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 (Fourth Cycle-CGPA-3.52)
'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 2025-26)

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	45 hrs

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,...

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	30 hrs

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	60 hrs

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	30 hrs

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

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 Physics	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	45 hrs

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

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	30 hrs

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	60 hrs

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	30 hrs

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	30 hrs

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 –
Item No. –02

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 2025-26)

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 2025-26

Signature of

Name
Head, Department of Physics
Changu Kana Thakur
A.C.S. College, New Panvel
(Autonomous)

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)

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.

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, analyse, 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, analyse 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)

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

Choice Based Credit System

Under New Education Policy (NEP) 2020

(To be implemented from the academic year 2025-2026)

Course Structure

Credit Structure of the S.Y.B. Sc. (Physics) Semester III and IV

Sr.No	Course	Credit	T/ P	Evaluation Marks
1	Major Physics I	02	02 (T)	50 (T) : 30(E) + 20(I)
2	Major Physics II	02	02 (T)	50 (T) : 30(E) + 20(I)
3	Practicals Major I +II	02	02(P)	100 (P)
4	SEC Physics / CEP	02	02(P)	50 (P)
5	AEC	02	02(T)	50 (T) : 30(E) + 20(I)
6	VEC	02	02(T)	50 (T) : 30(E) + 20(I)
7	OE	02	02(T)	50 (T) : 30(E) + 20(I)
8	CC	02	02(T)	50 (T) : 30(E) + 20(I)
9	Minor Maths /Chemistry	02	02 (T)	50 (T) : 30(E) + 20(I)
10	Practicals Minor Maths /Chemistry	02	02 (P)	50 (P)
11	IKS Physics /Major Physics 3	02	02(T)	50 (T) : 30(E) + 20(I)
	Total	22		700

Abbreviations Used

- POs : Program Outcomes
- PS : Program Structure
- PSOs : Program Specific Outcomes
- COs : Course Outcomes
- TLP : Teaching-Learning Process
- AM : Assessment Method
- DSC : Discipline Specific Core
- DSE : Discipline Specific Elective
- GE : Generic Elective
- OE : Open Elective
- VSC : Vocational Skill Course
- SEC : Skill Enhancement Course
- IKS : Indian Knowledge System
- AEC : Ability Enhancement Course
- VEC : Value Education Course
- OJT : On Job Training (Internship)
- FP : Field project
- CEP : Community engagement and service
- CC : Co-curricular Courses
- RM : Research Methodology
- RP : Research Project
- MJ : Major Course
- MN : Minor Course

Examination Scheme

Choice Based Credit System (CBCS) Revised Scheme of Examination

1. For Major Courses (50 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

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 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 S.Y.B. Sc. (Physics)
Choice Based Credit System
Under New Education Policy (NEP) 2020
(To be implemented from the academic year 2025-2026)

No. of Courses	Semester III	Credits	No. of Courses	Semester IV	Credits
A	***Discipline Specific Course (Major)***		**A**	***Discipline Specific Course (Major)***	
01	Mathematical Physics and Analog Electronics	02	01	Thermodynamics, Oscillations and Electronics	02
02	Optics and Photonics	02	02	Digital Electronics And 8085 Microprocessor	02
03	IKS - Astronomy and Cosmology	02	03	Basic of quantum mechanics and Properties of Material	02
04	Practicals of Mathematical Physics and Analog Electronics and Optics and Photonics	02	04	Practicals of Thermodynamics, Oscillations and Electronics and Digital Electronics and 8085 Microprocessor	02
B	***Discipline Specific Course (Minor)***		***B***	***Discipline Specific Course (Minor)***	
05	Analog Electronics and Optics	02	05	Mechanics, Thermodynamics, Digital Electronics	02
06	Practical of Analog Electronics and Optics	02	06	Practical of Mechanics, Thermodynamics, Digital Electronics	02
C	***Open Elective***		***C***	***Open Elective***	
07	NA	04	07	NA	04
D	***Skill Enhancement Course (SEC)***		***D***	***Community Engagement Projects (CEP)***	
08	Basics of Electricity and Electronics	02	08	(Title not required)	02
E	***Ability Enhancement Course (AEC) (Any One)***		***E***	***Ability Enhancement Course (AEC) (Any One)***	

09	Communication Skills - English	02	09	Communication Skills - English	02
F	***Co-curricular Courses (Any One)***		***F***	***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 2025-2026

