Academic Council Date –13 June, 2024
Item No. – 2

Janardan Bhagat Shikshan Prasarak Sanstha's

CHANGU KANA THAKUR

Arts, Commerce and Science College, New Panvel (Autonomous)

Re-accredited A+ Grade by NAAC (Third Cycle-CGPA-3.61)
'College with Potential for Excellence' Status Awarded by UGC
'Best College Award' by University of Mumbai

As per National Education Policy - 2020

Title of the Programme

B. Sc. in Physics

(Faculty of Science)

Syllabus for F.Y. B. Sc. (Physics)

Semester I and II

(With effect from the academic year 2024-25)

Janardan Bhagat Shikshan Prasarak Sanstha's

CHANGU KANA THAKUR

Arts, Commerce and Science College, New Panvel (Autonomous)

As per National Education Policy - 2020

Sr. No.	Heading	Particulars
1	Title of program	B.Sc in Physics
2	Eligibility	XII passed out
3	Duration of program	1 year
4	Intake Capacity	40
5	Scheme of Examination	60:40
6	Standards of Passing	
7	Semesters	I & II
8	Program Academic Level	UG
9	Pattern	Semester
10	Status	Revised
11	To be implemented from Academic Year	Academic Year 2024-25

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Janardan Bhagat Shikshan Prasarak Sanstha's
CHANGU KANA THAKUR
Arts, Commerce and Science College, New Panvel (Autonomous)

Program Outcomes (POs)

PO No.	POs Statement After completing the Bachelor of Science Program, students will be able to-	Knowledge and Skill
PO-1	The knowledge of the disciplines and in-depth and extensive knowledge, understanding and skills in a specific field of interest.	Disciplinary knowledge
PO-2	An ability to develop and conduct experiments, analyze, and interpret data and use scientific judgement to draw conclusions	Scientific reasoning
PO-3	An ability to use current technology, and modern tools necessary for creation, analysis, dissemination of information.	Digital literacy
PO-4	Innovative, professional, and entrepreneurial skills needed in various disciplines of science.	Life-long learning
PO-5	An ability to achieve high order communication skills	Communication Skills
PO-6	An ability to collect, analyze and evaluate information and ideas and apply them in problem solving using conventional as well as modern approaches	Problem solving
PO-7	A sense of social responsibility; intellectual and practical skills and demonstration of ability to apply it in real-world settings.	Reflective thinking
PO-8	An ability to engage in independent and life-long learning through openness, curiosity, and a desire to meet new challenges.	Life-long learning
PO-9	A capacity to relate, collaborate, and lead others, and to exchange views and ideas to work in a team to achieve desired outcomes	Teamwork
PO-10	An ability to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings	Leadership
PO-11	An ability to understand values, ethics, and morality in a multidisciplinary context	Moral and ethical awareness

Janardan Bhagat Shikshan Prasarak Sanstha's
CHANGU KANA THAKUR
Arts, Commerce and Science College, New Panvel (Autonomous)

Program Specific Outcomes (PSOs)

PSO No.	PSOs Statement
	After completing the Bachelor of Science Program, students will be able to-
PSO-1	Develop a comprehensive understanding of the principles of mechanics, optics, modern Physics, properties of matter
PSO-2	Gain proficiency in analyzing and designing analog and digital electronic circuits.
PSO-3	Explore the applications of Friction, Elasticity, viscosity and digital electronics in daily life.
PSO-4	Gain insights into the implications of Optical instruments in day to day life
PSO-5	Learn the principles of Quantum mechanics and their application to explain macroscopic properties of systems from microscopic behavior.
PSO-6	Comprehend the structure of atoms, including quantum states and spectra.
PSO-7	Develop skills in designing and implementing electronic instruments for specific applications.

Janardan Bhagat Shikshan Prasarak Sanstha's
CHANGU KANA THAKUR
Arts, Commerce and Science College, New Panvel (Autonomous)

Preamble

The Major 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. Questions 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. Questions 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. Questions 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. Questions 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. Questions 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

Passed 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 may be amended as and when required with authorisation of Academic bodies.

Janardan Bhagat Shikshan Prasarak Sanstha's

CHANGU KANA THAKUR

Arts, Commerce and Science College, New Panvel (Autonomous)

Syllabus for F.Y.B. Sc. (Physics)

Choice Based Credit System

Under New Education Policy (NEP) 2020

(To be implemented from the academic year 2024-2025)

No. of Courses	Semester I	Credits	No. of Courses	Semester II	Credits
A	***Discipline Specific Course (Major)***		**A**	***Discipline Specific Course (Major)***	
1	Mechanics, Properties of matter and Electronics	3+1	1	Optics and Modern Physics	3+1
2	General Chemistry I	3+1	2	General Chemistry II	3+1
3	Maths	3+1	3	Maths	3+1
B	***Indian Knowledge System (IKS)***		***B***	***Open Elective (OE)***	
4	IKS	02	4	Solar Energy -Fundamentals & its Applications	02
D	***Skill Enhancement Course (SEC)***		***D***	***Skill Enhancement Course (SEC)***	
5	Basic mechanics and Electronics	02	5	Basics of Optics & Electronics	02
F	***Value Education Course (Any One)***		***F***	***Value Education Course (Any One)***	
6	Digital Technology and Solutions	02	6	Digital Technology and Solutions	02
7	Understanding India	02	7	Understanding India	02
8	Environmental Studies	02	8	Environmental Studies	02
E	***Ability Enhancement Course (AEC) (Any One)***		***E***	***Ability Enhancement Course (AEC) (Any One)***	
9	Marathi	02	9	Marathi	02
10	Hindi	02	10	Hindi	02
G	***Co-curricular Courses (Any One)***		***G***	***Co-curricular Course (Any One)***	
11	Foundation Course in NSS-I	02	11	Foundation Course in NSS-II	02
12	Foundation Course in NCC-I	02	12	Foundation Course in NCC-II	02
13	Foundation Course in PE-I	02	13	Foundation Course in PE-II	02
14	Foundation Course in PA-I	02	14	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 2024-2025

SEMESTER I

Course Code	Course Type	Course Title	Credit
USC1PH1	Major (Physics-1)	Mechanics ,Properties of Matter & Basic Electronics	03
USC1PHP1	Major Practical	Practicals of USC1PH1	01
USEC1BME	SEC	Basic mechanics and Electronics	02
UVEC1DT1	VEC	Digital Technology I	02
Total Credits			08

Course Description: B.Sc. (Physics)	
Semester	I
Course Name	Physics-1 (Mechanics ,Properties of Matter & Basic Electronics)
Course Code	USC1PH1
Eligibility for the Course	12th Science of all recognised Board
Credit	3
Hours	3 Hrs. per week (30 Hours)

CO No.	**COs Statement**
	After completing the Bachelor of Science Program, students will be able to-
CO-1	Derive theorem related to fluids ,solid, different circuits
CO-2	Implement logic gates, universal building blocks, and adders in digital electronics
CO-3	Calculate Friction coefficient, ripple factor,Elasticity , coefficient of viscosity,...

Mechanics ,Properties of Matter & Basic Electronics		
Unit	**Course Description**	Hrs
1.1	**Friction:** Advantages & disadvantages of friction in daily life, Friction as the component of Contact force, Kinetic Friction, Static friction, laws of friction [HCV]: 6.1 to 6.5,	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	**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
2.2	**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	
3.1	**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**
3.2	**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:

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

[HCV] : H. C. Verma, Concepts of Physics – Part I, (Second Reprint of 2020), Bharati Bhavan Publishers and Distributors

[VKM]: V K Mehta and R Mehta Electronics Principals, Multi coloured Revised 11th Ed. reprint in 2012, S Chand.

[LMS] : Digital Principles and Applications By Leach, Malvino, Saha Seventh edition.

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

Course Description: B.Sc.(Physics)	
Semester	I
Course Name	Practicals of USC1PH1
Course Code	USC1PHP1
Eligibility for the Course	12th Science of all recognised Board
Credit	1
Hours	2 Hrs. per week

CO No.	**COs Statement**
	After completing the Bachelor of Science Program, students will be able to-
CO-1	Calculate physical constants of liquid and solid

CO-2	Design circuits to verify the circuits law
CO-3	Anticipate the basic skills of handling calculator & measuring instruments

Group	Course Description
A	**Group A** Skill 1. Measurement of Time period 2. Use of Scientific Calculator: mathematical function, shift keys 3. Graph plotting: range selection, slope of straight line Practicals (Any 03) 1. Y by vibrations: Flat spiral Spring 2. Torsional Oscillation 3. Bifilar Pendulum 4. To determine Coefficient of Viscosity (η) of a given liquid by Poisseuli's Method
B	**Group B** Skill 1. Use of DMM 2. Testing of electronic components 3. Testing of IC's (Logic gates) Practicals (Any 03) 1. Thevenin's theorem 2. Rectifier circuits with filter 3. Zener diode as a voltage regulator 4. Maximum power transfer theorem
C	**Group 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

References:

1. Advanced course in Practical Physics D. Chattopadhyay, PC Rakshit & B Saha. (6th Edition) Book and Allied Pvt. Ltd.
2. B.Sc. PRACTICAL Physics – Harnam Singh S. Chand & Co. Ld. 2001
3. A test book of advanced practical PHYSICS _ SAMIR Kumar Ghosh, New Central Book Agency (3rd edition)
4. B.Sc. Practical Physics – CL Arora (1st Edition) -2001 S. Chand and Co Ltd.
5. Practical Physics CL Squires (3rd Edition) Cambridge University
6. University Practical Physics – DC Tayal. Himalaya Publication
7. Advanced Practical Physics – Worsnop Flint.

Course Description: B.Sc.(Physics)	
Semester	I
Course Name	SEC (Basic Mechanics & Electronics)
Course Code	USEC1BME
Eligibility for the Course	12th Science of all recognised Board
Credit	2
Hours	4 Hrs per week

CO No.	**COs Statement**
	After completing the Bachelor of Science Program, students will be able to-
CO-1	Anticipate the technical skills of handling basic measuring instruments
CO-2	Determine the physical constant of solid, liquid
CO-3	Design the circuits to verify the laws of circuits

Group	**Course Description**
A	**Group A (Any 6)** 1. Familiarisation of measuring instruments- Vernier Calliper, Screw gauge. 2. Familiarisation of measuring instruments-Travelling Microscope 3. Determination of density - Measurement of radius of ball bearing 4. Hooke's Law 5. Stokes law 6. Simple pendulum 7. Surface Tension 8. Resonance pendulum 9. Determination of flow rate using burette 10. Use of Spherometer to determine radius of spherical surface 11. Study the trajectory of a projectile by launching an object horizontally a measuring its range.
B	**Group B (Any 6)** 1. Ohm's law 2. Series CR circuit 3. Series LR circuit 4. Frequency of A. C. mains 5. LDR characteristics 6. Thermistor characteristics 7. Temperature coefficient of conducting material

C	**Group 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

References:

1. Advanced course in Practical Physics D. Chattopadhyay, PC Rakshit & B Saha. (6th Edition) Book and Allied Pvt. Ltd.
2. B.Sc. PRACTICAL Physics – Harnam Singh S. Chand & Co. Ld. 2001
3. A test book of advanced practical PHYSICS _ SAMIR Kumar Ghosh, New Central Book Agency (3rd edition)
4. B.Sc. Practical Physics – CL Arora (1st Edition) -2001 S. Chand and Co Ltd.
5. Practical Physics CL Squires (3rd Edition) Cambridge University
6. University Practical Physics – DC Tayal. Himalaya Publication
7. Advanced Practical Physics – Worsnop Flint.

Course Description: B.Sc. (Physics)	
Semester	I
Course Name	VEC (Digital Technology I)
Course Code	UVEC1DT1
Eligibility for the Course	12th Science of all recognised Board
Credit	2
Hours	2 Hrs. per week (30 Hours)

CO No.	**COs Statement** **After completing the Bachelor of Science Program, students will be able to-**
CO-1	Discuss natural physical processes related to light waves, lens system, aberration
CO-2	Apply the principles and applications of various optical instruments.
CO-3	Explain the origins and key concepts of quantum mechanics

Digital Technology I		
Unit	**Course Description**	Hrs
1.1	**Introduction and evolution of Digital system** Role and significance of Digital technology, Information & Communication technology and tools, Computer system and its working, Software and its types, Operating Systems	15

1.2	**Communication and collaboration in Cyberspace:** Electronic communication: electronic emails , social media tools,Collaborative Digital platforms,Tools/Platforms for online learning, Collaboration using files haring, messaging, video conferencing, WWW, Web browsers, Search Engine, messaging, E mail, social networking	
2.1	**Computer based Information systems** Significance and types, e commerce & digital marketing, basic concep benefits & challenges	15
2.2	**Digital India and e Governance:** Initiatives, Infrastructure, services and empowerment, Application of Digital Financial Services: Savings and its future needs, Bank and banking products, Banking Service Delivery Channels –I, Banking Service Delivery Channels –II	
2.3	**Digital Financial Tools :** OTP, QR Code, Unified Payment Interface, Aadhar enabled payment system, USSD, Credit/Debit cards, e wallet, Internet Banking, NEFT/RTGS and IMPS, Online bill payment and POs,	

Reference books

1. Fundamentals of Computer Hardware : Tata MsGraw Hill
2. Data communication and Networking : Behrouz, Mcgraw Hill Education
3. Emerging Technologies in Computing : Theory, Practice and Advances : P.Kumar, A.Tomar, R.Sharma
4. Essentials of Cloud computing : K. Chandresekhran, CRC press 2014
5. Block chain : Blueprint for new economy , M.Swan O'Reilly Media, 2015
6. Understanding digital letarcies : A practical introduction. Rodney Jones and Christopher Hafner
7. Block chain : blueprint for new economy, M.Swan
8. https://www.digitalindia.gov.in
9. https://www.digilocker.gov.in

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
USC2PH2	Major (Physics-1)	Optics & Modern Physicss	03
USC2PHP2	Major Practical	Practicals of USC2PH2	01
USEC2BOE	SEC	Basics of Optics & Electronics	02
UVEC2DT2	VEC	Digital Technology II	02
UOE2SE	OE	Solar Energy- Fundamentals & Its Applications-I	02
Total Credits			10

Course Description: B.Sc. (Physics)	
Semester	II
Course Name	Physics-1 (Optics & Modern Physics)
Course Code	USC2PH2
Eligibility for the Course	12th Science of all recognised Board
Credit	3
Hours	3 Hrs. per week (30 Hours)

CO No.	**COs Statement**
	After completing the Bachelor of Science Program, students will be able to-
CO-1	Discuss natural physical processes related to light waves, lens system, aberration
CO-2	Apply the principles and applications of various optical instruments.
CO-3	Explain the origins and key concepts of quantum mechanics

Optics & Modern Physics		
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 lens, cardinal points of combination of two lenses. [BSA] : 4.2,4.3,4.8,4.9,4.10,4.12,4.17,5.2	15

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	**Optical Instrument :** Eyepieces, Telescope ,Human Eye, Travelling Microscope, Spectrometer,	15
2.2	**X rays** X-Rays production and properties. Continuous and characteristic X-Ray spectra, Bragg's Law, Applications of X-Rays. **[BSS]:** X- Rays: 6.2 to 6.4	
3.1	**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**
3.2	**Compton effect:** Compton effect, Pair production, Photons & Gravity, Gravitational Red Shift **[AB]:** Compton Effect: 2.7 to 2.9	

References:

1. [B**SS]:** 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.

Course Description: B.Sc.(Physics)	
Semester	II
Course Name	Practicals of USC2PH2
Course Code	USC2PHP2
Eligibility for the Course	12th Science of all recognised Board
Credit	1
Hours	2 Hrs. per week

CO No.	**COs Statement** **After completing the Bachelor of Science Program, students will be able to-**
CO-1	Anticipate the technical skill of handling basic instruments
CO-2	Measure the physical constant of prism and lens
CO-3	Design digital circuits to verify its law.

Group	Course Description
A	**Group A** Skill 1.Schuster method 2. Use of Spectrometer 3. Focal length of lens Practicals (Any 03) 1. Spectrometer: To determine refractive index μ of the material of prism 2. Spectrometer: To determine the angle of Prism. 3. To determine Cardinal points of the Lens system. 4. Use of travelling microscope : bore radius
B	**Group B** Skill 1. Plotting of log , semi log graph 2. Measurement of errors 3. Use of breadboard Practicals (Any 03) 1. Basic logic gates 2. NAND and NOR gate as a Universal building block. 3. Half adder and Full adder 4.De Morgan's theorem
C	**Group 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 up to the satisfaction of professor In-charge of practical. 3. Study tour. Students participating in the study tour must submit a study tour report

References:

1. Advanced course in Practical Physics D. Chattopadhyay, PC Rakshit & B Saha. (6th Edition) Book and Allied Pvt. Ltd.
2. B.Sc. PRACTICAL Physics – Harnam Singh S. Chand & Co. Ld. 2001
3. A test book of advanced practical PHYSICS _ SAMIR Kumar Ghosh, New Central Book Agency (3rd edition)
4. B.Sc. Practical Physics – CL Arora (1st Edition) -2001 S. Chand and Co Ltd.
5. Practical Physics CL Squires (3rd Edition) Cambridge University
6. University Practical Physics – DC Tayal. Himalaya Publication
7. Advanced Practical Physics – Worsnop Flint.

