an appreciation of the limits to our present understanding of the subject, its applications in various fields.
e. Provide for student interaction with high-level scientific expertise and advanced equipment in an environment committed to scientific advance.
f. Develop skills in gathering and interpreting the research results used to gain this understanding and thereby equip students with the foundations for their professional careers or additional study.

3.2 Communication Skills

a. Skills to communicate in written, numerical, graphical and verbal forms, in ways that are appropriate to different audiences and indifferent situations, ranging from scientific and industry reports, to group and individual oral presentations, and from blogs and outreach articles, to news articles and essays.
b. Formulate a coherent written, electronic or oral presentation on the basis of material gathered (e.g. textual, numerical, verbal, graphical) and organised independently on a given topic.
c. Express clearly ideas and arguments, both orally and in writing and in electronic media.
d. Use group discussions and joint seminar presentations to research and present work collaboratively; and Develop oral presentation and participation skills during seminars and group-work, and in written form through online e- learning tools, dissertations and essays.

3.3 Critical Thinking

a. Acquire an understanding of the concept in physics and related disciplines and an ability to understand, integrate, and extend it so that all fundamental geological concepts are accessible.
b. Acquire, digest and critically evaluate scholarly arguments, the assumptions behind them, and their theoretical and empirical components.

3.4 Problem Solving

a. Skills to recognise and articulate a problem and then apply appropriate conceptual frameworks and methods to solve it.
b. Emphasis is placed on larger, integrated problem-solving exercises, during which students are taught how to process complex data sets using a diverse range of skills and knowledge. This provides the foundation for student-led independent, but academically directed, project work.

3.5 Analytical Reasoning

a. A broad knowledge base in physics and related disciplines and an ability to understand, integrate, and extend it so that all fundamental physical concepts are accessible.
b. Competency in both theory and laboratory skills, and in data analysis, interpretation and presentation that permit the successful pursuit of pure or applied problems in Physics.

3.6 Research-Related Skills

a. Develop a research design, which has an appropriate problem related to physics but may incorporate some scientific methods, ability to plan and write a research paper.
b. Ability to process and interpret large, complex, datasets, to hypothesis set and test, and to function as a numerate, literate scientist able to prove insight and guidance related to real-world problems and issues.
c. Ability to apply knowledge and understanding to address familiar, unresolved and more open-ended problems.
d. Ability to collect, analyse, synthesise, summarise and inter-relate diverse processes and facts, to formulate and test hypotheses and reach conclusions.

3.7 Self and Time Management

a. Time management skills are developed through interaction with the assessment process in all years: students must learn how to meet deadlines for submission of continuous assessment material and how to set aside appropriate time to prepare for end of year examinations.
b. Time management is integral to the student's independent mapping project.

3.8 Team Work

a. Ability to contribute effectively to team objectives and interact productively with others both in project-related settings and in meetings.
b. This is addressed through group exercises in all years of the Physics programme, including in-class presentations, group lab-sessions where students use research equipment, mock-industry presentations to panels of outside industry experts, and group fieldwork mini-projects.

3.9 Scientific Reasoning

a. View the Physics from new and challenging perspectives of time, space, process and pattern.
b. Develop a systematic understanding of both core areas and advanced topics in the study of Physics
c. Provide for student interaction with high-level scientific expertise and advanced equipment in an environment committed to scientific advance.
d. Develop the ability to evaluate primary evidence critically; and the conceptual understanding to present arguments and solutions based on primary data and theory.

3.10 Digital Literacy

a. ability of advanced Word skills, databases and spreadsheets
b. ability to use digital resources for presentations

3.11 Moral and Ethical Values

a. The degree to which every student engages with these themes will vary but it is important that all think especially about ethical issues
b. Avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights, and adopting objectives, unbiased and truthful actions in all aspects of work.

3.12 Leadership Readiness

a. Provide training of the highest academic quality in Physical sciences in a challenging and supportive learning environment
b. Be accessible to those qualified at intake in a broad and diverse range of sciences.
c. Provide an excellent preparation for a career in professional practice in Material Sciences, and specialist areas of physics

3.13 Life-long Learning

a. ability to blend academic and practical skills
b. ability to transfer such skills to other domains of one's life and work

3.14 Global Competency

a. After completing course in Physics, the student is expected to be fully knowledgeable about the subject and not only from the point of view of examination.
b. He/She will be ready to accept challenges and stand in competition at a national and global level.

4. Qualification descriptors for a UG programs in Physics

4.1 Qualification descriptors for a B.Sc. Physics

The qualification descriptors for a B.Sc. Physics program may include the following.

The graduates should be able to:

- Demonstrate

  (i) a fundamental/systematic or coherent understanding of the academic field of Physics, its different learning areas like Astrophysics, Material science, Nuclear and Particle Physics, Condensed matter Physics, Atomic and Molecular Physics, Mathematical Physics, Analytical dynamics, Space science and applications, and its linkages with related disciplinary areas/subjects like Chemistry, Mathematics, Life sciences, Environmental sciences, Atmospheric Physics, Computer science, Information Technology;

  (ii) procedural knowledge that creates different types of professionals related to different areas of study in Physics outlined above, including research and development, teaching and government and public service;

  (iii) skills in areas related to specialization area relating the subfields and current developmentsin the academic field of Physics.
- Use knowledge, understanding and skills required for identifying problems and issues relating to Physics, collection of relevant quantitative and/or qualitative data drawing on a wide range of sources from various Physics laboratories of the world, and their application, analysis and evaluation using methodologies as appropriate to Physics for formulating new theories and concepts.
- Communicate the results of studies undertaken accurately in a range of different contexts using the main concepts, constructs and techniques of Physics. Develop communication abilities to present these results in technical as well as popular science meetings organized in various universities and other private organizations.
- Ability to meet one's own learning needs, drawing on a range of current research and development work and professional materials, and interaction with other physicists around the world.
- Apply one's knowledge of Physics and theoretical and laboratory skills to new/unfamiliar contexts to identify and analyse problems and issues and solve complex problems in Physics and related areas with well-defined solutions.
- Demonstrate Physics-related technological skills that are relevant to Physics-related job trades and employment opportunities.

5. Programme Learning Outcomes relating to B.Sc. Physics

5.1 Program Learning Outcomes in B.Sc. Physics

The student graduating with the Degree B.Sc. Physics should be able to

- Acquire

  i) a fundamental/systematic or coherent understanding of the academic field of Physics, its different learning areas and applications in basic Physics like Astrophysics, Material science, Nuclear and Particle Physics, Condensed matter Physics, Atomic and Molecular Physics, Mathematical Physics, Analytical dynamics, Space science, and its linkages with related disciplinary areas / subjects like Chemistry, Mathematics, Life sciences, Environmental sciences, Atmospheric Physics, Computer science, Information Technology;

  ii) procedural knowledge that creates different types of professionals related to the disciplinary/subject area of Physics, including professionals engaged in research and development, teaching and government/public service;

  iii) skills in areas related to one's specialization area within the disciplinary/subject area of Physics and current and emerging developments in the field of Physics.

- Demonstrate the ability to use skills in Physics and its related areas of technology for formulating and tackling Physics-related problems and identifying and applying appropriate physical principles and methodologies to solve a wide range of problems associated with Physics.
- Recognize the importance of mathematical modeling simulation and computing, and the role of approximation and mathematical approaches to describing the physical world.
- Plan and execute Physics-related experiments or investigations, analyze and interpret data/information collected using appropriate methods, including the use of appropriate software such as programming languages and purpose-written packages, and report accurately the findings of the experiment/investigations while relating the conclusions/findings to relevant theories of Physics.
- Demonstrate relevant generic skills and global competencies such as (i) problem-solving skills that are required to solve different types of Physics-related problems with well-defined solutions, and tackle open-ended problems that belong to the disciplinary-area boundaries; (ii) investigative skills, including skills of independent investigation of Physics-related issues and problems; (iii) communication skills involving the ability to listen carefully, to read texts and research papers analytically and to present complex information in a concise manner to different groups/audiences of technical or popular nature; (iv) analytical skills involving paying attention to detail and ability to construct logical arguments using correct technical language related to Physics and ability to translate them with popular language when needed; (v) ICT skills; (vi) personal skills such as the ability to work both independently and in a group.
- Demonstrate professional behavior such as (i) being objective, unbiased and truthful in all aspects of work and avoiding unethical, irrational behavior such as fabricating, falsifying or misrepresenting data or committing plagiarism; (ii)the ability to identify the potential ethical issues in work-related situations; (iii) appreciation of intellectual property, environmental and sustainability issues; and (iv) promoting safe learning and working environment.

PROGRAM LEVEL OUTCOME OF B.Sc. PHYSICS

An undergraduate student of the program of study in Physics should be able to

PLO 1 Demonstrate
(i) a fundamental/systematic understanding of the academic field of Physics, its different learning areas and applications, and its linkages with related disciplinary areas/subjects;
[Guiding Attribute : **Disciplinary (subject) Knowledge**]
(ii) procedural knowledge that creates different types of professionals related to the disciplinary/subject area of Physics, including professionals engaged in research and development, teaching and government/public service; [Guiding Attribute : **Communication Skills**]
(iii) Skills in areas related to one's specialization area within the disciplinary/subject area of Physics and current and emerging developments in the field of Physics.[Guiding Attribute : **Critical Thinking**]

PLO 2 Demonstrate the ability to use Physics skills such as formulating and tackling Physics-related problems and identifying and applying appropriate physical principles and methodologies to solve a wide range of problems associated with Physics. [Guiding Attribute: **Problem Solving]**.

PLO 3 Recognize the importance of mathematical techniques and computing to describe the physical world.[Guiding Attribute : **Analytical Reasoning**]

PLO 4 Plan and execute physics-related experiments or investigations, analyse and interpret data/information collected using appropriate methods, including the use of appropriate software such as programming languages and report accurately the findings of the experiment/investigations while relating the conclusions/findings to relevant theories of Physics.[Guiding Attribute : **Research related skills]**

PLO 5 Demonstrate relevant generic skills and global competencies such as
(i) problem-solving skills that are required to solve different types of physics-related problems with well-defined solutions, and tackle open-ended problems that may cross disciplinary-area boundaries; [Guiding Attribute : **Scientific Reasoning]**
(ii) investigative skills, including skills of independent investigation of physics-related issues and problems; [Guiding Attribute : **Reflective thinking]**
(iii) communication skills involving the ability to listen carefully, to read texts and research papers analytically and to present complex information in a concise manner to different groups/audiences; [Guiding Attribute : **Self-directed learning]**
(iv) analytical skills involving paying attention to detail and ability to construct logical arguments using correct technical language related to physics; [Guiding Attribute : **Logical Reasoning]**
(v) ICT skills; [Guiding Attribute : **Digital Literacy**]
(vi) Personal skills such as the ability to work both independently and in a group. Guiding Attribute : **Team working**]

PLO 6 Demonstrate subject-related and transferable skills that are relevant to some of the job trades and employment opportunities.
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; [Guiding attribute: **Cooperation / Team work**]
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; [Guiding attribute: **Leadership readiness / quality]**
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; [Guiding attribute: **Information / Digital Literacy**]
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; [Guiding attribute: **Moral and ethical awareness / reasoning]**
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; [Guiding attribute: **Multicultural competence]**

6. STRUCTURE OF B.Sc. PROGRAMME IN PHYSICS

B.Sc. PHYSICS CURRICULUM FOR THE STUDENTS ADMITTED FROM 2021-2022 ONWARDS UNDER LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)

	S. No.	Subject Code	Part	Title of the Paper	Credit	Maximum Marks			Hrs/ Week	Passing Minimum	
						Internal	External	Total		External	Total
SEMESTER – 1	1.	21TAM11L	I	Language I – Tamil – Paper I	3	50	50	100	6	20	40
	2.	21ENG12L	II	Language II – English – Paper I	3	50	50	100	6	20	40
	3.	21BPH13C	III	Core 1: Properties of Matter & Sound	5	50	50	100	5	20	40
	4.	21BPH14A	III	Allied I: Allied Mathematics – I	5	50	50	100	8	20	40
	5.	21ENV1GE	IV	Environmental Studies	2	50	50	100	2	20	40
				Total	**18**			**500**	**27**		
	6.		III	Core Practical I: General Experiments – I	Examination at the end of II Semester				3		

	S. No.	Subject Code	Part	Title of the Paper	Credit	Maximum Marks			Hrs/ Week	Passing Minimum	
						Internal	External	Total		External	Total
SEMESTER – 2	1.	21TAM21L	I	Language I – Tamil – Paper II	3	50	50	100	6	20	40
	2.	21ENG22L	II	Language II – English – Paper II	3	50	50	100	6	20	40
	3.	21BPH23C	III	Core 2: Heat and Thermodynamics	5	50	50	100	5	20	40
	4.	21BPH24A	III	Allied I: Allied Mathematics – II	5	50	50	100	8	20	40
	5.	21BPH25P	III	Core Practical I: General Experiments – I	2	50	50	100	3	20	40
	6.	21VAL2GE	IV	Value Education	2	50	50	100	2	20	40
				Total	**20**			**600**	**30**		

	S. No.	Subject Code	Part	Title of the Paper	Credit	Maximum Marks			Hrs/ Week	Passing Minimum	
						Internal	External	Total		External	Total
SEMESTER – 3	1.	21TAM31L	I	Language I – Tamil – Paper III	3	50	50	100	6	20	40
	2.	21ENG32L	II	Language II – English – Paper III	3	50	50	100	6	20	40
	3.	21BPH33C	III	Core 3: Mechanics	5	50	50	100	4	20	40
	4.	21BPH34A	III	Allied II: Allied Chemistry – I	4	30	45	75	5	18	30
	5.	21BPH35S	IV	Skill Based Elective – I: Energy Physics	3	50	50	100	4	20	40
				Total	**18**			**475**	**25**		
	6.		III	Core Practical II: General Experiments – II	Examination at the end of IV Semester				2		
	7.		III	Allied Practical: Allied Chemistry Practical	Examination at the end of IV Semester				3		

	S. No.	Subject Code	Part	Title of the Paper	Credit	Maximum Marks			Hrs/ Week	Passing Minimum	
						Internal	External	Total		External	Total
SEMESTER – 4	1.	21TAM41L	I	Language I – Tamil – Paper IV	3	50	50	100	6	20	40
	2.	21ENG42L	II	Language II – English – Paper IV	3	50	50	100	6	20	40
	3.	21BPH43C	III	Core 4: Optics	5	50	50	100	4	20	40
	4.	21BPH44A	III	Allied II: Allied Chemistry – II	4	30	45	75	5	18	30
	5.	21BPH45S	IV	Skill Based Elective –II: Biomedical Instrumentation	3	50	50	100	4	20	40
	6.	21BPH46P	III	Core Practical II: General Experiments – II	2	50	50	100	2	20	40
	7.	21BPH47P	III	Allied Practical: Allied Chemistry Practical	2	25	25	50	3	10	20
	8.	21EXA4GE	V	Extension Activities: NCC/NSS/P.Ed,/YRC	1						
				Total	**23**			**625**	**30**		

	S. No.	Subject Code	Part	Title of the Paper	Credit	Maximum Marks			Hrs/ Week	Passing Minimum	
						Internal	External	Total		External	Total
SEMESTER – 5	1.	21BPH51C	III	Core 5: Mathematical Physics	5	50	50	100	4	20	40
	2.	21BPH52C	III	Core 6: Electricity and Magnetism	5	50	50	100	4	20	40
	3.	21BPH53C	III	Core 7: Electronics	5	50	50	100	4	20	40
	4.	21BPH54S	IV	Skill Based Elective – III: Digital Electronics and Microprocessor	3	50	50	100	4	20	40
	5.	21BPH5EL	IV	Non-Major Elective – I: Principles of Physics – I	2	50	50	100	3	20	40
				Total	**20**			**500**	**19**		
	6.		III	Core Practical III: General Experiments – III	Examination at the end of VI Semester				3		
	7.		III	Core Practical IV: Analog Electronics and ‘C’ Programming	Examination at the end of VI Semester				3		
	8.		III	Core Practical V: Digital Electronics and Microprocessor	Examination at the end of VI Semester				3		
	9.		III	Project and Viva-voce	Examination at the end of VI Semester				2		

	S. No.	Subject Code	Part	Title of the Paper	Credit	Maximum Marks			Hrs/ Week	Passing Minimum	
						Internal	External	Total		External	Total
SEMESTER – 6	1.	21BPH61C	III	Core 8: Quantum Mechanics and Relativity	5	50	50	100	4	20	40
	2.	21BPH62C	III	Core 9: Solid State Physics and Nuclear Physics	5	50	50	100	4	20	40
	3.	21BPH63C	III	Core 10: Atomic Physics and Spectroscopy	5	50	50	100	4	20	40
	4.	21BPH64S	IV	Skill Based Elective – IV: Computer Programming in ‘C’	3	50	50	100	4	20	40
	5.	21BPH6EL	IV	Non-Major Elective – II: Principles of Physics – II	2	50	50	100	3	20	40
	6.	21BPH65P	III	Core Practical III: General Experiments – III	2	50	50	100	3	20	40
	7.	21BPH66P	III	Core Practical IV: Analog Electronics and ‘C’ Programming	2	50	50	100	3	20	40
	8.	21BPH67P	III	Core Practical V: Digital Electronics and Microprocessor	2	50	50	100	3	20	40
	9.	21BPH68V	III	Project and Viva-voce	15	50	50	100	2	20	40
				Total	**41**			**900**	**30**		

Subject	Part	Number of Papers	Credit/Paper	Total Credits	Duration of Examination	Total Marks
Language I: Tamil	I	4	3	12	3 Hours	400
Language II: English	II	4	3	12	3 Hours	400
Core	III	10	5	50	3 Hours	1000
Core Practical	III	5	2	10	3 Hours	500
Allied – Mathematics	III	2	5	10	3 Hours	200
Allied – Chemistry	III	2	4	8	3 Hours	150
Allied Chemistry Practical	III	1	2	2	3 Hours	50
Project	III	1	15	15	---	100
Skill Based Elective	IV	4	3	12	3 Hours	400
Non-Major Elective	IV	2	2	4	3 Hours	200
Environmental Studies& Value Education	IV	2	2	4	3 Hours	200
Extension Activities	V			1	---	---
Total		**37**		**140**		**3600**

Year	Subject Title	Sem	Sub Code	Hours/ Week
2021-22 Onwards	Core 1: Properties of Matter and Sound	I	21BPH13C	5

COURSE LEVEL OUTCOMES:

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

CLO-1 Revise the principles of elasticity through the study of Young's Modulus and rigidity modulus
CLO-2 Analyze the principles of fluid flow and apply them in equations governing fluid dynamics
CLO-3 Explain the basic concepts of surface tension and its applications
CLO-4 Discuss the laws of gravitation and apply it in compound pendulum to determine the acceleration due to gravity
CLO-5 Recognize with the general terms in acoustics like Intensity, Reverberation and learn in detail about the production, detection and application of ultrasonic waves
CLO-6 Execute experiments related to Young's modulus, rigidity modulus, gravitation, surface tension and viscosity and extrapolate the skills to new unfamiliar contexts
CLO-7 Recall the principles and basic equations and apply them to unseen problems

UNIT 1: Elasticity

Stress-strain definitions – Different moduli of elasticity – Poisson's ratio – Relation between the elastic moduli – Twisting couple on a cylinder – Determination of rigidity modulus – Static torsion method (Searle's apparatus –Scale and telescope)

Bending of beam – Expression for bending moment – Expression for depression – Measurement of Young's modulus by Non-Uniform bending and Uniform bending – I section of girders

UNIT 2: Hydrodynamics and Viscosity

Equation of continuity – Energy of the liquid – Euler's equation for unidirectional flow – Bernoulli's theorem – Explanation and Applications of Bernoulli's theorem.