SEMESTER III

Course Code	Course Type	Course Title	Credit
USC3PH3	Major (Physics-1)	Mathematical Physics and Analog Electronics	02
USC3PH4	Major (Physics-2)	Optics and Photonics	02
USC3PHP	Major Practical	Practicals of Mathematical Physics and Analog Electronics and Optics and Photonics	02
USC3PH5	IKS	Astronomy and Cosmology	02
USEC3BEE	SEC	Basics of Electricity and Electronics	02
USC4MTDEM	Minor	Analog Electronics and Optics	04
Total Credits			**08**

Course Description: B.Sc. (Physics)	
Semester	III
Course Name	Physics-1 (Mathematical Physics and Analog Electronics)
Course Code	**USC3PH3**
Eligibility for the Course	F.Y.B.Sc Pass out
Credit	2
Hours	30 hrs

CO No.	COs Statement After completing the Bachelor of Science Program, students will be able to-
CO-1	Summarize basics of Integral calculus and its applications, semiconductor, Transistor
CO-2	Solve numerical problems based on Vector integrals
CO-3	Discuss basic of Semiconductor and its Application, Transistors,

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	

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

Course Description: B.Sc. (Physics)	
Semester	III
Course Name	Physics-2 (Optics and Photonics)
Course Code	**USC3PH4**
Eligibility for the Course	F.Y.B.Sc Pass out
Credit	2
Hours	30 hrs

CO No.	**COs Statement** **After completing the Bachelor of Science Program, students will be able to-**
CO-1	Understand the fundamentals of laser operation and applications
CO-2	Analyze the properties and applications of optical fibers
CO-3	Apply the principles of diffraction to understand the behavior of light waves
CO-4	Comprehend the concept of polarization and its practical applications

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

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	

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

Course Description: B.Sc. (Physics)	
Semester	III
Course Name	Practicals of Mathematical Physics and Analog Electronics and Optics and Photonics
Course Code	USC3PHP
Eligibility for the Course	F.Y.B.Sc Pass out
Credit	2
Hours	60 hrs

CO No.	**COs Statement** **After completing the Bachelor of Science Program, students will be able to-**
CO-1	Familiarize with basic electronic components
CO-2	Experiment with transistor amplifier
CO-3	Inspect frequency response, voltage gain

Group	Course Description
A	**Skill** 1. Designing of circuit on breadboard 2. Transistor, Diode testing 3. Component testing, colour code of resistors, capacitors **Practicals (Any 06)** 1. I/p and O/p characteristics of CE amplifier 2. CE amplifier: determination of bandwidth 3. CE amplifier: variation of gain with load 4. PN junction Forward biased and Reverse biased 5. Diode as a temperature sensor 6. photodiode 7. CB amplifier: determination of bandwidth 8. CB amplifier: variation of gain with load 9. Solving Gradient theorem, 10. Solving divergence theorem
B	**Skill** 1. Schuster method 2. Error Analysis 3. Plotting of graph 4. Demonstration of fresnel diffraction **Practicals (Any 06)** 1. Thickness of wire using a laser 2. To determine divergence of laser 3. Optical lever 4. Cauchy's constant 5. Brewster law 6. Rydberg's constant 7. Fresnel's bi-prism: determination of wavelength 8. Double refraction 9. Measurement of 'g' using bar pendulum 10. Fresnel's biprism
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	IKS(Astronomy and Cosmology)
Course Code	USC3PH5
Eligibility for the Course	F.Y.B.Sc Pass out
Credit	2
Hours	30 hrs

CO No.	**COs Statement**
	After completing the Bachelor of Science Program, students will be able to-
CO-1	Analyze ancient Indian astronomical sources, evaluating the accuracy of observations, theories, and calculations based on the available historical records.
CO-2	Compare ancient Indian astronomical theories with those from other civilizations, understanding the cultural and scientific contexts.
CO-3	Develop skills in analyzing ancient Indian astronomical observations, including star positions, planetary motions, eclipses, and celestial events.

Ancient Indian Astronomy		
Unit	**Course Description**	Hrs
	Astronomical Calculations, And Cosmological Insights	
1.1	Parahita system of astronomy and dark system of astronomy, astronomical calculations, calendrical studies, and establishes rules for empirical observation), Aryabhata (earth rotation, shining of moon), Brahmasphutasiddhanta (motion of planets)	15
1.2	Varahamihira (panchasiddhantika), Mahabhaskariya, lahubhaskariya & aryabhatiya bhashya (Planetary longitudes, heliacal rising and setting of the planets, conjunctions among the planets and stars, solar and lunar eclipses, and the phases of the Moon), Sisyadhiveddhida (grahadhyaya, goladhyaya),	