Course Description: B.Sc.(Physics)	
Semester	II
Course Name	SEC (Basics of Optics & Electronics)
Course Code	USEC2BOE
Eligibility for the Course	12th Science of all recognised Board
Credit	2
Hours	4 Hrs per week

CO No.	**COs Statement**
	After completing the Bachelor of Science Program, students will be able to-
CO-1	Anticipate the technical skills of handling basic measuring instruments
CO-2	Verify light law using grating, laser sources
CO-3	Design the circuits to verify the laws of circuits

Group	**Basics of Optics & Electronics**
A	**Group A (Any 6)** 1. Single slit diffraction 2. Reflection law using laser source 3. Refraction law using laser source 4. Total internal reflection using laser source 5. Diffraction of light through grating 6. Refractive index of solution using LASER 7. image formation by number of plane mirror 8. Focal length of concave mirror 9. Familiarization of Spectrometer 10. Focal length of lens
B	**Group B (Any 6)** 1. Transistor as a switch 2. De Sauty's bridge 3. Seven segment display 4. IC 555 timer as a Astable Multivibrator (using CRO) 5. High pass filter 6. Band pass filter 7. Transistor CE characteristics 8. Diode Forward and Reverse bias

C	**Group 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 up to the satisfaction of professor In-charge of practical. 3. Study tour. Students participating in the study tour must submit a study tour report

References:

1. Advanced course in Practical Physics D. Chattopadhyay, PC Rakshit & B Saha. (6th Edition) Book and Allied Pvt. Ltd.
2. B.Sc. PRACTICAL Physics – Harnam Singh S. Chand & Co. Ld. 2001
3. A test book of advanced practical PHYSICS _ SAMIR Kumar Ghosh, New Central Book Agency (3rd edition)
4. B.Sc. Practical Physics – CL Arora (1st Edition) -2001 S. Chand and Co Ltd.
5. Practical Physics CL Squires (3rd Edition) Cambridge University
6. University Practical Physics – DC Tayal. Himalaya Publication
7. Advanced Practical Physics – Worsnop Flint.

Course Description: B.Sc. (Physics)	
Semester	II
Course Name	VEC (Digital Technology II)
Course Code	UVEC2DT2
Eligibility for the Course	12th Science of all recognised Board
Credit	2
Hours	2 Hrs. per week (30 Hours)

CO No.	**COs Statement** **After completing the Bachelor of Science Program, students will be able to-**
CO-1	Discuss the principles, models, and transmission media of communication systems, future trends and implications of digital technologies on various sectors.
CO-2	Analyze the need for digital inclusion and empowerment, along with the associated challenges.
CO-3	Evaluate government-to-citizen (G2C) services, including online portals and mobile applications for accessing government services.
CO-4	Examine blockchain technology and its implications for security initiatives by the Government of India..

Unit	**Course Description**	Hrs

1.1	**Communication systems** Principles, model & transmissions media, Computer network, Internet: concept and applications.	15
1.2	**Digital Inclusion and Digital Empowerment** Need and Challenges, Vision of Digital India : e Hospital, e pathshala, BHIM, swayam portal, e kranti (Electronic delivery services), e health campaign, Digital signatures	
2.1	**Government-to-Citizen (G2C) Services:** The digital services provided by the government to citizens like online portals, mobile applications, and other digital platforms to access government services	15
2.2	**Digital Safety Measurements Tools:** Online security and privacy, threats in digital world : various forms of viruses, Data breach and cyber Attacks, Blockchain technology, Security initiatives by Govt of India, Cyber security	
2.3	**Emerging Technologies and their applications:** Overview of cloud computing, Big Data, IoT, Virtual reality, Robotics, AI, 3 D printing, future of digital technologies.	

References:

1. Fundamentals of Computer Hardware : Tata MsGraw Hill
2. Data communication and Networking : Behrouz, Mcgraw Hill Education
3. Emerging Technologies in Computing : Theory, Practice and Advances : P.Kumar, A.Tomar, R.Sharma
4. Essentials of Cloud computing : K. Chandresekhran, CRC press 2014
5. Block chain : Blue print for new economy , M.Swan O Really Media, 2015
6. Understanding digital letarcies : A practical introduction. Rodney Jones and Christopher Hafner
7. Block chain : blue print for new economy, M.Swan
8. https://www.digitalindia.gov.in
9. https://www.digilocker.gov.in
10. https://www.cybercrime.gov.in
11. https://www.cybersafety.gov.in
12. https://www.meity.gov.in

Course Description: B.Sc. (Physics)	
Semester	II
Course Name	OE(Solar Energy- Fundamentals & Its Applications-I)
Course Code	UOE2SE
Eligibility for the Course	12th Science of all recognised Board
Credit	2
Hours	2 Hrs. per week

CO No.	COs Statement After completing the Bachelor of Science Program, students will be able to-
CO-1	Learn and acquire hands-on experience in the handling Solar / PV cells
CO-2	Learn and acquire knowledge the solar energy and its relevance.
CO-3	Design and trouble shoots the basic electrical circuits through hands-on mode
CO-4	Design basic solar systems.
CO-5	Familiarize to determine the effect of several variables on the output
CO-6	Identify the basic components used for Solar systems
CO-7	Explores energy from the sun in terms of radiant energy to expand on the concept of electricity generation.

Unit	Course Description	Hrs
1.1	**Sources Of Energy** : Geothermal energy, Wind Energy, Tidal and Wave Energy	15
1.2	**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	
2.1	**Types of Solar PV system** : Rooftop & Solar utilities, Types of Solar Panels	
2.2	**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	

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)**.	30

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

Academic Council Date –13 June, 2024
Item No. –2

Janardan Bhagat Shikshan Prasarak Sanstha's

CHANGU KANA THAKUR

Arts, Commerce and Science College, New Panvel (Autonomous)

Re-accredited A+ Grade by NAAC (Third Cycle-CGPA-3.61)
'College with Potential for Excellence' Status Awarded by UGC
'Best College Award' by University of Mumbai

As per National Education Policy - 2020

Title of the Programme

B. Sc. in Physics

(Faculty of Science)

Syllabus for S.Y. B. Sc. (Physics)

Semester III and IV

(With effect from the academic year 2024-25)

Janardan Bhagat Shikshan Prasarak Sanstha's

CHANGU KANA THAKUR

Arts, Commerce and Science College, New Panvel (Autonomous)

As per National Education Policy - 2020

Sr. No.	Heading	Particulars
1	Title of program	B.Sc in Physics
2	Eligibility	F.Y.BSC passed out
3	Duration of program	1 year
4	Intake Capacity	40
5	Scheme of Examination	60:40
6	Standards of Passing	
7	Semesters	III & IV
8	Program Academic Level	
9	Pattern	Semester
10	Status	as per NEP 2020
11	To be implemented from Academic Year	Academic Year 2024-25

Mrs. G. U. Patil
Head, Department of Physics
Changu Kana Thakur
A.C.S. College, New Panvel
(Autonomous)

Prof. (Dr.) S.K. Patil
Principal
Changu Kana Thakur
A.C.S. College, New Panvel
(Autonomous)

C.K.T.A.C.S. COLLEGE NEW PANVEL

Janardan Bhagat Shikshan Prasarak Sanstha's
CHANGU KANA THAKUR
Arts, Commerce and Science College, New Panvel (Autonomous)

Program Outcomes (POs)

PO No.	POs Statement After completing the Bachelor of Science Program, students will be able to-	Knowledge and Skill
PO-1	The knowledge of the disciplines and in-depth and extensive knowledge, understanding and skills in a specific field of interest.	Disciplinary knowledge
PO-2	An ability to develop and conduct experiments, analyze, and interpret data and use scientific judgement to draw conclusions	Scientific reasoning
PO-3	An ability to use current technology, and modern tools necessary for creation, analysis, dissemination of information.	Digital literacy
PO-4	Innovative, professional, and entrepreneurial skills needed in various disciplines of science.	Life-long learning
PO-5	An ability to achieve high order communication skills	Communication Skills
PO-6	An ability to collect, analyze and evaluate information and ideas and apply them in problem solving using conventional as well as modern approaches	Problem solving
PO-7	A sense of social responsibility; intellectual and practical skills and demonstration of ability to apply it in real-world settings.	Reflective thinking
PO-8	An ability to engage in independent and life-long learning through openness, curiosity, and a desire to meet new challenges.	Life-long learning
PO-9	A capacity to relate, collaborate, and lead others, and to exchange views and ideas to work in a team to achieve desired outcomes	Teamwork
PO-10	An ability to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings	Leadership
PO-11	An ability to understand values, ethics, and morality in a multidisciplinary context	Moral and ethical awareness

Janardan Bhagat Shikshan Prasarak Sanstha's

CHANGU KANA THAKUR

Arts, Commerce and Science College, New Panvel (Autonomous)

Program Specific Outcomes (PSOs)

PSO No.	PSOs Statement
	After completing the Bachelor of Science Program, students will be able to-
PSO-1	Apply advanced mathematical methods such as differential equations, linear algebra, and complex analysis to solve physical problems.
PSO-2	Design and implement analog signal processing circuits including filters and amplifiers.
PSO-3	Analyze the motion of particles and rigid bodies in various force fields.
PSO-4	Design and analyze optical instruments such as microscopes, telescopes, and cameras.
PSO-5	Solve the Schrödinger equation for different potentials and interpret the solutions..
PSO-6	Apply statistical mechanics to relate macroscopic thermodynamic properties to microscopic behavior.
PSO-7	Test electronic circuits using standard laboratory equipment.
PSO-8	Implement combinational and sequential digital logic circuits.
PSO-9	Write and debug assembly language programs for the 8085 microprocessor.

Janardan Bhagat Shikshan Prasarak Sanstha's
CHANGU KANA THAKUR
Arts, Commerce and Science College, New Panvel (Autonomous)

Preamble

The new curriculum offers courses in the core areas of Mechanics, Acoustics, optics, Theory of Relativity and Quantum physics etc. The courses will train students with sound theoretical and experimental knowledge that suits the need of academics and industry. In addition to the theoretical course work, students also learn physics laboratory methods for different branches of physics, specialised measurement techniques, analysis of observational data, including error estimation.

Students will have a deeper understanding of laws of nature through subjects like classical mechanics, quantum mechanics, statistical physics etc. Students' ability to problem solving will be enhanced. Students can apply principles in physics to real life problems. Subjects like Integrated electronics and Microprocessors will enhance logical skills as well as employability skills. Numerical methods and Mathematical Physics provide analytical thinking and provide a better platform for higher level physics and research.

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. Questions 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. Questions 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. Questions 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.

3) All these rules maybe amended as and when required with authorisation of Academic bodies.

Janardan Bhagat Shikshan Prasarak Sanstha's

CHANGU KANA THAKUR

Arts, Commerce and Science College, New Panvel (Autonomous)

Syllabus for S.Y.B. Sc. (Physics)

Choice Based Credit System

Under New Education Policy (NEP) 2020

(To be implemented from the academic year 2024-2025)

No. of Courses	Semester I	Credits	No. of Courses	Semester II	Credits
A	***Discipline Specific Course (Major)***		**A**	***Discipline Specific Course (Major)***	
1	Mathematical Physics ,Analog Electronics, Classical Mechnics	3+1	1	Quantum mechanics, Thermodynamics, Electronics	3+1
2	Optics	3+1	2	Digital Electronics And 8085 Microprocessor	3+1
B	***Vocational Skill Course (VSC)***		***B***	***Skill Enhancement Course (SEC)***	
3	Basic mechanics and Electronics	02	3	Basics of Optics & Electronics	02
C	***Minor course(Any One)***		***C***	***Minor course(Any One)***	
4	Maths	3+1	4	Maths	3+1
5	Chemistry	3+1	5	Chemistry	3+1
D	***Open elective Course (Any One)***		***D***	***Open elective Course (Any One)***	
6	Physical Geography	02	6	Physical Geography	02
7	Economics	02	7	Economics	02
8	Indian politics	02	8	Indian poltics	02
E	***Field Project (FP)***		***E***	***Community Oriented (CO)***	
9	Physics field project	02	9	Physics community oriented	02
F	***Ability Enhancement Course (AEC)***		***F***	***Ability Enhancement Course (AEC)***	
10	Communication skills in English	02	10	Communication skills in English	02
G	***Co-curricular Courses (Any One)***		***G***	***Co-curricular Course (Any One)***	
11	Foundation Course in NSS-I	02	11	Foundation Course in NSS-II	02
12	Foundation Course in NCC-I	02	12	Foundation Course in NCC-II	02
13	Foundation Course in PE-I	02	13	Foundation Course in PE-II	02
14	Foundation Course in PA-I	02	14	Foundation Course in PA-II	02
Total Credits		22	Total Credits		22

Choice Based Credit System (CBCS)
S.Y.B. Sc. Physics Syllabus
To be implemented from the Academic year 2024-2025

SEMESTER III

Course Code	Course Type	Course Title	Credit
USC3PH1	Major Physics I	Mathematical Physics ,Analog Electronics, Classical Mechanics	03
USC3PH2	Major Physics II	Optics	03
USC3PHP	Practical	Practicals of USC3PH1 and USC3PH2	02
UVSC3BTSM	VSC Physics	Basic Techniques for synthesis of materials	02
USC3PMM	Minor Physics	Properties of Matter	03 +1
USC3FPPH	Field project	Physics field project	02
Total Credits			**16**

Course Description: B.Sc. (Physics)	
Semester	III
Course Name	Major Physics-1 (Mathematical Physics ,Analog Electronics, Classical Mechanics)
Course Code	USC3PH1
Eligibility for the Course	12th Science of all recognised Board
Credit	3
Hours	3 Hrs. per week

CO No.	**COs Statement**
	After completing the Bachelor of Science Program, students will be able to-
CO-1	Solve numerical problems based on laws of conservation of momentum & energy, compound pendulum, damped harmonic oscillator, forced harmonic oscillator, Vector integrals, transistors, General amplifier.
CO-2	Determine the operating point, stability factor for different transistor biasing methods, conditions for forced & damped harmonic oscillator, time period of compound pendulum, Momentum for particles.
CO-3	Discuss basic of Semiconductor and its Application, Transistors, Oscillators, Opamp, Gradient, Curl, Divergence terms & its applications, laws of

	conservation of momentum & energy, compound pendulum, damped & forced harmonic oscillator

Unit	Course Description	Hrs
1.1	**GRADIENT, DIVERGENCE AND CURL:** The ∇ operator, Definitions and physical significance of Gradient, Divergence and Curl; Distributive Laws for Gradient, Divergence and Curl (Omit proofs); Problems based on Gradient, Divergence and Curl. [MS]:4.1,4.2,4.3,4.4,4.5	15
1.2	**LINE INTEGRAL** Line, Surface and Volume Integrals, The Fundamental Theorem of Gradient (statement & Relevance), The Fundamental Theorem of Divergence (statement & Relevance) , The Fundamental Theorem of Curl(statement & Relevance) [MLB] :6.8,6.10,6.11 , [SLS] :5.1,5.3,5.4,5.5,6.1,6.2,6.3	
2.1	**PRACTICAL APPLICATIONS OF SEMICONDUCTOR:** Review of Semiconductor Diodes: p and n type semiconductors. Barrier Formation in PN Junction Diode, Forward and Reverse Biased Diode. PN junction and its characteristics. Principle and structure of LEDs, Photodiode, Seven segment display [VKM]:5.1,5.8,5.9,5.10,5.11,5.14,5.16,5.19,7.2,7.3, 7.4,7.5,7.6,7.7,7.9,7.10	15
2.2	**TRANSISTOR BIASING** Inherent Variations of Transistor Parameters, Stabilisation, Essentials of a Transistor Biasing Circuit, Stability Factor, Methods of Transistor Biasing, Base Resistor Method, Voltage Divider Bias Method, Stability factor for Potential Divider Bias. [VKM] : 9.1 – 9.13	
2.3	**GENERAL AMPLIFIER CHARACTERISTICS** Concept of amplification, amplifier notations, current gain, Voltage gain, power gain, input resistance, output resistance,Practical circuit of transistor amplifier, phase reversal, frequency response, Decibel gain and Band width [AM] :7.1-7.8; [VKM] :13.1, 13.4	
3.1	**DYNAMICS OF SYSTEM OF PARTICLES** Centre Of Mass, Motion Of The Centre Of Mass, Linear Momentum Of A Particle Linear Momentum Of A System Of Particles, Linear Momentum w.r.t. CM Coordinate (I.E Shift Of Origin From Lab To CM), Conservation Of Linear Momentum, Some Applications Of The Momentum Principle, System Of Variable Mass Torque Acting On A Particle, Angular Momentum Of A Particle, Angular Momentum Of System Of Particles, Total Angular Momentum w.r.t. CM Coordinate, Conservation of Angular Momentum, Numericals. [MHP]: 4.2, 4.3, 4.4 , 9.1, 9.1.1(1 &4) ;[MMH]: 6.1-6.8 , 6.12, 6.13, 6.14 [PRH]: 9.1-9.7 , 15.1-15.8	**15**
3.2	**SIMPLE HARMONIC OSCILLATIONS**	

