Janardan Bhagat Shikshan Prasarak Sanstha's

CHANGU KANA THAKUR ARTS, COMMERCE & SCIENCE COLLEGE, NEW PANVEL (AUTONOMOUS)

Re-accredited 'A+' Grade by NAAC
'College with Potential for Excellence' Status Awarded by UGC
'Best College Award' by University of Mumbai

Program: Bachelor's in Science (B. Sc.)
Physics

SYLLABUS

(Approved in the Academic council meeting dated 27th July, 2023)

F. Y. B. Sc. Physics
Undergraduate Certificate in the field of Physics

Revised as per
NEP 2020
Choice Based Credit System (60:40)
w.e.f. Academic Year 2023-2024

BACHELOR'S IN SCIENCE (B. Sc.)

Programme Outcomes

Sr. No.	After completion of B.Sc. program students will acquire	Graduate Attribute
PO1	The knowledge of the disciplines and in-depth and extensive knowledge, understanding and skills in a specific field of interest.	Disciplinary knowledge
PO2	An ability to develop and conduct experiments, analyse, and interpret data and use scientific judgment to draw conclusions.	Scientific reasoning
PO3	An ability to use current technology, and modern tools necessary for creation, analysis, dissemination of information.	Digital literacy
PO4	Innovative, professional, and entrepreneurial skills needed in various disciplines of science.	Life-long learning
PO5	An ability to achieve high order communication skills.	Communication skills
PO6	An ability to collect, analyse and evaluate information and ideas and apply them in problem solving using conventional as well as modern approaches	Problem solving
PO7	A sense of social responsibility; intellectual and practical skills and demonstration of ability to apply it in real-world settings.	Reflective thinking
PO8	An ability to engage in independent and life-long learning through openness, curiosity, and a desire to meet new challenges.	Life-long learning
PO9	A capacity to relate, collaborate, and lead others, and to exchange views and ideas to work in a team to achieve desired outcomes	Teamwork
PO10	An ability to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	Leadership
PO11	An ability to understanding values, ethics, and morality in a multidisciplinary context.	Moral and ethical awareness

Preamble :

The curriculum is framed to equip students to grasp the basic concepts of physics and in addition have a broader vision. A dynamic curriculum accommodates fast faced developments in the knowledge of the subject concerned by introducing innovative concepts, multidisciplinary profile and standard education.

The programme also aims to provide an intellectually stimulating environment to develop skills and enthusiasm of students to the best of their potential. It also helps in giving need based education in physics of the highest quality at the undergraduate level.

In this programme, we aim to provide a solid foundation in all aspects of physics and to show a broad spectrum of modern trends in physics and to develop experimental, computational and mathematical skills of students. The syllabus is framed in such a way that it bridges the gap between the plus two and the postgraduate level of physics by providing a more complete and logical framework in almost all areas of basic physics.

Examination Scheme

Choice Based Credit System (CBCS)

Revised Scheme of Examination

1. For Major Courses (100 Marks)

The performance of the learners shall be evaluated into two components. The learner's Performance shall be assessed by Internal Assessment with 40% marks in the first component by conducting the Semester End Examinations with 60% marks in the second component.
The allocation of marks for the Internal Assessment and Semester End Examinations are as shown below:-

A) Internal Assessment: 40 **%**

Sr. No.	Particular	Marks
01	One periodical class test / online examination to be conducted in the given semester	20 Marks
02	Group/ Individual Survey Project/Presentation and write up on the selected units of the courses /Case studies / Test based on tutorials /Book Review /Poetry Appreciation/ Open Book Test	15 Marks
03	Active participation in routine class instructional deliveries and overall conduct as a responsible learner, mannerism and articulation and exhibition of leadership qualities in organizing related academic activities	05 Marks

B) Semester End Examination: 60 %

● Duration: The examination shall be of 2 hours duration

.

Theory question paper pattern
1. There shall be three/four questions each of 20/15 marks. 2. All questions shall be compulsory with internal options. 3. Question may be subdivided into sub-questions a, b, c… and the allocation of marks depends on the weightage of the unit.

Question Paper Pattern for Continuous Internal Assessment

Sr. No.	Particular	Marks
1	Match the Column / Fill in the Blanks / Multiple Choice Questions/ True/False/Answer in One or Two Lines (Concept based Questions) (1 Marks each)	20
2	Open Book Test - High order thinking questions (HOTS)	15

Question Paper Pattern for Practical Examination

Sr. No.	Particular for practical examination	Marks
1	Laboratory Work	40
2	Journal	05
3	Viva	05
TOTAL		50 Marks

2. For Value Education Courses (VEC)/ Ability Enhancement Courses (AEC) /Indian Knowledge System (IKS) (50 Marks)

The performance of the learners shall be evaluated into two components, as the first component by 'Continuous Internal Assessment (CIA)' with 40% marks and as the second component by conducting the 'Semester End Examinations (SEE)' with 60% marks. The allocation of marks for the Continuous Internal Assessment (CIA) and Semester End Examinations (SEE) are as shown below:

A) Continuous Internal Assessment (CIA): 40 % 20 Marks

Sr. No.	Particular	Marks
01	One periodical class test / online examination to be conducted in the given semester	20 Marks

Question Paper Pattern

(Periodical Class Test)

Maximum Marks: 20 Duration: 40 Minutes
Questions to be set: 02
All Questions are Compulsory

Question No.	Particular	Marks
Q-1	Match the Column / Fill in the Blanks / Multiple Choice Questions/ Answer in One or Two Lines (Concept based Questions) (1 Marks / 2 Marks each)	10 Marks
Q-2	Answer in Brief (Attempt any Two of the Three) (5 Marks each)	10 Marks

B) Semester End Examination (SEE): 60 % 30 Marks

- Duration: The examination shall be of 1 hour's duration.

Question Paper Pattern

Theory question paper pattern
1. There shall be two/three questions each of 15/10 marks. 2. All questions shall be compulsory with internal options. 3. Question may be subdivided into sub-questions a, b, c… and the allocation of marks depends on the weightage of the unit.

3. Co-Curricular Courses (CC) (50 Marks)

The performance of the learners shall be evaluated into two components. The allocation of marks are as shown below:

A) Continuous Internal Assessment (CIA): 40 % 20 Marks

Sr. No.	Particular		Marks
01	One project / case study based on curriculum to be assessed by the teacher concerned		20 Marks
	Written Document	15 Marks	
	Viva/presentation	05 Marks	

B) Semester End Examination (SEE): 60 % 30 Marks

- Duration: The examination shall be of 1 hour's duration.

Question Paper Pattern

Theory question paper pattern
1. There shall be two/three questions each of 15/10 marks. 2. All questions shall be compulsory with internal options. 3. Question may be subdivided into sub-questions a, b, c… and the allocation of marks depends on the weightage of the unit.

4. For Vocational Skill Courses (VSC), Skill Enhancement Courses (SEC) and Minor Courses (50 Marks)

The performance of the learners shall be evaluated into two components. The allocation of marks are as shown below:

A) Practical Examinations (PE)/Field Work (FW)/Test Based on Tutorials: 40 % 20 Marks

Journal/Lab book/workbook, Viva Voce	05 Marks
Practical/Laboratory Work/field work/Test based on tutorials	15 Marks

B) Semester End Examination (SEE): 60 % 30 Marks

- Duration: The examination shall be of 1.30 hour's duration.

Question Paper Pattern

Theory question paper pattern
1. There shall be two/three questions each of 15/10 marks. 2. All questions shall be compulsory with internal options. 3. Question may be subdivided into sub-questions a, b, c… and the allocation of marks depends on the weightage of the unit.

5. For Open Elective Courses (OE) (50 Marks)

The performance of the learners shall be evaluated into two components. The allocation of marks are as shown below:

A) Continuous Internal Assessment (CIA): 40 % **20 Marks**

Sr. No.	Particular	Marks
01	One project / case study / Test based on Practical skills/test based on tutorials (Workbook)/ Open book test/ Field work based on curriculum to be assessed by the teacher concerned	20 Marks

B) Semester End Examination (SEE): 60 %

30 Marks

- Duration: The examination shall be of 1 hour's duration.

Question Paper Pattern

Theory question paper pattern
1. There shall be two/three questions each of 15/10 marks. 2. All questions shall be compulsory with internal options. 3. Question may be subdivided into sub-questions a, b, c… and the allocation of marks depends on the weightage of the unit.

Passing Standard

- For Major courses: The learners shall obtain minimum of 40% marks (i.e. 16 out of 40) in the Continuous Internal Assessment (CIA) and 40% marks in Semester End Examination (SEE) (i.e. 24 out of 60) separately, to pass the course and minimum of Grade D, wherever applicable, to pass a particular semester. A learner will be said to have passed the course if the learner passes the Continuous Internal Assessment (CIA) and Semester End Examination (SEE).
- For AEC, VEC, VSC, SEC, IKS, Minor, OE and CC courses: Learners should remain present for Continuous Internal Assessment (CIA) and Semester End Examination (SEE)/ Practical Examination (PE). A learner will be said to have passed the course if the learner obtains minimum of 40% marks in the Continuous Internal Assessment (CIA) and Semester End Examination (SEE)/ Practical Examination together and obtain minimum 10 marks out of 30 marks in Semester End Examination (SEE)/ Practical Examination (PE).