	siddhanta siromani, kadanakutuhala (planetary positions, conjunctions, eclipses, cosmography), siddhanta sekhara, yantra-kiranavali, Sphuṭanirṇaya, Uparagakriyakrama	
	Positional Systems, Timekeeping, and Astronomical Instruments	
2.1	Positional astronomy (sun, planets, moon, coordinate systems, precision of the equinox and its effects, eclipses, comets and meteors), Mahayuga & Kalpa system Yuga system, ayanas, months, tithis and seasons, time units, sun and moon's motion, planet position, ayana chalana, zero-precision year, katapayadi system, Indian nakshatra system, astronomy.	15
2.2	Instruments for naked eye astronomy (vedic observatories). The principal and application of Samrat Yantra, Jai Prakash Yantra, Disha Yantra, Rama Yantra, Chakra Yantra, Rashiwalya Yantra, Dingash Yantra, Utaansh Yantra	

Reference books:

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

Course Description: B.Sc. (Physics)	
Semester	III
Course Name	SEC (Basics of Electricity and Electronics)
Course Code	USEC3BEE
Eligibility for the Course	F.Y.B.Sc Pass out
Credit	2
Hours	60 hrs

CO No.	**COs Statement**
	After completing the Bachelor of Science Program, students will be able to-
CO-1	Designing practical circuits integrate sensors and control components for practical, real-world applications.
CO-2	Build and analyze circuits using Ohm's and Kirchhoff's laws.
CO-3	Verify theoretical concepts with virtual lab simulations
CO-4	troubleshoot and optimize circuit performance through iterative experiments.

Practicals (Any 12)
1. To find equivalent resistance in parallel using Ohm's law 2. To find equivalent resistance in Series using Ohm's law 3. To find impedance of circuit 4. To verify kirchoff law of voltage using Bulb using virtual lab https://phet.colorado.edu/sims/html/circuit-construction-kit-dc-virtual-lab/latest/circuit-construction-kit-dc-virtual-lab_en.html 5. To verify kirchoff law of voltage using Bulb using virtual lab https://phet.colorado.edu/sims/html/circuit-construction-kit-dc-virtual-lab/latest/circuit-construction-kit-dc-virtual-lab_en.html 6. To verify kirchhoff's law of voltage in series 7. To verify kirchhoff's law of voltage in parallel 8. Use of single switch 9. Use of Double switch 10. One way light bulbs 11. Use of potentiometer to control brightness of LED 12. Water level detector using resistor **13.** Collection of information related to different circuits with its practical applications (equivalent of 3 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	III
Course Name	Minor (Analog Electronics and Optics)
Course Code	USC3AEOM
Eligibility for the Course	F.Y.B.Sc Pass out
Credit	2
Hours	30 hrs

CO No.	**COs Statement** **After completing the Bachelor of Science Program, students will be able to-**
CO-1	Demonstrate the working principles of diodes and their applications
CO-2	Design and analyze different biasing techniques for transistors to ensure stable operation in amplifier circuits.

CO-3	Compare and contrast different types of lasers based on their construction, working principles, and applications.
CO-4	Discuss the components of optical fibre communication systems, including sources, detectors, and connectors, and their role in data transmission.

Analog Electronics and Optics		
Unit	**Course Description**	Hrs
1.1	**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
1.2	**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	
2.1	**LASER** 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	15
2.2	**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	

References:

[VKM] : Principles of Electronics – V. K. Mehta and Rohit Mehta. (S. Chand Multicoloured illustrative edition)
[SP]: Modern Physics Concept and Applications – Sanjeev Puri, Narosa Publication

Course Description: B.Sc. (Physics)	
Semester	III
Course Name	Minor Practical (Practical of Analog Electronics and Optics)
Course Code	USC3AEOPM

Eligibility for the Course	F.Y.B.Sc Pass out
Credit	2
Hours	60 hrs

Practicals

Group	Course Description
A	**Group A** Skill 1. Designing of circuit on breadboard 2. Transistor, Diode testing 3. Component testing, colour code of resistors, capacitors Practicals (Any 06) 1. I/p and O/p characteristics of CE amplifier 2. CE amplifier: determination of bandwidth 3. CE amplifier: variation of gain with load 4. PN junction Forward biased and Reverse biased 5. Diode as a temperature sensor 6. photodiode 7. CB amplifier: determination of bandwidth 8. CB amplifier: variation of gain with load 9. Solving Gradient theorem, 10. Solving divergence theorem
B	Skill 1. Schuster method 2. Error Analysis 3. Plotting of graph 4. Demonstration of fresnel diffraction Practicals (Any 06) 1. Thickness of wire using a laser 2. To determine divergence of laser 3. Optical lever 4. Cauchy's constant 5. Brewster law 6. Rydberg's constant 7. Fresnel's bi-prism: determination of wavelength 8. Double refraction 9. Measurement of 'g' using bar pendulum 10. Fresnel's biprism

C	**Group C** Any 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.