Stream lined motion - Turbulent motion - Coefficient of Viscosity and its dimensions– Rate of flow of a liquid in a capillary tube – Poiseuille's formula – Experiment to determine the coefficient of viscosity of liquid – Study of variation of viscosity of liquid with temperature - applications of viscosity

UNIT 3: Surface Tension

Definition and dimensions of surface tension – Explanation of Surface tension on Kinetic theory – Pressure difference across a liquid surface – Excess pressure inside a curved liquid surface – Experimental determination of surface tension of a liquid by Jaegar's method – Variation of surface tension with temperature – Quincke's method and Drop weight method of determining the surface tension of liquid –Problems in Work done and Excess pressure.

UNIT 4: Gravitation

Newton's law of gravitation – Kepler's laws of planetary motion – Determination of G by Boy's experiment – Gravitational field and gravitational potential – Gravitational potential and field due to a spherical shell – Gravitational potential and field due to a solid sphere – Variation of 'g' with latitude, altitude and depth – The compound pendulum (theory and

experiment).

UNIT 5: Sound

Simple harmonic motion – forced vibrations and resonance – Characteristics of musical sound – Determination of frequency by Melde's method – Frequency of AC using sonometer

Acoustics – Reverberation – Sabine's Reverberation formula – Determination of Absorption coefficient.

Ultrasonics – Piezo-electric effect and Magnetostriction effect – Production of Ultrasonics by Piezoelectric oscillator and Magnetostriction oscillator – Detection and Applications of Ultrasonic waves

PRACTICALS:

- Determination of Rigidity Modulus of a wire using torsional pendulum
- Determination of Young's Modulus of a beam using uniform and non-uniform bending methods (Pin and Microscope, and optic lever)
- Determination of acceleration due to gravity using Compound Pendulum
- Determination of surface tension of a liquid and interfacial surface tension of liquids using drop weight method
- Determination of the viscosity of highly viscous liquids using Stoke's method
- Determination of the frequency of AC main using sonometer

PEDAGOGY STRATEGIES:

- Board and Chalk lecture
- Powerpoint slide presentations
- Assignments
- Laboratory classes
- Quizzes

REFERENCES:

1. R. Murugeshan, Properties of Matter, S. Chand & Co. Pvt. Ltd., New Delhi, Revised Edition, 2017
2. D.S. Mathur, Elements of Properties of Matter, S. Chand & Co. Pvt.Ltd.,
3. Brijlal & N. Subramanyam, Properties of Matter, Vikas Publishng. Pvt. Ltd, 2005.
4. Brijlal & N. Subramanyam, A Text Book of Sound, Vikas Publishing. Pvt. Ltd, 2008
5. Brijlal & N. Subramanyam, Waves and Oscillations, Vikas Publishing. Pvt. Ltd, 2008
6. Richard P.Feynman "Lectures on Physics .Vol. 1 & II" The New Millennium, First Edition 2012
7. David Halliday and Robert Resnick, Fundamentals of Physics by Wiley Plus., 2013

FURTHER READING:

1. B.H. Flowers and E. Mendoza, Properties of Matter, Wiley Plus, 1991
2. H.R. Gulati, Fundamentals of General properties of matter, S. Chand & Co. Pvt. Ltd, 2012
3. Chatterjee and Sen Gupta, A treatise on general properties of matter, New central

Books agency (p) Ltd, Kolkata, 2001
4. R.L. Saihgal, A Text Book of Sound, S. Chand & Co. Pvt. Ltd., New Delhi, 1979

WEB-RESOURCES:

1. https://www.pbslearningmedia.org/subjects/science/physical-science/matter-and-interactions/properties-of-matter
2. https://www.khanacademy.org/science/physics/centripetal-force-and-gravitation/gravity-newtonian/v/introduction-to-newton-s-law-of-gravitation
3. https://physicstoday.scitation.org/doi/10.1063/1.1580055

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES							
	Course Level Outcomes (CLO)						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	
Communication Skills	✓	✓	✓	✓	✓		✓
Critical Thinking	✓	✓	✓	✓	✓	✓	✓
Research-related skills					✓	✓	✓
Analytical reasoning	✓	✓					✓
Problem Solving		✓		✓		✓	✓
Team work			✓	✓		✓	

Year	Sem.	Subject Code	Title of the paper	Hours/Week
2021 -2022 onwards	**I**	**21ENV1GE**	**ENVIRONMENTAL STUDIES (For all UG courses)**	**2**

COURSE LEARNING OUTCOMES:

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

1. Recognize the role of the environment and the need to conserve it for sustaining life.
2. Enumerate the natural resources
3. Explores the adverse effects of deforestation and over exploitation of natural resources
4. Associate the components of the ecosystem and need for biodiversity conservation.
5. Evaluate the environmental pollution hazards and their effects on the living system.
6. Interpret the different disaster management procedures.
7. Analyse the climatic change and global effects
8. Infer the need for environmental laws in the constitution of India.
9. Relate the growth of the human population and its impact on the environment.

UNIT 1:

Environment – Introduction – Nature - Scope – Content – Need for study. Natural resources- Forest and energy resources- Use and overexploitation - deforestation. Energy resources- renewable and non-renewable energy resources.

UNIT 2:

Ecosystem – concept – types- Forest, Grassland, Desert and Aquatic (Pond)- Structure and function of an ecosystem – Producers- consumers and decomposers – Food chain – food web- ecological pyramids- energy flow. Biodiversity and its conservation- *in situ* and *ex situ* conservation- Mega biodiversity centres and hotspots.

UNIT 3:

Environmental pollution- definition- causes-effects and control measures of air, water, soil, thermal and nuclear pollution. Waste management- Industrial and solid waste. Disaster management – earthquake, cyclone, flood and landslides.

UNIT 4:

Social Issues and the environment-Urbanization-Urban problems related to energy and watershed management. Environmental Ethics- Issues and possible solutions- Wasteland reclamation- Climate change - causes and effects. Global warming- Acid rain- Ozone layer depletion- Public awareness. Environmental laws- Environment Protection Act, Wildlife Protection Act, Forest Conservation Act.

UNIT 5:

Human population and its impact on environment- Population growth- Resettlement and Rehabilitation of project affected persons- Case studies – Sardar Sarovar Project,

Maharashtra and Bandipur National Park- Project Tiger, Karnataka, NTPC, India. Role of Indian and Global religions and Cultures in environmental conservation- Case study: sacred groves in Western Ghats (kavu) & Chinese culture. Human and Wildlife Conflict.

PEDAGOGY STRATEGIES

- Board and Chalk lectures
- PowerPoint slide presentations
- Assignments

Textbooks:

1. Sharma, P. D. 2000. Ecology & Environment. Rastogi Publications, Meerut, India.
2. Bharucha, E. 2003. Text book of Environmental Studies. UGC, New Delhi & Bharati Vidyapeeth Institute of Environmental Education and Research, Pune.
3. Arumugam, M. and Kumaresan, V. 2016. Environmental Studies (Tamil version). Saras Publications, Nagerkoil.

Online/E-Resources:

https://www.edx.org/course/subject/environmental-studies
https://www.coursera.org/courses?_facet_changed_=true&domains=life-sciences%2Cphysical- science-and-engineering%2Csocial-sciences&query=environmental%20science%20and%20sustainability&userQuery=environmental% 20science%20and%20sustainability
https://www.open.edu/openlearn/nature-environment/free-courses

COURSE LEVEL MAPPING OF PROGRAMME LEVEL OUTCOME:

Program Level Outcomes (PLO)	**Course Level Outcome (CLO)**								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Disciplinary Knowledge		✓	✓		✓	✓			
Communication Skills		✓		✓				✓	✓
Critical Thinking	✓		✓		✓		✓		
Research related skills	✓		✓			✓		✓	
Analytical reasoning	✓			✓		✓		✓	
Problem Solving		✓	✓			✓			✓
Team Work				✓	✓		✓		✓
Moral and ethical awareness		✓		✓		✓		✓	✓

Year	Subject Title	Sem	Sub Code	Hours/ Week
2021-22 Onwards	Core 2: Heat and Thermodynamics	II	21BPH23C	5

COURSE LEVEL OUTCOMES:

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

CLO-1 Explain the concept of heat, temperature and thermal expansion and its applications in thermometers.
CLO-2 Use thermocouple to measure temperature.
CLO-3 Define specific heat capacity of gas and discuss different theories on specific heat capacity.
CLO-4 Familiarize the kinetic theory of gases and appreciate the use of Joule Thomson effect at low temperature used for liquefaction of gases.
CLO-5 Know the heat transfer mechanism via conduction, convection and radiation and thermal conduction in various materials.
CLO-6 Utilize the fundamental knowledge in Black Body radiations and its energy distribution in the thermal spectrum.
CLO-7 Identify the quantitative methods used in thermal physics.

UNIT I:
Thermometry: Temperature coefficient of Resistance – Platinum Resistance Thermometer – Thermocouple – Seebeck Effect – Peltier Effect – Thermoelectric thermometer – Thermoelectric diagrams.
Calorimetry: Specific heat of solids – Copper block calorimeter – Nernst vacuum calorimeter – Newton's law of cooling – Specific heat capacity of a liquid by cooling – Callendar and Barnes continuous flow method – Specific heat capacity of gases – Relation between them – Joly's differential steam calorimeter – Regnault's method.

UNIT II:
Kinetic Theory of Gases: Postulates – pressure exerted by a perfect gas - Degree of freedom and Theorem of equipartition of energy – Maxwell's law of velocity distribution - Viscosity of gases – Mean free path – Van der Waals equation – Critical constants and their determination.
Low Temperature Physics: Joule-Thomson Effect – Liquefaction of air, hydrogen and helium – Helium I and II – Adiabatic demagnetization.
Superconductivity: Discovery – Critical Temperature – Meissner Effect – Isotope effect- Types of superconductors – applications.

UNIT III:
Entropy: Carnot's Theorem – Otto Cycle – Petrol Engine – Diesel Engine – Clapeyron's Latent heat equation – Entropy – Change in entropy (Reversible and irreversible process) – Temperature-Entropy diagram – Entropy of a perfect gas – Maxwell's thermodynamical relations and applications – Helmholtz function – Gibb's function –Enthalpy.

UNIT IV:
Thermal Conduction: Conduction, convection and radiation – Coefficient of thermal conductivity, thermal diffusivity – Lee's disc method of determining the thermal conductivity of a bad conductor – Searle's method – Forbe's method – Spherical Shell method – Cylindrical flow

of heat – Thermal conductivity of rubber – Thermal conductivity of glass – Heat Flow through a compound wall -Wiedemann-Franz law.

UNIT V:

Thermal Radiation: Properties of thermal radiations - Black body – Kirchoff's law of heat radiation – Prevost's theory of heat exchange – Stefan's law – Mathematical derivation – Derivation of Newton's law of cooling from Stefan's law – Experimental verification of Stefan's law – Distribution of energy in the spectrum of black body – Derivation of Planck's law – Derivation of Wien's law and Rayleigh-Jean's law from Planck's law.

PRACTICALS:

- Determine the Specific Heat Capacity by Newton's Law of Cooling.
- Determine the thermal conductivity of a bad conductor by Lee's disc method.
- Determination of resistance of a thermistor.
- Band gap energy of semiconductor.
- Study the variation of thermo-emf of a thermocouple with difference of temperature of its two junctions using the data available in the literature.

PEDAGOGY STRATEGIES:

- Board and chalk lecture
- Powerpoint slide presentations
- Assignments
- Laboratory classes
- Seminar

REFERENCES:

1. Brijlal and Subramaniyam, Heat and Thermodynamics, S. Chand & Co., 2001
2. Kiruthiga Sivaprasath,R. Murugeshan, Thermal Physics, 5th Edition, S. Chand & Co. 2004
3. J. B. Rajam and C. L Arora, Heat and Thermodynamics, S. Chand & Co.1983.
4. M. Narayanamoorthy and N. Nagarathinam, Heat, National publishing Co, Chennai, Eight edition, 1987
5. A.B.Gupta and H.P.Roy, Heat and thermodynamics, New Central Book Agency (P) Ltd, Calcutta, 1995.
6. J.K.Sharma and K.K.Sarkar, Thermodynamics and Statistical Physics, Himalaya Publishing House, 2018.
7. R. Murugesan, Thermal Physics, S.Chand & Co., 2008.

FURTHER READING:

1. M.W. Zemansky, Richard Dittman, Heat and Thermodynamics, Tata McGraw-Hill, 1981.
2. Meghnad Saha, and B.N.Srivastava, A Treatise on Heat, Indian Press, 1958.
3. S. Garg, R. Bansal and Ghosh, Thermal Physics, 2nd Edition, Tata McGraw-Hill, 1993.
4. S.J. Blundell and K.M. Blundell, Concepts in Thermal Physics, 2nd Ed., Oxford University Press, 2012.
5. D.S. Mathur, Heat and Thermodynamics, S. Chand & Co. 2014.
6. Brijlaland Subramaniyam, Heat and Thermodynamics & Statistical physics, S.Chand &

Co., 2015.
7. Agarwal, Singhal, Sathyaprakash, Heat and Thermodynamics, Kedar Nath Ramnath and Co., 2003.

WEB-RESOURCES:

1. https://opentextbc.ca/universityphysicsv2openstax/chapter/heat-transfer-specific-heat-and-calorimetry/
2. https://www.askiitians.com/revision-notes/physics/kinetic-theory-of-gases/
3. http://www.daviddarling.info/encyclopedia/P/porous_plug_experiment.html
4. http://home.iitk.ac.in/~gtm/thermodynamics/lecture14/14_2.htm
5. https://www.emedicalprep.com/study-material/chemistry/states-of-matter/liquefaction-of-gases/
6. https://www.nuclear-power.net/nuclear-engineering/thermodynamics/laws-of-thermodynamics/heat- engines/
7. https://www.khanacademy.org/science/physics/thermodynamics/specific-heat-and-heat-transfer/thermal-conduction-convection-and-radiation/

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES							
	Course Level Outcomes (CLO)						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Disciplinary Knowledge	✓		✓	✓	✓	✓	✓
Communication Skills	✓		✓				
Critical Thinking	✓	✓		✓	✓	✓	✓
Research-related skills						✓	
Analytical reasoning	✓	✓		✓	✓	✓	✓
Problem Solving				✓			
Team work				✓			

Year	Subject Title	Semester	Sub Code
2021 -22 Onwards	**VALUE EDUCATION – GANDHIAN THOUGHTS (For all UG courses)**	**II**	**21VAL2GE**

COURSE LEVEL OUTCOMES:

On the successful completion of the course, student will be able to:

1. Interpret Gandhiji's experiments to his spiritual pursuits and search for purity, political activities through fasting protests, and even his role as an educator using diet and meals as teaching exercises.
2. Lead a life marked with humility and truthfulness and subsequent realization of the Truth as the purpose of human life.
3. Infer lessons that are fundamental to living in harmony and social progress such as respect, empathy, equality, solidarity and critical thinking.
4. Promote tolerance and understanding above and beyond our political, cultural and religious differences.
5. Create special emphasis on the defense of human rights, the protection of ethnic minorities
6. Emerge as responsible citizens with clear conviction to practice values and ethics in life.
7. Transform themselves to become good leaders.
8. Realize their role and contribution to the nation building.
9.