Rules of A.T.K.T.

I. A learner shall be allowed to keep term for Semester II irrespective of the number of courses of failure in the Semester I.

II. A learner shall be allowed to take Admission to Semester III if he/she passes both Semester I and Semester II

OR

A learner shall be allowed to keep term for Semester III, if he/she fails in not more than two Major courses and not more than eight other courses of Semester I and Semester II taken together with not more than four other courses each in Semester I and Semester II.

III. A learner shall be allowed to keep term for Semester IV irrespective of the number of courses of failure in the Semester III.

IV. A learner shall be allowed to take Admission to Semester V and Keep Terms if he/she Passes in all Semester I and Semester II and failed in not more than two Major courses and not more than eight other courses of Semester III and Semester IV taken together with not more than four other courses each in Semester III and Semester IV

OR

Passes in all Semester III and Semester IV and failed in not more than two Major courses and not more than eight other courses of Semester I and Semester II taken together with not more than four other courses each in Semester I and Semester II.

V. A learner shall be allowed to keep term for Semester VI irrespective of the number of courses of failure in the Semester V.

VI. The result of Semester VI shall be withheld by the College till the learner passes all the Semesters from I – V.

VII. A Learner is allowed to take admission in semester VII (UG Hon. /PG Part I) only if he passed all courses of semesters I to VI (132 Credits).

- **Eligibility Condition to appear for Additional Examination of any Semester**

(Applicable only for Regular Semester End Examinations)

A learner who remains absent in some or all the subjects on medical grounds or for representing the College or University in NSS, NCC, Sports, Cultural Activities or co-curricular/extracurricular/extension activities with prior permission of the Principal or Head of the institute reported to the examination section, by producing necessary documents and testimonials, will be allowed to appear for the Additional Semester End Examination (ASEE). This is not applicable for any A.T.K.T. / Supplementary Examinations.

- **Supplementary Examination (SE)**

The college will conduct supplementary examinations for semester II, IV, and VI after the declaration of their respective results.

Note:

1) It is noted that the concerned regulation of the College is amended and implemented to Semester I to Semester II of undergraduate programmes, under faculty of Arts, Commerce and Science with effect from the academic year 2023 - 2024.
2) All these rules maybe amended as and when required with authorisation of Academic bodies.

Choice Based Credit System (CBCS)
F.Y.B. Sc. Physics Syllabus
To be implemented from the Academic year 2023-2024
Course Structure

No. of Courses	Semester I	Credits	No. of Courses	Semester II	Credits
A	***Discipline Specific Course (Major)***		**A**	***Discipline Specific Course (Major)***	
1	Classical Physics, Mathematical Physics	02+01	1	Optics, Applied Mathematics	02+01
2	D. C. Circuits and Digital Electronics	02+01	2	A.C.Circuits and Modern Physics	02+01
B	***Indian Knowledge System (IKS)***		***B***	***Minor***	
4	Ancient Indian Astronomy	02	3	Digital Electronics	01+01
C	***Vocational Skill Course (VSC)***		***C***	***Vocational Skill Course (VSC)***	
5	Fundamentals of Arduino using simulations	01+01	4	Practical Applications Of Arduino based device -I	01+01
D	***Skill Enhancement Course (SEC)***		***D***	***Skill Enhancement Course (SEC)***	
6	Instrumentation Techniques in Physics	01+01	5	Basic of Electronics	01+01
E	***Open Elective (OE)***		***E***	***Open Elective (OE)***	
7	Computer Hardware-1	02	6	Computer Hardware- 2	02
8	Basics of Electricity for wiring	02	7	Solar Energy- Fundamentals & Its Applications-I	02
F	***Value Education Course (Any One)***		***F***	***Value Education Course (Any One)***	
9	Digital Technology and Solutions	02	8	Digital Technology and Solutions	02
10	Understanding India	02	9	Understanding India	02
11	Environmental Studies	02	10	Environmental Studies	02

E	***Ability Enhancement Course (AEC) (Any One)***		***E***	***Ability Enhancement Course (AEC) (Any One)***	
12	Marathi	02	12	Marathi	02
13	Hindi	02	13	Hindi	02
G	***Co-curricular Courses (Any One)***		***G***	***Co-curricular Course (Any One)***	
14	Foundation Course in NSS-I	02	14	Foundation Course in NSS-II	02
15	Foundation Course in NCC-I	02	15	Foundation Course in NCC-II	02
16	Foundation Course in PE-I	02	16	Foundation Course in PE-II	02
17	Foundation Course in PA-I	02	17	Foundation Course in PA-II	02
	Total Credits	22		Total Credits	22

Choice Based Credit System (CBCS)
F.Y.B. Sc. Physics Syllabus
To be implemented from the Academic year 2023-2024

SEMESTER I

Course Code	Course Type	Course Title	Credit
USC1PH1	Major Subject I	Classical Physics, Mathematical Physics	02
USC1PHP1	Major Subject I Practical	Physics Practical I	01
USC1PH2	Major Subject II	D. C. Circuits and Digital Electronics	02
USC1PHP2	Major Subject II Practical	Physics Practical II	01
UIKS1AIA	IKS	Ancient Indian Astronomy	02
UVSC1FAS	VSC1	Fundamentals of Arduino using simulations	01
UVSC1FAS	VSC I Practical	Practical- Fundamentals of Arduino using simulations	01
USEC1ITP	SEC1	Instrumentation Techniques in Physics	01
USEC1ITP	SEC1 Practical	Practical -Instrumentation Techniques in Physics	01
Total Credits			**12**

Open Elective Courses

Course Code	Course Type	Course Title	Credit
UOE1CH	Open Elective 1	Computer Hardware-1	02
UOE1BEW	Open Elective 2	Basics of Electricity for wiring	02
		Total Credits	**04**

Semester I

Course Description: B.Sc. (Physics)	
Semester	I
Course Name	Physics-1 (Classical Physics, Mathematical Physics)
Course Code	USC1PH1
Eligibility for the Course	12^{th} Science of all recognised Board
Credit	2
Hours	2 Hrs. per week (30 Hours)

Course Objectives	1) To define Elasticity, Fluid Dynamics, Vector algebra, crystal structure.
	2) To describe the different types of coordinate systems.
	3) To explain the physical properties of a fluid and the consequence of such properties on fluid flow & Basics of Solid State Physics

Course Outcomes	**After completing the course, Student will be able to:**
	1) Summarise properties of matter, vectors algebra..
	2) Apply laws of vector algebra, elasticity, fluid dynamics concepts in various physical situations.
	3) Explain crystal system, crystal planes and its direction, different coordinate system and interconversion between them, mechanical properties of matter and fluid with its .
	4) Solve sums based on miller indices, Bravais lattices, vector algebra, elasticity, fluid dynamics.

Classical Physics, Mathematical Physics		
Unit	**Course Description**	Hrs
1.1	**Elasticity:** Review of Elastic constants Y, K, η and σ; Equivalence of shear strain to compression and extension strains. Relations between elastic constants, Couple for twist in cylinder. **[DSM] :** : 8.1,8.2,8.3,8.8,8.0,8.12,8.13,8.14,8.15,8.17	15

1.2	**Fluid Dynamics**: Equation of continuity, Bernoulli's equation, applications of Bernoulli's equation, streamline and turbulent flow, Poiseuille's equation. **[DSM] :** : 12.1,12.3,12.5, 12.6(2),12.7,12.11	
1.3	**Crystalline Structure:** Introduction, Lattice points and space lattice, The basis and crystal structure, Unit Cells and lattice parameters, Primitive Cells, Crystal Systems, Crystal Symmetry, Bravais space lattices, Metallic crystal structure, directions, planes, miller indices **[SOP]** : 4.1,4.2,4.3,4.4,4.5,4.6,4.14,4.15,4.18	
2.1	**Vector Algebra**: Vectors, Scalars, Vector algebra, Laws of Vector algebra, Unit vector, rectangular unit vectors, Components of a vector, Scalar fields, Vector fields, Problems based on Vector algebra. Dot or Scalar product, Cross or Vector product, Commutative and Distributive Laws, Scalar Triple product, Vector Triple product (Omit proofs). Problems and applications based on Dot, Cross and Triple products. **[SLS]** : 1.1,1.2,1.3,1.4,1.6,1.7,2.1,2.2,2.3,2.4	15
2.2	**Coordinate System:** Introduction of coordinate system, types of coordinate system, Curvilinear Coordinates: Cylindrical Coordinates, Spherical Coordinates, Transformation of Cartesian coordinates to curvilinear coordinates and vice versa and Problems **[SLS]** : 7.1,7.2,7.3,7.4 **[CH]** :1.6.1,1.6.2,1.6.8	

References:

1. [DSM] : D S Mathur, Element of Properties of Matter, S Chand & Co

2. [HCV] : H. C. Verma, Concepts of Physics – (Part–I), 2002 Ed. Bharati Bhavan Publishers.