Choice Based Credit System (CBCS)
S.Y.B. Sc. Physics Syllabus
To be implemented from the Academic year 2025-2026

SEMESTER IV

Course Code	Course Type	Course Title	Credit
USC4PH6	Major (Physics-1)	Thermodynamics, Oscillations and Electronics	02
USC4PH7	Major (Physics-2)	Digital Electronics And 8085 Microprocessor	02
USC4PHP	Major Practical	Practicals of Thermodynamics, Oscillations and Electronics and Digital Electronics And 8085 Microprocessor	02
USC4PH8	Major (Physics-3)	Basic of quantum mechanics and Properties of Material	02
USC4MTDEM	Minor	Mechanics, Thermodynamics, Digital Electronics	04
Total Credits			**08**

Course Description: B.Sc. (Physics)	
Semester	IV

Course Name	Physics-1 (Thermodynamics, Oscillations and Electronics)
Course Code	USC4PH6
Eligibility for the Course	F.Y.B.Sc Pass out
Credit	2
Hours	30 hrs

CO No.	**COs Statement**
	After completing the Bachelor of Science Program, students will be able to-
CO-1	summarize the thermodynamics law, Feedback Amplifier and its applications
CO-2	Explain the application of thermodynamics law and simple Harmonic oscillations
CO-3	Apply the feedback concepts in 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 Thermodynamics, OPAMP and oscillators

Unit	**Course Description**	Hrs
1.1	**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	15
1.2	**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	
2.1	**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
2.2	**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	
2.3	**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:

[BSH] : Brijlal, Subramanyam and Hemne, Heat, Thermodynamics and Statistical Physics, S Chand Revised, Multicolor 2007-Ed

[PRH] Physics – I : Robert Resnick and David Halliday

[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

[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	Physics-2 (Digital Electronics And 8085 Microprocessor)
Course Code	USC4PH7
Eligibility for the Course	F.Y.B.Sc Pass out
Credit	2
Hours	30 hrs

CO No.	**COs Statement** **After completing the Bachelor of Science Program, students will be able to-**
CO-1	Explain the principles of sequential logic and differentiate between various types of flip-flops such as SR, D, JK, and T flip-flops.
CO-2	Explain the architecture, pin configuration, and instruction set of the 8085 microprocessor.
CO-3	Demonstrate interfacing techniques for memory and I/O devices with the 8085 microprocessor.
CO-4	Develop and debug assembly-level programs for various arithmetic, logical, and control operations using the 8085 instruction set.

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, 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	15
1.2	**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	
2.1	**8085 MICROPROCESSOR ARCHITECTURE** Introduction, Features of Intel 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
2.2	**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	

References:

[[LMS]: Digital Principles and Applications by Leach, Malvino, Saha Seventh edition.
[VB]: 8- bit microprocessor by V.J. Vibhute & P.B. Borole, Techmax publication, Fifth Revised Edition

Course Description: B.Sc. (Physics)	
Semester	IV
Course Name	Practicals of Thermodynamics, Oscillations and Electronics and Digital Electronics and 8085 Microprocessor
Course Code	USC4PHP
Eligibility for the Course	F.Y.B.Sc Pass out

Credit	2
Hours	60 hrs

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	Skills 1.Use of Stop watch for time measurement 2. Use of thermometer 3. Graph Plotting : slope from curve Practical (Any 6) 1. Lee method 2. Stefan law 3. Specific Heat 4. Kater's Pendulum 5. Resonance – Helmholtz Tube 6. Logarithmic decrement & Damping Coefficient of simple Pendulum 7. OPAMP : inverting 8. OPAMP : non inverting 9. Wein bridge Oscillator 10. find a amplitude and frequency using CRO
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	Physics- 3 (Basic of quantum mechanics and Properties of Material
Course Code	USC4PH8
Eligibility for the Course	F.Y.B.Sc Pass out
Credit	2
Hours	30 hrs

CO No.	**COs Statement** **After completing the Bachelor of Science Program, students will be able to-**
CO-1	Summarize basic concepts related to Quantum Mechanics
CO-2	Explain postulates of quantum mechanics, operators, expectation values in quantum mechanics and Schrodinger's equation
CO-3	To analyze the electrical properties of materials through energy band theory, conductivity mechanisms, and temperature effects.
CO-4	To understand the origin of magnetism, different types of magnetic ordering, and the concept of magnetic hysteresis in materials.