	The Simple Harmonic Oscillator, Relation Between Simple Harmonic Motion And Uniform Circular Motion, Two Body Oscillations, Compound Pendulum, Expression For Period, Maximum And Minimum Time Period, Centres Of Suspension And Oscillations Reversible Compound Pendulum, Bessel's Formula, Kater's Reversible Pendulum, Compound Pendulum And Simple Pendulum- A Relative Study, Numericals. [MHP]: 4.2, 4.3, 4.4, 9.1, 9.1.1(1 &4) ;[MMH]: 7.1, 7.2, 7.3, 7.7.1, 7.7.2, 7.8 [PRH]: 9.1-9.7, 15.1-15.8	

References:

[SLS] :Vector Analysis , Murray Spiegel, Seymour Lipschutz, Deniis Spellman, 2nd Edition
[MLB] :Mathematical Methods in Physical Sciences, 3rd Edition, Mary Ll. Boas
[VKM] : Principles of Electronics – V. K. Mehta and Rohit Mehta. (S. Chand Multicoloured illustrative edition)
[AM] : [Electronic devices and circuits – An introduction Allan Mottershead (PHI Pvt. Ltd.– EEE – Reprint – 2013)
[MS]:Murray R Spiegel, Schaum's outline of Theory and problems of Vector Analysis, Asian Student Edition
[MHP] Mechanics : H. S. Hans and S. P. Puri, Tata McGraw Hill (2nd edition)
[MMH] Mechanics : Prof. D. S. Mathur and Dr. P.S. Hemne, S. Chand Publication

Course Description: B.Sc. (Physics)	
Semester	III
Course Name	Major Physics-2 (Optics)
Course Code	USC3PH2
Eligibility for the Course	12th Science of all recognised Board
Credit	3
Hours	3 Hrs. per week

CO No.	**COs Statement** **After completing the Bachelor of Science Program, students will be able to-**
CO-1	Explain the factors affecting Acoustics of buildings, Principle of operation of LASER and Propagation of light through Optical Fiber, variation of Physical and Chemical properties in the interior of the Earth, Continental drift, Plate tectonics, Types of plates and Cause of Earthquake
CO-2	Interpret the concept of relativistic simultaneity, how events that are simultaneous in one frame of reference may not be simultaneous in another frame.
CO-3	Discuss the concept of mass-energy equivalence as introduced by the Special Theory of Relativity, including the famous equation $E=mc^2$

Unit	**Course Description**	Hrs
1.1	**LASER**	15

	Introduction, transition between atomic energy states, Principle of Laser, Properties of Laser: Coherence Properties of LASER, Spatial Coherence Length, Directionality, Intensity, Helium–Neon Laser, Application of Laser, Holography [SP]: 9.1, 9.2, 9.3, 9.4, 9.4.1, 9.4.2, 9.4.3, 9.4.4, 9.6 & 9.10	
1.2	**FIBRE OPTICS:** Light propagation through Fibres, Fibre Geometry, Internal reflection, Numerical Aperture, Step-Index and Graded-Index Fibres, Applications of Optical Fibres. [SP]: 13.3, 13.3.1, 13.3.2, 13.3.3, 13.5 & 13.9	
2.1	**FRESNEL'S DIFFRACTION:** **(Review of Huygens's - Fresnel theory, Distinction between interference and diffraction,** Fresnel and Fraunhoffer types of diffraction) Fresnel's assumptions, Rectilinear propagation (Half period zones) of light, Diffraction pattern due to straight edge, Positions of maxima and minima in intensity, Intensity at a point inside the geometrical shadow(straight edge), Diffraction due to a narrow slit, Diffraction due to a narrow wire [OSB]: 17.1-17.5, 17.10-17.12; [OAG]: 20.1, 20.2, 20.6, 20.7	
2.2	**POLARIZATION:** (Introduction of Polarization, Natural light is unpolarized, Unpolarized and Polarized light, Brewster's law, Polaroid sheets) Types of polarization, Plane polarized light, Circularly polarized light, Elliptically polarized light, Partially polarized light, Production of Plane polarized light, Polarization by reflection from dielectric surface, Polarization by refraction –pile of plates, Polarization by scattering, Polarization by selective Absorption, Polarization by double refraction, Polarizer and Analyzer, Malus' Law, Anisotropic crystal, Calcite crystal, Optic Axis, Double refraction in calcite crystal, Huygens' explanation of double refraction, Ordinary and Extraordinary rays, Positive and Negative crystals, Superposition of waves linearly polarized at right angles, Superposition of e-Ray and o-Ray, Retarders, Quarter wave plate, Half wave plate, Production of linearly polarized light, Production of elliptically polarized light, Production of circularly polarized light, Analysis of polarized light, Applications of polarized light. [OSB]: 20.1-20.11, 20.18-20.22, 20.26 ; [OAG]: 22.1-22.7	15
3.1	**ELECTRICAL PROPERTIES OF MATERIALS:** Review of energy band diagram for materials, conductors, semiconductors and insulators, Electrical conductivity in metals, semiconductors and insulators (dielectrics), effect of temperature on conductivity. [VR]: 14.1, 14.2, 14.3; [RH]: 7.3, 8.1	**15**
3.2	**MAGNETIC PROPERTIES OF MATERIALS:** Origin of magnetism in solids (basic idea), Types of magnetic order (paramagnetism, diamagnetism, antiferromagnetism, ferromagnetism, ferrimagnetism), magnetic hysteresis. [RH]: 15.1.1, 15.1.2, 15.1.3, 15.1.4, 15.1.5	

References:

[SP]: Modern Physics Concept and Applications – Sanjeev Puri, Narosa Publication
[OSB]: A Textbook of Optics: Dr. N. Subrahmanyam, Brijlal, Dr M. N.Avadhaanulu (S. Chand, 25th Revised edition 2012 Reprint 2013)
[OAG]: OPTICS (5th Edition): Ajoy Ghatak
[RH]: Electronic Properties of Materials, Rolf E Hummel.
[VR]: Materials Science and Engineering: A First Course by V. Raghavan

Course Description: B.Sc.(Physics)	
Semester	III
Course Name	Practicals of USC3PH1 and USC3PH2
Course Code	USC3PHP
Eligibility for the Course	12th Science of all recognised Board
Credit	1
Hours	2 Hrs. per week

CO No.	**COs Statement**
	After completing the Bachelor of Science Program, students will be able to-
CO-1	Experiment with CE amplifier, compound Pendulum
CO-2	Inspect frequency response, voltage gain, acceleration of gravity.
CO-3	Construct electronic circuits using resistor, capacitor, diode, transistor.

Group	**Course Description**
A	**Group A** Skill 1. Designing of circuit on breadboard 2. Measurement of time 3. Component testing, colour code of resistors, capacitors etc Practicals (Any 06) 1. CE amplifier: determination of bandwidth 2. CE amplifier: variation of gain with load 3. Kater's Pendulum 4. Resonance Pendulum 5. Moment of Inertia of compound pendulum by method of coincidence. 6. Solving Gradient theorem, 7. Solving divergence theorem 8. C1/C2 by de- Sauty's method.

B	**Group B** Skill 1. Schuster method 2. Error Analysis 3. Plotting of graph Practicals (Any 06) 1. Optical lever 2. Resolving power of telescope 3. Cauchy's constant 4. R. I. of liquid using Laser 5. Brewster law 6. Single slit diffraction 7. Polarisation 8. Fresnel's bi-prism: determination of wavelength 9. Double refraction
C	**Group 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

References:

1. Advanced course in Practical Physics D. Chattopadhyay, PC Rakshit & B Saha. (6th Edition) Book and Allied Pvt. Ltd.
2. B.Sc. PRACTICAL Physics – Harnam Singh S. Chand & Co. Ld. 2001
3. A test book of advanced practical PHYSICS _ SAMIR Kumar Ghosh, New Central Book Agency (3rd edition)
4. B.Sc. Practical Physics – CL Arora (1st Edition) -2001 S. Chand and Co Ltd.
5. Practical Physics CL Squires (3rd Edition) Cambridge University
6. University Practical Physics – DC Tayal. Himalaya Publication
7. Advanced Practical Physics – Worsnop Flint.

Course Description: B.Sc.(Physics)	
Semester	III
Course Name	VSC (Basic Techniques for synthesis of materials)
Course Code	UVSC3BTSM
Eligibility for the Course	12^{th} Science of all recognised Board
Credit	2
Hours	4 Hrs per week

CO No.	**COs Statement**
	After completing the Bachelor of Science Program, students will be able to-

CO-1	Anticipate the fundamental concepts of solution preparation, including molarity, molality, molar mass, molecular weight, solute, solvent, and solution.
CO-2	Apply mathematical calculations for preparing molar solutions and composites accurately.
CO-3	Demonstrate proficiency in using laboratory solution preparation devices like weighing balances and magnetic stirrers, understanding their principles, advantages, and limitations.
CO-4	Familiarize yourself with various synthesis methods such as microwave synthesis, co-precipitation, hydrothermal, ultrasonication, and silar techniques, understanding their principles and applications in practical experiments.
CO-5	Develop hands-on skills in preparing solutions, synthesizing materials, and conducting experiments using appropriate laboratory techniques and equipment.
CO-6	Analyze experimental data, interpret results, and draw conclusions based on the principles of solution chemistry and synthesis methods.

Practicals (Any 16)

1. Identification and study of different laboratory precise measuring instruments.
2. Study and use a weighing machine .
3. Study and use of magnetic stirrer, magnetic needle.
4. Use of pH meter and Litmus paper and check the pH of solution (soap, sea water, distilled water, milk, dishwasher, face wash, shampoo)
5. Check the pH of the Glucose solution in 500 ml distilled water.
6. Check the pH of different solutions (milk , sugar syrup, lemon) with different ratios with water and classify them in acid, base and neutral.
7. Prepare 800 ml of 2M neutral salt like NaCl, KCL solution
8. Prepare 1000 ml of 1M acid like dilute H2SO4 solution
9. Prepare 1000 ml of 0.1 M Base like NaOH solution.
10. Prepare Composite by Weight of any material in a 1:2 ratio.
11. Prepare Composite by Volume of any material in a 1:2 ratio.
12. Prepare sulphate material (ZnSo4) by microwave synthesis methods
13. Prepare Metal oxide (ZnO) thin film by silar method.
14. Prepare sulphides(CdS /ZnS)thin film by silar method.
15. Synthesis of Sulphides and Nitrides (zinc sulphide and copper Nitrite) using microwave synthesis
16. Synthesis of phosphates using sonication
17. Study of the acids of vegetables and fruits.
18. Preparation of plant extract of different plants and identify it's pH.
19. To measure intensity of light by using Lux meter
20. To measure audibility using a sound meter.
21. Collection of different synthesis for preparation of nanomaterials (equivalent to two Practicals)

Reference Books:

1. A Handbook of Laboratory preparation solutions, M. H. Gabb, W. B. Latchem
2. Synthesis and Applications of Nanoparticles , Atul Thakur, Preeti Thakur, S. M. Paul khaurana.
3. The laboratory companion Gary S. Coyne

Course Description: B.Sc. (Physics)	
Semester	III
Course Name	Minor (Properties of Matter)
Course Code	USC3PMM
Eligibility for the Course	12th Science of all recognised Board
Credit	3+1
Hours	2 Hrs. per week

CO No.	**COs Statement**
	After completing the Bachelor of Science Program, students will be able to-
CO-1	Measure different mechanical properties of Solids like the Moment of Inertia, Modulus of Elasticity
CO-2	Apply laws of elasticity, moment of inertia concepts in various physical situations
CO-3	Describe the fundamental concepts of electrical conductivity, resistivity, and dielectric properties of materials
CO-4	Classify materials based on their magnetic properties and explain the role of crystal structure and chemical composition in these properties

Unit	**Course Description**	Hrs
1.1	**ELASTICITY:** 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	**MOMENT OF INERTIA:** Rotational Dynamics: Centre of Mass, Motion of CoM, Centre of Mass and Laboratory frames, Angular momentum of a particle and system of particles, Principle of conservation of angular momentum, Rotation about a fixed axis, Moment of Inertia, Perpendicular and Parallel Axis Theorems, Calculation of moment of inertia for cylindrical and spherical bodies.	
2.1	**ELECTRICAL PROPERTIES OF MATERIALS:** Review of energy band diagram for materials, conductors, semiconductors and insulators, Electrical conductivity in metals, semiconductors and insulators (dielectrics), effect of temperature on conductivity.	15

	[VR]: 14.1, 14.2, 14.3 [RH]: 7.3, 8	
2.2	**MAGNETIC PROPERTIES OF MATERIALS:** Origin of magnetism in solids (basic idea), Types of magnetic order (paramagnetism, diamagnetism, antiferromagnetism, ferromagnetism, ferrimagnetism), magnetic hysteresis. [RH]: 15.1.1, 15.1.2, 15.1.3, 15.1.4, 15.1.5	

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
3. [RH]: Electronic Properties of Materials, Rolf E Hummel.
4. [VR]: Materials Science and Engineering: A First Course by V. Raghavan

Group	Course Description
A	**Skill Experiment (2)** 1. Use of Vernier Calliper 2. Use of Micrometer Screw gauge 3. Measurement of Time period **Practicals (any 6)** 1. Torsional Oscillation 2. Bifilar Pendulum 3. Flywheel 4. Y by vibrations: Flat spiral Spring 5. Y by vibrations: Single Cantilever 6. Modulus of rigidity: Flat spiral Spring 7. Moment of Inertia of Solid disc 8. Moment of Inertia of cylindrical rod
B	**Skill Experiment (2)** 1. Use of DMM 2. Plotting of Graph 3. Testing of components **Practicals (Any 6)** 1. Thermistor Characteristics 2. Temperature coefficient of conductor 3. LDR characteristics 4. p-n junction diode as a forward bias 5. Seven segment display 6. Measurement of Capacitance using CR circuit

References

1. D. C. Tayal, edited by 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.

Choice Based Credit System (CBCS)
S.Y.B. Sc. Physics Syllabus
To be implemented from the Academic year 2024-2025

SEMESTER IV

Course Code	Course Type	Course Title	Credit
USC4PH1	Major Physics I	Quantum mechanics, Thermodynamics, Electronics	03
USC4PH2	Major Physics II	Digital Electronics And 8085 Microprocessor	03
USC4PHP	Practical	Practicals of USC4PH1 and USC4PH2	02
USEC4EDC	SEC Physics	Electronic devices and circuits	02
USC4OEM	Minor Physics	Optics and electronics	03 +1
USC4COPH	Community oriented	Physics community oriented	02
Total Credits			**16**

Course Description: B.Sc. (Physics)	
Semester	IV
Course Name	Major Physics-1 (Quantum mechanics, Thermodynamics, Electronics)
Course Code	USC4PH1
Eligibility for the Course	12th Science of all recognised Board
Credit	3
Hours	3 Hrs. per week

CO No.	**COs Statement**
	After completing the Bachelor of Science Program, students will be able to-
CO-1	Explain postulates of quantum mechanics, operators, expectation values in quantum mechanics and Schrodinger's equation, thermodynamics law
CO-2	Design basic circuits using Op-amp , transistor , oscillator
CO-3	Apply the OPAMP, Oscillators circuits for various applications like Inverting, Noninverting, Integrator, Differentiator, Wein bridge oscillator to find voltage gain and critical frequency.