UNIT I: Birth and Parentage - Childhood - At the High school - Stealing and Atonement - Glimpses of Religion - Gandhi's choice - Experiments in Dietetics - Acquaintance with Religions - The Great Exhibition.

UNIT II: The first case - Preparing for South Africa - same experiences - on the way to Pretoria – Coolie - Natal Indian Congress - Education of Children - Brahmacharya.

UNIT III: Simple life - The Boer war - Sanitary Reform and Famine Relief - Lord Curzon's Darbar - A month with Gokhale - Experiments in Earth and water treatment - Indian opinion - Coolie Locations or Ghettoes - The Black plague.

UNIT IV: The Magic spell of a Book - The Zulu Rebellion - The Birth of Satyagraha - More experiments in Dietetics - Kasturbai's Courage - Domestic Satyagraha- Fasting - Shanti Niketan - Woes of Third-Class passengers.

UNIT V: Kumbha mela - Lakshman Jhula - Founding of the Ashram - Abolition of Indentured Emigration - The Kheda Satyagraha - The Rowlatt Bills - Navajivan and young India - Congress Initiation - The Birth of Khadi.

TEXT BOOKS

1. M.K.GANDHI, "The Story of My Experiments with Truth", An Autobiography Apple publishing International(P) Ltd, Chennai.

2.
. மகாத்மா காந்தியின் சுயசரிதை - சத்தியசோதனை தமிழாக்கம் -
-ரா.வேங்கடராஜுலு, நவஜீவன் பரசுராலயம், அகமதாபாத

PEDAGOGY STRATEGIES

- Board and Chalk lecture
- Powerpoint slide presentations
- Seminar
- Assignments
- Quizes
- Group discussion
-

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES.

			Course Level Outcomes (CLO)							
			1	2	3	4	5	6	7	8
Program Level Outcomes (PLO)	1	Reflective thinking	✓	✓			✓		✓	✓
	2	Communication skills		✓		✓	✓	✓	✓	✓
	3	Critical thinking	✓			✓		✓	✓	✓
	4	Multicultural competence				✓	✓	✓	✓	✓
	5	Analytical reasoning		✓	✓	✓		✓		
	6	Problem solving		✓	✓	✓		✓	✓	✓
	7	Team work	✓		✓		✓	✓	✓	
	8	Leadership readiness/qualities			✓		✓	✓		✓
	9	Moral and ethical awareness	✓		✓		✓	✓		✓

Year	Subject Title	Sem	Sub Code	Hours / Week
2021-22 Onwards	Core Practical - I: General Experiments - I (Examination at the end of II Semester) (Any 12)	II	21BPH24P	3

COURSE LEVEL OUTCOMES:

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

CLO-1 Apply knowledge of mathematics and physics fundamentals as an instrumentation to arrive solution for various problems.
CLO-2 Categorize the usage of basic laws and theories to determine various properties of the materials given and demonstrate the knowledge about the materials
CLO-3 Group the application of the experiments and safety in using instruments
CLO-4 Use standard methods to calibrate the given low range voltmeter and ammeter and to measure resistance of the given coil and various physical quantities.
CLO-5 Use basic laws to study the spectral properties and optical properties of the given prism.
CLO-6 Work independently and function as a team
CLO-7 Analyze and interpret the data obtained through experiments

1. Young's Modulus – Non-Uniform bending (Pin & Microscope)
2. Young's Modulus – Uniform bending (Optic lever)
3. Rigidity Modulus of a Wire – Torsion Pendulum (with mass)
4. Acceleration due to gravity – Compound Pendulum
5. Surface Tension of Liquid and Interfacial Surface Tension of liquids – Drop Weight method
6. Viscosity of Highly Viscous Liquids – Stoke's method
7. A.C Frequency – Sonometer
8. Specific Heat Capacity – Newton's Law of Cooling
9. Thermal Conductivity of a bad conductor – Lee's disc method
10. Refractive index – Solid Prism – Spectrometer
11. Refractive index – Liquid Prism – Spectrometer
12. Specific Resistance – Post-office Box
13. Calibration of low range voltmeter – Potentiometer
14. Moment of a Magnet – Tan C Position
15. Magnetic flux – Field along the axis of a coil
16. Moment of magnet – Field along the axis of a coil
17. Determination of resistance of a thermistor
18. Diode -voltage doubler
19. Band gap energy of semiconductor

PRACTICALS/ASSIGNMENTS/TUTORIALS:

1. Group Discussion: Measurement of Least count, identifying zero error, understanding the units involved in using instruments like screw gauge, Vernier calipers, spectrometer and travelling microscope.
2. Theoretical measurement of acceleration due to gravity on various parts of earth and other celestial bodies and understand the Kepler's law of gravitation

3. Assignment on specific heat capacity of solids and liquids
4. Assignment on the important terms used in magnetism

PEDAGOGY STRATEGIES:

- Board and chalk lecture
- Demonstration classes
- Group discussions
- Laboratory classes

REFERENCES:

1. M.N. Srinivasan, A Text book of Practical Physics ,S.Chand and sons, 2013
2. Dr. R. Sathyamoorthy Practical Physics, Apsara Publications, 2019
3. C.L.Arora, B.Sc Practical Physics, S.Chand & Co, 2010

FURTHER READING:

1. Harnam Singh, Dr. P.S.Hemne ,B.Sc Practical Physics, S.Chand, 2018
2. R.P.Goyal, Unified Physics, Shiva Lal Agarwal &vCo, 2020
3. Ashok Sharma, R.P. Arora, Modern Approach to Practical Physics, 2019
4. Ashok Sharma, Practical Physics, MBD group, 2019

WEB-RESOURCES:

1. https://www.preproom.org/practicals/physics.aspx?page=3
2. https://ocw.metu.edu.tr/course/view.php?id=167
3. https://www.leybold-shop.com/physics/physics-experiments.html
4. http://www.indosawedu.com/college-physics-lab.php
5. https://bscphysicspractical.blogspot.com/2019/12/bsc-first-year-practical-physics.html

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES							
	Course Level Outcomes (CLO)						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Disciplinary Knowledge	✓	✓		✓	✓		✓
Communication Skills							
Critical Thinking	✓		✓	✓			✓
Research-related skills		✓	✓		✓		
Analytical reasoning		✓	✓			✓	✓
Problem Solving		✓					✓
Team work						✓	
Moral and ethical awareness						✓	
Multicultural Competence						✓	

Year	Subject Title	Sem	Sub Code	Hours/ Week
2021-22 Onwards	Core 3: Mechanics	III	21BPH33C	5

COURSE LEVEL OUTCOMES:

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

CLO-1 Integrate the concept of statics, and the rigid body dynamics in terms of moment of inertia
CLO-2 Acquire the knowledge of experimental ideas of finding moment inertia
CLO-3 Use the knowledge of oscillators to industrial applications
CLO-4 Organize Hydrostatics techniques with various new concepts
CLO-5 Justify Friction and center of gravity in real life situation
CLO-6 Apply the knowledge about the System of particles to everyday life
CLO-7 Develop skills in formulating and solving Rigid body problems.

Unit I: Statics
Definition Centre of Gravity – solid hemisphere, hollow hemisphere – solid cylinder – tetrahedron – right solid cone - Friction – Laws of friction – Coefficient of friction – angle of friction – cone of friction – limiting friction – Acceleration down an Inclined plane - Equilibrium of a body on a rough inclined plane (free and forced) – Friction clutch.

Unit II: System of Particles
Momentum and Angular momentum of a system - Torque acting on a system - Conservation of linear and Angular momentum - Energy of system of particles - Conservation of energy - Center of mass and its properties - Motion of Rocket - Collision-Elastic and inelastic collision - Impulse-Impact - Direct and Oblique impact - Loss in Kinetic energy

Unit III: Dynamics of Rigid bodies
The rigid body - Constraints defining the Rigid body - Degrees of freedom for a Rigid body - Relation between angular momentum and angular velocity - Moment of inertia - Theorem of Perpendicular and Parallel axes - Calculation of moment of inertia for Rectangular lamina, Ring, Disc, Solid Sphere, Hollow Sphere and Fly Wheel - Kinetic energy of body Rolling on a horizontal Plane

Unit IV: Oscillations
Linear harmonic Oscillator - Energy of Simple harmonic Oscillator - Simple harmonic Oscillation of Loaded spring, LC Circuit and Helmholtz resonator - Lissajous Figures - Composition of two simple harmonic vibrations of equal time periods acting at right angles - Composition of two simple harmonic motions at right angles to each other and having time periods in the ratio 1:2 - Damped harmonic oscillators - Energy of damped harmonic oscillators.

Unit V: Hydrostatics
Hydrostatic pressure - Hydrostatic pressure due to liquid column - Hydrostatic Paradox - a liquid transmit pressure equally in all directions - Pascal's law - Thrust on immersed plane - Centre of Pressure: Definition – Change of depth of center of pressure - Expression for Centre of Pressure of rectangular lamina with one side on the surface of the liquid. - Principle of Archimedes - Laws of

Floatation - Equilibrium of floating bodies - Stability of Equilibrium – Rolling and pitching of ship-Determination of Metacentric height of ship - Pressure due to Compressible fluid - Measurement of atmospheric pressure - change of pressure with Altitude

SEMINARS/ASSIGNMENTS/PRACTICALS:

1. Mechanics-Day to day life, Moment of inertia-some implications
2. Comment on how atmospheric pressure is measured
3. Discuss the applications of friction
4. Write the whole concept of Rocket
5. Express you view of moment of inertia with examples
6. Describe the concept of Flotation
7. To Determine the moment of inertia of fly wheel

PEDAGOGY STRATEGIES:

- Board and chalk lecture
- Powerpoint slide presentations
- Assignments
- Seminars
- Laboratory classes

REFERENCES:

1. D.S.Mathur, Mechanics,, S.Chand and Company Limited, New Delhi, 2000
2. R.Murugeshan, Mechnics and Mathematical Physics, S.Chand & Co. Ltd, New Delhi, 2008
3. M.Narayanamurthi and Nagarathinam, Dynamics, The national publishing company, 2008
4. M.Narayanamurthi and N.Nagarathinam, Statics, Hydrostatics and Hydrodynamics, The national Publishing company, 2008
5. Brijlal ,N. Subramanyam, Jivan Seshan, Mechanics and Electrodynamics, S.Chand, Eruasia Publishing House (Pvt) Ltd, 2005

FURTHER READING:

1. C.Kittel, W.Knight,et al, Mechanics, Berkeley Physics, vol.1, Tata McGraw-hill, 2007
2. Resnick, Halliday and Walker 8/e Physics, Wiley, 2008
3. G.R.Fowles and G.L.Cassiday, Analytical Mechanics, Cengage Learning, 2005
4. R.P.Feynman, R,B,Leighton,M.Sands, Feynman Lectures, Vol.1, Pearson Education, 2008
5. D.Kleppner, R.J.Kolenkow , An Introduction to Mechanics, Mc Graw Hill, 1973

WEB-RESOURCES:

1. Science direct
2. Wikipedia
3. NPTEL
4. EKEEDA
5. AFROTECMODS

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES							
	Course Level Outcomes (CLO)						
	1	2	3	4	5	6	7
Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
Communication Skills	✓		✓	✓	✓		
Critical Thinking	✓		✓			✓	✓
Research-related skills			✓			✓	
Analytical reasoning	✓	✓					✓
Problem Solving	✓		✓		✓		✓
Team work		✓			✓	✓	

Year	Subject Title	Sem	Sub Code	Hours/ Week
2021-22 Onwards	**Skill Based Elective- I: Energy Physics**	**III**	**21BPH35S**	**4**

COURSE LEVEL OUTCOMES:

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

CLO-1 Identify energy demand and relate with the available energy sources
CLO-2 Recognize the need of non-conventional energy sources
CLO-3 Realize the nature of solar radiations and the conversion of solar radiation into thermal energy by means of solar energy collectors
CLO-4 Acquire an idea about solar energy and its conversion into heat energy, solar energy harvesting devices like solar cells, solar greenhouses, etc.
CLO-5 Apply the working principle of wind energy conversion systems
CLO-6 Analyze harnessing of Biomass energy, Geothermal and Ocean energies
CLO-7 Familiarise the need and principles of Direct Energy Conversion using Tidal and Wave Energy

UNIT I: Introduction to Energy Sources

An Introduction to Energy Sources – Energy sources and their availability – Conventional energy sources – Non - conventional energy sources – Renewable energy sources – advantages of renewable energy – obstacles to the implementation of renewable energy systems – prospects of renewable energy sources.

UNIT II: Solar Radiation and its Measurement

Introduction – solar constant – solar radiation at the Earth's surface – solar radiation measurements – solar radiation data – solar energy collectors – physical principles of the conversion of solar radiation into heat – flat-plate collectors – typical liquid collectors – typical air collectors – advantages of flat plate collectors – concentrating collector – focusing and non-focusing types – selective absorber coatings.

UNIT III: Application of Solar Energy

Solar water heating – space heating – active and passive system – space cooling – LiBr-H_2O absorption air conditioning system – solar thermal electric conversion – solar electric power generation – solar cells – principles – solar cell modules – solar cell connecting arrangements – Agricultural and industrial process heat – solar distillation – solar pumping – solar furnace – solar cooking – simple box type cooker – Multi-reflector type solar cooker – solar green houses.

UNIT IV: Wind Energy

Basic principles of wind energy conversion – wind data and energy estimation- basic components of a wind energy conversion system (WECS) – classification of

WEC systems – advantages and disadvantages of a WECS – wind energy collectors – horizontal axis wind machines – vertical axis wind machines – safety systems – environmental aspects – global warming.

UNIT V: Renewable Energy Sources, Biomass and Biogas

Energy from the ocean: ocean thermal electric conversion (OTEC) – tidal energy – geothermal energy. Energy from biomass: biomass conversion technologies – wet and dry processes – photosynthesis; Biogas generation – introduction – basic processes and energetics – factors affecting the bio-digestion and generation of gas – Fuel cells – Battery – Classification of batteries.

PRACTICALS/ASSIGNMENTS:

1. Availability of Energy Sources
2. Solar Energy and its Applications

PEDAGOGY STRATEGIES:

- Board and chalk lecture
- Powerpoint slide presentations
- Assignments
- Group discussions
- Quizzes

REFERENCES:

1. G.D.Rai, Non-conventional Energy Sources, Khanna Publishers, 2008.
2. H.P. Garg and J. Prakash, Solar Energy Fundamentals and Applications, Tata McGraw – Hill Publishing Company Ltd., 1997.
3. M.P.Agarwal, Solar energy, S. Chand and Co. Ltd., 1983.
4. S.P.Sukhatme and J K Nayak, Solar energy, Tata McGraw Hill Publishing Company Limited,4th Edition, 2017.
5. D. Yogi Goswami, F. Kreith, Jan F. Krieder, Principles of Solar Engineering, 2nd Edition Philadelphia, PA: Taylor & Francis, 2000.

FURTHER READING:

1. G.D. Rai. Solar Energy Utilisation, Khanna Publishers, New Delhi, 5th Edition, 2009
2. Energy Technology by S. Rao and Dr. B.B. Parulekar, Khanna Publishers, New Delhi, 2nd Edition, 1997
3. Godfrey Boyle, Renewable Energy: Power for a Sustainable Future, Alden Oess Limited, Oxford University Press, 1996
4. Jyoti Parikh, Energy Models for 2000 and Beyond, Tata McGraw Hill Publishing Company Limited, 1997.
5. Dr. P. Jayakumar, Solar Energy, Resource Assessment Handbook, 2009.

WEB-RESOURCES:

1. https://freevideolectures.com/course/4480/nptel-non-conventional-energy-resources

2. https://gecraipur.ac.in/pdf2019/ET_Study/Non - conventional%20Energy%20Sources.pdf
3. https://en.wikipedia.org/wiki/List_of_books_about_renewable_energy

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES							
	Course Level Outcomes (CLO)						
	1	2	3	4	5	6	7
Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
Communication Skills	✓				✓		✓
Critical Thinking		✓		✓	✓	✓	
Research-related skills	✓	✓			✓		✓
Analytical reasoning			✓		✓	✓	
Problem Solving					✓		
Moral and ethical awareness						✓	

Year	Subject Title	Sem	Sub Code	Hours/ Week
2021-22 Onwards	Core IV: Optics	IV	21BPH43C	5

COURSE LEVEL OUTCOMES:

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

CLO-1 Analyze the fundamental concepts of aberration, coma, distortion, astigmatism, and eyepieces.
CLO-2 Determine the refractive index of different liquids and thickness of thin materials using interference principle.
CLO-3 Acquire knowledge on Fresnel and Fraunhofer diffraction and describe the distinction between interference and diffraction.
CLO-4 Explain the fundamental principles of polarization and analyze the different types of polarized light.
CLO-5 Describe the fundamental concepts, characteristics and production of laser,
CLO-6 Discuss the hazards and safe usage of lasers and identify the applications of laser in medicine, industry, communication, computer and military.
CLO-7 Outline the basics of fiber optics and explain the fiber optics communication system.

UNIT I: Geometrical optics
Aberration – Spherical aberration – Minimization of spherical aberration – Chromatic aberration in lenses – Longitudinal and lateral chromatic aberration – Condition for achromatism when two lenses are separated – Coma, Curvature, Distortion and Astigmatism (Qualitative treatment only). Eyepieces – Huygen's eyepiece – Ramsden eyepiece – Comparison of Ramsden eyepiece with Huygen's eyepiece.