3. [SOP] : S.O.Pillai, Solid state Physics, New Age International Publishers

4. [SLS] :Vector Analysis , Murray Spiegel, Seymour Lipschutz, Deniis Spellman, 2nd Ed.

5. [CH] : Introduction to Mathematical Physics,Charlie Harper, PH publishers

Additional Reference:

1. Thornton and Marion, Classical Dynamics ,(5th Ed)

2. Halliday, Resnick and Walker, Fundamental of Physics (extended) , (6th Ed.), John Wiley and Sons

3.. Hans and Puri, Mechanics –, 2nd Ed. Tata McGraw Hill

4. Charlie Harper, Introduction to Mathematical Physics , 2009 (EEE) PHI Learning Pvt. Ltd

5. B.S.Rajput - Mathematical Physics

Course Description: B.Sc.(Physics)	
Semester	I
Course Name	Physics Practical I
Course Code	USC1PHP1
Eligibility for the Course	12th Science of all recognised Board
Credit	1
Hours	2 Hrs. per week (45 Hours)

Course Objectives	
	1) To determine mechanical properties of solids like the Moment of Inertia, Modulus of Elasticity, Coefficient of Viscosity, temperature coefficient of resistance of Thermistor and Joule's Constant.
	2) To measure the frequency of Alternating Current (AC) & study its response to electrical components like resistor, capacitor & Inductor.
	3) To obtain the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
	4) To explore the concepts of Boolean algebra and logic gate truth tables for circuit analysis.
	5) To understand the advantages and limitations of rectifiers for rectification purposes.
	6) To gain proficiency in finding Thevenin equivalent circuits and calculating equivalent resistances and voltage sources
	7) To learn how to analyze and design zener diode voltage regulation circuits.

Course Outcomes	**After completing the course, Student will be able to:**
	1) Make use of Scientific calculator, graph plotting.
	2) Measure different mechanical properties of Solids like the Moment of Inertia, Modulus of Elasticity, Coefficient of Viscosity, temperature coefficient of resistance of Thermistor and Joule's Constant
	3) Demonstrate experiments related to mechanics & crystal.

Unit	Course Description (Paper I)	Hrs
A	**Regular experiments (any 6)** 1. To study Thermistor characteristic 2. Y by vibrations: Flat spiral Spring **3.** Coordinate system 4. Torsional Oscillation 5. Bifilar Pendulum 6. To determine Coefficient of Viscosity (η) of a given liquid by Poisseuli's Method 7. Study of crystal structures	20
B	**Skill Experiments**: 1. Use of Scientific Calculator: mathematical function, shift keys 2. Graph plotting: range selection, slope of straight line 3. Use of Traveling Microscope 4.Use of measuring instruments	10
C	**Any one out of the following is equivalent to two experiments from section A and/ or B** 1. Students should collect the information of at least five Physicists with their work. Report that in a journal. 2. Students should carry out mini-project upto the satisfaction of professor In-charge of practical. 3. Study tour. Students participating in the study tour must submit a study tour report.	15

Course Description: B.Sc.(Physics)	
Semester	I
Course Name	Physics-II (Analog Electronics)
Course Code	USC1PH2
Eligibility for the Course	12^{th} Science of all recognised Board
Credit	2
Hours	2 Hrs per week (30 Hours)

Course Objectives	
	1) To introduce various network theorems, such as thevenin's theorem, Norton's theorem, superposition theorem, maximum power transfer theorem, and other relevant theorems.
	2) To design and construct combinational logic circuits using logic gates to perform specific functions.
	3) To understand different number systems, including decimal, binary, octal, and hexadecimal, and be proficient in converting numbers between these systems.
	4) To recognize the practical applications of D.C. circuits in various electronic devices and systems, such as power supplies and electronic controls.

Course Outcomes	**After completing the course, Student will be able to:**
	1) Apply Thevenin's Theorem and Norton's Theorem to simplify complex circuits and calculate equivalent circuits with respect to a specific load.
	2) Develop critical thinking skills by analyzing various circuit configurations and choosing appropriate methods to solve complex circuit problems.
	3) Differentiate between series and parallel D.C. circuits, calculating equivalent resistances and current/voltage distribution.
	4) Develop strong problem-solving skills in circuit analysis, enabling them to approach complex D.C. circuit problems methodically and confidently.
	5) Analyze logic gates (AND, OR, NOT, XOR, etc.).
	6) Design combinational logic circuits using logic gates

Analog Electronics		
Unit	**Course Description**	Hrs
1.1	**Circuit theorems**: (Review: ohm's law, Kirchhoff's laws) Superposition Theorem, Thevenin's Theorem, Ideal Current Sources, Norton's Theorem, Reciprocity Theorem, Maximum Power Transfer Theorem. Numericals related to circuit analysis using the above theorems. **[CR]**: Circuit Theorems: 7.7 to 7.11	15
1.2	**DC power supply**: Bridge rectifier, its PIV and its Ripple factor, Capacitor Filter, Inductor filter, CLC or Pi Filter. Zener diode as voltage stabiliser **[VKM]**: DC: 6.8 to 6.15, 6.17 to 6.20, 6.21, 6.27	
2.1	**Number System:** Binary number system , Arithmetic building blocks , Types of registers, Digital IC, signal levels, Binary to Decimal ,Decimal to binary , Hexadecimal number, Hexadecimal to decimal Conversion, Decimal to hexadecimal conversion, Hexadecimal to binary conversion, Binary to hexadecimal conversion, Binary addition, Unsigned binary numbers, Sign magnitude numbers , 1's complement , 2's complement , Converting to and from 2's complement representation , 2's complement arithmetic, The adder- subtractor (ignore IC specific diagrams) **[LMS]** : Number System : 5.1, 5.2, 5.3, 5.5, 6.1, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8 **[VKM]**: 26.1 to 26.9	15
2.2	**Digital Electronics**: Logic gates (Review), NAND and NOR as universal building blocks. EX-OR gate: logic expression, logic symbol, truth table, Implementation using basic gates and its applications, Boolean algebra, Boolean theorems. De Morgan theorems, Half adder and Full adder **[VKM]**: Digital electronics: 26.15 to 26.17, 26.20, 26.21, 26.22, 26.32	

References:

1. [CR]: D. Chattopadhyay, P C Rakshit , Electricity and Magnetism 7th Ed. New Central Book agency.
2. [VKM]: V K Mehta and R Mehta Electronics Principals, Multi coloured Revised 11th Ed. reprint in 2012, S Chand.
3. [LMS] : Digital Principles and Applications By Leach, Malvino, Saha Seventh edition

Additional References :

1. A B Bhattacharya, Electronics Principles And Applications, Central publisher.
2. A P Malvino, Digital Principles and Applications: Tata McGraw Hill
3. Tokheim, Digital electronics, 4thed, McGraw Hill International Edition.

Course Description: B.Sc.(Physics)	
Semester	I
Course Name	Physics Practical II
Course Code	USC1PHP2
Eligibility for the Course	12th Science of all recognised Board
Credit	2
Hours	2 Hrs per week (45 Hours)

Course Objectives	1) To measure the frequency of Alternating Current (AC) & study its response to electrical components like resistor, capacitor & Inductor.
	2) To obtain the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits. 3) To explore the concepts of Boolean algebra and logic gate truth tables for circuit analysis.
	5) To understand the advantages and limitations of bridge rectifiers for rectification purposes.
	6) To gain proficiency in finding Thevenin equivalent circuits and calculating equivalent resistances and voltage sources.
	7) To learn how to analyze and design zener diode voltage regulation circuits.

Course Outcomes	**After completing the course, Student will be able to:**
	1) Design voltage regulation circuits using Zener diodes
	2) Analyze complex circuits and simplify them using Thevenin equivalents.
	3) Analyze the rectification process in AC to DC conversion.
	4) Understand the basic concepts of logic gates, including their types (AND, OR, NOT, NAND, NOR, XOR, etc.) and how they function.

Unit	Course Description (Paper II)	Hrs
A	**Regular Experiment (any 6)** 1. De Morgan's theorem 2. NAND and NOR gate as a Universal building block 3. Logic Gate 4. Zener Diode as a Voltage regulator 5. Bridge Rectifier 6. Norton's Theorem 7. Thevenin's Theorem	20
B	**Skill Experiments**: 1. Use of DMM 2. Testing of Components 3.Absolute and relative errors calculation. 4.measurements of Resistors, capacitor	10
C	**Any one out of following is equivalent to two experiments from section A and/ or B** 1. Students should collect the information of at least five Physicists with their work. Report that in a journal. 2. Students should carry out mini-project upto the satisfaction of professor In-charge of practical. 3. Study tour. Students participating in the study tour must submit a study tour report.	15

References

1. D. C. Tayal, edited by Ila Agarwal, University Practical Physics, 1st edition, Himalaya Publishing House
2. Harman Singh, B.Sc. Practical Physics, 7th edition, S. Chand Publication.
3. C. L. Arora, B.Sc. Practical Physics, 21st edition, S. Chand Publication.