CO-4	Solve numerical sums related to Quantum Mechanics, Thermodynamics, OPAMP and oscillators

Unit	Course Description	Hrs
1.1	**BASIC CONCEPTS OF QUANTUM MECHANICS: I** Concept of wave function, Born interpretation of wave function. Normalisation of wave functions, stationary states, Postulates of Quantum Mechanics. Superposition principle, Schrondinger Equation, Numericals [BMC] :5.1-5.7 ; [SBS] :4.1-4.12	15
1.2	**BASIC CONCEPTS OF QUANTUM MECHANICS : II** Concepts of operator in quantum mechanics examples, position, momentum and energy operators. Eigenvalue equations, expectation values of operators	
2.1	**BEHAVIOUR OF REAL GASES:** Behaviour of real gases and real gas equation, Van der Waal equation [BSH]: 2.1 to 2.12	15
2.2	**THERMODYNAMICS:** Thermodynamic Systems, Zeroth law of thermodynamics, Concept of Heat, The first law, Non Adiabatic process and Heat as a path function, Internal energy, , Heat Capacity and specific heat, Applications of first law to simple processes, general relations from the first law, Indicator diagrams, Work done during isothermal and adiabatic processes, Worked examples, Problems. [BSH]: 4.1 to 4.14	
3.1	**FEEDBACK** General theory of feedback, Types of Feedback, Advantage of Negative Voltage feedback, reasons for negative feedback, loop gain. [AM]: 10.2,10.3,10.4,10.5	**15**
3.2	**OSCILLATORS** Introduction, effect of positive feedback. Requirements for oscillations, phase shift oscillator, Wien Bridge Oscillator, Colpitt's oscillator, Hartley oscillator [VKM]:14.1,14.2,14.3,14.5,14.6,14.8,14.10,14.11,14.13,14.14	
3.3	**OPERATIONAL AMPLIFIERS** Introduction, Schematic symbol of OPAMP, Output voltage from OPAMP, AC analysis, Bandwidth of an OPAMP, Slew rate, Frequency Response of an OPAMP, OPAMP with Negative feedback, Inverting Amplifier, Non-Inverting Amplifier, Voltage Follower, Summing Amplifier, Applications of Summing amplifier, OPAMP Integrator and Differentiator, Critical frequency of Integrator	

	[VKM] : 25.1, 25.2, 25.3, 25.4,25.5,25.8,25.16,,25.17,25.19,25.20,25.23,25.24,25.26,25.27,25.35 ,25.36,25.37	

References:

[BMC] :Concepts of Modern Physics – A. Beiser, Mahajan, Choudhary (6th Ed.) Tata McGraw Hill.
[SBS] :Quantum Mechanics – S P Singh, M K Bagade, Kamal Singh, - S. Chand : 2004 Ed.
[CR] :Quantum Mechanics, Statistical Mechanics and Solid State Physics: An introduction , D. Chattopadhyay, P.C.Rakshit
[VKM] : Principles of Electronics – V. K. Mehta and Rohit Mehta. (S. Chand – Multicoloured illustrative edition)
[AM] : Electronic devices and circuits – An introduction Allan Mottershead (PHI Pvt. Ltd.– EEE – Reprint – 2013)

Course Description: B.Sc. (Physics)	
Semester	IV
Course Name	Major Physics-2 (Digital Electronics And 8085 Microprocessor)
Course Code	USC4PH2
Eligibility for the Course	12th Science of all recognised Board
Credit	3
Hours	3 Hrs. per week

CO No.	**COs Statement**
	After completing the Bachelor of Science Program, students will be able to-
CO-1	Determine physical constants of solids, the Resolving power of telescope & grating, wavelength of the monochromatic light, refractive index.
CO-2	Design & construct MS-JK flip flop (IC 7476), Latch (IC 7400/IC 7402) , 8:3 Priority Encoder (IC 74LS148) and 3:8 Decoder (IC 74LS138), shift register, oscillator, Half adder and full adder using EX-OR gate, Op-amp as a Differentiator and Integrator.
CO-3	Develop a programme using 8085 microprocessor.
CO-4	Experiment with IC-7486, IC-7408, IC-7476, IC-7400, IC-7402, IC-74148, IC-74138, IC-74194, IC-741, spectrometer, telescope

Optics & Modern Physics		
Unit	**Course Description**	Hrs
1.1	**FLIP-FLOPS** RS Flip-Flops (only NOR gate latch, NAND gate latch), Gated Flip-Flops, Edge-Triggered RS Flip-Flop, Edge- Triggered D Flip-Flop,	15

	Edge-Triggered J-K Flip-Flop, JK Master- Slave Flip-Flops, Bounce elimination switch [LMS]: 8.1, 8.2, 8.3, 8.4, 8.5, 8.8, 8.9	
1.2	**555 TIMER:** Review Block diagram, Monostable, Bistable and Astable operation Voltage Controlled Oscillator, Pulse Width modulator, Pulse Position Modulation, Triggered linear ramp generator. KVR: 14.5.2.1, 14.5.2.5, 14.5.2.6, 14.5.4.1	
2.1	**BUILDING CONCEPT OF MICROPROCESSOR** Introduction, Study of Memory, Input Device, Output Device, Input/output Device Central Processing Unit. [VB] : 3.1 , 3.2 , 3.3 (3.3.1 , 3.3.2 , 3,.3.3) , 3.4. , 3.5 , 3.6 , 3.7	
2.2	**8085 MICROPROCESSOR** Introduction, Features of Inter 8085, Pin Diagram of 8085, 8085 CPU Architecture Arithmetic and Logical Group (ALU, Accumulator, Temporary Register, Flag Register (PSW), Register Group (Temporary Registers (W and Z), General purpose registers, Special Purpose registers), Interrupt Control, Serial I/O Control Group, Instruction Register Decoder and Control Group (Instruction Register, Instruction Decoder, Timing and Control) [VB]: 4.1 ,4.2, 4.3., 4.4, 4.5 (4.5.1, 4.5.2, 4.5.3, 4.5.4), 4.6 (4.6.1, 4.6.2, 4.6.3),4.7, 4.8, 4.9 (4.9.1, 4.9.2, 4.9.3)	15
3.1	**8085 INSTRUCTIONS SET** Introduction, Flowchart, Classification of Instruction Set (Data Transfer Group, Arithmetic Group, Logical Group, Branching Group, Stack and Machine Control Group), Notations used in Instructions and Opcode, Data Transfer Group, Program Examples for Data Transfer Group, Arithmetic Operation Group, Branch Group, Logical Group, Addressing Modes, 8085 Programmers Model. [VB]: 6.1 , 6.2 , 6.3 6.4 , 6.5 , 6.6 , 6.7 , 6.8 (6.8.1 , 6.8.2 , 6.8.3 , 6.8.8 , 6.8.9, 6.8.10 ,6.8.11 (A part Block Transfer) , 6.9 (6.9.1 upto 6.9.19) , 6.12 , 6.13	**15**
3.2	**BASICS OF COMMUNICATION:** Block diagram of communication system, types of communication system: simplex, duplex, analog and digital communication, Electromagnetic spectrum, baseband and broadband communication. Noise concept and types, signal to noise ratio, noise figure, noise temperature. [LF]: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6; [GK]: 1.1 – 1.6, 2.1 – 2.6	

References:

[LMS]: Digital Principles and Applications by Leach, Malvino, Saha Seventh edition.
KVR: Functional Electronics, K.V. Ramanan-TMH Publication
KVR: Functional Electronics, K.V. Ramanan-TMH Publication

[GK]: Electronics Communication Systems by George Kennedy, Bernard Davis & S R M Prasanna, fifth edition, McGraw Hill Education (India) Pvt. Ltd.
[LF]: Communication Electronics: Principles and applications by Louis E Frenzel, 3rd edition TMH Publications.

Course Description: B.Sc.(Physics)	
Semester	IV
Course Name	Practicals of USC4PH1 and USC4PH2
Course Code	USC4PHP
Eligibility for the Course	12th Science of all recognised Board
Credit	1
Hours	2 Hrs. per week

CO No.	**COs Statement**
	After completing the Bachelor of Science Program, students will be able to-
CO-1	Perform measurements of the voltage gain using OPAMP, physical constants related to heat.
CO-2	Construct circuits using ICs for OPAMP, Encoder, decoder, Flips flop applications
CO-3	Verify the truth table of ICS with its application.

Group	**Course Description**
A	**Group A** Skills 1. Introduction of Sci lab 2. Testing of IC 3. Use of CRO Practical (Any 6) 1. OPAMP : inverting 2. OPAMP : non inverting 3. OPAMP : integrator 4. OPAMP : Differentiator 5. Wein bridge Oscillator 6. Temperature coefficient of resistor 7. Lee method 8. Stefan law 9. Eigen value using Sci lab

B	**Group B** Skills 1. Circuit designing 2. Charging and discharging of capacitor 3. 8085 instructions Practicals (any 6) 1. Study of 8085 microprocessor kit and commands 2. Two-digit Decimal addition, subtraction 3. To find largest number/ smallest number 4. Memory block transfer from one location to another 5. Arrange number in ascending/descending order 6. Half adder and full adder using EX-OR gate (IC7486, IC 7408) 7. Study of MS-JK flip flop (IC 7476) 8. Study of Latch (IC 7400/ IC 7402) 9. Study of 8:3 Priority Encoder (IC 74LS148) 10. Study of 3:8 Decoder (IC 74LS138) 11. Shift Register (IC 74194)
C	**Group 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

References:

1. Advanced course in Practical Physics D. Chattopadhyay, PC Rakshit & B Saha. (6th Edition) Book and Allied Pvt. Ltd.
2. B.Sc. PRACTICAL Physics – Harnam Singh S. Chand & Co. Ld. 2001
3. A test book of advanced practical PHYSICS _ SAMIR Kumar Ghosh, New Central Book Agency (3rd edition)
4. B.Sc. Practical Physics – CL Arora (1st Edition) -2001 S. Chand and Co Ltd.
5. Practical Physics CL Squires (3rd Edition) Cambridge University
6. University Practical Physics – DC Tayal. Himalaya Publication
7. Advanced Practical Physics – Worsnop Flint.

Course Description: B.Sc.(Physics)	
Semester	IV
Course Name	SEC (Electronic devices and circuits)
Course Code	USEC4EDC
Eligibility for the Course	12th Science of all recognised Board
Credit	2
Hours	4 Hrs per week

CO No.	COs Statement **After completing the Bachelor of Science Program, students will be able to-**
CO-1	Anticipate fundamental Concepts of power supply circuits, function of transformers and electronic components such as resistors, switches, relays, and fuses in circuits .
CO-2	Designing Electronic Circuits such as P-N junction diodes , transistor, clipping circuits etc
CO-3	Develop Practical Skills and Application of Assembling solar study lamp, a personal computer etc.
CO-4	Familiarize with various types of Integrated Circuits (ICs), their pin configurations, and testing procedures, and utilize IC manuals for reference and troubleshooting.
CO-5	Hands-on Experience of transistors, amplifiers,oscillators, IC and flip-flops.

Practicals (Any 16)

1. Practical use of: Power Supply (study the variation in line and load voltage), Transformer
2. Study of Electronic Components:(a) Resistor (study the types, potential divider arrangement).(b) Switches, Relays, Fuse (basic function).
3. P-N Junction Diode (study V-I Characteristics)
4. Study the clipping circuits using diode
5. Study the transfer characteristics of all the clipping circuits in CRO.
6. Study of Transistors (manual study, CB/CC Characteristics, parameters).
7. Study of Transistor as switch
8. Use of IC 555 as timer
9. Study of Counter
10. Study of Amplifiers (Design of CB/CC, find Rin, Ro, Av).
11. Design and testing of (Hartley /Colpitt) transistorized oscillators .
12. Familiarization with IC types, pin number, testing, IC Manual.
13. Familiarization with different types of LED's, seven segment displays. Study the use of 7447 BCD to seven segment decoder.
14. Study of Flip-Flop IC chips and designing of D type flip-flops using IC7400.
15. Connection of Solar study lamp
16. MUX(4:1)IC 74153
17. DEMUX (1:4) IC 74151
18. Introduction and assembly of PC
19. Use of single and dual Switch
20. Study of RC phase shift oscillator
21. Collection of information related to different IC used in Mobile phones, laptops (equivalent of 2 Practicals)

Reference:

1. Electronic Devices and Circuits: Discrete and Integrated, Denton J. Dailey
2. Practical electronics for inventors Scherz, Monk, Paul, Simon
3. Fundamentals of Electronic Devices and Circuits (Algorithms for Intelligent Systems), G. S. Tomar

Course Description: B.Sc. (Physics)	
Semester	IV
Course Name	Minor (Optics and electronics)
Course Code	USC4OEM
Eligibility for the Course	12th Science of all recognised Board
Credit	3+1
Hours	2 Hrs. per week

CO No.	**COs Statement**
	After completing the Bachelor of Science Program, students will be able to-
CO-1	To explain the principles and applications of light, lenses, spectrometry, and combinational logic circuits.
CO-2	To explore the fundamental concepts and practical applications of optics and combinational logic circuits.

Classical Physics, Mathematical Physics		
Unit	**Course Description**	Hrs
1.1	**LIGHT:** Introduction, brief history, Sources of light, properties of light, Refractive Index, Law of Reflection, Law of Refraction, Dispersion, Visible range, Light rays, Reflection at plane surfaces (Mirrors) [BSA] : 1.1,1.2,1.4,1.5, 1.6,,1.8,1.10,3.1,3.2,3.3	15
1.2	**LENS :** Lens Maker's Formula (Review), Newton's lens equation, magnification-lateral, longitudinal and angular, Equivalent focal length of two thin lenses. [BSA] : 4.2,4.3,4.8,4.9,4.10,4.12,4.17,5.2	
1.3	**SPECTROMETER :** Introduction, parts of spectrometer, use of spectrometer	
2.1	**COMBINATIONAL LOGIC CIRCUITS:** Introduction, Multi-input, multi-output Combinational circuits, Code converters design and implementations Arithmetic Circuits: Introduction, Adder, BCD Adder, Excess – 3 Adder, Binary Subtractors, BCD Subtractor, Multiplier, Comparator.	15
2.2	Introduction, Multiplexer, Demultiplexer, Decoder, ALU, Encoders.	

References

1. [BSA] : Brijlal, Subramanyam and Avadhanulu A Textbook of Optics, 25th revised ed.(2012) S. Chand
2. [LMS]: Digital Principles and Applications by Leach, Malvino, Saha Seventh edition.
3. [RPJ] : Modern Digital Electronics by R. P. Jain, Tata McGraw Hill, 3rd edition.

Additional References:

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

Group	Course Description
A	**Skill Experiment (2)** 1. Spectrometer Schuster's method 2. Spherometer 3. Focallength of Lens **Practicals(any 6)** 1. Lens combination 2. Spectrometer: angle of prism 3. Spectrometer: RI of prism 4. Optical lever : radii of Lens 5. RI of water by laser beam 6. Multiple plane mirrors 7. Law of Reflection 8. Law of Refraction
B	**Skill Experiment (2)** 1. colour code of resistors, capacitors etc 2. Wiring of a simple circuit using a breadboard. 3. Testing of Logic gate IC's **Practicals(any 6)** 1. Half adder and full adder using EXOR gate (IC7486, IC 7408) 2. IC 7483 Adder 3. IC 7483 subtractor 4. Study of 8:3 Priority Encoder (IC 74LS148) 5. Study of 3:8 Decoder (IC 74LS138) 6. 1:4 demultiplexer 7. 4:1 Multiplexer 8. diode ROM arrayarray

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.