UNIT II: Interference
Theory of interference fringes – Fresnel's bi-prism – Interference due to reflected light – Condition for maxima and minima – Testing of flat surfaces - Fringes produced due to wedge shaped films – Determination of wedge angel and thickness of the spacer – Newton's Rings method – Theory – Determination of refractive index of a liquid – Michelson's interferometer – Determination of wavelength of a monochromatic source.

UNIT III: Diffraction
Diffraction – Fresnel diffraction – Rectilinear propagation of light – Zone plate – Action of zone plate for an incident spherical wave font – Difference between a zone plate and a convex lens – Distinction between Fresnel diffraction and Fraunhofer diffraction – Fraunhofer diffraction – Fraunhofer diffraction at a single slit - Distinction between interference and diffraction – Plane diffraction grating – Theory – Determination of wavelength.

UNIT IV: Polarization
Polarization – Plane of vibration and plane of polarization - Malus law – Double refraction – Huygen's explanation of double refraction in uniaxial crystals – Optic axis – Positive and negative crystals – Nicol prism – Nicol prism act as a polarizer and analyzer – Quarter wave

plate – Half wave plate – Production and analysis of plane polarized light, circularly polarized light and elliptically polarized light - Optical activity – Specific rotation – Laurent 's half shade polarimeter – Determination of specific rotatory power of solution.

UNIT V: Laser and Fiber Optics

Laser – Characteristics of Laser – Induced absorption - Spontaneous and Stimulated emissions – Einstein's coefficients – Concept of Laser - Population inversion – Pumping – Various pumping methods – Active medium – Metastable states – Optical Resonator – He-Ne gas laser – Semiconductor laser – Applications of laser. Optical fiber – Principle – Guiding mechanism – Total internal reflection in fiber - Critical angle – Types of optical fiber based on Number of modes and refractive index - Fiber optic communication system (Block diagram) – Advantages of optical fiber communication systems.

PRACTICALS/ASSIGNMENTS:

- Determination of the refractive index of different liquids by Newton's rings method.
- Determination of the thickness of thin materials by air wedge method.
- Calculate the resolving power of prism and grating.
- Determination of the specific rotatory power of solution using the Laurent's half shade polarimeter.
- Prepare the assignment based on a topic 'Applications of laser in industry, communication, military, medicine and computer'.
- Collect data based on a topic 'Fiber optic communication system'.
- Prepare a model article based on a topic 'Global warming'.

PEDAGOGY STRATEGIES:

- Board and chalk lecture
- Powerpoint slide presentations
- Assignments
- Seminars
- Group discussions
- Laboratory classes
- Quizes

REFERENCES:

1. N.Subramanyam, Brijlal and M.N.Avadhanullu, A text book of Optics, S.Chand and Co. Ltd., New Delhi, 2007.
2. R.Murugesan, Optics and Spectroscopy, S.Chand and Co. Ltd., New Delhi, 2005.
3. A.Sundaravelusamy, Optics, Priya Publications, Karur, 2000.
4. A.Selvarajan, S.Kar and T.Srinivas, Optical Fiber Communication, Tata McGraw Hill Publishing Company Ltd., New Delhi 2004.

FURTHER READING:

1. A.B.Gupta, Modern Optics, Books and Allied (P) Ltd., 2010.
2. Singhal and Agarwal, Optics and Atomic Physics, Pragati Prakshan, Meerut, 2002.

3. Gerd Keisser, Optical Fiber Communications, McGraw Hill Higher Education, New Delhi, 2010.

WEB-RESOURCES:

1. https://www.opticsthewebsite.com
2. https://www.microscopyu.com
3. https://openstax.org
4. https://physicsclassroom.com
5. https://rp-photonics.com

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES							
	Course Level Outcomes (CLO)						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
Communication Skills			✓		✓		
Critical Thinking	✓		✓	✓	✓	✓	✓
Research-related skills		✓	✓	✓	✓	✓	✓
Analytical reasoning	✓						
Problem Solving		✓				✓	
Team work		✓	✓		✓		✓

Year	Subject Title	Sem	Sub Code	Hours/ Week
2021-22 Onwards	Skill Based Elective -II: Biomedical Instrumentation	IV	21BPH45S	4

COURSE LEVEL OUTCOMES:

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

CLO-1 Develop a thorough understanding of biomedical measurements
CLO-2 Describe the origin of biopotentials and explain the role of biopotential electrodes.
CLO-3 Identify the necessity of equipment to a specific problem.
CLO-4 Integrate information learnt about biomedical signals, sensors and instrumentation design.
CLO-5 Analyze the performance characteristics of the instrumentation systems
CLO-6 Acquire knowledge of how different types of electrical medical equipment work, advantages, and disadvantages of different methods, as well as sources of error and risks linked to the various methods.
CLO-7 Explain the physical and medical principles of biomedical instrumentation.

UNIT I: Human Physiological Systems
Cells and their structure – Transport of ions through the cell membrane – Resting and action potentials – Characteristics of resting potential – Bio-electric potentials – Nerve Tissues and organs– Different systems of human body – Skeletal, Circulatory, Respiratory, Digestive, Excretory, Regulatory, Reproductive and Muscular systems.

UNIT II: Biopotential Electrodes
Design of medical instruments – Components of the biomedical instrument system – Electrodes – Half cell potential, Electrode paste, Electrode material – Types of electrodes – Microelectrodes – Depth and Needle electrodes – Surface electrodes – Chemical electrodes.

UNIT III: Transducers
Transducers – Types – Active transducers – Magnetic induction type – Piezoelectric type – Photovoltaic type – Thermoelectric type – Basics of sensors– Passive transducers – Resistive Transducers – Strain gauge - Gauge factor – Photoresistor – Thermistor – Metallic wire transducers – Capacitive Transducers – Inductive Transducers – LVDT.

UNIT IV: Biopotential Recorders
Characteristics of the recording system – Writer and pen damping effects –recording set up – Electrocardiography – Origin of cardiac action potential – ECG lead configurations – ECG Electroencephalography – Origin of EEG – Brain waves – Placement of electrodes – EEG recording set up – Electromyography– Echocardiography.

UNIT V: Advances in Biomedical Instrumentation

Computers in medicine – Lasers in medicine – Basic principle – Laser instrumentation – Advantages in laser surgery – Photothermal applications – Photochemical applications – Endoscopes – Endoscopic laser coagulator- Cryogenic surgery – Nuclear imaging techniques Computer Tomography – Principle – Block diagram –Applications of Computer Tomography.

PRACTICALS/ASSIGNMENTS:

1. Different systems of human body
2. Structure of plant and animal cells
3. Recording set up of Electrocardiography
4. Lasers in Medicine
5. Computers in Medicine

PEDAGOGY STRATEGIES:

- Board and chalk lecture
- Powerpoint presentations
- Assignments
- Seminar

REFERENCES:

1. Dr. M. Arumugam, Biomedical Instrumentation, Anuradha Agencies, 2010.
2. Cromwell, Weibl and Pfeiffer, Biomedical Instrumentation and Measurements, Prentice Hall Inc., 1980.
3. H.S. Kalsi, Electronic Instrumentation, Tata McGraw Hill Co., 2013.
4. Aston, Principles of Biomedical Instrumentation and Measurements, Merrill Pub. Co., 1990.
5. RS Khandpur, Handbook of Biomedical Instrumentation, Tata McGraw Hill Co., 2014.

FURTHER READING:

1. J.J. Carr, J.M. Brown, Introduction to Biomedical Equipment Technology, Prentice Hall, 2nd Edition, 2001.
2. J.G. Webster, Medical Instrumentation: Application and Design, Wiley, 2010.
3. L.A. Geddes and L.E. Baker, Principles of Applied Biomedical Instrumentation, Wiley Interscience, 3rd Edition, 1989.
4. Mandeep Singh, Introduction to Biomedical Instrumentation, Prentice Hall India Learning Private Limited, 2010
5. J. Cameron, Medical Physics, Wiley Publications, 1st Edition, 1978.
6. Myer Kutz, Standard Handbook of Biomedical Engineering and Design, McGraw Hill Publisher, 2003.
7. R. Anandanatarajan, Biomedical Instrumentation and Measurements, PHI Learning Pvt. Ltd., 2011.

WEB-RESOURCES:

1. https://www.electrical4u.com/introduction-to-biomedical-instrumentation/

2. https://www.slideshare.net/PrincyRandhawa/biomedical-instrumentation-60215990
3. https://sites.google.com/site/mdotarif/teaching/bmi
4. https://www.youtube.com/watch?v=iK-6q4nnmtA
5. https://www.sanfoundry.com/best-reference-books-biomedical-instrumentation/

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES							
	Course Level Outcomes (CLO)						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
Communication Skills	✓			✓			✓
Critical Thinking					✓		
Research-related skills		✓		✓	✓	✓	
Analytical reasoning	✓			✓		✓	
Problem Solving					✓		
Team work							
Moral and ethical awareness		✓				✓	

Year	Subject Title	Sem	Sub Code	Hours / Week
2021-22 Onwards	Core Practical - II: General Experiments - II (Examination at the end of IV Semester) (Any12)	IV	21BPH46P	3

COURSE LEVEL OUTCOMES:

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

CLO-1 Apply knowledge of mathematics and physics fundamentals as an instrumentation to arrive solution for various problems.
CLO-2 Combine usage of basic laws and theories to determine various properties of the materials
CLO-3 Justify the application of the experiments with safe in usage
CLO-4 Use standard methods to calibrate the given low range voltmeter and ammeter and to measure resistance of the given coil and various physical quantities.
CLO-5 Discuss the basic laws to study the spectral and optical properties using prism and grating.
CLO-6 Develop the skill of constructing electrical circuits
CLO-7 Analyse and interpret the data obtained through experiments

1. Wavelength of sodium light – Fresnel Biprism
2. Radius of curvature of convex lens – Newton's Rings method
3. Thickness of a thin wire – Air Wedge
4. Refractive index – Small angle prism – Spectrometer
5. Refractive index – solid prism – i-d curve – Spectrometer
6. Refractive index – solid prism – i-i' curve – Spectrometer
7. Wavelength of mercury spectrum – Grating – Spectrometer
8. Frequency of a bar – Melde's method
9. Elastic constants of a material – Searle's method
10. Determine the Moment of inertia of a Fly Wheel
11. Young's Modulus – Uniform bending (Pin & Microscope)
12. Young's Modulus – Non-uniform bending(Optic lever)
13. Rigidity modulus – Static Torsion method
14. Acceleration due to gravity – Kater's Pendulum
15. Surface Tension of a liquid – Capillary Rise method
16. Viscosity of liquid – Capillary flow method
17. Specific heat capacity – Joule's Calorimeter
18. Specific resistance of a coil of wire – Meter bridge
19. Calibration of low range Ammeter – Potentiometer
20. Specific Resistance – Potentiometer
21. Calibration of high range voltmeter – Potentiometer
22. Coefficient of thermal expansion of a metallic rod – Optic lever method

PRACTICALS/ASSIGNMENTS/TUTORIALS:

1. Group Discussion: (i) Phase change at reflection (conditions), (ii) Reflection in thin films, (iii) Is it possible to have interference a lens of short focal length?, (iv) Refractive

index of liquid using Newton's rings and (v) Mechanical parts of optical bench
2. Determination of wavelength of solar spectrum
3. Assignment on the manufacturing of grating
4. Assignment on the importance of Young's modulus and Rigidity modulus in day to day life
5. Important terminology used in electricity
6. Understanding the conversion of a galvanometer into a voltmeter/ammeter.

PEDAGOGY STRATEGIES:

- Board and chalk lecture
- Demonstration classes
- Group discussions
- Laboratory classes

REFERENCES:

1. M.N.Srinivasan, A Text book of Practical Physics ,S.Chand and sons, 2013
2. Dr. R. Sathyamoorthy Practical Physics, Apsara Publications, 2019
3. C.L.Arora, B.Sc Practical Physics, S.Chand & Co, 2010
4. Prakash and Ramakrishna, A Text Book of Practical Physics, 11th Edn, 2011, Kitab Mahal

FURTHER READING:

1. Harnam Singh, Dr.P.S.Hemne , B.Sc Practical Physics, S.Chand, 2018
2. R.P.Goyal, Unified Physics, Shiva Lal Agarwal & Co, 2020
3. Ashok Sharma, R.P. Arora, Modern Approach to Practical Physics, 2019
4. Ashok Sharma, Practical Physics, MBD group, 2019

WEB-RESOURCES:

1. https://www.preproom.org/practicals/physics.aspx?page=3
2. https://ocw.metu.edu.tr/course/view.php?id=167
3. https://www.leybold-shop.com/physics/physics-experiments.html
4. http://www.indosawedu.com/college-physics-lab.php
5. https://bscphysicspractical.blogspot.com/2019/12/bsc-first-year-practical-physics.html

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES							
	Course Level Outcomes (CLO)						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Disciplinary Knowledge	✓				✓	✓	
Communication Skills	✓	✓		✓	✓		✓
Critical Thinking	✓			✓		✓	
Research-related skills		✓	✓				
Analytical reasoning	✓	✓	✓		✓	✓	✓
Problem Solving	✓			✓		✓	
Team work		✓			✓		✓

Year	Subject Title	Sem	Sub Code	Hours/ Week
2021-22 Onwards	Core 5: Mathematical Physics	V	21BPH51C	4

COURSE LEVEL OUTCOMES:

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

CLO-1 Deduce vector calculus and explain conservative and non-conservative field and recognize theorems such as Gauss divergence, Stokes's theorem and Green's theorem.

CLO-2 Explain basic properties of matrices, different types of matrices and their correspondence to physical quantities

CLO-3 Execute special functions to solve integrals.

CLO-4 Develop analytical skills for solving mathematical problems

CLO-5 Summarize Lagrangian mechanics and apply it to solve small oscillation problems

CLO-6 Discuss Hamiltonian Approach and its applications

CLO-7 Apply Hamilton's equation to Simple pendulum, Compound pendulum, Linear Harmonic Oscillator and particle in a central force field

UNIT I: Vector Calculus in three dimensions

Gradient of a scalar field – Physical interpretation – Divergence of a vector function – Curl of a vector function and its physical significance – conservative and non-conservative field – curl, divergence and gradient in cylindrical and spherical coordinates – Laplacian operator – Laplace's equation – Gauss divergence theorem – Stokes's theorem – Green's theorem

UNIT II: Matrices

Introduction – Special types of matrices – Transpose of a matrix – The conjugate of a matrix – Conjugate transpose of a matrix – Symmetric and Antisymmetric – Hermitian and skew Hermitian – Orthogonal and unitary matrices – Properties – Characteristics equation – Roots and characteristics vector – Diagonalization of matrices – Cayley-Hamilton theorem – Problems.

UNIT III: Special Functions

Beta and Gamma functions – Different forms of beta and gamma functions – relation between beta and gamma functions – Evaluation of Γ (n) and β (m,n) functions – Dirac Delta function – some representations of delta function – properties of delta function, Fourier Transform of delta function, Laplace Transform of delta function

UNIT IV: Lagrangian Formulation

Constraints and their classification – Degrees of freedom – Generalised co-ordinates – Generalized displacement, velocity, momentum and force – Principle of virtual work and D'Alembert's Principle – Lagrangian equation of motion from D'Alembert's Principle – Application of Lagrangian equation to simple pendulum, Compound pendulum, Linear harmonic oscillator and Atwood's machine.

UNIT V: Hamiltonian Formulation

Phase space – Hamiltonian function H – Hamilton's canonical equations of motion – Physical significance of H – Applications of Hamilton's equation to Simple pendulum, Compound pendulum, Linear Harmonic Oscillator and particle in a central force field – Poisson's bracket and its properties.

PRACTICALS/ASSIGNMENTS:

- Making video clippings on divergence and convergence
- Multiply matrices using C program
- Assignments on Characteristics equation, Roots and characteristics vector, Diagonalization of matrices and Cayley-Hamilton theorem
- Preparation of MCQ for vector calculus and special functions

PEDAGOGY STRATEGIES:

- Board and Chalk lecture
- Powerpoint slide presentation
- Assignments
- Seminar
- Computer programming

REFERENCES:

1. Satyaprakash,Mathematical Physics with Classical Mechanics, Sultan Chand & Sons, 2021
2. B.S.Rajput, Mathematical Physics, Pragathi Prakashan, 2017
3. H.K.Dass, & Dr.Rama Verma, Mathematical Physics , S.Chand, 2019
4. B.D.Gupta, Mathematical Physics, Vikas publishing house,1980
5. S.L.Kakani , C.Hemrajani,Mathematical Physics,CBS publication,2018
6. S.Pal and S.C. Bhunia, Engineering Mathematics, Oxford University Press, 2015

FURTHER READING:

1. M.P.Pranab Kumar Chattopadhyay, Mathematical Physics, New Age Publications, 2013
2. V.Balakrishnan, Mathematical physics with applications, problems and solutions ANE books, 2019
3. Partha Goswami, Mathematical Physics, Cengage, 2012
4. Dr.R.K.Bera & Dr.A.K.Bandyopadhyay, Dr.P.C.Ray,New Age Int (P) Ltd, 2017
5. George B.Arfken & Hans J.Weber, Mathematical methods for Physicists, Elsevier Inc, 2005
6. K.F Riley, M.P. Hobson and S. J. Bence, Mathematical Methods for Physics and Engineers, 3rd Ed., Cambridge University Press, 2006
7. P. Dennery and A.Krzywicki, Mathematics for Physicists, Dover Publications, 1967

WEB-RESOURCES:

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2. https://drive.google.com/file/d/1PD8QlJtGoNyFtLOMOl_kROOELIZ8RzoB/view
3. https://drive.google.com/file/d/1Pz7iKljml5IVsJfEf3vk7yJD4bNDhd_n/view
4. https://drive.google.com/file/d/1Oy5-eD8VW9_LatLZNljhXUeRAvh531BK/view
5. https://drive.google.com/file/d/1OrhCMh8NG2ovzOMlAaWsCr04sPaRkxRf/view?usp=drivesdk

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES							
	Course Level Outcomes (CLO)						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Disciplinary Knowledge	✓	✓			✓	✓	
Communication Skills	✓	✓				✓	
Critical Thinking	✓						
Research-related skills			✓	✓		✓	✓
Analytical reasoning		✓	✓	✓	✓	✓	✓
Problem Solving		✓			✓	✓	✓
Team work		✓	✓	✓			✓

Year	Subject Title	Sem	Sub Code	Hours/ Week
2021-22 Onwards	Core 6: Electricity and Magnetism	V	21BPH52C	4

COURSE LEVEL OUTCOMES:

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

CLO-1 Define Gauss' law and study the application in various configurations.
CLO-2 Discuss the concept of capacitor and apply the concepts for sphere, cylinder, parallel plate, Guard ring and dielectrics and solve problems
CLO-3 Apply magnetic field inside and outside solenoid and toroids in solving problems
CLO-4 Discuss the concepts related to Faraday's law, induced emf and Maxwell's equation.
CLO-5 Conversant with the concept of a magnetic field and explain different types of magnetic materials.
CLO-6 Recognize the importance of mathematical techniques and computing to describe Maxwells' laws
CLO-7 Account for the importance of electricity and magnetism in society and conversant with safe use of electrical equipment

UNIT I: Electrostatics
Gauss's Law – Proof – Field due to a uniformly charged hollow cylinder – Mechanical force experienced by unit area of a charged conductor – Calculation of increase in radius of electrified soap bubble – Energy stored per unit volume in the medium surrounding the charged capacitor - Deduction of Coulomb's inverse square law from Gauss's Law – Electrical images – Definition – Magnitude and location of image charge – Electric potential and electric field at an external point – Electric field at a point on the surface of the sphere – Surface density of charge on the sphere – Force of attraction between the charge +q and the sphere by the method of electrical images – Poisson's and Laplace's equations.