Indian Knowledge System (Credit 2)

Course Description: B.Sc. (Physics)	
Semester	I
Course Name	Ancient Indian Astronomy(IKS)
Course Code	UIKS1AIA
Credit	2
Hours	2 Hrs per week (30 Hours)

Course Objectives	
	1) To introduce students to the fundamental concepts and principles of Ancient Indian Astronomy.
	2) To provide an overview of the historical development and evolution of Indian astronomical knowledge
	3) To explore the contributions of ancient Indian astronomers and their significant discoveries.
	4) To understand the philosophical and spiritual underpinnings of Indian astronomy.

Course Outcomes	**After completing the course, Student will be able to:**
	1) analyze ancient Indian astronomical sources, evaluating the accuracy of observations, theories, and calculations based on the available historical records.
	2) compare ancient Indian astronomical theories with those from other civilizations, understanding the cultural and scientific contexts.
	3) Develop skills in analyzing ancient Indian astronomical observations, including star positions, planetary motions, eclipses, and celestial events.

Module/ Unit	**Course Description**	Hrs
1.1	Parahita system of astronomy and dark system of astronomy, Manda samskara, sighra samskara. Vedanga Jyotisha (astronomical calculations, calendrical studies, and establishes rules for empirical observation), Aryabhata (earth rotation, shining of moon), Brahmasphutasiddhanta (motion of planets),	15 hrs.

1.2	varahmihira (pancasiddhantika), Mahabhaskariya, lahubhaskariya & arybhatiya bhashya (Planetary longitudes, heliacal rising and setting of the planets, conjunctions among the planets and stars, solar and lunar eclipses, and the phases of the Moon), Sisyadhiveddhida (grahadhyaya, goladhyaya), siddhantasiromani, karanakutuhala (planetary positions, conjunctions, eclipses, cosmography), siddhantasekhara, yantra-kiranavali, Sphuṭanirṇaya, Uparagakriyakrama.	
2.1	Positional astronomy (sun, planets, moon, coordinate systems, precision of the equinox and its effects, eclipses, comets and meteors), Mahayuga & Kalpa system Yuga system, ayanas, months, tithis and seasons, time units, sun and moon's motion, planet position, ayanachalana, zero-precision year, katapayaadi system, Indian nakshatra system, astronomy	15 hrs
2.2	Instruments for naked eye astronomy (vedic observatories). The principal and application of Samrat Yantra, Jai Prakash Yantra, Disha Yantra, Rama Yantra, Chakra Yantra, Rashiwalya Yantra, Dingash Yantra, Utaansh Yantra	

Reference books:

- Textbook on IKS by Prof. B Mahadevan, IIM Bengaluru.
- BV subbarayappa, The Tradition of Astronomy in India: History of Science, Philosophy and Culture in Indian Civilization Vol. IV, Part 4: Jyotihsastra (History of Science, Philosophy & Culture in Indian Civilization), centre for studies in civilization, 2008

Vocational Skill Course (Credit 1+1)

Course Description: B.Sc. (Physics)	
Semester	I
Course Name	Fundamentals of Arduino using simulations
Course Code	UVSC1FAS
Eligibility for the Course	12th Science of all recognized Board
Credit	1
Hours	1 Hr per week (15 Hours)

Course Objectives	
	1) Learners get familiarized with basic of electrical components
	2) Enable the Learners to experience various circuit designing using breadboard using simulations
	3) Empower learners to learn the basic programming of Arduino
	4) Enable learners to apply basic Arduino based programs in practical daily life

Course Outcomes	**After completing the course, Student will be able to:**
	1) Explain basic components used with Arduino kit like breadboard, various basic electrical Components & Ardui. no
	2) Acquire basic of basic electrical circuits, basic Arduino programs using simulations.
	3) Design the basic Arduino programs for practical applications

Unit	**Course Description**	Hrs
1.1	**Basics of Electronics:** What is Electricity, current, Voltage, Power, Circuit, Analog Vs Digital, LED, Resistors, Capacitors, Transistor, Diode, Variable Resistor, LDR, DC Motor, Push button, Temperature Sensor, Piezo buzzer, Servo motor, LCD Display, Connecting wires, Breadboard, Microcontroller.	4
1.2	**Arduino :** Pinout of Arduino UNO, ATmega328p microcontroller.	4
1.3	**Arduino Coding Basics** Brackets, Line comments, Coding Screen, Setup, Loop, Pinmode(), digitalread ( ), **,**digitalWrite ( ), **delay,** Arduino Syntax , Function, Tools Tab, Semicolon, Program Flow, Flow chart,	3

1.4	**Use of Simulator** Arduino IDE, How to access simulator?, Tinkercad, Features of Tinkercad, Code example to blink an LED	4

Reference books:

1. Hans-Petter Halvorsen : Introduction to Arduino
2. Brian w. Evans :arduino programming notebook
3. Alan G. Smith : Introduction to Arduino A piece of cake!
4. Simon Monk, Programming Arduino: Getting Started with Sketches, Second Edition (Tab) 2nd Ed
5. Damon Parke : Arduino Programming: The Ultimate Guide For Making The Best Of Your Arduino Programming Projects Kindle Edition
6. https://www.tinkercad.com/blog/official-guide-to-tinkercad-circuits

Course Description: B.Sc.(Physics)	
Semester	I
Course Name	Practicals - Fundamentals of Arduino using simulations
Course Code	UVSC1FAS
Eligibility for the Course	12^{th} Science of all recognized Board
Credit	1
Hours	2 Hrs per week

Course Objectives	1) Learners get exposure with various electronic components like temperature sensor, Ultrasonic range finder, microcontroller used in Arduino UNO.
	2) Learners gets skill develop in designing circuits to be connected to Arduino UNO.
	3) Learners enable design programs code for Arduino UNO

Course Outcomes	**After completing the course, Student will be able to:**
	1) To get hands-on experience in usage of various Sensors..
	2) To acquire basic working knowledge of program code of Arduino UNO.
	3) Learn and acquire skill to apply program code in practical life using various basic sensors.

Course Description
Regular experiments (any 8) 1. Capacitance measurement 2. Resistance measurement 3. Temperature using Thermistor 4. Ultrasonic ranger 5. Pulse rate sensor 6. IR sensor 7. Touch Capacitive sensor 8. Touch Capacitive sensor with buzzer 9. Students should collect the information of at least five sensor with their principle. Report that in a journal **(Equivalent to two experiments.)** 10. Students should carry out mini-project upto the satisfaction of professor In-charge of practical. (**Equivalent to two experiments**) 11. Study tour. Students participating in the study tour must submit a study tour report (**Equivalent to two experiments**)

References

1. Hans-Petter Halvorsen : Introduction to Arduino
2. Brian w. Evans :arduino programming notebook
3. Alan G. Smith : Introduction to Arduino A piece of cake!
4. Simon Monk, Programming Arduino: Getting Started with Sketches, Second Edition (Tab) 2nd Ed
5. Damon Parke : Arduino Programming: The Ultimate Guide For Making The Best Of Your Arduino Programming Projects Kindle Edition
6. https://www.tinkercad.com/blog/official-guide-to-tinkercad-circuits

Skill Enhancement Course (Credit 1+1)

Course Description: B.Sc. (Physics)	
Semester	I
Course Name	Instrumentation Techniques in Physics
Course Code	**USEC1ITP**
Eligibility for the Course	12th Science of all recognized Board
Credit	1
Hours	15 Hours

Course Objectives	1) Learners get exposure with various aspects of instruments and their usage through hands-on mode.
	2) Learners gets skill develop in handling various basic tool instruments.
	3) Learners enable the problem solving skill

Course Outcomes	**After completing the course, Student will be able to:**
	1) Learn and acquire the knowledge of various measuring instruments and their uses.
	2) To acquire basic working knowledge of Oscillation , fluid dynamics.
	3) Learn and acquire skill to use mechanical tools to make simple measurement of length, height, time, area and volume & to use spectrometer, lens.

Unit	**Course Description**	Hrs
1.1	**Introduction to measuring instruments:** Measuring units. conversion to SI and CGS. Familiarization with meter scale, Vernier calliper, Screw gauge and their utility. Measure the dimension of a solid block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet, etc. Use of Sextant to measure height of buildings, mountains, etc	3
1.2	**Optics :** Spectrometer, lens, prism	4
1.3	**Mechanics :** Newtons law of motion	4
1.4	**Properties of Fluid** Surface Tension	4

Reference Books:

1. Mechanical workshop practice, K.C. John, 2010, PHI Learning Pvt. Ltd.

Course Description: B.Sc. (Physics)	
Semester	I
Course Name	Practicals -Instrumentation Techniques in Physics
Course Code	USEC1ITP
Eligibility for the Course	12th Science of all recognized Board
Credit	1
Hours	2 Hrs per week

Course Objectives	1) Learners get exposure with various aspects of instruments and their usage through hands-on mode
	2) Learners gets skill develop in handling various basic tool instruments.
	3) Learners enable the problem solving skill

Course Outcomes	**After completing the course, Student will be able to:**
	1) To get hands-on experience in usage of optical devices.
	2) To acquire basic working knowledge of oscillation, fluid dynamics
	3) Learn and acquire skill to use mechanical tools to make simple measurement of length, height, time, area and volume & to use spectrometer, lens.