Academic Council Date –13 June, 2024
Item No. – 5

Janardan Bhagat Shikshan Prasarak Sanstha's

CHANGU KANA THAKUR

Arts, Commerce and Science College, New Panvel (Autonomous)

Re-accredited A+ Grade by NAAC (Third Cycle-CGPA-3.61)
'College with Potential for Excellence' Status Awarded by UGC
'Best College Award' by University of Mumbai

B. Sc. in Physics

(Faculty of Science)

Syllabus for T.Y. B. Sc. (Physics)

Semester V and VI

(With effect from the academic year 2024-25)

Janardan Bhagat Shikshan Prasarak Sanstha's

CHANGU KANA THAKUR

Arts, Commerce and Science College, New Panvel (Autonomous)

Sr. No.	Heading	Particulars
1	Title of program	B.Sc in Physics
2	Eligibility	Second Year pass out
3	Duration of program	1 year
4	Intake Capacity	40
5	Scheme of Examination	
6	Standards of Passing	
7	Semesters	V & VI
8	Program Academic Level	UG
9	Pattern	Semester
10	Status	
11	To be implemented from Academic Year	Academic Year 2024-25

Signature of Name

Head, Department of Physics

Changu Kana Thakur

A.C.S. College, New Panvel (Autonomous)

C.K.T.A.C.S. COLLEGE NEW PANVEL

Signature of

Prof. (Dr.) S.K. Patil

Principal

Changu Kana Thakur

A.C.S. College, New Panvel (Autonomous)

Janardan Bhagat Shikshan Prasarak Sanstha's

CHANGU KANA THAKUR

Arts, Commerce and Science College, New Panvel (Autonomous)

Program Outcomes (POs)

PO No.	POs Statement After completing the Bachelor of Science Program, students will be able to-	Knowledge and Skill
PO-1	The knowledge of the disciplines and in-depth and extensive knowledge, understanding and skills in a specific field of interest.	Disciplinary knowledge
PO-2	An ability to develop and conduct experiments, analyze, and interpret data and use scientific judgement to draw conclusions	Scientific reasoning
PO-3	An ability to use current technology, and modern tools necessary for creation, analysis, dissemination of information.	Digital literacy
PO-4	Innovative, professional, and entrepreneurial skills needed in various disciplines of science.	Life-long learning
PO-5	An ability to achieve high order communication skills	Communication Skills
PO-6	An ability to collect, analyze and evaluate information and ideas and apply them in problem solving using conventional as well as modern approaches	Problem solving
PO-7	A sense of social responsibility; intellectual and practical skills and demonstration of ability to apply it in real-world settings.	Reflective thinking
PO-8	An ability to engage in independent and life-long learning through openness, curiosity, and a desire to meet new challenges.	Life-long learning
PO-9	A capacity to relate, collaborate, and lead others, and to exchange views and ideas to work in a team to achieve desired outcomes	Teamwork
PO-10	An ability to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings	Leadership
PO-11	An ability to understand values, ethics, and morality in a multidisciplinary context	Moral and ethical awareness

Janardan Bhagat Shikshan Prasarak Sanstha's
CHANGU KANA THAKUR
Arts, Commerce and Science College, New Panvel (Autonomous)

Program Specific Outcomes (PSOs)

PSO No.	PSOs Statement
	After completing the Bachelor of Science Program, students will be able to-
PSO-1	Develop a comprehensive understanding of the principles of classical mechanics, including Newtonian mechanics, Lagrangian and Hamiltonian formulations.
PSO-2	Gain proficiency in analyzing and designing analog and digital electronic circuits.
PSO-3	Explore the applications of nuclear and particle physics in medicine, energy, and technology.
PSO-4	Gain insights into the implications of relativity on modern physics theories.
PSO-5	Learn the principles of statistical mechanics and their application to explain macroscopic properties of systems from microscopic behavior.
PSO-6	Explore applications of solid-state physics in technology and material science.
PSO-7	Comprehend the structure of atoms, including quantum states and spectra.
PSO-8	Apply principles of electrodynamics in real-world scenarios such as communication systems and waveguides
PSO-9	Develop skills in designing and implementing electronic instruments for specific applications.

Janardan Bhagat Shikshan Prasarak Sanstha's
CHANGU KANA THAKUR
Arts, Commerce and Science College, New Panvel (Autonomous)

Preamble

The Curriculum for T.Y.BSC Physics 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 completer and more logical framework in almost all areas of basic physics.

Janardan Bhagat Shikshan Prasarak Sanstha's
CHANGU KANA THAKUR
Arts, Commerce and Science College, New Panvel (Autonomous)

Syllabus for T.Y.B. Sc. (Physics) Semester V
Choice Based Credit System
(To be implemented from the academic year 2024-2025)

No. of Courses	Semester I	Credits	No. of Courses	Semester II	Credits
A	***Discipline Specific Course (Major)***		**A**	***Discipline Specific Course (Major)***	
1	Mathematical, Thermal and Statistical Physics	2.5	1	Classical Mechanics	2.5
2	Solid State Physics	2.5	2	Electronics	2.5
3	Atomic and Molecular Physics	2.5	3	Nuclear and Particle Physics	2.5
4	Electrodynamics	2.5	4	Special Theory of Relativity	2.5
5	Practicals of USC5PH1 & USC5PH2	3.0	5	Practicals of USC6PH1 & USC6PH2	3.0
6	Practicals of USC5PH3 & USC5PH4	3.0	6	Practicals of USC6PH3 & USC6PH4	3.0
7	Analog Circuits, Instruments And Consumer Appliances	2	7	Digital Electronics, Microprocessor ,Microcontroller and OOP	2
8	Practicals of USC5PH5	2	8	Practicals of USC6PH5	2
9	Basics of Electricity for wiring	2	9	Solar Energy-Fundamentals & Its Applications-I	2
Total Credits		22	Total Credits		22

Janardan Bhagat Shikshan Prasarak Sanstha's
CHANGU KANA THAKUR
Arts, Commerce and Science College, New Panvel (Autonomous)

Syllabus for T.Y.B. Sc. (Physics) Semester V
Choice Based Credit System
(To be implemented from the academic year 2024-2025)

SEMESTER V

Course Code	Course Type	Course Title	Credit
USC5PH1	Physics I	Mathematical, Thermal and Statistical Physics	2.5
USC5PH2	Physics II	Solid State Physics	2.5
USC5PH3	Physics III	Atomic and Molecular Physics	2.5
USC5PH4	Physics IV	Electrodynamics	2.5
USC5PH5	Physics V	Analog Circuits, Instruments And Consumer Appliances	2
USC5PHP1	Practical I	Practicals of USC5PH1 & USC5PH2	3.0
USC5PHP2	Practical II	Practicals of USC5PH3 & USC5PH4	3.0
USC5PHP3	Practical III	Practicals of USC5PH5	2
USC5BE	Credit course	Basics of Electricity for wiring	02
Total Credits			**22**

Course Description: B.Sc. (Physics)	
Semester	V
Course Name	Physics I (Mathematical, Thermal and Statistical Physics)
Course Code	USC5PH1
Eligibility for the Course	12th Science of all recognised Board
Credit	2.5
Hours	4 Hrs. per week

CO No.	**COs Statement**
	After completing the Bachelor of Science Program, students will be able to-

CO-1	Develop proficiency in using mathematical techniques such as differential equations, linear algebra, and complex analysis to solve physical problems.
CO-2	Explain Fermi-Dirac and Bose-Einstein statistics and their application to systems of indistinguishable particles.
CO-3	Apply statistical mechanics to explain the behavior of real gases, blackbody radiation, and specific heat capacities of solids.

Unit	**Course Description**	Hrs
1	**Probability** Review of basic concepts, introduction, sample space, events, independent events, conditional probability, probability theorems, methods of counting (derivation of formulae not expected), random variables, continuous distributions (omit joint distributions), binomial distribution, the normal distribution, the Poisson distribution. [MB]: 15.1-15.9 Expected to cover solved problems from each section and solve at least the following problems: section 2: 1-5, 11-15, section 3: 1, 3, 4, 5, section 4: 1, 3, 5,13, 21, section 5: 1, 10, 13, section 6: 1 to 9, section 8: 1 and 3, section 9: 2, 3, 4, 9., section 2: 1-5, 11-15, section 3: 1, 3, 4, 5, section 4: 1, 3, 5,13, 21, section, 5: 1, 10, 13, section 6: 1 to 9, section 8: 1 and 3, section 9: 2, 3, 4, 9.	15
2.1	**Complex functions and differential equations** 2.1 Functions of complex variables: The exponential and trigonometric functions, logarithms, complex roots and powers, inverse trigonometric functions, some applications. [MB]: 2.11 to 2.16 Expected to cover all solved problems. In addition, solve the following problems: section 2: 16 – 2, 3, 8, 9, 10.	15
2.2	Second-order nonhomogeneous equations with constant coefficients, method of separation of variables. [CH] :5.2.4, 5.3.1 to 5.3.4 Expected to cover all solved problems. In addition, solve the following problems: 5.17 a to e, 5.23, 5.26, 5.29 to 5.35.	
3	**Statistical Thermodynamics** Microstates and configurations, derivation of Boltzmann distribution, dominance of Boltzmann distribution, physical meaning of the Boltzmann distribution law, definition of , the canonical ensemble, relating Q to q for an ieal gas, translational partition function, equipartition theorem, energy, entropy [ER]: 13.1 to 13.5, 14.1, 14.2, 14.4, 14.8, 15.1, 15.4	**15**
4	**Classical and Quantum Statistics**	**15**

	The probability of a distribution, The most probable distribution, Maxwell- Boltzmann statistics, Molecular speeds. Bose-Einstein statistics, Black-body radiation, The Rayleigh-Jeans formula	

References:

1.MB: Mathematical Methods in the Physical sciences: Mary L. Boas Wiley India, 3rd ed.
2.ER: Thermodynamics, Statistical Thermodynamics and Kinetics: T. Engel and P. Reid , (Pearson).
3. AB: Perspectives of Modern Physics: Arthur Beiser, (Mc Graw Hill International).
4. CH: Introduction to Mathematical Methods: Charlie Harper (PHI Learning).

Additional References:

1. Mathematical Physics: A K Ghatak, Chua – 1995 Macmillian India Ltd.
2.Mathematical Method of Physics: Riley, Hobson and Bence, Cambridge (Indian edition).
3.Mathematical Physics: H. K. Das, S. Chand & Co.
4.Mathematical Methods of Physics: Jon Mathews & R. L. Walker, W A Benjamin inc.
5.A Treatise on heat: Saha and Srivastava (Indian press, Allahabad)
6.Statistical Physics: F. Reif (Berkeley Physics Course, McGraw Hill)
7.Introductory Statistical Mechanics: R. Bowley and M. Sanchez (Oxford Science Publications).
8.An Introduction to Thermal Physics: D. V. Schroeder (Pearson).
9.PROBABILITY: Schaum's Outlines Series by S. Lipschutz and M. L. Lipson (Mc Graw Hill International).

Course Description: B.Sc. (Physics)	
Semester	V
Course Name	Physics II (Solid State Physics)
Course Code	USC5PH2
Eligibility for the Course	12th Science of all recognised Board
Credit	2.5
Hours	4 Hrs. per week

CO No.	**COs Statement**
	After completing the Bachelor of Science Program, students will be able to-
CO-1	Explain the basics of crystallography, Electrical properties of metals, Band Theory of solids, demarcation among the types of materials, Semiconductor Physics and Superconductivity.
CO-2	Apply the basic concepts of Fermi probability distribution function, Density of states, conduction in semiconductors and BCS theory of superconductivity.
CO-3	Demonstrate quantitative problem-solving skills in all the topics covered.

Unit	Course Description	Hrs
1	**Electrical properties of metals** 1.1 Classical free electron theory of metals, Drawbacks of classical theory, Relaxation time, Collision time and mean free path 1.2 Quantum theory of free electrons, Fermi Dirac statistics and electronic distribution in solids, Density of energy states and Fermi energy, 1.3 The Fermi distribution function, Heat capacity of the Electron gas, Mean energy of electron gas at 0 K, [SSP] :6.2, 6.3, 6.4, 6.5, 6.14,6.15, 6.16, 6.17, 6.18, 6.20, 6.25,6.19	15
2	**Superconductivity** Superconductivity: Experimental Survey, Occurrence of Superconductivity, destruction of superconductivity by magnetic field, The Meissner effect, London equation, BCS theory of superconductivity, Type I and Type II Superconductors, Vortex state. Ref. [ISSP]: Introduction to Solid State Physics-Charles Kittel, 7th Ed. John Wiley & Sons: Topics from Chapter 12.	15
3	**Band Theory of Solids and Conduction in Semiconductors** 3.1 Band theory of solids, The Kronig- Penney model (Omit eq. 6.184 to 6.188), Brillouin zones, Number of wave functions in a band, Motion of electrons in a one-dimensional periodic potential, Distinction between metals, insulators and intrinsic semiconductors. [SSP]: 6. 36,6.37,6.38,6.39,6.40, 6.51 3.2 Electrons and Holes in an Intrinsic Semiconductor, Conductivity of a Semiconductor, Carrier concentrations in an intrinsic semiconductor, Donor and Acceptor impurities, Charge densities in a semiconductor, The continuity equation, Hall Effect. [EDC]: 4.1 to 4.10.	
4	**Diode Theory and superconductivity** 4.1. Semiconductor-diode Characteristics: Qualitative theory of the p-n junction, The p-n junction as a diode, Band structure of an open-circuit p-n junction, The current components in a p-n junction diode, Quantitative theory of p-n diode currents, The Volt-Ampere characteristics, The temperature dependence of p-n characteristics, Diode resistance. [EDC] : 5.1 to 5.8	**15**

References:

1.[ESSP]: Elementary Solid State Physics-Principles and Applications: M.Ali Omar, Pearson Education, 2012.
2.[SSP]: Solid State Physics: S. O. Pillai, New Age International, 6th Ed.
3.[EDC]: Electronic Devices and Circuits: Millman, Halkias & Satyabrata Jit. (3rd Ed.) Tata McGraw Hill.
4.[ISSP]: Introduction to Solid State Physics - Charles Kittel, 7th Ed. John Wiley & Sons.

5.[MPSSP]: Modern Physics and Solid-State Physics: Problems and solutions New Age International.

Additional References:

1.Solid State Physics: A. J. Dekker, Prentice Hall.
2.Electronic Properties of Materials: Rolf Hummel, 3rd Ed. Springer.
3.Semiconductor Devices: Physics and Technology, 2nd Ed. John Wiley & Sons.
4.Solid State Physics: Ashcroft & Mermin, Harcourt College Publisher.

Course Description: B.Sc. (Physics)	
Semester	V
Course Name	Physics II (Solid State Physics)
Course Code	USC5PH2
Eligibility for the Course	12th Science of all recognised Board
Credit	2.5
Hours	4 Hrs. per week

CO No.	**COs Statement**
	After completing the Bachelor of Science Program, students will be able to-
CO-1	Explain the basics of crystallography, Electrical properties of metals, Band Theory of solids, demarcation among the types of materials, Semiconductor Physics and Superconductivity.
CO-2	Apply the basic concepts of Fermi probability distribution function, Density of states, conduction in semiconductors and BCS theory of superconductivity.
CO-3	Demonstrate quantitative problem-solving skills in all the topics covered.

Unit	**Course Description**	Hrs
1	**Electrical properties of metals** 1.4 Classical free electron theory of metals, Drawbacks of classical theory, Relaxation time, Collision time and mean free path 1.5 Quantum theory of free electrons, Fermi Dirac statistics and electronic distribution in solids, Density of energy states and Fermi energy, 1.6 The Fermi distribution function, Heat capacity of the Electron gas, Mean energy of electron gas at 0 K, [SSP] :6.2, 6.3, 6.4, 6.5, 6.14,6.15, 6.16, 6.17, 6.18, 6.20, 6.25,6.19	15
2	**Superconductivity** Superconductivity: Experimental Survey, Occurrence of Superconductivity, destruction of superconductivity by magnetic field, The Meissner effect, London equation, BCS theory of superconductivity, Type I and Type II Superconductors, Vortex state.	15

	Ref. [ISSP]: Introduction to Solid State Physics-Charles Kittel, 7th Ed. John Wiley & Sons: Topics from Chapter 12.	
3	**Band Theory of Solids and Conduction in Semiconductors** 3.1 Band theory of solids, The Kronig- Penney model (Omit eq. 6.184 to 6.188), Brillouin zones, Number of wave functions in a band, Motion of electrons in a one-dimensional periodic potential, Distinction between metals, insulators and intrinsic semiconductors. [SSP]: 6. 36,6.37,6.38,6.39,6.40, 6.51 3.2 Electrons and Holes in an Intrinsic Semiconductor, Conductivity of a Semiconductor, Carrier concentrations in an intrinsic semiconductor, Donor and Acceptor impurities, Charge densities in a semiconductor, The continuity equation, Hall Effect. [EDC]: 4.1 to 4.10.	**15**
4	**Diode Theory and superconductivity** 4.1. Semiconductor-diode Characteristics: Qualitative theory of the p-n junction, The p-n junction as a diode, Band structure of an open-circuit p-n junction, The current components in a p-n junction diode, Quantitative theory of p-n diode currents, The Volt-Ampere characteristics, The temperature dependence of p-n characteristics, Diode resistance. [EDC] : 5.1 to 5.8	**15**

References:

1.[ESSP]: Elementary Solid State Physics-Principles and Applications: M.Ali Omar, Pearson Education, 2012.
2.[SSP]: Solid State Physics: S. O. Pillai, New Age International, 6th Ed.
3.[EDC]: Electronic Devices and Circuits: Millman, Halkias & Satyabrata Jit. (3rd Ed.) Tata McGraw Hill.
4.[ISSP]: Introduction to Solid State Physics - Charles Kittel, 7th Ed. John Wiley & Sons.
5.[MPSSP]: Modern Physics and Solid-State Physics: Problems and solutions New Age International.