UNIT II: Capacitors and Electrometers
Capacitance of a conductor – Principle of a Capacitor – Capacitance of a spherical capacitor (outer, inner sphere earthed) – Capacitance of cylindrical and parallel plate capacitors – Effect of a dielectric -Polarization of Dielectric materials - Capacitors in series and parallel – Energy stored in a charged capacitor – Loss of energy on sharing of charges between two capacitors – Guard ring capacitor – Kelvin's absolute electrometer – Measurement of potential difference between two given points -Determination of Relative permittivity of a material– The Quadrant electrometer – Construction and working (no derivation) – Problems in Parallel plate capacitors, Effect of Dielectric , Capacitors in Series and Parallel and Energy stored in a charged capacitor.

UNIT III: Magnetic effects of electric current
Fleming's left hand rule – The Biot-Savart Law – Force on a current carrying conductor in a magnetic field – Force between two parallel current carrying conductors – Force experienced by an electron moving in a magnetic Field – Moving coil Ballistic Galvanometer – correction for damping - Figure of merit of a B.G – Comparison of two capacitance using B.G – Ampere's circuital law – Differential form of Ampere's law – Magnetic field inside a long solenoid – Magnetic induction due to a toroid.

UNIT IV: Electromagnetic Induction and Dynamics of charged particles

Faraday's laws of electromagnetic induction – Lenz's law – Fleming's right hand rule – Self-inductance and its determination by Rayleigh method – Mutual inductance and its experimental
determination – Growth and decay of current in a circuit containing a resistance and inductance – Motion of charged particle in uniform constant magnetic field – Motion of charged particle in crossed electric and magnetic fields.

UNIT V: Magnetism

Permeability and susceptibility – Relation between relative permeability and susceptibility – Determination of susceptibility by Guoy's method and Curie – balance method – Experiment to draw M-H curve (horizontal model) – Energy loss due to hysteresis – the importance of hysteresis curves – magnetic properties - magnetic circuit – magnetic circuit of an electromagnet.

ASSIGNMENTS:

1. Solve problems in Parallel plate Capacitor, Effect of dielectric, Capacitors in series and parallel and Energy stored in charged capacitor
2. Formulation of Gauss's law, Faraday's law, Lens's law, Maxwell's equation
3. Magnetic properties, magnetic circuit and magnetic circuit of an electromagnet

PEDAGOGY STRATEGIES:

- Board and chalk lecture
- Powerpoint slide presentations
- Assignments
- Seminars

REFERENCES:

1. R.Murugeshan, Electricity and Magnetism, S.Chand & Co. Ltd., Ram Nagar, New Delhi, 2008
2. Brijlal & Subramaniam, Electricity and Magnetism, Ratna Prakashan Mandir, Educational & University Publication 1751/18, Barya Ganj, New Delhi, 2006
3. DC Dayal, Electricity and Magnetism, Himalaya Publishing House, 2019
4. Sehgal – Chopra- Sehgal, Electricity and magnetism, Sultan Chand and sons Ltd, New Delhi, 6th edition reprint, 2010
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2. Edward M. Purcell, Electricity and Magnetism, Tata McGraw-Hill Education, 1986
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6. M.N.O. Sadiku, Elements of Electromagnetics, Oxford University Press, 2010.

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4. http://www.slideshare.net/SalehIbneOmar/presentation-on-electromagnetic-induction?
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COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES							
	Course Level Outcomes (CLO)						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Disciplinary Knowledge	✓		✓	✓			✓
Communication Skills		✓	✓	✓			✓
Critical Thinking	✓		✓		✓	✓	
Research-related skills		✓		✓	✓	✓	
Analytical reasoning	✓		✓	✓		✓	✓
Problem Solving		✓	✓		✓		
Team work				✓	✓		
Moral and ethical awareness							✓

Year	Subject Title	Sem	Sub Code	Hours/ Week
2021-22 Onwards	Core 7: Electronics	V	21BPH53C	4

COURSE LEVEL OUTCOMES:

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

CLO-1 Explain the characteristics of various semiconductor diodes and transistor with proper biasing.
CLO-2 Construct rectifier and filter circuits and learn their actions; Calculate the efficiency and ripple factor of rectifiers.
CLO-3 Establish the relation between current amplification factors of transistors for computing problems.
CLO-4 Apply the transistor action for amplifiers and oscillators, and analyze the frequency response.
CLO-5 Illustrate the construction, working and application of FET, SCR and UJT.
CLO-6 Discover the basics of operational amplifier and use it for various applications.
CLO-7 Demonstrate experiments using Diodes, Transistors, JFET, UJT and OP-AMP and extrapolate the analytical skills to new unfamiliar contexts.

UNIT I: Diodes, Rectifiers and Filters
Diodes: Characteristics of PN Junction diode – Zener Diode – Zener Voltage Stabilization – Light Emitting Diode – Photodiode – Tunnel Diode.
Rectifiers: Half Wave Rectifier – Efficiency and Ripple Factor – Centre-tapped Full-Wave Rectifier – Bridge Rectifier – Efficiency and Ripple Factor.
Filter Circuits: Capacitor Filter – Choke input Filter – Capacitor input Filter (Pi Filter).

UNIT II: Transistors and Transistor Biasing
Transistor action – Expression for collector current in common base and common emitter connections – Relation between β and α – Problems in β and α relation - Characteristics of CB connection – Characteristics of CE connection – Transistor load line analysis: DC load line – Operating point.
Transistor biasing – Stabilisation – Essentials of a transistor biasing circuit – Stability factor – Base resistor method of transistor biasing – Voltage divider bias method.

UNIT III: FET, SCR and UJT
JFET – Difference between JFET and BJT – Principle and working of JFET – Output characteristics – Important terms – Parameters of JFET.
MOSFET – Types of MOSFET – Circuit operation of D-MOSFET – D-MOSFET Transfer characteristics – E-MOSFET.
SCR – Working – V-I characteristics of SCR – Important terms – SCR as a switch.
UJT – Construction and operation – Characteristics of UJT – Advantages – UJT as Relaxation Oscillator.

UNIT IV: Amplifiers and Oscillators
Classification of amplifiers – RC coupled transistor amplifier – Transformer-coupled amplifier – Direct coupled amplifier – Difference between voltage and power amplifiers –

Class A, B and C power amplifiers – Maximum collector efficiency of transformer coupled class A power amplifier – Thermal runaway – Heat sink – Push-pull amplifier.
Sinusoidal Oscillator – Types – Oscillatory circuit – Positive feedback – Barkhausen criterion – Colpitt's oscillator – Hartley oscillator – Phase shift oscillator – Wien bridge oscillator.

UNIT V: Operational Amplifier
Introduction to Operational Amplifier (OP-AMP) – Symbol and Polarity conventions – Characteristics of an Ideal OP-AMP – Virtual Ground and Summing Point – Applications: Negative Scaler – Positive Scaler – Unity Follower – Adder – Subtractor – Integrator – Differentiator – Comparator.

PRACTICALS/ASSIGNMENTS:

- Junction diode-forward bias characteristics and Zener diode-reverse bias characteristics
- Transistor Characteristics – Common Emitter configuration
- Hartley Oscillator using Transistor
- JFET – Transfer Characteristics
- UJT – V-I characteristics
- Summing Amplifier using Operational Amplifier IC741
- Differential Amplifier using Operational Amplifier IC741
- Integrator and Differentiator using Operational Amplifier
- Colpitt's Oscillator using Operational Amplifier
- Phase Shift oscillator using Operational Amplifier
- Op-Amp as Digital to Analog converter – Weighted resistor method
- Op-Amp as Digital to Analog converter – R-2R ladder method

PEDAGOGY STRATEGIES

- Board and chalk lecture
- Powerpoint presentations
- Assignments
- Laboratory classes

REFERENCES:

1. V.K. Mehta and Rohit Mehta, Principles of Electronics, S. Chand & Co. Ltd., 2005.
2. B.L. Theraja, Basic Electronics (Solid State), S. Chand & Co. Ltd., 2006.
3. S. L. Gupta and V. Kumar, Handbook of Electronics, Pragati Prakashan, 2013.
4. R.S. Sedha, A textbook of Applied Electronics by S. Chand & Co. Ltd., 2013.

FURTHER READING:

1. Anwar A. Khan and Kanchan K. Dey, A First Course in Electronics, PHI, 2006.
2. Chinmoy Saha, Arindam Halder and Debarati Ganguly, Basic Electronics: Principles and Applications, Cambridge University Press, 2018.
3. Theodore F. Bogart,Jr., Electronic Devices and Circuits, Pearson, 2004.
4. Robert L. Boylestad and Louis Nashelsky, Electronic devices and Circuit theory, PHI, 2010.

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6. Mitchel E. Schultz, Grob's Basic Electronics, McGraw-Hill, 2016.

WEB-RESOURCES:

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3. ocw.mit.edu
4. www.mgcub.ac.in
5. nptel.ac.in
6. www.electronics-tutorials.ws
7. brainzorp.files.wordpress.com

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES							
	Course Level Outcome (CLO)						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Disciplinary Knowledge	✓	✓			✓	✓	
Communication Skills							✓
Critical Thinking		✓				✓	
Research-related Skills		✓		✓			✓
Analytical Reasoning		✓	✓				
Problem Solving		✓	✓	✓		✓	✓
Team Work				✓			✓

Year	Subject Title	Sem	Sub Code	Hours/ Week
2021-22 Onwards	**Skill Based Elective-III: Digital Electronics and Microprocessor**	**V**	**21BPH54S**	**4**

COURSE LEVEL OUTCOMES:

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

CLO-1 Categorize the number systems, binary arithmetic and codes
CLO-2 Assess the synthesis of Boolean functions, simplification and construction of digital circuits by employing Boolean algebra
CLO-3 Classify the logic gates, arithmetic digital circuits and flip-flops
CLO-4 Utilize sequential systems by selecting Flip-Flops as a building blocks and transform into registers and counters
CLO-5 Design combinational circuits and sequential circuits by employing flip-flops and to learn A/D and D/A converters
CLO-6 Outline the basics of microprocessor and assembly language programming with examples with special reference to Intel µP 8085
CLO-7 Create programmes using assembly language and execute the programme using a µP kit

UNIT I: Number systems, binary arithmetic and codes
Introduction – number system – binary numbers – decimal to binary conversion – octal number – octal to binary conversion – hexadecimal numbers – hexadecimal to binary conversion – hexadecimal to octal conversion – floating point representation of numbers
Arithmetic operation – binary addition – subtraction - multiplication – division – 1's complement subtraction – 2's complement subtraction– weighted binary codes – 8421 code – 2421 code -non weighted codes – excess – 3 code – Gray codes – error – detecting codes – error correcting codes – alpha numeric codes

UNIT II: Boolean algebra and minimization techniques
Boolean logic operations – logical AND operation – logical OR operation – logical complementation – basic laws of Boolean algebra –DeMorgan's theorem – minimization of Boolean expression using algebraic method – sum of products and product of sums – minterms – maxterms – deriving sums of products and product of sum expression from truth–tables – Karnaugh map – simplification with and without don't care conditions (up to 4 variables only)

UNIT III: Logic gates, arithmetic circuits and flip-flops
Positive and negative logic designations – logic gates – OR, AND, NOT, NAND, NOR – gates – universal gates – EXOR gate – EXNOR gate
Arithmetic circuits – half adder – full adder – half subtractor – full subtractor – parallel binary adder – parallel binary subtractor – binary to gray – gray to binary code convertors
Flip-flops – SR flip-flop – D flip-flop – JK flip-flop – T flip-flop – Edge triggering in flip-flops – master-slave JK flip-flop

UNIT IV: Applications of flip-flops, A/D and D/A convertors
Shift registers – serial in serial out – serial in parallel out – parallel in serial out – parallel in parallel out – registers

Counters – asynchronous counters – ripple counter – MOD – 3, MOD-6 and MOD -10 counters (using JK flip-flops only)
A/D converters – simultaneous type and counter type
D/A convertors – weighted resister and R- 2R ladder type

UNIT V: Microprocessor architecture, instruction set and assembly language programs
The 8085 microprocessor – microprocessor communication and bus timing – De multiplexing the lower order address buses - generating control signals – a detailed look at the 8085 microprocessor and its architecture - decoding and executing instructions
Instruction classification – data transfer – arithmetic operations – logical instructions – branching instructions
Instruction format – 1 byte, 2 byte and 3 byte instructions – ALP for addition, subtraction, multiplication and division.

PRACTICALS/ASSIGNMENTS:

- Verification of truth tables of OR, AND, NOT, NAND, NOR and Ex-OR gates (Using ICs)
- Verification of truth tables of OR, AND, NOT, NAND, NOR and Ex-OR gates (Using Discrete Components)
- Verification of De Morgan's Theorems
- NAND as Universal Building Block
- NOR as Universal Building Block
- Half Adder and Full Adder
- Half Subtractor and Full Subtractor
- Binary to Gray and Gray to Binary converters
- Construction of SR and JK Flip-flop using NOR gates
  Assignments on codes and waited codes, simplification of Boolean expressions using table method, design of modules counters, digitalmeter construction for temperature, resistance, pressure, speed etc and latest microprocessors and their features.
  Quiz programs on number system, 9's and 10's complement subtraction in decimal numbers, output of different electronic circuits for different inputs and outputs of different assembly language programs

PEDAGOGY STRATEGIES:

- Board and Chalk lecture
- Powerpoint slide presentations
- Assignments
- Laboratory classes

REFERENCES:

1 S. Salivahanan and S. Arivazagan,Digital Circuits and Design, Vikas Publishing House, 4th edition
2 Ramesh P Gaonkar, Microprocessor Architecture, programming and applications, Penram Publishing House, 5th edition

3 Donald P Leach, Albert Paul Malvino and GoutamSaha, Digital Principle and Applications, Tata McGraw-Hill, 8th edition
4 Morris Mano, Digital logic and Computer design, Pearson education India, 1st edition
5 A. Anandkumar, Fundamentals of Digital Circuit, Prentice Hall of India, 3rd revised edition
6 Aditya P Mathur, Introduction to Microprocessors, Tata McGraw-Hill publishing company, 3rd edition

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1 Venugopal, Digital Circuits and systems, Tata McGraw Hill, 2011.
2 G K Kharate , Digital Electronics, Oxford University Press, 2010.
3 R.J.Tocci, N.S.Widmer, Digital Systems: Principles & Applications, PHI Learning, 2001
4 Shimon P. Vingron, Logic circuit design, Springer, 2012.
5 SubrataGhoshal, Digital Electronics, Cengage Learning, 2012.
6 S.K. Mandal, Digital Electronics, 1st edition, McGraw Hill, 2010.
7 A. Wadhwa, Microprocessor 8085: Architecture, Programming and interfacing, PHI Learning, 2010.