Course Description (Any 8)	Hrs
1. Familiarization of measuring instruments- Vernier Calliper, Screw guage. 2. Familiarization of measuring instruments-Travelling Microscope 3. Determination of density - Measurement of radius of ball bearing. 4. Familiarization of Spectrometer 5. Focal length of lens 6. Simple pendulum. 7. Newton's third law 8. stokes law 9. Surface Tension 10. Students should collect the information of at least five Physicists with their work. Report that in a journal (E**quivalent to two experiments**.) 11. Students should carry out mini-project upto the satisfaction of professor In-charge of practical. (E**quivalent to two experiments**.) 12. Study tour. Students participating in the study tour must submit a study tour report (E**quivalent to two experiments**.)	15 hrs

References

1. D. C. Tayal, edited by Ila Agarwal, University Practical Physics, 1st edition, Himalaya Publishing House
2. Harman Singh, B.Sc. Practical Physics, 7th edition, S. Chand Publication.
3. C. L. Arora, B.Sc. Practical Physics, 21st edition, S. Chand Publication.

Open Elective to be offered to other Department (Credit 2)
Open Elective - I

Course Description: B.Sc. (Physics)	
Semester	I
Course Name	Open Elective (BCOM), Computer Hardware-1
Course Code	UOE1CH
Eligibility for the Course	12 th (Commerce)
Credit	2
Hours	30 hours

Course Objectives	1) The course aims to introduce students to the basic concepts and principles of electronics. This includes understanding the behavior of electronic components, circuits, and systems..
	2) Learners should develop a solid foundation in the theory of electronics. They should understand concepts such as voltage, current, resistance, capacitance, inductance, and power.
	3) The course aims to develop practical skills in working with electronic components and circuits. Students should learn how to use basic tools and equipment, read schematics and datasheets, and build and test simple electronic circuits

Course Outcomes	**After completing the course, Student will be able to:**
	1) Analyze simple electronic circuits using Ohm's law and Kirchhoff's laws, calculating voltages, currents, and resistances
	2) Develop critical thinking skills by diagnosing and rectifying common electronic circuit issues and malfunctions.
	3) Measure voltage and current accurately using appropriate tools such as multimeters.

Module/Unit	Course Description	Hrs.
1.1	Basic Electricity and conducting Material. Introduction, Current, Voltage, emf, Power generation system, Types of Conductors, Semiconductors - Silicon, Germanium.	15 hrs.
1.2	Electronics Components. Resistors, Capacitors, Inductors, Transforms, Types, working and Properties, Voltage and current sources, Diode, Zener diode, Photo diode, Light emitting diode (LED), Transistors (NPN, PNP), their characteristics and uses, Field effect transistor, Photo transistor.	
1.3	Electronics Circuits. AC Fundamentals, Ohm's law, Series and Parallel connection of Registers and Capacitors, Rectifier circuits. Basic Switch Mode Power Supply (SMPS)	

Reference books:

1. Electronic Principles (7th Edition) by Albert Malvino & David J Bates, Mc Graw-Hill Publication
2. Digital computer Electronics. By Albert Paul Malvino Tata Mc Graw-Hill Public

Course Description (Practicals) (Any 6)	Hrs
1. 7 segment display 2. Diode ROM array 3. Installation of different Operating Systems 4. Installation of different device drivers 5. Assembling and Disassembling of a Computer System 6. Students should collect the information of at least five Computer Accessories with their work. Report that in a journal. (**Equivalent to two experiments)** 7. Students should carry out mini-project upto the satisfaction of professor In-charge of practical. (**Equivalent to two experiments)** 8. Study tour. Students participating in the study tour must submit a study tour report (**Equivalent to two experiments)**	15 hrs

Reference Book:

1. Windows 10 Inside Out by Craig Stinson and Carl Siechert, Microsoft pr.
2. Digital Electronics Principles and Applications by Roger L. Tokheim, McGraw Hill Education.

Open Elective - II

Course Description: B.Sc. (Physics)	
Semester	I
Course Name	Basics of Electricity for wiring
Course Code	UOE1BEW
Eligibility for the Course	12th pass (Arts/ Commerce)
Credit	02
Hours	30 hours

Course Objectives	
	1) Learners get familiarized with various mechanical and electrical devices.
	2) Enable the Learners to experience various mechanical and electrical tools through hands-on mode.
	3) To develop the skill of soldering and connecting electrical circuits.

Course Outcomes	**After completing the course, Student will be able to:**
	1) Learn and acquire hands-on experience in the usage of multimeters, soldering iron, oscilloscopes, power supplies.
	2) Design and trouble shoots the basic electrical circuits through hands-on mode
	3) Identify the basic components used for Electronic & Electrical experiments

Module/Unit	**Course Description**	**Hrs.**
1.1	**FUNDAMENTALS ELECTRICITY TERMS :** Particle, Current, Voltage, ,Resistance ,Ohm's Law, Power Sources/Voltage Sources, Types of Current, Electrical devices, Source and Load, Series and parallel circuits, power, Power in a series Circuit,Power in a Parallel Circuit,Fundamentals Terms related to circuit connection,Kirchhoff's Law	**15hrs**

1.2	**TRANSFORMER : FUNDAMENTAL TERMS, TYPES** Amplitude, Instantaneous value, cycle, Time period, frequency, phase angle, Phase difference, flux, faraday law, AC waveform, Transformer, Single Phase Transformer, Insulating Oil, Three Phase Transformer	
1.3	**ELECTRICAL WIRING COMPONENTS AND ACCESSORIES:** Wiring materials, Conducting Material, Wiring Accessories, Holders, Conduit Wiring, Wires and cables POWER BILLING Star rating of home appliances (Terminology, Energy efficiency, Star rating Concept	

Course Description (Practicals)	Hrs
1. Identify and draw the figure of various wiring material 2. Identify and connect the accessories with the wires 3. To connect different types of components with wires in a junction box. 4. study of wiring components(Wires, Switches, Fuses, sockets, plug, lamps and lamp holders, rating of different accessories) 5. Control of two lamps from two switches (looping system) 6. Study of fluorescent tube circuit , Study of compact Fluorescent lamps(CFL) and Light Emitting Diode(LED) lamps. 7. Series connection 8. Parallel connection 9. To check the connection of the lamp by one switch (series) 10. Quiz bulb 11. Students should collect the information of at least five Electrical appliance with their work. Report that in a journal. (**Equivalent to two experiments)** 12. Students should carry out mini-project upto the satisfaction of professor In-charge of practical. (**Equivalent to two experiments)** 13. Study tour. Students participating in the study tour must submit a study tour report. (**Equivalent to two experiments)**	15

Reference Books:

1. V. N. Mittal and Arvind Mittal; " Basic Electrical Engineering" McGraw Hill
2. Vincent DelToro, "Electrical engineering Fundamentals", PHI second edition 2011
3. Bolestaad, :"Electronics Devices and Circuits Theory", Pearson Education India
4. Edward Hughes, "Electrical Technology,", Pearson Education 5. D.P. Kothari and Nagrath " Theory and Problems in electrical Enginering.
5. Learning Material for Basic material for Basic Electrical sytem**.**

Choice Based Credit System (CBCS)
F.Y.B. Sc. Physics Syllabus
To be implemented from the Academic year 2023-2024
SEMESTER II

Course Code	Course Type	Course Title	Credit
USC2PH1	Major Subject I	Optics, Applied Mathematics	02
USC2PHP1	Major Subject I Practical	Physics Practical I	01
USC2PH2	Major Subject II	A.C.Circuits and Modern Physics	02
USC2PHP2	Major Subject II Practical	Physics Practical II	01
USC2MIDE	Minor	Digital Electronics	01
USC2MIDE	Minor Practical	Practical - Digital Electronics	01
UVSC2FAD	VSC2	Practical Applications of Arduino based device -I	01
UVSC2FAD	VSC2 Practical	Practical- Practical Applications of Arduino based device -I	01
USEC2BE	SEC2	Basic of Electronics	01
USEC2BE	SEC2 Practical	Practical- Basic of Electronics	01
Total Credits			12

Open Elective Courses

Course Code	Course Type	Course Title	Credit
UOE2CH	Open Elective 3	Computer Hardware-II	02
UOE2SE	Open Elective 4	Solar Energy- Fundamentals & Its Applications-I	02
Total Credits			04

Semester- II

Major I (Credit 2+1)

Course Description: B.Sc. (Physics)	
Semester	II
Course Name	Physics-I (Optics, Applied Mathematics)
Course Code	USC2PH1
Eligibility for the Course	12th Science of all recognised Board
Credit	2
Hours	30 Hrs

Course Objectives	1) To explain the lens defects due to the spherical nature of the lens.
	2) To explain transient response of AC Circuits using differential equations.
	3) To apply differential equations to AC circuits.