Additional References:

1.Solid State Physics: A. J. Dekker, Prentice Hall.
2.Electronic Properties of Materials: Rolf Hummel, 3rd Ed. Springer.
3.Semiconductor Devices: Physics and Technology, 2nd Ed. John Wiley & Sons.
4.Solid State Physics: Ashcroft & Mermin, Harcourt College Publisher.

Course Description: B.Sc. (Physics)	
Semester	V
Course Name	Physics III (Atomic and Molecular Physics)
Course Code	USC5PH3
Eligibility for the Course	12th Science of all recognised Board
Credit	2.5
Hours	4 Hrs. per week

CO No.	COs Statement **After completing the Bachelor of Science Program, students will be able to-**
CO-1	Explain application of quantum mechanics in atomic physics, the importance of electron spin, symmetric and antisymmetric wave functions and vector atom model, Effect of magnetic field on atoms and its application and an insight into spectroscopy.
CO-2	Apply principles of quantum mechanics to describe atomic orbitals, probability densities, and electron transitions.
CO-3	Interpret rotational and vibrational spectra and understand the concept of selection rules in molecular transitions.

Unit	Course Description	Hrs
1	**Basic of QM** 1.1. Hydrogen atom: Schrödinger's equation for Hydrogen atom, Separation of variables, Quantum Numbers: Total quantum number, Orbital quantum number, Magnetic quantum number. Angular momentum, Electron probability density (Radial part). 1.2. Electron spin: The Stern-Gerlach experiment, Pauli's Exclusion Principle Symmetric and Anti-symmetric wave functions. [B] : 9.1 to 9.9, 10.1, 10.3. 2	15
2	2.1. Spin orbit coupling, Total angular momentum, Vector atom model, L-S and j-j coupling. Origin of spectral lines, Selection rules. 2.2 Effect of Magnetic field on atoms, the normal Zeeman effect and its explanation (Classical and Quantum), The Lande g - factor, Anomalous Zeeman effect. [B]: 10.2, 10.6, 10.7, 10.8, 10.9. ,11.1, 11.2	15
3	3.1 Molecular spectra (Diatomic Molecules): Rotational energy levels, Rotational spectra, Vibrational energy levels, Vibrational-Rotational spectra. Electronic Spectra of Diatomic molecules: The Born-Oppenheimer approximation, Intensity of vibrational-electronic spectra: The Franck-Condon principle. [B]: 14.1, 14.3, 14.5, 14.7	**15**
4	4.1 Raman effect: Quantum Theory of Raman effect, Pure Rotational Raman spectra: Vibrational Raman spectra: Raman activity of vibrations, Experimental set up of Raman Effect. 4.2. Electron spin resonance: Introduction, Principle of ESR, ESR spectrometer	**15**

References:

[B]: Perspectives of Modern Physics: Arthur Beiser Page 8 of 18 McGraw Hill.
[BM]: Fundamentals of Molecular
Spectroscopy: C. N. Banwell & E. M. McCash (TMH).(4th Ed.)

[GA]: Molecular structure and spectroscopy: G Aruldhas (2nd Ed) PHI learning Pvt Ltd.
[AP]: Atomic Physics (Modern Physics): S.N. Ghoshal. S. Chand Publication
(for problems on atomic Physics).

Course Description: B.Sc. (Physics)	
Semester	V
Course Name	Physics IV (Electrodynamics)
Course Code	USC5PH4
Eligibility for the Course	12th Science of all recognised Board
Credit	2.5
Hours	4 Hrs. per week

CO No.	**COs Statement**
	After completing the Bachelor of Science Program, students will be able to-
CO-1	Analyze the behavior of dielectrics in electric fields, including concepts of polarization, dielectric constant, and susceptibility.
CO-2	Apply Ampère's law to determine magnetic fields in systems with high symmetry and solve problems involving magnetic materials.
CO-3	Develop quantitative problem solving skills

Unit	**Course Description**	Hrs
1	**Electrostatics** 1.1 Review of Coulomb & Gauss law, The divergence of E, Applications of Gauss' law, The curl of E. Introduction to potential, The potential of a localized charge distribution. Poisson's equation and Laplace's equation. 1.2. Boundary conditions and Uniqueness theorems, Conductors and Second Uniqueness theorem. [DG]: 2.1.1 to 2.1.3, 2.2.2 to 2.2.4, 2.3.1 to 2.3.4,3.1.1 to 3.1.4, 3.1.5, 3.1.6, 3.2.1 to 3.2.4	15
2	**Electrostatics in Matter and Magnetostatics** 2.1. Dielectrics, Induced Dipoles, Alignment of polar molecules, Polarization, Bound charges and their physical interpretation, Gauss' law in presence of dielectrics, A deceptive parallel, Susceptibility, Permittivity, Dielectric constant and relation between them, Energy in dielectric systems. 2.2 Review of Biot-Savart's law and Ampere's law, Straight-line currents, The Divergence and Curl of B, Applications of Ampere's Law in the case of a long straight wire and a long solenoid, Comparison of Magnetostatics and Electrostatics, Magnetic Vector Potential. [DG]: 4.1.1 to 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.4.1, 4.4.3, 5.2.1, 5.3.1 to 5.3.4, 5.4.1	15
3	**Magnetostatics in Matter and Electrodynamics**	**15**

	3.1. Magnetization, Bound currents and their physical interpretation, Ampere's law in magnetized materials, A deceptive parallel, Magnetic susceptibility and permeability. 3.2. Energy in magnetic fields, Electrodynamics before Maxwell, Maxwell's correction to Ampere's law. [DG]: 6.1.1, 6.1.4, 6.2.1, 6.2.2, 6.2.3, 6.3.1, 6.3.2, 6.4.1, 7.2.4, 7.3.1 to 7.3.6	
4	**Electromagnetic Waves** 4.1. The continuity equation, Poynting's theorem 4.2. The wave equation for E and B, Monochromatic Plane waves, Energy and momentum in electromagnetic waves, Propagation in linear media, Reflection and transmission of EM waves at normal incidence.	**15**

References

1.[DG]: Introduction to Electrodynamics, David J. Griffiths (3rd Ed) Prentice Hall of India.

Additional References

1.Introduction to Electrodynamics: A. Z. Capria and P. V. Panat, Narosa Publishing House.
2.Engineering Electrodynamics: William Hayt Jr. & John H. Buck (TMH).
3.Foundations of Electromagnetic Theory: Reitz, Milford and Christy.
4.Solutions to Introduction to Electrodynamics: David J. Griffiths (3rd Ed) Prentice Hall of India.

Course Description: B.Sc.(Physics)	
Semester	V
Course Name	Practicals of USC5PH1 & USC5PH2
Course Code	USC5PHP1
Eligibility for the Course	12th Science of all recognised Board
Credit	3
Hours	6 Hrs. per week

Course Description
SKILL EXPERIMENTS 1. Estimation of errors from actual experimental data 2. Optical Levelling of Spectrometer 3. Schuster's method 4. Laser beam profile 5. Use of electronic balance: Find the density of a solid cylinder **EXPERIMENTS (minimum 8)** 1. Determination of 'g' by Kater's pendulum 2. Surface tension of soap solution

3. Elastic constants of a rubber tube
4. Restoring force per unit extension of a spiral spring by statistical method
5. To Determine the Coefficient of Damping, Relaxation Time And Quality Factor Of A Damped Simple Harmonic Motion Using A Simple Pendulum
6. Dispersive power of Prism
7. Determination of dielectric constant
8. Logarithmic decrement
9. Searle's Goniometer
10. Determination of Rydberg's constant
11. Edser's 'A' pattern
12. Determination of slit width by Step slit
13. Determination of e/m by Thomson's method
14. R. I. by total internal reflection
15. Velocity of sound in air using CRO

Course Description: B.Sc.(Physics)	
Semester	V
Course Name	Practicals of USC5PH3 & USC5PH4
Course Code	USC5PHP2
Eligibility for the Course	12th Science of all recognised Board
Credit	3
Hours	6 Hrs. per week

Course Description

SKILL EXPERIMENTS

1. soldering and testing of an astable multivibrator (Tr./IC555). circuit on PCB
2. Dual trace CRO: Phase shift measurement
3. C1/C2 by B G
4. Internal resistance of voltage and current source
5. Use of DMM to test diode, transistor and b factor

EXPERIMENTS (minimum 8)

1. Mutual inductance by BG.
2. Capacitance by parallel bridge
3. Hysteresis loop by CRO
4. L/C by Maxwell's bridge
5. Band gap energy of Ge diode
6. Design and study of transistorized astable multivibrator (BB)
7. Design and study of Wien bridge oscillator
8. Design and study of first order active low pass filter circuit (BB)

9. Design and study of first order active high pass filter circuit (BB)
10. Application of IC 555 timer as a ramp generator (BB)
11. LM 317 as constant current source
12. Counters Mod 2, 5, 10 (2 x 5, 5 x 2)

References:

1. Advanced course in Practical Physics: D. Chattopadhyay, PC. Rakshit & B. Saha (8th Edition) Book & Allied Pvt. Ltd.
2. BSc Practical Physics: Harnam Singh. S. Chand & Co. Ltd. – 2001.
3. A Text book of Practical Physics: Samir Kumar Ghosh New Central Book Agency (4th edition).
4. B Sc. Practical Physics: C. L. Arora (1st Edition) – 2001 S. Chand & Co. Ltd.
5. Practical Physics: C. L. Squires – (3rd Edition) Cambridge University Press.
6. University Practical Physics: D C Tayal. Himalaya Publication.
7. Advanced Practical Physics: Worsnop & Flint.

Course Description: B.Sc. (Physics)	
Semester	V
Course Name	Physics V (ANALOG CIRCUITS, INSTRUMENTS AND CONSUMER APPLIANCES.)
Course Code	USC5PH5
Eligibility for the Course	12th Science of all recognised Board
Credit	2
Hours	4 Hrs. per week

CO No.	**COs Statement**
	After completing the Bachelor of Science Program, students will be able to-
CO-1	Identify and classify different types of chemical sensors based on their detection mechanisms, such as electrochemical sensors, optical sensors, and gas sensors.
CO-2	Explore advanced features of modern CROs, including digital storage, waveform capture, FFT (Fast Fourier Transform) analysis, and automated measurements.
CO-3	Apply signal conditioning techniques such as amplification, filtering, and isolation to prepare signals for digitization.
CO-4	Apply data acquisition systems in various fields such as scientific research, industrial automation, environmental monitoring, and medical diagnostics.
CO-5	Develop diagnostic devices and instruments for medical diagnosis, disease screening, and treatment planning.

Unit	Course Description	Hrs
1	1. Transducers: Definition, Classification, Selection of transducer. 2. Electrical transducers: Thermistor, Thermocouple, Pressure Transducer: Strain gauges (wire, foil, & semiconductor), Displacement transducer: LVDT, Peizo-electric Transducer. [Ref. 2, 3, 6 & 9] 3. Chemical sensors: PH sensor, Gas sensor (Fundamental aspects), Humidity sensor (Resistive). [R6, R7]. 4. Electronic Weighing Systems: Operating principle, Block diagram, features [Ref12 & 13]. 5. Optoelectronic Devices: LDR, LED (Construction, Working & Applications), Multicolour LED, Seven Segment Display, Liquid Crystal Display (LCD), Photodiode (construction, Characteristics & applications), Phototransistor. [Ref. 1, 2 & 3]	15
2	1. Half wave precision rectifier, Active Peak detector, Active Positive Clamper [M & B]. 2. Active Positive and Negative Clippers [G] 3. Microphones: characteristics, types (list only), carbon microphone and dynamic type microphone (principle, construction and working) [R4]. 4. Loud speakers: Characteristics, Dynamic (Moving coil type) speaker, Multi-way speaker system (woofer and tweeter) [R4] 5. Switching Regulators: Basic and Monolithic Switching regulators (buck, boost and buck – boost) (Only basic Configurations) Ref M: 24.7 6. Cathode Ray Oscilloscope: Single trace CRO (Block diagram), Front Panel Controls (Intensity, Focus, Astigmatism, X & Y position, Level knob, Time base (Time/Division) and attenuation (Volts/Division) knobs,X-Y mode), Dual Trace CRO (Block diagram), Probes: 1:1&10:1. Digital Storage Oscilloscope [R3 &10]. 7. DMM: 3 ½ Digit, resolution and sensitivity, general specification. [R3]	15
3	1. Data acquisition system: Objectives of DAS, Signal conditioning of inputs, Single channel Data Acquisition system, Multichannel Data Acquisition system. [Data Transmission systems IEEE-488 GPIB*][Ref. 11] 2. D to A Converters: Resistive divider network, Binary ladder network [Ref 7 & 8] 3. A to D Converters: Successive approximation type, Voltage to Time (Single slope, Dual slope). [Ref. 7 & 8]	**15**

4	1. Printed Circuit Board: Idea of PCB, advantages, copper clad, Etching processes, Principle of Photolithography (For PCB). [Ref. 4, 14 & 15]. 2. Microwave Oven: Operating principle, block diagram, features. [Ref. 12 & 13] 3. Medical instruments: Bio-Potential, Types of electrodes, ECG, EEG, EMG, CT Scan and MRI (principle, block diagram and features),Ultrasonography: working principle [R 16, 17 and18].	**15**

References:

1. A Textbook of Applied Electronics – R S Sedha, S Chand & Company, New Delhi.
2. Basic Electronics Solid state - B. L. Thereja, S Chand & Company, New Delhi.
3. Electronic Instrumentation – H S Kalsi, Tata McGraw-Hill Publishing Company Limited, New Delhi.
4. Electronic components and materials: Principles, Manufacture and Maintenance- S. M. Dhir, Tata McGraw-Hill Publishing Company, Limited, New Delhi.
5. Measurement and Instrumentation Principles: Alan S. Morris., Butterworth-Heinemann.
6. Transducers and display systems: B. S. Sonde, Tata McGraw-Hill Publishing Company Limited, New Delhi.
7. Digital principles and applications: A.P. Malvino and D. P. Leach. Tata McGraw-Hill.
8. Data Converters– B. S. Sonde, Tata McGraw-Hill Publishing Company Limited, New Delhi.
9. Modern Electronic Instruments and Measurement techniques- Albert D. Helfrick, Willam D. Cooper, Prentice Hall India Pvt. Ltd, New Delhi.
10. A course in electrical and electronic Measurements and Instrumentation: A. K. Sawhney, DhanpatRai and Sons. https://www.scribd.com/document/258017718/A-K-sawhney-A-Course-in-Electrical-and-Electronic-Measurements-and-Instrumentation
11. Instrumentation Devices & Systems , 2nd Edition Tata McGrawHill- C.S. Rangan, G.R. Sarma,V.S. Mani
12. Consumer Electronics R. P. Bali, Pearson Education (2008), S.P Bali, “Consumer Electronics”, Pearson Education Asia Pvt., Ltd., 2008 Edition,
13. Printed Circuits Handbook pdf, Clyde F. Coombs. Jr. , McGraw Hill Handbooks, 6th ed.
14. PCB design basics, Mahmoud Wahby, EDN Networks, Nov 2013.

15. Introduction to Bio-medical Electronics: Joseph-Du-bary, McGraw Hill Co. Ltd.
16. Medical instrumentation Application and design- J. C. Wobster
17. Biomedical instruments and measurements – L. Cromwell, F. J. Weibell, Printice hall of India of India Pvt. Ltd, New Delhi.