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	**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
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:

[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
[BMC] :Concepts of Modern Physics – A. Beiser, Mahajan, Choudhary (6th Ed.) Tata McGraw Hill.vh

Course Description: B.Sc. (Physics)	
Semester	IV
Course Name	Minor (Mechanics, Thermodynamics, Digital Electronics)
Course Code	USC4MTDEM
Eligibility for the Course	F.Y.B.Sc Pass out
Credit	2
Hours	30 hrs

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

CO-1	Evaluate the relationship between damped and forced oscillations in various applications.
CO-2	Understand the laws of thermodynamics and their physical significance.
CO-3	Design and implement sequential circuits using flip-flops.
CO-4	Analyze circuit diagrams and timing sequences involving the 555 timer.

Mechanics, Thermodynamics, Digital Electronics		
Unit	**Course Description**	Hrs
1.1	**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	15
1.2	**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	
2.1	**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, 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	15
2.2	**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	

References:

[BSH] : Brijlal, Subramanyam and Hemne, Heat, Thermodynamics and Statistical Physics, S Chand Revised, Multicolor 2007-Ed

[PRH] Physics – I : Robert Resnick and David Halliday

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

Course Description: B.Sc. (Physics)	
Semester	IV
Course Name	Minor Practical (Practical of Mechanics, Thermodynamics, Digital Electronics)
Course Code	USC4MTDEPM
Eligibility for the Course	F.Y.B.Sc Pass out
Credit	2
Hours	60 hrs

Practicals

Group	**Course Description**
A	**Skills** 1.Use of Stop watch for time measurement 2. Use of thermometer 3. Graph Plotting : slope from curve **Practical (Any 6)** 1. Lee method 2. Stefan law 3. Specific Heat 4. Kater's Pendulum 5. Resonance helmholtz tube 6. Logarithmic decrement & Damping Coefficient of simple Pendulum 7. Exponential decay of Liquid
B	**Group B** Skills 1. Circuit designing 2. Charging and discharging of capacitor 3. Testing of IC's Practicals (any 6) 1. Half adder and full adder using EX-OR gate (IC7486, IC 7408) 2. Study of MS-JK flip flop (IC 7476) 3. Study of Latch (IC 7400/ IC 7402) 4. Study of 8:3 Priority Encoder (IC 74LS148) 5. Study of 3:8 Decoder (IC 74LS138) 6. Shift Register (IC 74194) 7. Study of Logic gate 8. NANA and NOR gate as a universal building block

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.

EXAMINATION EVALUATION PATTERN

S. Y. B.Sc. Physics (Sem. III& IV)

PHYSICS MAJOR I , II

30: External & 20: Internal

A) Internal Assessment: 40 % **20 Marks**

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

B) Semester End Examination: 60 % **30 Marks**

Duration: The examination shall be of 2 hours duration.

Theory	All questions are compulsory and will have internal options.		
	Q-1 (Unit-I)	Multiple Choice Questions	05 Marks (07)
		Attempt any two out of three.	10 Marks (03)
	Q-2 (Unit –II)	Multiple Choice Questions	05 Marks (07)

		Attempt any two out of three.	10 Marks (03)
	TOTAL		30 Marks
Practical	**The External examination for practical courses will be conducted as per the following scheme.**		
	Sr. No.	External Practical Examination	Marks
	1	Laboratory Work	80
	2	Journal	10
	3	Viva	10
	TOTAL		100 Marks

PHYSICS IKS /MAJOR 3

30: External & 20: Internal

A) Internal Assessment: 40 % 20 Marks

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

B) Semester End Examination: 60 % 30 Marks

Duration: The examination shall be of 2 hours duration.

Theory	All questions are compulsory and will have internal options.		
	Q-1 (Unit-I)	Multiple Choice Questions	05 Marks (07)
		Attempt any two out of three.	10 Marks (03)
	Q-2 (Unit –II)	Multiple Choice Questions	05 Marks (07)
		Attempt any two out of three.	10 Marks (03)
	TOTAL		30 Marks

SEC Physics

A) Practical 50 marks

Practical	**The External examination for practical courses will be conducted as per the following scheme.**		
	Sr. No.	External Practical Examination	Marks

	1	Laboratory Work	40
	2	Journal	05
	3	Viva	05
	TOTAL		50 Marks

PHYSICS MINOR

30: External & 20: Internal

A) Internal Assessment: 40 % 20 Marks

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

B) Semester End Examination: 60 % 30 Marks

Duration: The examination shall be of 2 hours duration.