Course Outcomes	**After completing the course, Student will be able to:**
	1) Apply lens maker equation, concepts of differential equation in circuits.
	2) Deduct current, charge in LR, RC circuit in terms of equation and graph, equivalent focal length, cardinal points for thin and thick lens.
	3) Discuss natural physical processes related to light waves, lens system, aberration
	4) Solve numerical problems related to homogenous and inhomogenous equations, lens, Aberration

Module/Unit	**Course Description**	**Hrs.**
1.1	**Lens** : Lens Maker's Formula (Review), Newton's lens equation, magnification-lateral, longitudinal and angular, Equivalent focal length of two thin lenses, thick lense, cardinal points of combination of two lense, cardinal points of thick lens **[BSA]** : 4.2,4.3,4.8,4.9,4.10,4.12,4.17,5.2	**15 hrs**

1.2	**Aberration**: Spherical Aberration, Reduction of Spherical Aberration, Chromatic aberration and condition for achromatic aberration **[BSA]** : 9.1,9.2,9.5,9.10,9.11,9.13	
2.1	**Differential equations**: Introduction, Ordinary differential equations, First order homogeneous and non- homogeneous equations with variable coefficients, Exact differentials, General first order Linear Differential Equation, Second-order homogeneous equations with constant coefficients. Problems depicting physical situations like LC and LR circuits, Simple Harmonic motion (spring mass system) **[CH]**: 5.1, 5.2,5.2.1 (A, B, C) (Omit D)	**15 hrs**
2.2	**Transient response of circuits**: Series LR, CR (Growth and decay of currents/charge**.)** LCR circuits. Growth of currents/charge**.** **[CR]**: 14.1 to 14.3	

References

1. [BSA] : Brijlal, Subramanyam and Avadhanulu A Textbook of Optics, 25th revised ed.(2012) S. Chand

2. [CH] : Charlie Harper, Introduction to Mathematical Physics , 2009 (EEE) PHI Learning Pvt. Ltd.

3. [CR]: D. Chattopadhyay, P C Rakshit , Electricity and Magnetism 7th Ed. New Central Book

Additional References:

1. A K Ghatak, Chua, Mathematical Physics, 1995, Macmillan India Ltd.

2. Ken Riley, Michael Hobson and Stephen Bence, Mathematical Methods for Physics and Engineering, Cambridge (Indian edition).

3. H. K. Dass, Mathematical Physics, S. Chand & Co.

4. Jon Mathews & R. L. Walker, Mathematical Methods of Physics: W A Benjamin Inc. 11 .

5. Core PYTHON Applications Programming, Wesley J. Chun, 3rd Edition, Prentice Hall 2012.

Course Description: B.Sc.(Physics)	
Semester	II
Course Name	Physics Practical I
Course Code	USC2PHP1
Eligibility for the Course	12th Science of all recognised Board
Credit	1
Hours	45 hours

Course Objectives	1) To find the Refractive Index of transparent material.
	2) To determine the radius of curvature & cardinal points of the lens system.
	3) Understand the phenomenon of single-slit diffraction and its significance in understanding wave nature..

Course Outcomes	**After completing the course, Student will be able to:**
	1) Calculate the angular and spatial distribution of light intensity in the diffraction pattern.
	2) Utilise Optical Instruments such as the Spectrometer, Prism, Lenses for finding Optical properties like the Refractive Index of the material of the Prism, equivalent focal length.
	3) Apply skills experiment to optics and mechanics practical.
	4) Determine moment of inertia & acceleration due to gravity.

Unit	**Course Description (Paper I)**	**Hrs**

A.	**Regular Experiments (any 6)** 1. LR circuit 2. Newton's Rings: To determine radius of curvature of a given convex lens using Newton's rings 3. Spectrometer: To determine refractive index μ of the material of prism 4. Spectrometer: To determine the angle of Prism. 5. To determine Cardinal points of the Lens system. 6. Bar pendulum 7. Flywheel	20
B	Skill: 1. Schuster method 2. Spectrometer 3. Focal length of lens 4. Use of scientific calculator: sin, cos,,tan, , log , antilog function	10
C	**Any one out of following is equivalent to two experiments from section A and/or B** 1. Students should collect the information of at least five Physicists with their work. Report that in a journal. 2. Students should carry out mini-project upto the satisfaction of professor In-charge of practical. 3. Study tour. Students participating in the study tour must submit a study tour report.	15

Major II
(Credit 2+1)

Course Description: B.Sc. (Physics)	
Semester	II
Course Name	Physics II (A.C.Circuits and Modern Physics)
Course Code	**USC2PH2**
Eligibility for the Course	12th Science of all recognised Board
Credit	2
Hours	30 Hrs

Course Objectives	
	1) Explore the historical development of X-rays and their discovery by Wilhelm Conrad Roentgen..
	2) Trace the historical development of quantum mechanics and its origins in the early 20th century.
	3) Explore the concepts of impedance, phase difference, and phasors in A.C. circuits.
	4) Understand the principle of A.C. bridge circuits and their applications in measuring unknown impedances and quantities.

Course Outcomes	**After completing the course, Student will be able to:**
	1) Compare quantum mechanics with classical mechanics, recognizing the limitations of classical physics and the novel concepts introduced by quantum mechanics.
	2) Explain how the Compton Effect is applied in fields such as X-ray crystallography, where it contributes to understanding the structure of materials.
	3) Analyze AC circuits, including phasor representation, impedance, admittance, and the concept of complex numbers.
	4) Understand the working principles of AC bridges and their significance in precise measurement of resistance, capacitance, and inductance.

Modern Physics		
Unit	**Course Description**	Hrs
1.1	**Origin of Quantum Mechanics** Origin of Quantum theory, Black body (definition), Black Body spectrum, Wien's displacement law, Matter waves, wave particle duality, Heisenberg's uncertainty Principle. Davisson-Germer experiment. **[BSS]**: Origin of Quantum Mechanics: 2.1 to 2.6, 3.1 to 3.5 and 3.9(without application	15
1.2	**X rays** X-Rays production and properties. Continuous and characteristic X-Ray spectra, Bragg's Law, Applications of X-Rays **[AB]**: X- Rays: 2.5, 2.6 **[BSS]**: X- Rays: 6.2 to 6.4	
1.3	**Compton effect:** Compton effect, Pair production, Photons & Gravity, Gravitational Red Shift **[AB]:** Compton Effect: 2.7 to 2.9	
2.1	**Alternating current theory**: (Review : Concept of L, R, and C, AC circuit containing pure R, pure L and pure C) Representation of sinusoids by complex numbers using Phasor diagram, Series L-R, C-R and LCR circuits. Resonance in LCR series circuit, Power in ac circuit. Q-factor **[CR]**: 15.5 to 15.11	15
2.2	**AC bridges**: AC-bridges: General AC bridge, Maxwell's Bridge, de-Sauty's Bridge, Wien Bridge, Hay Bridge **[CR]**: 7.12(i),15.14	

References

1. [BSS]: N Subrahmanyam, Brijlal and Seshan, Atomic and Nuclear Physics Revised Ed. Reprint 2012, S. Chand.
2. [AB]: Arthur Beiser, Concepts of Modern Physics 6th Ed. Tata McGraw Hill 3. [CR]: D. Chattopadhyay, P C Rakshit, Electricity and Magnetism 7th Ed. New Central Book agency.
3. [CR]: D. Chattopadhyay, P C Rakshit , Electricity and Magnetism 7th Ed. New Central Book agency

Course Description: B.Sc. (Physics)	
Semester	II
Course Name	Physics Practical -II
Course Code	USC2PHP2
Eligibility for the Course	12th Science of all recognised Board
Credit	2
Hours	45 Hrs

Course Objectives	
	1) To demonstrate the applications of semiconductor devices as voltage regulators, rectifiers and amplifiers.
	2) To analyse the electrical circuits using network theorems
	3) Explore the effect of light intensity on the output voltage/current of an LDR-based circuit.
	4) Gain practical skills in measuring the frequency of AC mains using appropriate instruments or circuits
	5) Understand the behavior of a series RC (Resistor-Capacitor) circuit

Course Outcomes	**After completing the course, Student will be able to:**
	1) Understand the working principle of Light Dependent Resistors (LDRs)
	2) Measure the frequency of the AC mains using appropriate equipment
	3) Measure the unknown capacitance using de Sauty's bridge and compare it with theoretical values

Unit	**Course Description (Paper II)**	Hrs
A.	**Regular Experiments (any 6)** 1. LDR Characteristics 2. single slit diffraction 3. Frequency of AC mains 4. LCR parallel resonance 5. CR circuit 6. de Sauty's bridge	20

B	**Skill :** 1.Use of breadboard 2. Soldering (Use of PCB) 3.Testing of IC 4. Laser beam divergence, Intensity	10
C	**Any one out of following is equivalent to two experiments from section A and/or B** 1. Students should collect the information of at least five Physicists with their work. Report that in a journal. 2. Students should carry out mini-project upto the satisfaction of professor In-charge of practical. 3. Study tour. Students participating in the study tour must submit a study tour report.	15

References

1. D. C. Tayal, edited by Ila Agarwal, University Practical Physics,1st edition, Himalaya Publishing House

2. Harman Singh, B.Sc. Practical Physics, 7th edition, S. Chand Publication.

3. C. L. Arora, B.Sc. Practical Physics, 21st edition, S. Chand Publication.

Minor (Credit 1+1)

Course Description: B.Sc. (Physics)	
Semester	II
Course Name	Digital Electronics
Course Code	**USC2MIDE**
Credit	1
Hours	1 Hr per week (15 Hours)

Course Objectives	
	1) Introduce students to Boolean algebra laws and the rules of logic simplification, enabling them to simplify complex logic expressions and optimise logic circuits.
	2) Illustrate real-world applications of logic gates and number systems in digital systems, computer architecture, microprocessors, and electronic devices.
	3) Provide an in-depth understanding of binary, octal, decimal, and hexadecimal number systems, including conversion between different bases and their significance in computer programming and digital systems.