Course Description: B.Sc.(Physics)	
Semester	V
Course Name	Practicals of USC5PH5
Course Code	USC5PHP3
Eligibility for the Course	12th Science of all recognised Board
Credit	2
Hours	3 Hrs. per week

GROUP	**Course Description**
A	**GROUP - A** 1. Thermistor Characteristics –Thermal and electrical. (H & C) 2. Thermistor as sensor in temperature to voltage converter using OPAMP. (C&D Ch.8) 3. Study of LVDT characteristics. (K Ch. 13) 4. Study of Load Cell / Strain Guage. (K Ch. 13) 5. Study of seven segment display. 6. Characteristics of Photo diode and photo transistors.
B	**GROUP -B** 1. Basic Instrumentation Amplifier using 3 Op-Amps coupled to resistance bridge. (C & D Ch. 8) 2. Temperature to frequency Conversion using 555 timer. (C & D Ch.13) 3. OPAMP D/A Converter: Binary weighted resistors. 4. OPAMP D/A Converter: Ladder network. (M & L Ch. 12) 5. Sample and hold circuit using op-amp 741. (G Ch. 8) 6. Peak detector using op-amp 741. (G Ch. 8)

C	**GROUP -C** 1. Half wave precision rectifier using precision op-amps (OPA177) (C & D Ch. 7) 2. Study of Positive and Negative Clippers on CRO 3. Positive and Negative Clampers using single power supply op-amp (124/324). (G Ch. 8) 4. Second Order active Low Pass filter for Butterworth filter circuit 5. Second Order active High Pass filter (K.Ch15) 6. Active Notch Filter (frequency response & phase relation) (K.Ch.15) 7. Square and Triangular wave generator using OPAMPs with concept of duty cycle (M.Ch 23)
D	**GROUP-D** 1. Study of variable dual power supply using LM 317& LM 337 (± 3v to ± 15v). (C&D Ch.13) 2. Constant Current source using OPAMP and PNP transistor (o/p current less than 50 mA) (C & D Ch 5) 3. Simple microphone amplifier using a transistor. 4. Low voltage audio amplifier using IC LM386 5. Construction of Audio power amplifier using IC TBA 810. 6. Making PCB for simple circuits (like rectifiers, regulators, oscillators, multivibrators, op-amp applications, single stage amplifier etc.), building and testing of the circuit. 7. Visit to Hospital/Diagnostic Center/ Bio-medical Research Laboratory and submission of its report.

References:

1. H & C: Modern Electronic Instrumentation & Measurement Techniques by Albert D. Helfrick & William D. Cooper PHI) Edition.
2. C & D: OPAMPs and linear integrated circuits" by Coughlin &
3. F. F. Driscoll (6th edition PHI)
4. G: OPAMPs and linear integrated circuits by R.A. Gayakwad (4th edition, PHI).
5. M: Electronic Principles by A. P. Malvino, (PHI), 6th edition.
6. K: Electronic Instrumentation by H. S. Kalsi, (TMH) 2nd Edition
7. M & L: Digital Principle and Applications" by Malvino and Leach, (TMH), 5th edition,
8. RPJ: Modern Digital Electronics, R .P. Jain, (TMH), 3rd edition

Course Description: B.Sc. (Physics)	
Semester	V
Course Name	Credit course (Basics of Electricity for wiring)
Course Code	USC5BE
Eligibility for the Course	12th Science of all recognised Board
Credit	2
Hours	4 Hrs. per week

CO No.	**COs Statement** **After completing the Bachelor of Science Program, students will be able to-**
CO-1	Learn and acquire hands-on experience in the usage of multimeters, soldering iron, oscilloscopes, power supplies.
CO-2	Design and trouble shoots the basic electrical circuits through hands-on mode
CO-3	Identify the basic components used for Electronic & Electrical experiments

Unit	**Course Description**	Hrs
1	**FUNDAMENTALS ELECTRICITY TERMS :** 1. 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	15
2	**TRANSFORMER : FUNDAMENTAL TERMS, TYPES** 1. 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	15

3	**ELECTRICAL WIRING COMPONENTS AND ACCESSORIES:** 1. 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 2.	**15**
4	**HANDS ON TRAINING** 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	**15**

References:

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**.**

Janardan Bhagat Shikshan Prasarak Sanstha's
CHANGU KANA THAKUR
Arts, Commerce and Science College, New Panvel (Autonomous)

Syllabus for T.Y.B. Sc. (Physics) Semester VI
Choice Based Credit System
(To be implemented from the academic year 2024-2025)

SEMESTER VI

Course Code	Course Type	Course Title	Credit
USC6PH1	Physics I	Classical Mechanics	2.5
USC6PH2	Physics II	Solid State Physics	2.5
USC6PH3	Physics III	Atomic and Molecular Physics	2.5
USC6PH4	Physics IV	Electrodynamics	2.5
USC6PH5	Physics V	Digital Electronics, Microprocessor ,Microcontroller and OOP	2
USC6PHP1	Practical I	Practicals of USC5PH1 & USC5PH2	3.0
USC6PHP2	Practical II	Practicals of USC5PH3 & USC5PH4	3.0
USC6PHP3	Practical III	Practicals of USC6PH5	2
USC6SE	Credit course	Solar Energy- Fundamentals & Its Applications-I	2
Total Credits			**22**

Course Description: B.Sc. (Physics)	
Semester	VI
Course Name	Physics I (Classical Mechanics)
Course Code	USC6PH1
Eligibility for the Course	12th Science of all recognised Board
Credit	2.5
Hours	4 Hrs. per week

CO No.	**COs Statement**
	After completing the Bachelor of Science Program, students will be able to-
CO-1	Analyze simple nonlinear systems and understand the conditions leading to chaotic behavior.

CO-2	Develop proficiency in using analytical techniques and mathematical tools to solve complex problems in classical mechanics.
CO-3	Apply Newton's laws to solve problems involving forces, motion, and energy in single and multi-particle systems.

Unit	Course Description	Hrs
1	**Central Force** 1.1. Motion under a central force, the central force inversely proportional to the square of the distance, Elliptic orbits, The Kepler problem. 1.2. Moving origin of coordinates, Rotating coordinate systems, Laws of motion on the rotating earth, The Foucault pendulum, Larmor's theorem. [KRS]: 3.13 - 3.15, 7.1 - 7.5.	15
2	**Lagrange's equations** 2.1. D'Alembert's principle, Constraints, Examples of holonomic constraints, examples of nonholonomic constraints, degrees of freedom and generalized coordinates. 6.2. Lagrange's equations (using D'Alembert's principle), properties of Lagrange's equations, illustrative problems. [PVP]: 4.2 to 4.9, 5.2 to 5.4, 7.2, 7.3.	15
3	**Fluid Motion and Rigid body rotation** 3.1. Kinematics of moving fluids, Equation of motion for an ideal fluid, Conservation laws for fluid motion, Steady flow. 3.2. Rigid dynamics: introduction, degrees of freedom, rotation about an axis: orthogonal matrix, Euler's theorem, Eulerian angles, inertia tensor, angular momentum of rigid body, [KRS]: 8.6 to 8.9 [PVP]: 16.1 to 16.10	**15**
4	**Non-Linear Mechanics** 4.1. Nonlinear mechanics: Qualitative approach to chaos, The anharmonic oscillator, 4.2. Transition to chaos: Bifurcations and strange attractors, Aspects of chaotic behaviour (Logistic map). [BO]: 11.1, 11.3 to 11.5	**15**

References

1.[PVP]: Classical Mechanics, P. V. Panat (Narosa).
2.[KRS]: Mechanics: Keith R. Symon, (Addision Wesely) 3rd Ed.
3.[BO]: Classical Mechanics- a Modern Perspective: V. D. Barger and M. G. Olsson. (Mc Graw Hill International 1995 Ed.)

Additional References

1.Classical Mechanics: Herbert Goldstein (Narosa 2nd Ed.).
2.An Introduction to Mechanics: Daniel Kleppner & Robert Kolenkow Tata Mc Graw Hill (Indian Ed. 2007).
3.Chaotic Dynamics- an introduction: Baker and Gollub
(Cambridge Univ. Press).
4.Classical Mechanics: J. C. Upadhyaya (Himalaya Publishing House).

Course Description: B.Sc. (Physics)	
Semester	VI
Course Name	Physics II (Electronics)
Course Code	USC6PH2
Eligibility for the Course	12th Science of all recognised Board
Credit	2.5
Hours	4 Hrs. per week

CO No.	**COs Statement**
	After completing the Bachelor of Science Program, students will be able to-
CO-1	Analyze the operation and characteristics of basic semiconductor devices such as diodes, transistors (BJT and FET), and their applications in circuits.
CO-2	Design analog electronic circuits for various applications, such as signal amplification and filtering.
CO-3	Explain the fundamentals of digital electronics, including logic gates, Boolean algebra, and combinational and sequential circuits.

Unit	**Course Description**	Hrs
1	**JFET, MOSFET** 1.1. Field effect transistors: JFET: Basic ideas, Drain curve, The transconductance curve, Biasing in the ohmic region and the active region, Transconductance, JFET common source amplifier, JFET analog switch. 1.2. MOSFET: Depletion and enhancement mode, MOSFET operation and characteristics, digital switching. 1.3. SCR – construction, static characteristics, Analysis of the operation of SCR, Gate Triggering Characteristics. 1.4. UJT: Construction, Operation, characteristics and application as a relaxation oscillator. [MB]: 13.1 to 13.9, 14.1, 14.2, 14.4, 14.6. [AM]: 28.1, 28.5	15
2	**OPAMP** 2.1. Op Amp Applications: Log amplifier, Instrumentation amplifiers, Voltage controlled current sources (grounded load), First order Active filters, Astable using OP AMP, square wave and triangular wave generator using OP AMP, Wein-bridge oscillator using OP AMP, Comparators with Hysteresis, Window Comparator. [MB]: 17.1 to 17.5, 20.5, 20.8, 21.4, 22.2, 22.3, 22.7, 22.8, 23.	15
3	**Multivibrators & 555 Timer** 3.1. Transistor Multivibrators: Astable, Monostable and Bistable Multivibrators, Schmitt trigger. 3.2. 555 Timer: Review Block diagram, Monostable operation Voltage Controlled Oscillator, Triggered linear ramp generator.	**15**

	3.3. Regulated DC power supply: Supply characteristics, series voltage regulator, short circuit protection (current limit and fold back) Monolithic linear IC voltage Regulators. (LM 78XX, LM 79XX, LM 317, LM337). [AM]: 18.11 [KVR]: 14.5.2.1, 14.5.2.5, 14.5.2.6, 14.5.4.1 [MB]: 23.8, 23.9, 24.1, 24.3, 24.4	
4	**Digital Communications** 4.1. Logic families: Standard TTL NAND, TTL NOR, Open collector gates, three state TTL devices, MOS inverters, CMOS NAND and NOR gates, CMOS characteristics. 4.2. Digital Communication Techniques: Digital Transmission of Data, Benefits of Digital Communication, Disadvantages of Digital Communication, Parallel and Serial Transmission, Pulse Modulation, Comparing Pulse-Modulation Methods (PAM, PWM, PPM), Pulse-Code Modulation. [ML]: 6.2, 6.4, 6.6, 6.7, 7.2 to 7.4. [LF]: 7.1, 7.2, 7.4	**15**

References

1.MB: Electronic Principles, Malvino & Bates -7th Ed TMH Publication.
2.AM: Electronic Devices and Circuits, Allen Mottershead -PHI Publication.
3.KVR: Functional Electronics, K.V. Ramanan-TMH Publication.
4.ML: Digital Principles and Applications, Malvino and Leach (4th Ed) (TMH).
5.LF: Communication Electronics: Principles and applications, Louis E Frenzel 4th edition TMH Publications.

Course Description: B.Sc. (Physics)	
Semester	VI
Course Name	Physics III (Nuclear and Particle Physics)
Course Code	USC6PH3
Eligibility for the Course	12th Science of all recognised Board
Credit	2.5
Hours	4 Hrs. per week

CO No.	**COs Statement**
	After completing the Bachelor of Science Program, students will be able to-
CO-1	Apply knowledge of decay processes to solve problems related to half-life, decay constant, and activity of radioactive materials. .
CO-2	Explain the principles and operation of nuclear reactors and the process of nuclear energy generation.
CO-3	Comprehend different nuclear models, such as the liquid drop model, shell model, and collective model, and their applications in explaining nuclear structure and stability.

Unit	Course Description	Hrs
1	**Alpha & Beta Decay** 1.1. Alpha decay: Velocity, energy, and Absorption of alpha particles: Range, Ionization and stopping power, nuclear energy levels. Range of alpha particles, Alpha decay paradox: Barrier penetration (Gamow's theory of alpha decay and Geiger- Nuttal law). 1.2. Beta decay: Introduction, Velocity and energy of beta particles, Energy levels and decay schemes. [IK]: 13. 1, 13.2, 13.5, 14.1, 14.7 [SBP]: 4. 2. 1, 4. 2. 2, 4. 2. 3, 1.2.3, 4. 3. 1, 4. 3. 2, 4. 3. 3, 4. 3. 5, [SNG]: 5.5.	15
2	**Gamma Decay & Nuclear Models** 2.1. Gamma decay: Introduction, selection rules, Internal conversion, nuclear isomerism, Mossbauer effect. 2.2 Nuclear Models: Liquid drop model, Weiz sacker's semi-empirical mass formula, Mass parabolas - Prediction of stability against beta decay for members of an isobaric family, Stability limits against spontaneous fission. Shell model (Qualitative), Magic numbers in the nucleus. [SBP]: 4. 2. 1, 4. 2 .2, 4. 2. 3, 4. 4. 4, 9.4,5.1, 5.3, 5.4, 5.5. [AB]: 11.6-pages (460,461).	15
3	**Nuclear Energy & Particle Accelerators** 3.1. Nuclear energy: Introduction, Asymmetric fission - Mass yield, Emission of delayed neutrons, nuclear release in fission, Nature of fission fragments, Energy released in the fission of U235, Fission of lighter nuclei, Fission chain reaction, Neutron cycle in a thermal nuclear reactor (Four Factor Formula) Particle Accelerators: Van de Graaff Generator, Cyclotron, Synchrotron, Betatron and Idea of Large Hadron Collider. [SBP]: 6.1, 6.3 to 6.9, 9.6, 9.7, 8.1,8.2,8.3, 1.1.4 (i), 1.1.4 (ii), 1.1.4 (iii), 1.1.4 (iv), 6.9, [AB]: 13.3	**15**
4	**Nuclear force & Elementary particles** 4.1. Nuclear force: Introduction, Deuteron problem, Meson theory of Nuclear Force- A qualitative discussion. 4.2. Elementary particles: Introduction, Classification of elementary particles, Particle interactions, Conservation laws (linear & angular momentum, energy, charge, baryon number & lepton number), particles and antiparticles (Electrons and positrons, Protons and antiprotons, Photons, Mesons, Quark model (Qualitative). [SBP]: 8.6 [DCT]: 18.1, 18.2,18.3, 18.4, 18.5 to 18.9 [AB]: 13.5	**15**

References

1.AB: Concepts of Modern Physics: Arthur Beiser, Shobhit Mahajan, S Rai Choudhury (6th Ed.) (TMH).
2.SBP: Nuclear Physics, S.B. Patel (Wiley Eastern Ltd.).
3.IK: Nuclear Physics, Irving Kaplan (2nd Ed.) (Addison Wesley).

4. SNG: Nuclear Physics, S. N. Ghoshal (S. Chand & Co.)
5. DCT: Nuclear Physics, D. C. Tayal (Himalayan Publishing House) 5th ed.

Additional References

1. Modern Physics: Kenneth Krane (2nd Ed.), John Wiley & Sons.
2. Atomic & Nuclear Physics: N Subrahmanyam, Brij Lal. (Revised by Jivan Seshan.) S. Chand.
3. Atomic & Nuclear Physics: A B Gupta & Dipak Ghosh Books & Allied (P)Ltd.
4. Introduction to Elementary Particles: David Griffith, Second Revised Edition, Wiley-VCH.

Course Description: B.Sc. (Physics)	
Semester	VI
Course Name	Physics IV (Special Theory of Relativity)
Course Code	USC6PH4
Eligibility for the Course	12th Science of all recognised Board
Credit	2.5
Hours	4 Hrs. per week

CO No.	**COs Statement** **After completing the Bachelor of Science Program, students will be able to-**
CO-1	Explain the significance of Michelson Morley experiment and failure of the existing theories to explain the null result
CO-2	Derive and apply Lorentz transformations to describe the relationship between coordinates in different inertial frames of reference.
CO-3	Analyze relativistic collisions and apply conservation laws in relativistic scenarios.
CO-4	Solve problems based on length contraction, time dilation, velocity addition, Doppler effect, mass energy relation and resolve paradoxes in relativity like twin paradox etc.