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4. https://youtu.be/DBTna2ydmC0

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES							
	Course Level Outcome (CLO)						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Disciplinary Knowledge	✓	✓	✓		✓	✓	
Communication Skills			✓			✓	
Critical Thinking	✓	✓		✓	✓		✓
Research-related Skills			✓				✓
Analytical Reasoning	✓		✓	✓	✓		✓
Problem Solving		✓		✓			
Team Work	✓			✓	✓		✓

Year	Subject Title	Sem	Sub Code	Hours/ Week
2021-22 Onwards	Core 8: Quantum Mechanics and Relativity	VI	21BPH61C	4

COURSE LEVEL OUTCOMES:

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

CLO-1 Discuss the dual nature of light and appreciate the emergence of Quantum Mechanics.
CLO-2 Solve eigenvalue and eigen function for free particle problems
CLO-3 Outline the fundamentals in operator formalism
CLO-4 Compare inertial and non-inertial frame of references and hence transformation equations
CLO-5 Impart tensors to learn equations for relativistic particles.
CLO-6 Discuss the need for special theory of relativity and explain its role in understanding length contraction and time dilation
CLO-7 Explain the gravitational effect using General theory of Relativity

UNIT I:
Introduction – Dual nature of light - de Broglie wave length – Phase velocity – Group velocity – Relation between Phase and Group velocity, Davisson and Germer experiment – G.P. Thomson's Experiment – Problems – Heisenberg uncertainty Principle – Position measurement – Diffraction of electron by a slit – Gamma ray microscope thought experiment – Application of uncertainty Principle: Energy and radius of Bohr First Orbit – Why electron cannot present in the nucleus – Problems

UNIT II:
Time dependent and independent of Schrodinger's equation – Physical interpretation of wave function – Normalized and Orthogonal wave function – Postulates of quantum mechanics – Expectation values of dynamical quantities – Probability current density – Ehrenfest's theorem – Particle in a box (one dimensional case) – Rectangular potential barrier – Linear Harmonic oscillator – Problems

UNIT III:
Significance of various quantum numbers n, l, m – Electron probability density – The operator formalism in quantum mechanics – Momentum Operator – Hamiltonian Operator – Hermitian Operators – Properties of Hermitian Operators – Commutation relation between Position and Momentum – Hamiltonian and momentum – Concepts of orbital angular momentum – Components of L and L^2 – Ladder operators

UNIT IV:
Frames of reference – Newtonian Relativity – Galilean Transformation equations – Michelson – Morley experiment and explanation of the negative result – General theory of Relativity – Effect of gravitational field on a ray of light – Gravitational red shift – Black hole – Problems

UNIT V:
Postulates of special theory of relativity – Lorentz transformation equations – Length contraction – Time dilation – Addition of velocities – Variation of mass with velocity – Mass energy equivalence – Minkowski's four-dimensional space. Tensors: Covariant – Contravariant – Mixed tensors

PRACTICALS/ASSIGNMENTS:

- Problems in de Broglie hypothesis
- Applications of Heisenberg Uncertainty principle
- Commutation relation between physical observables
- Problems in relativity

PEDAGOGY STRATEGIES

- Board and chalk lecture
- Powerpoint slide presentations
- Assignments
- Group discussions
- Quizes

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1. S.P. Singh and M.K. Bagde, Elements of Quantum Mechanics, S. Chand & Company Ltd. 8th Edition, 2003.
2. R. Murugesan and Krithika Sivaprasath, Modern Physics, S. Chand & Company Ltd. Revised Edition, 2006.
3. Sathya Prakash and Swathi Saluja, Quantum Mechanics, Kedar Nath and Ram Nath, 3rd Edition, 2000.
4. Arthur Beiser, Concepts in Modern Physics, Tata McGraw Hill Publishers, 6th Edition 2002.
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6. G. Aruldass, Quantum Mechanics, PHI, 2nd Edition, 2008.
7. D.J. Griffiths, Introduction to Quantum mechanics, PHI, 6th Edition, 1995.

FURTHER READING:

1. Y. Peleg, R. Prini, E. Zaarur, Schaum's Outline of Theory and Problems of Quantum Mechanics, Schaum's Outline series, MGH, (ISBN 0070540187)
2. W. Greiner, Quantum Mechanics: An Introduction, Springer, 4th Edition, 2001.
3. D.G. Swanson, Quantum Mechanics: Foundation and Applications, Taylor and Francis, 3rd Edition, 2006.
4. R. Shankar, Principles of Quantum Mechanics, Plenum Press, 2nd Edition, 2014.
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2. https:/www.iop.org

3. https:/www.einstein-online.info
4. https:/physics.mq.edu.au
5. https:/www.theguardian.com

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES							
	Course Level Outcome (CLO)						
	1	2	3	4	5	6	7
Disciplinary Knowledge	✓		✓	✓	✓		✓
Communication Skills							
Critical Thinking	✓	✓	✓		✓	✓	
Research-related Skills		✓					✓
Analytical Reasoning	✓			✓	✓	✓	
Problem Solving		✓				✓	
Team Work						✓	✓
Moral and Ethical Awareness							
Multicultural Competence							

Year	Subject Title	Sem	Sub Code	Hours/ Week
2021-22 Onwards	Core 9: Solid State Physics and Nuclear Physics	VI	21BPH62C	4

COURSE LEVEL OUTCOMES:

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

CLO-1 Conversant with crystal structure and able to solve problems in atomic packing and atomic radius
CLO-2 Discuss the concept of X-ray diffraction by various methods, types of bonding and crystal imperfections
CLO-3 Apprehend the properties of nuclear structure and different nuclear models
CLO-4 Identify the principle and working of various particle accelerators and detectors
CLO-5 Conceive the ideas of nuclear reactors and acquire a knowledge of elementary particles
CLO-6 Explain fission and fusion well as nuclear processes to produce nuclear energy in nuclear reactor and stellar energy in stars.
CLO-7 Describe radioactivity, nuclear reactions and application of radioisotopes

UNIT I: Structure of Solids:
Crystalline and amorphous solids – Crystal structure: Basis and crystal structure – Primitive lattice cell and unit cell – Bravais lattices in two dimensions and in three dimensions – Lattice planes and Miller indices – Inter-planar distance – Spacing between planes in SC, FCC and BCC – Atomic packing – Atomic radius – Lattice constant and density – Problems in atomic packing, atomic radius – Crystal structures (SC, FCC, BCC, HCP, Diamond)

UNIT II: X-ray Diffraction: Bragg's law – Laue method – Rotating crystal method – Powder photograph method.
Bonding in Solids: (Qualitative treatment) Ionic – Covalent – Metallic – Molecular bonds.
Crystal Defects: (Qualitative Study) Frenkel defect – Schottky defect – Edge dislocation – Screw dislocation – Colour centres – Grain boundaries

UNIT III: Introduction to the Nucleus:
General properties of Nucleus – Binding energy – Nuclear stability – Liquid drop model – Bohr Wheeler theory – Semi empirical mass formula – Shell model – Nuclear forces –Yukawa's Meson theory of nuclear forces.
Radioactivity: Natural Radioactivity – Alpha, Beta and Gamma rays – Law of successive disintegration – Transient and secular equilibrium – Artificial transmutation – Rutherford's experiment – Nuclear reactions – Artificial Radioactivity – Preparation of radio isotopes – Applications of radio isotopes.

UNIT IV:
Particle accelerators: Linear accelerator – cyclotron – Betatron.
Detectors: Solid state detectors – Proportional counter – GM counter – Wilson's cloud chamber – Neutron – Discovery – Properties – Thermal neutrons and fast neutrons.

UNIT V:

Nuclear fission: Nuclear fission – Chain reaction, Multiplication factor and critical size – Atom bomb – Nuclear reactors – Breeder reactor.

Nuclear Fusion: Nuclear Fusion – Carbon-Nitrogen cycle – Proton-proton cycle – Thermonuclear reactions – Transuranic elements.

Elementary particles: Classification – Particles and antiparticles – Fundamental interactions – Elementary particle quantum number – Conservation laws.

ASSIGNMENTS:

- Lattice planes and Miller indices
- Classification of crystal defects
- Significance of radioactivity
- Disccovery of neutron
- Thermonuclear reactions

PEDAGOGY STRATEGIES:

- Board and chalk lecture
- Powerpoint slide presentations
- Assignments
- Group discussions
- Laboratory classes
- Quizzes

REFERENCES:

1. Gupta, Kumar, Solid State Physics, Nath & Co, 2012
2. R. Murugesan & Kiruthiga Sivaprasath, Modern Physics, S.Chand&Co, Delhi, 2006
3. D.C. Tayal , Nuclear Physics, Himalaya publishing House, 2011
4. Charles Kittel, Introduction to Solid State Physics, 8th Edition, Wiley India Pvt. Ltd., 2004
5. J.P. Srivastava, Elements of Solid State Physics, 4th Edition, Prentice-Hall of India, 2015

FURTHER READING:

1. Leonid V. Azaroff, Introduction to Solids, Tata Mc-Graw Hill, 2004
2. M.A. Wahab , Solid State Physics, Narosa Publications, 2011
3. Kenneth S. Krane ,Introductory nuclear Physics, Wiley India Pvt. Ltd., 2008
4. Bernard L. Cohen, Concepts of nuclear physics, Tata Mcgraw Hill, 1998
5. Arthur.Beiser, Concepts of Modern Physics, Tata Mc-Graw Hill, New Delhi, 2002

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5. https://application.wiley-vch.de/books/sample/3527406018_c01.pdf

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES							
	Course Level Outcome (CLO)						
	1	2	3	4	5	6	7
Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
Communication Skills							
Critical Thinking	✓		✓	✓		✓	
Research-related Skills	✓	✓		✓	✓	✓	✓
Analytical Reasoning	✓			✓	✓	✓	
Problem Solving	✓		✓		✓	✓	
Team Work		✓					

Year	Subject Title	Sem	Sub Code	Hours/ Week
2021-22 Onwards	Core 10: Atomic Physics and Spectroscopy	VI	21BPH63C	4

COURSE LEVEL OUTCOMES:

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

CLO-1 Review different atom models and analyze their drawbacks
CLO-2 Categorize the quantum numbers and coupling schemes
CLO-3 Examine the impact of electric and magnetic fields on atomic spectra
CLO-4 Discuss photoelectric effect, photo cells and their applications
CLO-5 Distinguish rotational, vibrational and electronic spectra of molecules
CLO-6 Analyze Raman effect and its applications
CLO-7 Solve problems using Bohr formulae and discuss the phenomenon of photoelectric emission

UNIT I: Structure of the Atom
Bohr atom model – Postulates – The Bohr formulae – Calculation of total energy – Problems on radius and energy of electron in an orbit- Bohr's interpretation of hydrogen spectrum – Spectral series of hydrogen atom – Effect of nuclear motion on atomic spectra – Evidences in favour of Bohr's theory – Ritz combination principle – Bohr's correspondence principle – Sommerfeld's relativistic atom model – Elliptical orbits for hydrogen – Expression for total energy – Fine structure of H_α line

UNIT II: Vector Atom Model
Spatial quantization – Spinning electron – Quantum numbers associated with vector atom model – Coupling schemes – L-S coupling – The j-j coupling – The Pauli's Exclusion principle – Magnetic dipole moment due to orbital motion of the electron – Magnetic dipole moment due to spin – The Stern and Gerlach experiment

UNIT III: Effect of magnetic and electric field on the spectrum of an atom
Optical spectra – Spectral notation – fine structure of sodium D-line – Hyperfine structure – Zeeman Effect – Experimental arrangement for normal Zeeman effect – Lorentz classical theory of normal Zeeman effect – Expression for Zeeman shift – Larmor's theorem – Quantum mechanical explanation of normal Zeeman effect – Explanation of Anomalous Zeeman effect – Stark effect – Paschen Back effect

UNIT IV: Photoelectric Effect
The Nature of Photo-particles – Lenard Method of determination of e/m of photoelectrons – Richardson and Compton experiment – Experimental investigations on the Photo electric effect – Laws of photoelectric emission – Failure of electromagnetic theory – Einstein's Photo electric equation – Experimental verification of Einstein's Photoelectric equation by Millikan's Experiment – Photoelectric cells – Photo emissive cell – Photovoltaic cell – Photoconductive cell – Photomultiplier – Applications of photoelectric cell- Problems on photoelectric emission

UNIT V: X-ray and Molecular spectra
X-ray spectra – Continuous X-ray spectrum – Characteristic X-ray spectrum – Moseley's law – Compton scattering – Experimental verification – Molecular spectra – Theory of origin of pure

rotational spectrum of a diatomic molecule – Theory of origin of the vibration-rotation spectrum of a diatomic molecule – Electronic spectra of molecules – Rayleigh's scattering – Raman effect – Experimental study of Raman effect – Quantum theory of Raman effect – Distinction between IR and Raman spectra – Applications

ASSIGNMENTS/ GROUP DISCUSSION:

- Evidences in favour of Bohr's theory
- Modifications of Bohr's theory - Sommerfeld's relativistic atom model
- Magnetic dipole moment due to orbital and spin motion of the electron
- Normal and Anomalous Zeeman effect
- Failure of electromagnetic theory and Einstein's Photo electric equation
- Continuous and characteristic X-ray spectra
- Significance of Mosley's law

PEDAGOGY STRATEGIES

- Board and chalk lecture
- Powerpoint slide presentations
- Assignments
- Group discussions

REFERENCES:

1. R. Murugesan & Kiruthiga Sivaprasath, Modern Physics, S.Chand & Company, Delhi, 2006
2. Arthur. Beiser, Concepts of Modern Physics, Tata Mc - Graw Hill, New Delhi, 2002
3. J.B. Rajam, Atomic Physics, S.Chand & Company, Delhi, 2005
4. Gupta, Kumar and Sharma, Elements of Spectroscopy, Pragati Prakashan, Meerut, 2007
5. G. Aruldhas, Molecular Structure and spectroscopy, Prentice Hall of India Pvt. Ltd., New Delhi, 2004

FURTHER READING:

1. G. Aruldhas and P.Rajagopal, Modern Physics, Prentice Hall of India, New Delhi, 2005
2. N. Subramaniam, Brijlal and Jivan Seshan, Atomic and Nuclear Physics, S.Chand & Co, Delhi, 2007
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5. Gurdeep Chatwal and Shyam Anand , Spectroscopy (Atomic and Molecular), Himalaya Publishing House, 1987

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3. https://cutt.ly/JndJpCt
4. https://cutt.ly/bndJkTq
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COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES							
	Course Level Outcomes (CLO)						
	1	2	3	4	5	6	7
Disciplinary Knowledge	✓	✓	✓	✓			✓
Communication Skills	✓		✓	✓	✓	✓	
Critical Thinking		✓		✓	✓		✓
Research-related skills		✓	✓	✓		✓	
Analytical reasoning	✓		✓		✓	✓	✓
Problem Solving			✓	✓	✓		✓
Team work	✓	✓			✓	✓	

Year	Subject Title	Sem	Sub Code	Hours/ Week
2021-22 Onwards	Skills based elective-IV : Computer Programming in 'C'	VI	21BPH64S	4

COURSE LEVEL OUTCOMES:

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

CLO-1 Explain variables, constants and data types used in C language.
CLO-2 Use the control statements for writing efficient programs.
CLO-3 Solve mathematical equations using C programming
CLO-4 Recognize the importance of mathematical functions and use of them in programs.
CLO-5 Identify physics problems and compile 'C' program to solve them
CLO-6 Create user defined functions, discuss them and specify situations to extrapolate them
CLO-7 Use the acquired skills for scripting system applications

UNIT I:
Character set – C tokens – Keywords and identifiers – Constants – Variables – Data types (primary data types) – Declaration of variables.
Relational operators – Logical operators – Assignment operators – Increment and decrement operators – Conditional operators.
Arithmetic expressions – Evaluation of expressions – Precedence of arithmetic operators – Operator precedence and associativity – Mathematical functions.

UNIT II:
Reading a character – Writing a character – Formatted input – Formatted output – Simple 'if' statement – The 'if…else' statement – Nesting 'if …else' statement – The 'switch' statement – The 'go to' statement- The 'while' statement – The 'do' statement – The 'for' statement.

UNIT III:
One dimensional array's – Two dimensional arrays – Declaring and initializing string variables – Reading strings from terminal – Writing strings to screen – String handling functions – Need for user defined functions – The form of C functions – Category of functions – No arguments and no return values – Arguments but no return values – Arguments with return values.

UNIT IV:
Structure definition – Giving values to members – Structure initialization
Understanding pointers – Accessing the address of a variable – Declaring and initializing pointers – Accessing a variable through its pointer
File management – introduction – defining and opening a file – closing a file – input / output operations using fprintf and fscanf functions.

UNIT V:
Conversion of centigrade temperature to Fahrenheit and Fahrenheit to Centigrade temperature – The acceleration due to gravity as a function of altitude – Solution of quadratic equation – Arranging the elements of an array in the ascending and descending order – Matrix addition, Subtraction and Multiplication.

PRACTICALS AND OTHER ACTIVITIES:

1. Conversion of centigrade temperature to Fahrenheit temperature and Fahrenheit temperature to centigrade temperature.
2. Solution of Quadratic equation.
3. Ascending and descending order using an array.
4. Matrix Addition and Subtraction.

PEDAGOGY STRATEGIES:

- Board and chalk lecture
- Powerpoint slide presentations
- Assignments
- Seminars
- Laboratory classes

REFERENCES:

1. E. Balagurusamy, Programming in ANSI C, TMH 5TH ED, 2011
2. Yashavant Kanetkar, Let us C, 16th Ed., BPB Publications, 2016

FURTHER READING:

1. Herbert Schildt, C: The Complete Reference‖, McGraw Hill, New Delhi, 2000.
2. Kernighan B. W. and Ritchie D. M., C Programming Language (ANSI C)‖, Prentice Hall of India, New Delhi, 2006.
3. Deitel H. M. and Deitel P. J., C: How To Program‖, Prentice Hall of India, New Delhi, 2012
4. Gottfried B., Programming with C, Tata McGraw Hill, New Delhi, 2009
5. Rama N. Reddy Carol A. Ziegler, C Programming for Scientists and Engineers With Applications, Jones and Bartlett, New Delhi 2010.
6. Gottfried, Programming With C - Sie - Sos, McGraw Hill
7. Kamthane, Programming in C, Third Edition, Pearson, 2015
8. K R Venugopal; Sudeep R Prasad, Mastering C, McGraw Hill Education, Second Ed., 2017
   Yashavant Kanetkar, Let us C Solutions Paperback, 16th Ed., BPB Publications, 2016

WEB-RESOURCES:

1. C Programming Notes.
2. Programming in C- Unix system calls and subroutines using C.
3. C lesson by Chris Sawtell
4. Comp.Lang.C- Frequently asked questions.
5. Collection of C programming material at Lysator Society.
6. A collection of useful libraires written in C.
7. The programming language standard.
8. High level and low-level programming in C.