Theory	All questions are compulsory and will have internal options.		
	Q-1 (Unit-I)	Multiple Choice Questions	05 Marks (07)
		Attempt any two out of three.	10 Marks (03)
	Q-2 (Unit –II)	Multiple Choice Questions	05 Marks (07)
		Attempt any two out of three.	10 Marks (03)
	TOTAL		30 Marks
Practical	**The External examination for practical courses will be conducted as per the following scheme.**		
	Sr. No.	External Practical Examination	Marks
	1	Laboratory Work	40
	2	Journal	05
	3	Viva	05
	TOTAL		50 Marks

Academic Council Date –
Item No. – 05

Janardan Bhagat Shikshan Prasarak Sanstha's

CHANGU KANA THAKUR

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

Re-accredited A++ Grade by NAAC (Fourth Cycle-CGPA-3.52)
'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 2025-26)

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**	S.Y.B. Sc. pass out
3	**Duration of program**	1 year
4	**Intake Capacity**	40
5	**Scheme of Examination**	60:40
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 2025-26

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)

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 complete and more logical framework in almost all areas of basic physics.

Course Structure

Credit Structure of the T.Y.B. Sc. (Physics) Semester V and VI

Sr.No	Course	Credit	T/ P	Evaluation Marks
1	Major Physics I	04	04 (T)	100 (T) :60(E) + 40(I)
2	Major Physics II	04	04 (T)	100 (T) :60(E) + 40(I)
3	Practicals Major I +II	02	02(P)	100 (P)
4	VSC / OJT	04	04(P)	100 (P)
5	Minor Maths /Chemistry	04	02 (T) +02(P)	50(T) :30(E) + 20(I) 50(P)
6	Elective Physics III	04	03(T)+ 01(P)	100 (T) : 60(E) + 40(I) 50(P)
	Total	22		650

‘

Abbreviations Used

- POs: Program Outcomes
- PS: Program Structure
- PSOs: Program Specific Outcomes
- COs: Course Outcomes
- TLP : Teaching-Learning Process
- AM : Assessment Method
- DSC : Discipline Specific Core
- DSE : Discipline Specific Elective
- GE : Generic Elective
- OE : Open Elective
- VSC : Vocational Skill Course
- SEC : Skill Enhancement Course
- IKS : Indian Knowledge System
- AEC : Ability Enhancement Course
- VEC : Value Education Course
- OJT : On Job Training (Internship)
- FP : Field project
- CEP : Community engagement and service
- CC : Co-curricular Courses
- RM : Research Methodology
- RP : Research Project
- MJ : Major Course
- MN : Minor Course

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
	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.

05

Janardan Bhagat Shikshan Prasarak Sanstha's

CHANGU KANA THAKUR

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

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

Choice Based Credit System

Under New Education Policy (NEP) 2020

(To be implemented from the academic year 2025-2026)

No. of Courses	Semester V	Credits	No. of Courses	Semester VI	Credits
A	***Discipline Specific Course (Major)***		**A**	***Discipline Specific Course (Major)***	
01	Atomic Physics and Mechanics	04	01	Nuclear Physics and Optics	04
02	Solid State Physics and Electrodynamics	04	02	Electronics and Relativity	04
03	Practicals of Atomic Physics and mechanics & Solid State Physics and Electrodynamics	02	03	Practicals of Nuclear Physics and Optics & Electronics and Relativity	02
B	***Elective Course***		***B***	***Elective Course***	
04	Introduction to C++ programing	03	04	Basics of Python programing	**03**
05	Practicals of Introduction of C++	01	05	Practicals of Basics of Python programing	**01**
C	***Discipline Specific Course (Minor)***		***C***	***Discipline Specific Course (Minor)***	
06	Mechanics, Analog Electronics and Properties of materials	02	06	Fluid Mechanics, Thermodynamics II, Digital Electronics	02
07	Practical of Mechanics, Analog Electronics and Properties of materials	02	07	Practical of Fluid Mechanics, Thermodynamics II, Digital Electronics	02
D	***Vocational Skill Courses***		***D***	***On Job Training***	
08	Experimental Physics	04	08	(Title not required)	04
Total Credits		**22**	**Total Credits**		**22**

Choice Based Credit System (CBCS)
T. Y.B. Sc. Physics Syllabus
To be implemented from the Academic year 2025-2026