Unit	**Course Description**	Hrs
1	**Introduction to Special theory of relativity:** 1.1 **REVIEW (INTRODUCTION)**Inertial and Non-inertial frames of reference, Galilean transformations, Newtonian relativity, Electromagnetism and Newtonian relativity. Attempts to locate absolute frame: Michelson- Morley experiment (omit derivation part), Attempts to preserve the concept of a preferred ether frame: Lorentz Fitzgerald contraction and Ether drag hypothesis (conceptual), Stellar aberration, Attempt to modify electrodynamics. 1.2 Relativistic Kinematics - I: Postulates of the special theory of relativity, Simultaneity, Derivation of Lorentz transformation equations. Some consequences of the Lorentz transformation equations: length	15

	contraction, time dilation and meson experiment, The observer in relativity. [RR]: 1.1 to 1.9, 2.1 to 2.5	
2	**Relativistic Kinematics - II** The relativistic addition of velocities, acceleration transformation equations, Aberration and Doppler effect in relativity, The common sense of special relativity. The Geometric Representation of Space-Time: Space-Time Diagrams, Simultaneity, Length contraction and Time dilation, The time order and space separation of events, The twin paradox. [RR]: 2.6 to 2.8, Supplementary topics A1, A2, A3, B1, B2, B3.	15
3	**Relativistic Dynamics** Mechanics and Relativity, The need to redefine momentum, Relativistic momentum, Alternative views of mass in relativity, The relativistic force law and the dynamics of a single particle, The equivalence of mass and energy, The transformation properties of momentum, energy and mass. [RR]: 3.1 to 3.7	**15**
4	**Relativity and Electromagnetism** Introduction, the interdependence of Electric and Magnetic fields, The Transformation for E and B, the field of a uniformly moving point charge, Force and fields near a current-carrying wire. The principle of equivalence and general relativity, Gravitational red shift. [RR]: 4.1 to 4.7. Note: (A good number of problems to be solved from Resnick).	**15**

References

1.RR: Introduction to Special Relativity: Robert Resnick (Wiley Student Edition).
2.Special theory of Relativity: A. P. French.
3.Very Special Relativity – An illustrated guide: by Sander Bais - Amsterdam University Press.
4.Chapter 1: Concepts of Modern Physics by Arthur Beiser.
5.Chapter 2: Modern Physics by Kenneth Krane.

Course Description: B.Sc.(Physics)	
Semester	VI
Course Name	Practicals of USC6PH1 & USC6PH2
Course Code	USC6PHP1
Eligibility for the Course	12th Science of all recognised Board
Credit	3
Hours	6 Hrs. per week

Course Description
DEMONSTRATION EXPERIMENTS 1. Open CRO, Power Supply, and Signal Generator: block diagrams 2. Data sheets: Diodes, Transistor, Op-amp & Optoelectronic devices 3. Use of LCR meter 4. Lux meter / Flux meter **EXPERIMENT (Minimum 8)** 1. Surface tension of mercury by Quincke's method 2. Thermal conductivity by Lee's method 3. To determine the impedance of an ac. circuit and verify the relation 4. Study of JFET characteristics 5. Restoring force per unit extension of a spiral spring dynamical methods 6. JFET as a common source amplifier 7. JFET as switch (series and shunt) 8. UJT characteristics and relaxation oscillator 9. Study of Pulse width modulation (BB) 10. Study of Pulse position modulation (BB) 11. To verify inverse law of photocell 12. R. P. of Telescope 13. Resolving power of Prism 14. To determine the Young's modulus of the material of a given beam supported on two knife-edges and loaded at the middle point 15. Double refraction 16. Lloyd's single mirror: determination of wavelength

Course Description: B.Sc.(Physics)	
Semester	VI
Course Name	Practicals of USC6PH3 & USC6PH4
Course Code	USC6PHP2
Eligibility for the Course	12th Science of all recognised Board
Credit	3
Hours	6 Hrs. per week

Course Description
DEMONSTRATION EXPERIMENTS 1. Zeeman Effect 2. Michelson's interferometer 3. Constant deviation spectrometer (CDS) 4. Digital storage oscilloscope (DSO) 5. Determination of Op-Amp parameters (offset voltage, slew rate,input impedance, output impedance, ACM) 6. Transformer (theory, construction and working), types of transformers and energy losses associated with them.

EXPERIMENT (Minimum 8)

1. Determination of M/C by using BG
2. Self-inductance by Anderson's bridge
3. Hall effect
4. Solar cell characteristics and determination of Voc, Isc and Pmax
5. Design and study of transistorized monostable multivibrator (BB)
6. Design and study of transistorized bistable multivibrator (BB)
7. Design and study of transistorised Astable multivibrator (BB)
8. Application of Op-Amp as a window comparator
9. Application of Op-Amp as a Log amplifier
10. Application of IC 555 as a voltage to frequency converter (BB)
11. Application of IC 555 as a voltage to time converter (BB)
12. LM-317 as variable voltage source
13. Shift register

References:

1. Advanced course in Practical Physics: D. Chattopadhyay, PC. Rakshit & B. Saha (8th Edition) Book & Allied (P) Ltd.
2. BSc Practical Physics: Harnam Singh. S. Chand & Co. Ltd. – 2001.
3. A Text book of Practical Physics: Samir Kumar Ghosh New Central Book Agency (4th edition).
4. B Sc. Practical Physics: C. L. Arora (1st Edition) – 2001 S. Chand & Co.
5. Practical Physics: C. L. Squires – (3rd Edition) Cambridge Univ. Press.
6. University Practical Physics: D C Tayal, Himalaya Publication.
7. Advanced Practical Physics: Worsnop & Flint.

Course Description: B.Sc. (Physics)	
Semester	VI
Course Name	Physics V (DIGITAL ELECTRONICS, MICROPROCESSOR, MICROCONTROLLER AND OOP)
Course Code	USC6PH5
Eligibility for the Course	12th Science of all recognised Board
Credit	2
Hours	4 Hrs. per week

CO No.	**COs Statement**
	After completing the Bachelor of Science Program, students will be able to-
CO-1	Apply Boolean algebra to simplify and design combinational logic circuits.
CO-2	Interface various sensors and actuators with Arduino boards for data collection and control.
CO-3	Apply Python for system administration, web scraping, and other automation tasks.

CO-4	Utilize the Standard Template Library (STL) for data structures, algorithms, and iterators in C++.
CO-5	Develop programs using classes, objects, inheritance, polymorphism, and encapsulation.

Unit	Course Description	Hrs
1	**DIGITAL ELECTRONICS** 1.1Combinational Logic Design: Introduction, Boolean identities, K – map (2, 3 and 4 variable), Ref: N G P 4.1 – 4.8. (additional ref. RPJ) 1.2 Design and implementations of: Decoders, Encoders, Multiplexers, De- multiplexers, Use of MUX and DEMUX in Combinational Logic design. Code Converters (based on – binary, BCD, Gray and Excess – 3 codes). Tri-State logic, buffers, D latch. Ref: N G P - 5.1 (only introduction), 5.3, 7.1 -7.6 (except 7.5) RPJ - 4.20. RG: 3.5.1, 3.5.2, 3.5.3, 3.5.4 & 3.5.5 NGP:Digital Electronics and Logic design by N G PALAN, https://archive.org/details/hellomr82k_gmail_DE RG: Microprocessor Architecture, Programming and Applications with the 8085, Ramesh Gaonkar, 5th Edition. RPJ: R. P. Jain, Modern Digital Electronics, Tata McGraw Hill, 4th Edition.	15
2	**INTRODUCTION TO MICROCONTROLLERS** 2.1 Introduction, Microcontrollers and Microprocessors, microprocessor verses microcontroller,History of Microcontrollers and Microprocessors, Pinout of Arduino UNO, ATmega328p microcontroller. flow chart ,Arduino Syntax,Brackets, Line comments, Coding Screen, Setup, Loop, Pinmode(), digitalread ( ), ,digitalWrite ( ), delay 2.2 Arduino program code , Function & data type : Arduino Serial, Serial print(), Serial. Print (value, format), Serial. println ( ) , Serial. available( ), Arduino Serial .read( ) , Arduino Serial.write( ), Serial.readString( ) , Arduino analogRead ( ), analogReference( ), Advantages of using Functions, Arduino Data Types- void Data Type, int Data Type , Char Data Type, Float Data Type ,Double Data Type,	15

	Unsigned int Data Type, short Data Type, long Data Type, , byte data type, word data type 2.3 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. Ref :Simon Monk, Programming Arduino: Getting Started with Sketches, Second Edition (Tab) 2nd Ed Ref :Hans-Petter Halvorsen : Introduction to Arduino Ref :Alan G. Smith : Introduction to Arduino A piece of cake! Ref :Brian w. Evans :arduino programming notebook	
3	**INTRODUCTION TO PYTHON:** 1.1 The way of the program : Introduction, what is a program? , Debugging, syntax error, runtime error, systematic error, first program, comments, values and type 1.2 Variable, Expressions & statements: Variables, variable names, Arithmetic operator, Assignment statement, variable names, expression & statement, order of operation, string operation, boolean expression, evaluating expression, logical operator, truth table,operand,condition execution, Alternative execution , chained condition . 1.3 Functions , Iterations, lists : Math function, composition, adding new function, Required argument, flow of execution, parameters & Argument, updating variables, while statement, algorithm, indexing list, list operation, list slice, list method, deleting variables Ref : How to Think Like a ComputerScientist: Learning with Python ,Documentation Release 3rd Edition written by Peter Wentworth, Jeffrey Elkner,Allen B. Downey and Chris Meyer Ref: Learn Python the Hard Way" by Zed A. Shaw	**15**
4	**BASIC CONCEPTS OF OBJECT ORIENTED PROGRAMMING AND C++** 1.1 Basics of Object-Oriented Programming & Beginning with C++: Basic concepts of Object-Oriented Programming, Benefits of OOP,	**15**

	Object- Oriented Languages, Applications of OOP. What is C++?, Applications of C++, A simple C++ program, More C++ Statements, Structure of C++ Program, Creating the Source File, Compiling and Linking. Ref EB: 1.5, 1.6, 1.7 & 1.8 EB: 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7 & 2.8 1.2 Tokens and Expressions in C++: Introduction, Tokens, Keywords, Identifiers and Constants, Basic Data Types, User-Defined Data Types, Derived Data Types, Symbolic Constants, Type Compatibility, Declaration of Variables, Dynamic Initialization of Variables, Reference Variables, Operators in C++, Scope Resolution Operator, Member Dereferencing Operators, Memory Management Operators, Manipulators, Type Cast Operator, Expressions and Their Types, Special Assignment Expressions Ref EB: 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 3.10, 3.11, 3.12, 3.13, 3.14, 3.15, 3.16, 3.17, 3.18, 3.19, 3.20, 3.21, 1.3 Control Structures and Functions: Control Structures, Functions: The Main Function, Function Prototyping, Call by Reference, Return by Reference, Inline Functions, Default Arguments, Constant Arguments,, Math Library Functions. Ref EB: 3.24, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9 & 4.11	

Reference:

1. EB: Object Oriented Programming with C++ by E Balagurusamy, Third /Fourth Edition, Tata McGraw-Hill Publishing Company Limited.
2. How to Think Like a ComputerScientist: Learning with Python ,Documentation Release 3rd Edition written by Peter Wentworth, Jeffrey Elkner,Allen B. Downey and Chris Meyer
3. Ref :Alan G. Smith : Introduction to Arduino A piece of cake!
4. Ref :Brian w. Evans :arduino programming notebook

Additional references:

1) Microprocessor and Applications by Vibhute and Borole, Techmax Publications,
2) Microprocessor, Principles & Applications by Gilmore (2nd Ed) TMH
3) Programming with C++ by D. Ravichandran, Tata McGraw-Hill Publishing Company Limited.
4) Starting out with C++ by Tony Gaddis, Third Edition, Addison Wesley Publishing

Company.
5) Digital Electronics - by A.P Godse & D.A Godse Technical publications, Pune, Revised third edition, 2008. Pg.No:2.25-2.70 (for K-maps).

Course Description: B.Sc.(Physics)	
Semester	VI
Course Name	Practicals of USC6PH5
Course Code	USC6PHP3
Eligibility for the Course	12th Science of all recognised Board
Credit	2
Hours	3 Hrs. per week

GROUP	**Course Description**
A	**GROUP – A: Digital Electronics** Name of the Experiments 1. Study of 3:8 Decoder (74LS138), 8:3 Priority Encoder (74LS148) and their applications. 2. Study of Latch (74LS373) and its application. 3. Study of 8:1 Multiplexer (74LS151), 1: 4 De-multiplexer (74LS155) and their applications. 4. Study of unidirectional buffer (74LS244) and bidirectional buffer (74LS245). 5. Design using K –map and implement 4:1 MUX, 1:4 DEMUX, 2bit comparator, Full adder and Full subtractor. [Note: Use suitable circuit simulator for implementation] 6. Designing (using K –map) and implementation of code convertors. (any two – Binary to Gray, Gray to Binary, BCD to Excess – 3 and Excess-3 to BCD) [Note: Use suitable circuit simulator for implementation]
B.	**Introduction to Microcontrollers** Name of the Experiments 1.Build a circuit on Arduino uno for Temperature Measurement using Thermistor. 2.Design and bulid a program with Arduino uno with Touch Capacitive sensor 3.Study of ultrasonic ranger to calculate distance with use of microcontroller

C.	**Group C:Introduction to Python** Name of the Experiments 1. Python Program to: (i) Add Two Numbers (ii)Largest Among Three Numbers 2. Python Program to Solve Quadratic Equation 3. Python Program to Convert: (i) Kilometers to Miles, (ii) Celsius To Fahrenheit, 4. Python Program to find: (i) Square Root of a Number (ii) Area of a Triang**le**
D.	**GROUP D: C++ Programming** Name of the Experiments 1. Program based on Input, Output Statements. (Programs to read any two numbers through keyboard and to perform simple arithmetic operations and to display the result). 2. Program based on Control Statements, Program based on if-else statement, Program based on nested if statement 3. Program based on for loop, while loop and do-while loop. 4. Program using switch statements and if-else ladder. 5. Program to study function declaration, function calling and function prototype.

Course Description: B.Sc. (Physics)	
Semester	V
Course Name	Credit course (Solar Energy- Fundamentals & Its Applications-I)
Course Code	USC6SE
Eligibility for the Course	12th Science of all recognised Board
Credit	2
Hours	4 Hrs. per week

CO No.	**COs Statement** **After completing the Bachelor of Science Program, students will be able to-**
CO-1	Learn and acquire hands-on experience in the handling Solar / PV cells.
CO-2	Learn and acquire knowledge the solar energy and its relevance.
CO-3	Design and trouble shoots the basic electrical circuits through hands-on mode

CO-4	Design basic solar systems.
CO-5	Familiarize to determine the effect of several variables on the output
CO-6	Identify the basic components used for Solar systems
CO-7	Explores energy from the sun in terms of radiant energy to expand on the concept of electricity generation.

Unit	Course Description
1	**Sources Of Energy :** Geothermal energy, Wind Energy, Tidal and Wave Energy
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	**Types of Solar PV system :** Rooftop & Solar utilities, Types of Solar Panels
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	**HANDS ON TRAINING** 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

References :

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

Examination Evaluation Pattern
Undergraduate Programmes of T. Y. B.Sc. Physics (Sem. V& VI)
60: External & 40: Internal

A) Internal Assessment: 40 % 40 Marks

Sr. No.	Particular	Marks
01	One periodical class test / online examination to be conducted in the given semester	20
02	Open Book Test (Department)	15
03	Active Participation	05

B) Semester End Examination: 60 % 60 Marks

Duration: The examination shall be of 2 hours duration.

<table>
<tr><td rowspan="11">Theory</td><td colspan="3">All questions are compulsory and will have internal options.</td></tr>
<tr><td rowspan="2">Q-1 (Unit-I, II, III, IV)</td><td>Multiple Choice Questions</td><td>12 Marks (14)</td></tr>
<tr><td>Answer in one line/ True or False</td><td>04 Marks (6)</td></tr>
<tr><td rowspan="2">Q-2 (Unit – I)</td><td>Attempt any one out of two.</td><td>07 Marks (04+3)</td></tr>
<tr><td>Attempt any one out of two.</td><td>04 Marks</td></tr>
<tr><td rowspan="2">Q-3 (Unit – II)</td><td>Attempt any one out of two.</td><td>07 Marks</td></tr>
<tr><td>Attempt any one out of two.</td><td>04 Marks</td></tr>
<tr><td rowspan="2">Q-4 (Unit III)</td><td>Attempt any one out of two.</td><td>07 Marks</td></tr>
<tr><td>Attempt any one out of two.</td><td>04 Marks</td></tr>
<tr><td rowspan="2">Q-5 (Unit IV)</td><td>Attempt any one out of two.</td><td>07 Marks</td></tr>
<tr><td>Attempt any one out of two.</td><td>04 Marks</td></tr>
<tr><td colspan="2">TOTAL</td><td>60 Marks</td></tr>
<tr><td rowspan="5">Practical</td><td colspan="3">The External examination for practical courses will be conducted as per the following scheme.</td></tr>
<tr><td>Sr. No.</td><td>External Practical Examination</td><td>Marks</td></tr>
<tr><td>1</td><td>Laboratory Work</td><td>80</td></tr>
<tr><td>2</td><td>Journal</td><td>10</td></tr>
<tr><td>3</td><td>Viva</td><td>10</td></tr>
<tr><td colspan="2">TOTAL</td><td>100 Marks</td></tr>
</table>