Course Outcomes	**After completing the course, Student will be able to:**
	1) comprehend the fundamental principles of logic gates, including AND, OR, NOT, NAND, NOR, and XOR gates. They will grasp the concept of digital logic and its applications in various electronic devices and systems.
	2) gain a thorough understanding of different number systems, including binary, octal, decimal, and hexadecimal. They will learn to convert numbers between these systems and understand their significance in computer programming and digital electronics.
	3) perform basic arithmetic operations (addition, subtraction, multiplication, and division) using binary numbers. They will also learn about binary-coded decimal (BCD) and its applications.

Digital Electronics		
Unit	**Course Description**	**Hrs**
1.1	**Number System:** Binary number system , Arithmetic building blocks , Types of registers, Digital IC, signal levels, Binary to Decimal ,Decimal to binary , Hexadecimal number, Hexadecimal to decimal Conversion, Decimal to hexadecimal conversion, Hexadecimal to binary conversion, Binary to hexadecimal conversion, Binary addition, Unsigned binary numbers, Sign magnitude numbers , 1's complement , 2's complement , Converting to and from 2's complement representation , 2's complement arithmetic, The adder-subtractor (ignore IC specific diagrams) **[LMS]** : Number System : 5.1, 5.2, 5.3, 5.5, 6.1, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8 **[VKM]**: 26.1 to 26.9	15
1.2	**Digital Electronics**: Logic gates (Review), NAND and NOR as universal building blocks. EX-OR gate: logic expression, logic symbol, truth table, Implementation using basic gates and its applications, Boolean algebra, Boolean theorems. De Morgan theorems, Half adder and Full adder **[VKM]**: Digital electronics: 26.15 to 26.17, 26.20, 26.21, 26.22, 26.32	

References

1. [VKM]: V K Mehta and R Mehta Electronics Principals, Multi coloured Revised 11th Ed. reprint in 2012, S Chand.
2. [LMS]: Digital Principles and Applications By Leach, Malvino, Saha Seventh edition.

Additional References:

1. A P Malvino, Digital Principles and Applications: Tata McGraw Hill
2. Tokheim, Digital electronics, 4thed, McGraw Hill International Edition.

Course Description: B.Sc. (Physics)	
Semester	II
Course Name	Practical-Digital Electronics
Course Code	**USC2MIDE**
Credit	1
Hours	15 Hours

Course Objectives	
	1) Explore the concepts of Boolean algebra and logic gate truth tables for circuit analysis.
	2) Explore the effect of light intensity on the output voltage/current of an LDR-based circuit.
	3) Understand the basic concepts of digital logic and binary arithmetic.
	4) Analyze and compare the outputs of Half Adder and Full Adder circuits for different binary inputs.

Course Outcomes	**After completing the course, Student will be able to:**
	1) Design combinational logic circuits using logic gates.
	2) construct truth tables of basic logic gates and understand their behavior.

Course Description (Practicals)	
1.Identification of Components- Resistor , Capacitor ,Transistor, LED, Diode, Resistance box, Rheostat, IC,Inductor coil, Use of breadboard ,LDR. 2.Testing of IC ,Soldering (Use of PCB) 3. Study of AND and NAND Gates 4. Study of OR and NOR Gates 5. To verify De Morgan's first Theorems 6. To verify De Morgan's Second Theorems 7. Students should collect the information of at least five Physicists with their work. Report that in a journal.(**Equivalent to two experiments.**) 8. Students should carry out mini-project upto the satisfaction of professor In-charge of practical.(**Equivalent to two experiments.**) 9.;Study tour. Students participating in the study tour must submit a study tour report. (**Equivalent to two experiments.**)	15 hrs

References

1. D. C. Tayal, edited by Ila Agarwal, University Practical Physics, 1st edition, Himalaya Publishing House
2. Harman Singh, B.Sc. Practical Physics, 7th edition, S. Chand Publication.
3. C. L. Arora, B.Sc. Practical Physics, 21st edition, S. Chand Publication.

Vocational Skill Course- 2 Credit (1+1)

Course Description: B.Sc. (Physics)	
Semester	II
Course Name	Practical Applications of Arduino based device -I
Course Code	UVSC2FAD
Eligibility for the Course	12th Science of all recognised Board
Credit	02
Hours	30 hours

Course Objectives	
	1) Learners get exposure with various electronic components like temperature sensor, Ultrasonic range finder, microcontroller used in Arduino UNO.
	2) Learners gets skill develop in designing circuits to be connected to Arduino UNO.
	3) Learners enable design programs code for Arduino UNO

Course Outcomes	**After completing the course, Student will be able to:**
	1) Explain various Sensors, program code of Arduino.
	2) Acquire basic working knowledge of program code of Arduino UNO.
	3) Design program code in practical life using various basic sensors, various electronic outputs devices

Module	**Course Description**	Hrs
1	**Basic electronic components & sensors** Resistors, Capacitor, Temperature Sensor LM35, SEN136B5B is an ultrasonic range finder, HC-SR04 ultrasonic sensor.	2
2	**Review of Arduino program code ,** Arduino Serial, Serial print(), Serial. Print (value, format), Flash Memory based strings, Serial. println ( ) , Serial. available( ), Arduino Serial .read( ) , Arduino Serial.write( ), Serial.readString( ) , Arduino analogRead ( ), analogReference( )	3
3	**Functions & Arduino Data Types** Advantages of using Functions, Arduino Data Types- void Data Type, int Data Type , Char Data Type, Float Data Type ,Double Data Type,	4

	Unsigned int Data Type, short Data Type, long Data Type, Unsigned long Data Type, byte data type, word data type,	
4	**Arduino Variables, Constants, Operators, loops** Arduino Variables, local, Global variable, Advantages of Variables, Constants, Pin level Constants, Arduino Operators, Arithmetic Operators, Compound Operators, Boolean Operators, Comparison Operators, Arduino if-else and else-if,Arduino for Loop	6

Reference Books:

1. Hans-Petter Halvorsen : Introduction to Arduino
2. Brian w. Evans :arduino programming notebook
3. Alan G. Smith : Introduction to Arduino A piece of cake!
4. Simon Monk, Programming Arduino: Getting Started with Sketches, Second Edition (Tab) 2nd Ed
5. Damon Parke : Arduino Programming: The Ultimate Guide For Making The Best Of Your Arduino Programming Projects Kindle Edition
6. https://www.tinkercad.com/blog/official-guide-to-tinkercad-circuits

Course Description: B.Sc. (Physics)	
Semester	II
Course Name	Practical- Practical Applications of Arduino based device -I
Course Code	UVS2FAD
Eligibility for the Course	12th Science of all recognised Board
Credit	02
Hours	15 Hours

Course Objectives	1) Learners get exposure with various electronic components like temperature sensor, Ultrasonic range finder, microcontroller used in Arduino UNO.
	2) Learners gets skill develop in designing circuits to be connected to Arduino UNO.
	3) Learners enable design programs code for Arduino UNO

Course Outcomes	**After completing the course, Student will be able to:**
	1) To get hands-on experience in usage of various Sensors.
	2) To acquire basic working knowledge of program code of Arduino UNO.

	3) Learn and acquire skill to apply program code in practical life using various basic sensor.

Course Description	Hrs
Regular experiments (Any 8) 1. Capacitance measurement 2. Resistance measurement 3. Temperature using Thermistor 4. Ultrasonic ranger 5. Pulse rate sensor 6. IR sensor 7. Touch Capacitive sensor 8. Touch Capacitive sensor with buzzer 9. Students should collect the information of at least five sensor with their principle. Report that in a journal **(Equivalent to two experiments.)** 10. Students should carry out mini-project upto the satisfaction of professor In-charge of practical. (**Equivalent to two experiments**) 11. Study tour. Students participating in the study tour must submit a study tour report (**Equivalent to two experiments**)	15

References

1. Hans-Petter Halvorsen : Introduction to Arduino
2. Brian w. Evans :arduino programming notebook
3. Alan G. Smith : Introduction to Arduino A piece of cake!
4. Simon Monk, Programming Arduino: Getting Started with Sketches, Second Edition (Tab) 2nd Ed
5. Damon Parke : Arduino Programming: The Ultimate Guide For Making The Best Of Your Arduino Programming Projects Kindle Edition
6. https://www.tinkercad.com/blog/official-guide-to-tinkercad-circuits

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Skill Enhancement Course (Credit 2)

Course Description: B.Sc. (Physics)	
Semester	II
Course Name	Basic of Electronics
Course Code	USEC2BE
Eligibility for the Course	12^{th} Science of all recognised Board
Credit	02
Hours	30 hours

Course Objectives	
	1) Learners get familiarized with various mechanical and electrical devices.
	2) Enable the Learners to experience various mechanical and electrical tools through hands-on mode.
	3) To develop the skill of soldering and connecting electrical circuits.