SEMESTER V

Course Code	Course Type	Course Title	Credit
USC5PH9	Major (Physics-I)	Atomic Physics and Mechanics	4
USC5PH10	Major (Physics-II)	Solid State Physics and Electrodynamics	4
USC5PHP	Major Practical	Practicals of Atomic Physics and mechanics & Solid State Physics and Electrodynamics	2
USC5PHE1	Major Elective	Introduction to C++ programing	3
USC5PHE1P	Major Elective Practical	Practicals of Introduction of C++	1
UVSC5EP	VSC	Experimental Physics	4
USC5MAEPM	Minor	Mechanics, Analog Electronics and Properties of materials	2
USC5MAEPPM	Minor Practical	Practical of Mechanics, Analog Electronics and Properties of materials	2
Total			22

Course Description: B.Sc. (Physics)	
Semester	V
Course Name	Physics-I (Atomic Physics and Mechanics)
Course Code	USC5PH9
Eligibility for the Course	S.Y.B. Sc. pass out
Credit	4
Hours	60 hrs

CO No.	**COs Statement**
	After completing the Bachelor of Science Program, students will be able to-
CO-1	Summarize the 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, Harmonic Oscillators

CO-2	Apply principles of quantum mechanics to describe atomic orbitals, probability densities, and electron transitions.
CO-3	Discuss the different kinds of coupling and effect of magnetic field on atoms with its application
CO-4	Interpret rotational and vibrational spectra and understand the concept of selection rules in molecular transitions.
CO-5	Compare the different types of Harmonic Oscillator

Unit	**Course Description**	Hrs
	BASIC OF QM	15
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	
	COUPLING	15
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	
	MOLECULAR SPECTRA	15
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	
	HARMONIC OSCILLATOR	**15**
4.1	**Damped Harmonic Oscillations :** Damped Harmonic Oscillator, Over-Damped, Critically Damped, Under-Damped, Energy Of Damped Oscillator, Quality Factor Of Damped Oscillator, Logarithmic Decrement, Relaxation Time, Numericals. [MHP]: 9.3, 9.4, 9.6, 9.7 [MMH]: 8.1, 8.2, 8.3, 8.4 [PRH]: 15.9, 15.10	

4.2	**Forced Harmonic Oscillations :**Forced damped harmonic oscillator, three cases, dependence of phase angle on driving frequency and damping, Amplitude resonance, velocity resonance, Quality factor of a driven oscillator, Numerical. [MHP]: 9.3, 9.4, 9.6, 9.7 [MMH]: 8.6, 8.7, 8.8, 8.9 [PRH]: 15.9, 15.10	

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).
[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
[PRH] Physics – I : Robert Resnick and David Halliday

Course Description: B.Sc. (Physics)	
Semester	V
Course Name	Physics-II(Solid State Physics and Electrodynamics)
Course Code	USC5PH10
Eligibility for the Course	S.Y.B. Sc. pass out
Credit	4
Hours	60 hrs

CO No.	**COs Statement** **After completing the Bachelor of Science Program, students will be able to-**
CO-1	Analyze the electronic properties of materials using band theory concepts to predict their electrical and optical behavior.
CO-2	Apply semiconductor diode principles in designing rectifiers, voltage regulators, and other basic electronic circuits.
CO-3	Apply boundary conditions to solve magnetostatic problems in matter.
CO-4	Derive the wave equation for electromagnetic waves in free space and various media using Maxwell's equations.

Unit	**Course Description**	Hrs

		15
1.1	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. SOP: Chapter 6: XXXVI, XXXVII, XXXVIII, XXXIX, XXXX, XXXXI	
1.2	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, Fermi level in extrinsic semiconductors, Diffusion, Carrier lifetime, The continuity equation, Hall Effect. MH : 4.1 to 4.10.	
		15
2.1	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. MH: 5.1 to 5.8	
2.2	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. CK: Chapter 12	
	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	
	Electromagnetic Waves	15

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, Reflection and Transmission of EM waves at oblique incidence. DG : 8.1.1, 8.1.2 DG : 9.2.1 to 9.2.3, 9.3.1 to 9.3.3	

References:

1. SOP: Solid State Physics: S. O. Pillai, New Age International, 6th Ed.
2. Electronic Devices and Circuits: Millman, Halkias & Satyabrata Jit. (3rd Ed.) Tata McGraw Hill.
3. CK: Introduction to Solid State Physics-Charles Kittel, 7th Ed. John Wiley & Sons
4. 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 Atomic Physics and Mechanics & Solid State Physics and Electrodynamics
Course Code	USC5PHP
Eligibility for the Course	12^{th} Science of all recognised Board
Credit	2
Hours	60 hrs