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES							
	Course Level Outcomes (CLO)						
	1	2	3	4	5	6	7
Disciplinary Knowledge	✓	✓	✓	✓	✓		
Communication Skills	✓					✓	
Critical Thinking			✓			✓	✓
Research-related skills							✓
Analytical reasoning		✓			✓	✓	✓
Problem Solving			✓	✓	✓	✓	✓
Team work	✓					✓	

Year	Subject Title	Sem	Sub Code	Hours/ Week
2021-22 Onwards	**Core Practical – III: General Experiments (Examination at the end of VI Semester) (Any 12)**	**VI**	**21BPH65P**	**3**

COURSE LEVEL OUTCOMES:

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

CLO-1 Design, carryout, record and analyse the experimental data.
CLO-2 Discuss the usage of basic laws and theories to determine various properties of the materials given.
CLO-3 Determine the spectral and optical properties of the given prisms and gratings.
CLO-4 Describe the working principle of series and parallel resonance circuits.
CLO-5 Identify the strength of the various materials using Young's modulus experiments.
CLO-6 Calculate the refractive index of various liquids using interference principle.
CLO-7 Calculate the EMF of various thermocouples.

List of the Experiments

1. Young's Modulus – Koenig's Method – Non uniform bending
2. Young's Modulus – Koenig's Method – Uniform bending
3. Young's Modulus – Cantilever – Static method
4. Young's Modulus – Cantilever – Dynamic method
5. Dispersive Power of a Prism – Spectrometer
6. Dispersive Power of a Grating – Spectrometer
7. Cauchy's Constants – Spectrometer
8. Spectrometer – Hartmann's Interpolation Formula
9. Solar Spectrum – Wavelength of Fraunhofer Lines – Spectrometer
10. Refractive index of a lens – Newton's Rings Method
11. EMF of a Thermocouple – Potentiometer
12. Carey Foster Bridge – Temperature Coefficient of Resistance
13. Series Resonance Circuit – Quality Factor of a Coil
14. Parallel Resonance Circuit – Quality Factor of a Coil
15. Self- Inductance of a Coil – Anderson's Method
16. Newton' Rings Method – Refractive Index of a Liquid
17. Air Wedge Method – Refractive Index of a Liquid
18. Comparison of Mutual Inductance of Coils – B.G.
19. Absolute Capacity of a Condenser – B.G.
20. Polarimeter - Specific Rotatory Power of Solution
21. Hysteresis Loop – Determination of Coercivity and Retentivity
22. Mirror Galvanometer – EMF of a Thermocouple
23. Copper Voltameter – B_H at a Place

PEDAGOGY STRATEGIES:

- Laboratory classes
- Demonstration
- Assignments

- Group discussion

REFERENCES:

1. M.N.Srinivasan, A Text book of Practical Physics ,S.Chand and sons, 2013
2. Dr. R. Sathyamoorthy Practical Physics, Apsara Publications, 2019
3. C.L.Arora, B.Sc Practical Physics, S.Chand & Co, 2010
4. Prakash and Ramakrishna, A Text Book of Practical Physics, 11th Edn, Kitab Mahal, 2011.

FURTHER READING:

1. Harnam Singh, Dr.P.S.Hemne , B.Sc Practical Physics, S.Chand, 2018
2. R.P.Goyal, Unified Physics, Shiva Lal Agarwal & Co, 2020
3. Ashok Sharma, R.P. Arora, Modern Approach to Practical Physics, 2019
4. Ashok Sharma, Practical Physics, MBD group, 2019

WEB-RESOURCES:

1. https://www.preproom.org/practicals/physics.aspx?page=3
2. https://ocw.metu.edu.tr/course/view.php?id=167
3. https://www.leybold-shop.com/physics/physics-experiments.html
4. http://www.indosawedu.com/college-physics-lab.php
5. https://bscphysicspractical.blogspot.com/2019/12/bsc-first-year-practical-physics.html

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES							
	Course Level Outcomes (CLO)						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
Communication Skills		✓		✓			
Critical Thinking		✓	✓		✓	✓	✓
Research-related skills		✓					✓
Analytical reasoning	✓		✓			✓	✓
Problem Solving		✓					
Team work	✓		✓	✓	✓		✓

Year	Subject Title	Sem	Sub Code	Hours/ Week
2021-22 Onwards	**Core Practical - IV: Analog Electronics and 'C' Programming (Examination at the end of VI Semester) (Any12)**	**VI**	**21BPH66P**	**3**

COURSE LEVEL OUTCOMES:

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

CLO-1 Recognize, design and construct electronic circuits using diode, transistor, FET and UJT
CLO-2 Interpret the working principle of amplifiers and oscillators
CLO-3 Evaluate the characteristics of diodes and transistors
CLO-4 Write programs in C language and execute them
CLO-5 Realize the arrays and functions in C programming and discuss
CLO-6 Use operational amplifiers in various electronic circuits
CLO-7 Construct a regulated power supply and analyze its performance

Analog Electronics

1. Junction diode-forward bias characteristics and Zener diode-reverse bias characteristics
2. Construction of IC Regulated Power supply using IC7805
3. Transistor Characteristics – Common Emitter configuration
4. Hartley Oscillator using Transistor
5. Astable multivibrator using transistor
6. JFET – Transfer Characteristics
7. UJT-V-I characteristics
8. Summing Amplifier using Operational Amplifier IC741
9. Differential Amplifiers using Operational Amplifier IC741
10. Zero crossing detector using Operational Amplifier IC741
11. Integrator and Differentiator using Operational Amplifier
12. Colpitt's Oscillator using Operational Amplifier
13. Phase Shift oscillator using Operational Amplifier
14. Op-Amp as Digital to Analog converter – Weighted resistor method
15. Op-Amp as Digital to Analog converter – R-2R ladder method

'C' Programs for

16. Conversion of centigrade temperature to Fahrenheit temperature and Fahrenheit temperature to centigrade temperature
17. Solution of Quadratic equation
18. Ascending and descending order using an array
19. Matrix Addition and Subtraction

PEDAGOGY STRATEGIES:

- Laboratory classes
- Demonstration
- Assignments

- Group discussions

REFERENCES:

1. R. A. Gayakwad, OP-Amps and Linear Integrated Circuit, 4th edition, Prentice Hall. , 2000.
2. Albert Malvino, Electronic Principle, Tata Mc-Graw Hill, 2008.
3. R.L. Boylestad & L.D. Nashelsky, Electronic Devices & circuit Theory, Pearson, 2009.
4. E. Balagurusamy, Programming in ANSI C, TMH 5TH ED, 2011
5. Yashavant Kanetkar, Let us C, 16th Ed., BPB Publications, 2016

FURTHER READING:

1. Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, Mc-Graw Hill, 1994.
2. Herbert Schildt, C: The Complete Reference‖, McGraw Hill, New Delhi, 2000.

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES							
	Course Level Outcomes (CLO)						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
Communication Skills				✓	✓	✓	
Critical Thinking	✓			✓	✓		
Research-related skills	✓	✓		✓	✓		
Analytical reasoning	✓	✓	✓	✓	✓	✓	✓
Problem Solving	✓	✓				✓	✓
Team work	✓	✓				✓	✓

Year	Subject Title	Sem	Sub Code	Hours/ Week
2021-22 Onwards	**Core Practical - V: Digital Electronics and 8085 Microprocessor (Examination at the end of VI Semester) (Any12)**	**VI**	**21BPH67P**	**3**

COURSE LEVEL OUTCOMES:

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

CLO-1 Verify the truth tables of basic logic gates and universal build blocks
CLO-2 Apply the theory to design the digital circuits
CLO-3 Design and verify truth tables of adder and subtractor
CLO-4 Construct and verify truth tables of Flip-flops and code converters
CLO-5 Write basic assembly language programmes for 8085
CLO-6 Test assembly language programmes for 8085
CLO-7 Compare the theoretical and experimental results

Digital Electronics

1. Verification of truth tables of OR, AND, NOT, NAND, NOR and Ex-OR gates (Using ICs)
2. Verification of truth tables of OR, AND, NOT, NAND, NOR and Ex-OR gates (Using Discrete Components)
3. Verification of De Morgan's Theorems
4. NAND as Universal Building Block
5. NOR as Universal Building Block
6. Half Adder and Full Adder
7. Half Subtractor and Full Subtractor
8. Binary to Gray and Gray to Binary converters
9. Construction of SR and JK Flip-flop using NOR gates

8085 Microprocessor

10. Addition of two 8 bit numbers
11. Subtraction of two 8 bit numbers
12. Block data transfer
13. Multiplication of two 8 bit numbers
14. Division of two 8 bit numbers
15. Generating natural numbers
16. Masking and Setting of bits
17. Largest/Smallest of an array
18. Finding 1's and 2's Complement

PEDAGOGY STRATEGIES

- Laboratory classes
- Demonstration

- Assignments
- Group discussion

REFERENCES:

1. J. Millman and C.C. Halkias, Integrated Electronics, 1991, Tata Mc-Graw Hill.
2. S. Salivahanan & N.S. Kumar, Electronic devices & circuits, 2012, Tata Mc-Graw Hill
3. A.P. Malvino, D.P. Leach and Saha, Digital Principles and Applications, 7th Ed., 2011, Tata McGraw Hill
4. Aditya P Mathur, Introduction to Microprocessors, Tata McGraw-Hill publishing company, 3rd edition
5. Ramesh P Gaonkar, Microprocessor Architecture, programming and applications, Penram Publishing House, 5th edition

FURTHER READING:

1. Modern Electronic Instrumentation and Measurement Tech., Helfrick and Cooper, 1990, PHI Learning .
2. Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, 2014, 6th Edn., Oxford University Press
3. M.H. Rashid, Microelectronic Circuits, 2nd Edn., 2011, Cengage Learning.
4. S.K. Mandal, Digital Electronics, 2010, 1st edition, McGraw Hill
5. A. Wadhwa, Microprocessor 8085:Architecture, Programming and interfacing, 2010, PHI Learning

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES							
	Course Level Outcomes (CLO)						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Disciplinary Knowledge	✓		✓	✓	✓	✓	
Communication Skills		✓		✓		✓	
Critical Thinking	✓	✓		✓	✓		✓
Research-related skills		✓	✓		✓		✓
Analytical reasoning	✓		✓		✓		✓
Problem Solving			✓	✓			
Team work		✓				✓	✓

Year	Subject Title	Sem	Sub Code	Hours/ Week
2021-22 Onwards	**Allied II: Allied Physics-I**	**IV**	**21BCH34A 21BMA34A 21BGI34A**	**5**

COURSE LEVEL OUTCOMES:

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

CLO-1 Explain the phenomenon of impact of elastic bodies and the rigid body dynamics in terms of moment of inertia and solve simple problems
CLO-2 Apply the theory of compound pendulum to determine the value of acceleration due to gravity in laboratory
CLO-3 Discuss the concepts of statics and hydrostatics and correlate to real life problems
CLO-4 Apply Newton's law of gravitation to understand the variation of acceleration due to gravity with altitude, depth and latitude
CLO-5 Use the principles of elasticity to the study of Young's modulus of materials
CLO-6 Discribe the role of Joule-Kelvin effect in liquefaction of air, hydrogen and helium
CLO-7 Explain optical phenomenon such as interference, holography and optical activity

UNIT 1: Mechanics

Impact of elastic bodies – Direct impact of two spheres – Impulse at the impact – Loss of kinetic energy due to direct impact of two smooth spheres – Oblique impact of two spheres – Moment of inertia (Definition) – Moment of inertia of a spherical shell about a diameter – Moment of inertia of a uniform solid cylinder – Theory of compound pendulum – Experimental determination of acceleration due to gravity using compound pendulum.

UNIT 2: Statics and Hydrostatics

Laws of friction - Angle and cone of friction - Motion up and down on a rough inclined plane (external force applied parallel to the plane) - Centre of gravity (Definition) - Centre of gravity of a solid cone - Centre of gravity of a solid hemisphere.

Centre of pressure: Centre of pressure of a rectangular lamina – Centre of pressure of a triangular lamina (Vertex in the surface of the liquid) – Stability of equilibrium of a floating body – Metacentre – Metacentric height – Determination of Metacentric height of a ship

UNIT 3: Gravitation, Elasticity and Ultrasonics

Gravitation: Newton's law of gravitation – Gravitational constant – Determination of G by Boy's method – Variation of 'g' with altitude, depth and latitude.

Bending of beams: Bending moment – Depression at the free end of a cantilever – Hooke's law – Kinds of moduli of Elasticity – Experimental determination of Young's Modulus by Uniform and Non-Uniform bending methods.

Ultrasonics: Production of ultrasonic waves by piezoelectric crystal method – Properties of Ultrasonic waves – Applications of Ultrasonics

UNIT 4: Thermal Physics

Specific heat capacities of a gas (C_p and C_v) – Relation between them – Joule- Kelvin effect –

Theory of porous plug experiment – Joule-Kelvin effect: Temperature of inversion – Liquefaction of air (Linde's process) – Liquefaction of hydrogen – Liquefaction of Helium – Properties of liquid Helium I and Helium II
Second law of thermodynamics – Carnot's theorem and its proof –Thermal conductivity of a bad conductor by Lee's disc method

UNIT 5: Optics

Coherent sources – Phase difference and path difference – Theory of interference fringes – Fringes produced by a wedge shaped thin film.

Holography: Introduction – Recording of a hologram and viewing a hologram – Applications of holography.

Polarization: Optical activity – Specific rotation-Laurent's half shade polarimeter – Determination of specific rotation of sugar solution.

PRACTICALS/ ASSIGNMENT:

- Determination of acceleration due to gravity using compound pendulum
- Experimental determination of Young's Modulus by Uniform and Non-Uniform bending methods
- Assignment on 'Joule- Kelvin effect in day-to-day life'
- Determination of thermal conductivity of a bad conductor by Lee's disc method
- Experiments using the fringes produced by a wedge shaped thin film
- Assignment on the medical applications of ultrasonic waves

PEDAGOGY STRATEGIES:

- Board and chalk lecture
- Assignments
- Seminars
- Laboratory classes

REFERENCES:

1. M. Narayanamurthi and N. Nagarathinam, Dynamics, The National Publishing Company, Chennai, 2005.
2. M. Narayanamurthi and N. Nagarathinam, Statics, Hydrostatics and Hydrodynamics - The National Publishing Company, Chennai, 2005.
3. Brijlal & N. Subramanyam, Properties of matter and sound, Vikas Publishng. Pvt. Ltd, 2005.
4. Brijlal and Subramaniyam, Heat and Thermodynamics, S. Chand &Co., 2001.
5. N. Subrahmanyam, Brijlal and MN Avadhanulu, A textbook of optics, S. Chand and Co.Ltd., New Delhi, 2006.

FURTHER READING:

1. R.Murugeshan, Mechnics and Mathematical Physics, S.Chand and Company Limited, New Delhi, Third Revised Edition, 2008.
2. Brijlal ,N. Subramanyam, Jivan Seshan, Mechanics and Electrodynamics, S.Chand,

Eruasia Publishing House (Pvt) Ltd., 2005.
3. Resnick, Halliday and Walker 8/e Physics, Wiley, 2008
4. D.S. Mathur, Heat and Thermodynamics, S. Chand & Co. 2014.
5. R. Murugesan, Optics and Spectroscopy, S.Chand & Co. Ltd., New Delhi. 2005

WEB-RESOURCES:

1. https://physicsabout.com/mechanics/
2. http://ocw.mit.edu/courses/#physics
3. http://hyperphysics.phy-astr.gsu.edu
4. https://www.coursera.org
5. https://physicsabout.com/modern-physics/optics/
6. http://nptel.ac.in/courses/115106090/

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES							
	Course Level Outcomes (CLO)						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Disciplinary Knowledge	✓	✓	✓		✓	✓	✓
Communication Skills	✓		✓			✓	✓
Critical Thinking		✓	✓	✓	✓	✓	✓
Analytical reasoning		✓		✓			
Problem Solving	✓	✓	✓	✓	✓		
Team work		✓	✓			✓	✓

Year	Subject Title	Sem	Sub Code	Hours/ Week
2021-22 Onwards	**Allied II: Allied Physics-II**	**IV**	**21BCH44A 21BMA44A 21BGI44A**	**5**

COURSE LEVEL OUTCOMES:

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

CLO-1 Describe the behaviour of electric and magnetic field in matter. Distinguish between different types of magnetic materials and different kinds of magnetism manifested in materials

CLO-2 Identify and calculate the magnetic field around a current carrying wire and inside a solenoid

CLO-3 Appreciate the (i) Behaviour of the positive rays (ii) nuclear fission and (iii) nuclear fusion

CLO-4 Discuss the working, characteristics and applications of diodes, transistors and rectifier circuits

CLO-5 Use the working knowledge of electronic components and explain the components used in various devices

CLO-6 Use the number system, binary arithmetic conversion and Logic gate configuration

CLO-7 Solve problems on code conversion, complements and simplification of Boolean function

UNIT I: Electricity and Magnetism

Statement of Gauss law–Proof –Principle of a Capacitor – Capacitance of a spherical capacitor (Outer and inner sphere earthed) – Energy stored in a charged capacitor -loss of energy on sharing of charges between two capacitors – Magnetic induction - Magnetization – Magnetic susceptibility – Magnetic permeability – Properties of Dia, Para, Ferro, Ferri and Anti ferromagnetic materials – Definition of Hysteresis – Experiment to draw M-H curve – Magnetic properties of soft iron and steel

UNIT II: Magnetic Effects of Current

Biot-Savart law – Fleming's Right hand rule – Magnetic induction at a point on the axis of a circular coil carrying current – Fleming's Left hand rule – Force on a current carrying conductor in a magnetic field – Force between two parallel current carrying conductors – Definition of ampere – Moving coil ballistic Galvanometer: Principle, Construction, Theory – Ampere's circuital law – Magnetic field inside a long solenoid

UNIT III: Modern Physics

Properties of cathode rays and positive rays – Positive ray analysis by Thomson's parabola method – Photoelectric effect – Laws of photoelectric emission – Einstein's photoelectric equation – Millikan's Experimental verification – Photoelectric cells

Natural and artificial radioactivity – Applications of radioisotopes – Nuclear fission – Energy released in fission – Nuclear fusion – Energy released in fusion

UNIT IV:Electronics

PN junction diode – Zener diode-Characteristics – Special Purpose Diodes: LED – Photodiode - Transistor characteristics (CE mode)- JFET – Difference between JFET and BJT – Principle and

working of JFET – output characteristics – Parameters of JFET – MOSFET - types - depletion and enhancement MOSFETS - their characteristics.