Course Outcomes	**After completing the course, Student will be able to:**
	1) Learn and acquire hands-on experience in the usage of multimeters, soldering iron, oscilloscopes, power supplies.
	2) Design and trouble shoots the basic electrical circuits through hands-on mode.
	3) Identify the basic components used for Electronic & Electrical experiments.

Unit	**Course Description**	Hrs
1.1	Electrical and Electronic Skill: Use of Multimeter: Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance.	4
1.2	Soldering: Introduction, Cored solder wire, soldering iron, soldering work station, soldering process, Soldering of electrical circuits having discrete components (R, L, C, diode) and ICs on PCB. Introduction of Breadboard	2
1.3	Cathode Ray Oscilloscope: Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only– no mathematical treatment), brief discussion on screen phosphor, visual persistence & chemical composition. Time base	6

	operation, Front panel controls. Specifications of a CRO and their significance.	
1.4	Ohm's law, Kirchoff voltage law - Series & parallel,PN junction diode, its application	3

Reference books:

1. Principles of Electronics , V.K.Mehta
2. Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
3. Electronic Devices and circuits, S. Salivahanan & N. S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill
4. Electronic circuits: Handbook of design and applications, U.Tietze, Ch.Schenk, 2008, Springer
5. Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India
6. A text book in Electrical Technology - B L Theraja – S. Chand and Company
7. New Engineering Technology, Lawrence Smyth/Liam Hennessy, The Educational Company of Ireland [ISBN: 0861674480]

Course Description: B.Sc. (Physics)	
Semester	II
Course Name	Practical - Basic of Electronics
Course Code	USEC2BE
Eligibility for the Course	12th Science of all recognised Board
Credit	02
Hours	15 hours

Course Objectives	
	1) Learners get familiarized with various mechanical and electrical devices
	2) Enable the Learners to experience various mechanical and electrical tools through hands-on mode.
	3) To develop the skill of soldering and connecting electrical circuits.

Course Outcomes	**After completing the course, Student will be able to:**
	1) Learn and acquire hands-on experience in the usage of multimeters, soldering iron,oscilloscopes, power supplies..
	2) Design and trouble shoots the basic electrical circuits through hands-on mode.
	3) Identify the basic components used for Electronic & Electrical experiments.

Course Description (Any 8)	Hrs
1. Soldering 2. component Identification & testing- transistor, resistor, Capacitor, Diodes, Resistance box, Rheostat, IC, Inductor coil, switches, LED, LDR 3. Familiarization with laboratory instruments - DMM, Function generator, DC power supply 4. Use of breadboard, PCB 5. Use of CRO 6. PN junction Diode as a forward bias & Reverse bias 7. Application of PN junction diode- Half wave Rectifier 8. Application of PN junction diode- Full wave Rectifier 9. Kirchoff voltage law- Series & parallel. 10. Students should collect the information of at least five Electronic devices using LED, diode, resistors etc . Report that in a journal (**Equivalent to two experiments.**) 11. Students should carry out mini-project upto the satisfaction of professor In-charge of practical. (E**quivalent to two experiments**.) 12. Study tour. Students participating in the study tour must submit a study tour report (E**quivalent to two experiments**.)	15

Reference Book

1. Basic Electronics (Solid State): B. L. Theraja S. Chand & Company, 2000.
2. Electronics Instrumentation: A. K. Sawney, Dhanpat Rai Publications.
3. A Textbook of Applied Electronics: R. S. Sedha, S. Chand Publications.
4. Basic Electronics and linear circuits: Bhargava and Gupta, TMH.
5. Electric Circuits: S. A. Nasar, Schaum's outline series, Tata McGraw Hill (2004).
6. Electrical Circuit Analysis: Mahadevan and Chitra, PHI.
7. Electronic instruments and measurement techniques: W. D. Cooper and A. D. Helfrick (PHI).
8. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill

Open Elective III (Credit 2)

Course Description: B.Sc. (Physics)	
Semester	II
Course Name	Open Elective (BCOM), Computer Hardware-2
Course Code	UOE2CH
Eligibility for the Course	12 th (Commerce)
Credit	02
Hours	15 hours

Course Objectives	
	1) Familiarize learners with the basic architecture and organization of a computer system, including the CPU, memory, storage devices, and input/output subsystems.
	2) Teach learners the practical skills required to assemble and disassemble a computer system, including installing and connecting hardware components properly
	3) Equip students with troubleshooting techniques to identify and resolve common hardware issues, such as faulty components, loose connections, and driver conflicts.

Course Outcomes	**After completing the course, Student will be able to:**
	1) Develop problem-solving skills to diagnose and troubleshoot common hardware issues, both in hardware and software interactions..
	2) Understand the fundamental concepts of computer architecture, including the organization and structure of various hardware components
	3) Explain recent advancements in computer hardware, including trends in processors, memory technologies, storage solutions, and energy-efficient designs.

Module/ Unit	**Course Description**	Hrs
1.1	Introduction to PC Hardware: Types of I/O devices and ports on a standard PC for connecting I/O devices, function of keyboard, interfaces, cable, connectors, function of mouse, function of monitor,	15 hrs
1.2	function of speaker and Mic, function of serial port,	

	parallel port, brief principle of communication through these ports, types of devices that can be connected, interface standards, printers and scanners, HDMI, VGA	

Course Description (Practicals) (Any 6)	**Hrs**
1. Installation of different Application Software 2. Installation and Troubleshooting of Printer (Dot-Matrix and Laser Printer) 3. Installation and Troubleshooting of Scanner (Photo & Bar Code Scanner) 4. Troubleshooting and Repair Operating System: Windows XP, Windows 7. 5. Students should collect the information of at least five Computer Accessories with their work. Report that in a journal. (Equivalent to two experiments) 6. Students should carry out mini-project upto the satisfaction of professor In-charge of practical. (Equivalent to two experiments) 7. Study tour. Students participating in the study tour must submit a study tour report (Equivalent to two experiments)	15 hrs

Reference Book

1. Networking Complete BPB Publication
2. Computer Networking Andrew S. Tanenbawan By PHI

Open Elective IV (Credit 2)

Course Description: B.Sc. (Physics)	
Semester	II
Course Name	Solar Energy- Fundamentals & Its Applications-I
Course Code	UOE2SE
Eligibility for the Course	12th pass (Arts/ Commerce)
Credit	01
Hours	15 hours

Course Objectives	
	1) Enable the Learners to experience various electrical tools and PV cells through hands-on mode
	2) Enable the Learners to understand the standards, safety measures
	3) Introduces Learners to the concept of converting sunlight to electricity with photovoltaic cells
	4) Learners get familiarized with various fundamentals of solar electricity, solar elements
	5) Learners get introduction of basic components of Solar system and its testing.
	6) Learners will be able to comprehend the calculation of Solar energy

Course Outcomes	**After completing the course, Student will be able to:**
	1) Learn and acquire hands-on experience in the handling Solar / PV cells.
	2) Learn and acquire knowledge the solar energy and its relevance.
	3) Design and trouble shoots the basic electrical circuits through hands-on mode
	4) Design basic solar systems.
	5) Familiarize to determine the effect of several variables on the output
	6) Identify the basic components used for Solar systems
	7) Explores energy from the sun in terms of radiant energy to expand on the concept of electricity generatio.

Unit	Course Description (Theory)	Hrs
1	**Sources Of Energy** : Geothermal energy, Wind Energy, Tidal and Wave Energy	4
2	**Fundamentals of Solar** : Solar electricity and solar heating, The source of solar power The principles of solar electricity, Understanding the terminology related to Solar, Photo Voltaic effect, solar electric system, Terminology used for solar Electricity	**3**
3	**Types of Solar PV system** : Rooftop & Solar utilities, Types of Solar Panels	**3**
4	**Components of a Solar Electric System**: Solar panels, A watt-peak rating, Advantages and Disadvantages of Solar Panel, Junction Boxes, Batteries Controller, Inverter, Electric Devices, Safety	**5**

Course Description (Practicals)	Hrs
1. Use of DMM 2. Identify solar PV elements. 3. Constructing the Photovoltaic Energy System for Light Source Changes 4. Effect of dust particle on Cell Current 5. Effect of Shading on Cell Current 6. Effect of angle of inclination on Cell Current 7. Students should collect the information of at least five solar energy appliances with their work. Report that in a journal. (**Equivalent to two experiments)** 8. **Study Tour.** Report that in a journal. (**Equivalent to two experiments)**.	15 hrs

Reference books:

1. Michael Boxell , Solar Electricity Handbook (2012 Edition), Greenstream publishing.
2. Baiano Reeves , Solar Power DIY Handbook.
3. Dick Erickson and Frank Vignola, EXPERIMENTS with PHOTOVOLTAIC CELLS