UNIT V: Digital Electronics

Number systems – Binary system – Addition - Subtraction – 1's and 2's Complement method of Subtraction – Multiplication – Division – Binary-to-decimal and decimal-to-binary conversion – AND, OR, NOT gates – NAND and NOR as universal gates – XOR gate – Laws of Boolean algebra – Simplification of Boolean expressions – De Morgan's theorems

PRACTICALS/ ASSIGNMENT

- Moment of magnet – Deflection magnetometer – Tan C Position
- Characteristics of Junction diode
- Verification of truth table – AND, OR, NOT logic gates
- Magnetic Material Properties
- Radioactivity-Applications
- Types of Diodes-Characteristics
- Solve – complement method of subtraction and simplification of Boolean expression

PEDAGOGY STRATEGIES:

- Board and chalk lecture
- Assignments
- Seminars
- Laboratory classes

REFERENCES:

1. R. Murugeshan, Electricity and Magnetism, S. Chand & Company Pvt. Ltd., New Delhi – 2015
2. R. Murugesan, KiruthigaSivaprasath, Modern Physics, S. Chand &Co Ltd.., New Delhi, 14th Revised edition, 2014.
3. Mehta V.K., Principles of Electronics, S. Chand and company Ltd, 2014.
4. R.Murugesan, Allied Physics-I & II, S. Chand & Co Ltd., New Delhi, 2015.
5. V. Vijayendran, Digital Fundamentals, S.Viswanathan, Printers & Publishers Private Ltd, Chennai, 2004.

FURTHER READING:

1. BrijLal and N. Subrahmanyam, A Text Book of Electricity and Magnetism, Ratan Prakasan Mandir Educational & University Publishers, New Deihi,2000
2. D. L. Sehgal, K. L. Chopra and N. K. Sehgal, Electricity and Magnetism, S. Chand & Sons. New Delhi. 1996.
3. A.P. Malvino, D.P. Leach, Digital Principles and Application, IV Edition, Tata McGraw Hill, New Delhi, 2011.
4. Arthur Beiser, Shobhit Mahajan, S. RaiChoudhury, Concepts of Modern Physics, Sixth edition, SIE, 2009.
5. W.H.Gothmann, Digital Electronics, Prentice Hall of India, Pvt. Ltd., New Delhi 1996.

WEB-RESOURCES:

1. https://physicsabout.com/electricity-magnetism/
2. https://physicsabout.com/modern-physics/
3. https://in.docworkspace.com/d/sIFu27Kpj8PXJhQY
4. https://www.youtube.com/playlist?list=PL350612601E2DBFDE
5. https://lecturenotes.in/l/wa00098
6. https://www.youtube.com/playlist?list=PL803563859BF7ED8C

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES							
	Course Level Outcomes (CLO)						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Disciplinary Knowledge	✓		✓	✓		✓	✓
Communication Skills	✓	✓	✓	✓			
Critical Thinking		✓	✓	✓	✓	✓	
Research-related skills				✓	✓		
Analytical reasoning	✓	✓	✓	✓		✓	✓
Problem Solving					✓	✓	✓
Team work				✓	✓		

Year	Subject Title	Sem	Sub Code	Hours/ Week
2021-22 Onwards	**Allied Physics Practical (Examination at the end of IV- Semester) (Any12)**	**III & IV**	**21BPH47P**	**2**

COURSE LEVEL OUTCOMES:

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

CLO-1 Develop the expertise in applying physical concepts to practical problems
CLO-2 Acquire knowledge in choosing appropriate tools and methods to solve scientific problems and understand safety measures in using instruments
CLO-3 Distinguish between elastic/inelastic and rigid/flexible materials by modulus of elasticity
CLO-4 Apply the principle of potentiometer to detect the potential difference/current flowing between two points
CLO-5 Demonstrate the detection of magnetic moment of a magnet
CLO-6 Realize the surface tension and interfacial surface tension by drop weight method
CLO-7 Construct and solve simple logic circuits

1. Young's Modulus – Non-Uniform bending – Pin and microscope
2. Young's Modulus – Uniform bending – Optic lever
3. Rigidity modulus – Static Torsion method
4. Refractive Index of the Solid prism – Spectrometer
5. Refractive Index of the Liquid Prism – Spectrometer
6. Thickness of a thin wire – Air Wedge
7. Frequency a bar – Melde's String
8. AC frequency – Sonometer
9. Calibration of low range voltmeter – Potentiometer
10. Specific resistance – Potentiometer
11. Moment of magnet – Deflection magnetometer – Tan C Position
12. Acceleration due to gravity – Compound Pendulum
13. Surface Tension of the liquid – Drop weight method
14. Viscosity of Liquid - Capillary flow method
15. Specific heat capacity of the liquid – Newton's law of Cooling
16. Verification of truth table – AND, OR, NOT logic gates
17. Characteristics of Junction diode
18. Thermal conductivity of a bad conductor – Lee's Disc method

REFERENCES:

1. Dr. S. Somasundaram, Practical Physics, Apsara Publications, 2012.
2. R. Sasikumar, Practical Physics, PHI Learning Pvt. Ltd., New Delhi, 2011.
3. M.N. Srinivasan, S. Balasubramanian, R. Ranganathan, A Textbook of Practical Physics, S. Chand & Sons., 2013.
4. Indu prakash, Ram Krishna, A.K. Jha, Practical Physics, Kitab Mahal Publishers, 2012.

5. C.L. Arora, B.Sc. Practical Physics, S. Chand Publications, 2010.

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1. https://www.aminotes.com/2016/12/practical-applied-physics-1-engineering.html
2. https://spark.iop.org/practical-physics#gref
3. https://www.youtube.com/watch?v=w8Dq8blTmSA
4. https://www.youtube.com/watch?v=o56BWcHZteQ

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES							
	Course Level Outcomes (CLO)						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
Communication Skills	✓				✓		
Critical Thinking		✓		✓	✓		✓
Research-related skills	✓		✓	✓		✓	✓
Analytical reasoning		✓		✓		✓	
Problem Solving	✓		✓				✓
Team work		✓					✓

Year	Subject Title	Sem	Sub Code	Hours/ Week
2021-22 Onwards	Non-Major Elective – I Principles of Physics – I	V	21BPH5EL	3

COURSE LEVEL OUTCOMES:

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

CLO-1 Interpret the basic concepts of mechanics, gravitation, properties of matter and sound.
CLO-2 Analyze the different types units used in all these branches
CLO-3 Translate functioning of day-to-day devices into technical view
CLO-4 Prepare to face general paper of competitive examinations
CLO-5 Explain how physics applies to phenomena in the world around them
CLO-6 Develop the safety measures in using physics instruments
CLO-7 Adopt new technologies in their discipline

UNIT I: Mechanics
Particle – Rest and Motion – Motion in one, two and three dimensions – Position, displacement and distance – Speed and Velocity – Acceleration – Momentum – Force – Equations of Motion –
Newton's Laws of motion – Applications of Newton's Laws of motion

UNIT II: Gravitation
Newton's law of gravitation – Universal Gravitation constant – Acceleration due to gravity- Variation of 'g' with altitude – Inertial mass – gravitational mass –Orbital velocity – Time period of a satellite – Uses of satellites

UNIT III: Properties of Matter
Elasticity – Stress – Strain – Elastic limit – Hooke's law – Experimental verification of Hooke's Law – Three moduli of elasticity – Pascal's law – Applications
Viscosity – Coefficient of Viscosity – Streamline flow and turbulent flow – Reynold's number – Stoke's law
Surface Tension – Forces of cohesion and adhesion – Experimental determination of surface tension of water by capillary rise method – Applications

UNIT IV: Sound
Transverse and Longitudinal waves – Relation between frequency, wavelength and velocity – Doppler effect (quantitative idea)- Applications – Laws of transverse vibration of stretched strings – Ultrasonics- Applications – Reverberation – Acoustics of buildings

UNIT V: Modern Physics
Nucleus – Nuclear Structure – Mass Number – Atomic Number – Nuclear Mass – Binding Energy - Nuclear Fission and Fusion – critical mass - Atom Bomb and Hydrogen Bomb.
Radioactivity – Properties of alpha, beta and gamma rays – Half –life period – Applications – X-rays – Properties of X-rays and its applications

ASSIGNMENTS:

1. Newton's laws of motion and its applications
2. Uses of Satellites
3. Applications of surface tension
4. Ultrasonics and its applications
5. Application of X-rays in day – to – day life

PEDAGOGY STRATEGIES

- Board and chalk lecture
- Powerpoint presentations
- Assignments

REFERENCES:

1. Narayanamoorthy, Textbook of Mechanics Part I and Part II, National Publishing Company, 2001.
2. Brijlal & N. Subramanyam, Properties of matter, Vikas Publishng. Pvt. Ltd, 2005.
3. Brijlal & N. Subramanyam, 'A Text Book of Sound', Vikas Publishing. Pvt. Ltd, 2008.
4. R. Murugeshan and Kiruthiga Sivaprasad, Modern Physics, S. Chand & Co., New Delhi, 2008.
5. R. Murugeshan, Properties of Matter, S. Chand & Co., New Delhi, 2001.

FURTHER READING:

1. P. Duraipandian, Laxmi Duraipandian, Muthamizh Jayapragasam, Mechanics, S. Chand & Co., New Delhi, 1988.
2. David Halliday and Robert Resnick, Fundamentals of Physics by Wiley Plus., 2013.
3. Arthur Beiser, Shobhit Mahajan, S. RaiChoudhury, Concepts of Modern Physics, Sixth edition, SIE, 2009.

WEB-RESOURCES:

1. http://zebu.uoregon.edu/1999/ph161/l4.html
2. https://ncert.nic.in/ncerts/l/keph108.pdf
3. https://www.youtube.com/watch?v=gAQ79rHFRfE
4. https://www.slideshare.net/PraveenVaidya1/fundamentals-of-modern-physics#:
5. https://www.tnpscshouters.com/2015/06/best-website-for-tamil-nadu-government.html

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES							
	Course Level Outcomes (CLO)						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
Communication Skills	✓		✓		✓		✓
Critical Thinking		✓	✓		✓	✓	
Research-related skills		✓			✓	✓	✓
Analytical reasoning			✓			✓	
Problem Solving	✓			✓			✓
Team work	✓				✓		

Year	Subject Title	Sem	Sub Code	Hours/ Week
2021-22 Onwards	**Non-Major Elective – II: Principles of Physics – II**	**VI**	**21BPH6EL**	**3**

COURSE LEVEL OUTCOMES:

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

CLO-1 Interpret the basic concepts of mechanics, gravitation, properties of matter and sound.
CLO-2 Analyze the different types units used in all these branches
CLO-3 Translate functioning of day-to-day devices into technical view
CLO-4 Prepare to face general paper of competitive examinations
CLO-5 Explain how physics applies to phenomena in the world around them
CLO-6 Develop the safety measures in using physics instruments
CLO-7 Adopt new technologies in their discipline

UNIT I: Electromagnetic Waves

Characteristics – Hertz experiment – Electro Magnetic Spectrum – uses – types of spectra –
Fluorescence – Phosphorescence – Raman Effect – Applications

UNIT II: Heat

Heat energy – Units – Specific heat capacity – Newton's law of cooling – Boyle's law – Charle's law – Gas equation – Kinetic theory of gases – Postulates – Degree of freedom – Isothermal and Adiabatic processes

UNIT III: Optics

Lens – Types – Defects of eye – Laws of reflection and refraction – Conditions for total internal reflection – Dispersion – Scattering – Rayleigh scattering – Colour of the sky – Raman Effect

UNIT IV: Electricity and Magnetism

Electric current – Current density – Ohm's law – Electrical resistivity and conductivity – Resistance– Resistors in series – Resistors in parallel – Kirchoff's law – Faraday's laws – Basic properties of magnets – Magnetic moment –Magnetic field – Magnetic induction – Properties of Dia, Para and Ferromagnetism – comparison – Magnetic lines of force

UNIT V: Communication Systems

Modes of propagation, ground wave – Sky wave propagation Radio transmission and reception – TV transmission and reception Radar – Principle – Applications

ASSIGNMENTS:

1. Electromagnetic spectrum
2. Isothermal and Adiabatic processes
3. Scattering and colour of the sky
4. Properties of magnetic materials
5. Radio and TV transmission

PEDAGOGY STRATEGIES

- Board and chalk lecture
- Powerpoint presentations
- Assignments

REFERENCES:

1. Brijlal & N. Subramanyam, Heat & Thermodynamics, S. Chand & Co, New Delhi, 2000.
2. N. Subrahmanyam, Brij Lal and M.N. Avadhanulu, A Text Book of Optics, S. Chand & Co., New Delhi, 2006.
3. Brijlal Subrahmanyam, Electricity and Magnetism, S.Chand & Co., New Delhi, 2000.
4. R.C. Ramanujam, Television and Radio Broadcasting, Aph Publishing Corporation, 2011.

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1. Narayanamoorthy and Krishna Rao, Heat, Triveni Publishers, Madras, 1969.
2. R. Murugeshan and Kiruthiga Sivaprasath, Optics and Spectroscopy, S. Chand & Co., New Delhi 2006.
3. R. Murugeshan, Electricity and Magnetism, S.Chand & Co., New Delhi, 2008.

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1. https://www.britannica.com/science/thermodynamics
2. https://www.slideshare.net/KoppSolutions/light-diffraction-and-optics
3. https://www.slideshare.net/makadelhi/electricity-and-magnetism-basic-concepts
4. https://byjus.com/jee/communication-systems/
5. https://www.tnpscshouters.com/2015/06/best-website-for-tamil-nadu-government.html

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES							
	Course Level Outcomes (CLO)						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
Communication Skills	✓		✓		✓		✓
Critical Thinking		✓	✓		✓	✓	
Research-related skills		✓			✓	✓	✓
Analytical reasoning			✓			✓	
Problem Solving	✓			✓			✓

7. Teaching Learning Methodologies

The learning outcomes-based course curriculum framework of Chemistry is designed to persuade the subject specific knowledge as well as relevant understanding of the course. The academic and professional skills required for Physics-based professions and jobs are also offered by same course in an extraordinary way. In addition, the learning experiences gained from this course should be designed and implemented for cognitive development in every student. The practical associated with this course helps to develop an important aspect of the teaching-learning process. Various types of teaching and learning processes will need to be adopted to achieve the same. The important relevant teaching and learning processes involved in this course are;

Class lectures
a. Seminars
b. Tutorials
c. Group discussions and Workshops
d. Peer teaching and learning
e. Question preparation
f. Subjective type
g. Long answer
h. Short answer
i. Objective type
• Multiple choice questions
• One answer/two answer type questions
• Assertion and reasoning
j. Practicum, and project-based learning
k. Field-based learning
l. Substantial laboratory-based practical component and experiments
m. Open-ended project work,
n. Games
o. Technology-enabled learning
p. Internship in industry, and research establishments.

The effective teaching strategies will also need to be adopted to develop problem-solving skills, higher-order skills of reasoning and analysis. The designed course also encourages fostering the social values/responsibility for maintaining and protecting the surrounding nvironment for improved living conditions. A learner centric and active participatory pedagogy shall be introduced in this framework.

8. Assessment Methods

Academic performance in various courses i.e. core, discipline electives, generic electives and skill enhancement courses are to be considered as parameters for assessing the achievement of students in Chemistry. A number of appropriate assessment methods of Chemistry will be used to determine the extent to which students demonstrate desired learning outcomes. Following assessment methodology should be adopted;

• The oral and written examinations (Scheduled and surprise tests),
• Closed-book and open-book tests,
• Problem-solving exercises,

• Practical assignments and laboratory reports,
• Observation of practical skills,
• Individual and group project reports,
• Efficient delivery using seminar presentations,
• Viva voce interviews are majorly adopted assessment methods for this curriculum.
• The computerized adaptive testing, literature surveys and evaluations, peers and self-assessment, outputs form individual and collaborators.