Group	**Course Description**

A	**SKILL EXPERIMENTS** 1. Estimation of errors from actual experimental data 2. Determine Time period 3. Focussing of travelling microscope 4. Use of electronic balance: Find the density of a solid cylinder **EXPERIMENTS (ANY 4)** 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 of A Damped Simple Harmonic Motion Using A Simple Pendulum 6. To Determine the Relaxation Time And Quality Factor of A Damped Simple Harmonic Motion Using A Simple Pendulum 7. Restoring force per unit extension of a spiral spring dynamical methods 8. To determine the Young's modulus of the material of a given beam supported on two knife-edges and loaded at the middle point 9. Determination of dielectric constant 10. Logarithmic decrement 11. Searle's Goniometer 12. Determination of Rydberg's constant 13. Edser's 'A' pattern 14. Velocity of sound in air using CRO
B	**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 (Any 4)** 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-I (Introduction to C++)
Course Code	USC5PHE1
Eligibility for the Course	S.Y.B. Sc. pass out
Credit	3
Hours	45 hrs

CO No.	**COs Statement**
	After completing the Bachelor of Science Program, students will be able to-
CO-1	Demonstrate foundational programming skills in C++ including algorithms, flowcharts, variables, operators, and control structures for logical problem-solving.
CO-2	Implement advanced techniques like functions, arrays, pointers, and strings to design efficient and modular programs..
CO-3	Utilize built-in libraries and advanced features like vectors, recursion, and string functions for solving complex computational tasks.

Unit	**Course Description**	Hrs
	PROGRAMMING LOGIC AND TECHNIQUES	15
1.1	Introduction, Algorithm, Flowchart , Introduction to C++: History of C++, Structure of C++ Program, Variables and Assignments: Variables, variable declarations, Identifiers, local and global variables, Constants, Reference variable, Symbolic constant.	
1.2	Operators: Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Operator Precedence, Input and Output: cin, cout, include directives and Namespaces, Comments, Data types Flow of Control: Compound statements, Loops: while, for, do while, nested loops, Decision	

	making: if – else, nested if else, switch, break and continue	
	FUNCTIONS	15
2.1	Function Prototypes, built in functions and user defined functions, Function overloading, Call by reference, Call by value, const member functions. Inline Functions and recursive functions, Math Library Functions.	
2.2	Derived Data types (Arrays , pointers , functions): Introduction to arrays, arrays in functions, 2-D arrays , Multidimensional arrays, Introduction to pointers, void pointers, pointers in function, pointer to constant and constant pointer, generic pointer. Strings and Vectors: String functions,	
	INTRODUCTION TO OOPS:	**15**
3.1	Need of object oriented programming, Comparison of procedural and object oriented approach, Applications of OOPs, Characteristics of OOPs – Objects, Classes, Data Abstraction, Encapsulation, Inheritance, Polymorphism, and Reusability.	
3.2	Classes and Objects: Classes, Class declaration, Creating Objects, Member function of a class, Objects as function arguments, Dynamic Memory Allocation, Static Data Members, Friend Function.	
3.3	Operator Overloading: Overloading the assignment operator, This pointer, Overloading arithmetic operators, Overloading the arithmetic assignment operators, Overloading the relational operators, Overloading the stream operators, Conversion operators ,Overloading the increment and decrement operators, Overloading the subscript operator.	

Reference Books:

1. "Programming: Principles and Practice Using C++" by Bjarne Stroustrup
2. "Data Structures and Algorithm Analysis in C++" by Mark Allen Weiss
3. "C++ Programming Language" by Bjarne Stroustrup

Course Description: B.Sc. (Physics)	
Semester	V
Course Name	Practicals of Introduction of C++
Course Code	USC5PHE1P
Eligibility for the Course	S.Y.B. Sc. pass out

Credit	1
Hours	15 hrs

Practicals (Any 06)

1. Write a program to display the message HELLO WORLD. And Write a program to declare some variables of type int, float and double. Assign some values to these variables & display these values.
2. Write a program to swap two numbers without using a third variable.
3. Write a program to find the area of rectangle, square and circle.
4. Write a program to check whether the number is positive, negative or zero.
5. Write a program to find the largest of three numbers.
6. Write a program to Check Whether a number is divisible by 5 or not.
7. Write a program to Check whether the alphabet is vowel or consonant
8. Write a program to enter a number from the user and display the month name. If number>13 then display
9. Write a program to check whether the number is even or odd.
10. Write a program to check whether the triangle is equilateral or isosceles.
11. write a program to find the days between two dates.
12. Write a program to find the largest value that is stored in the array.
13. Write a program to compute the sum of all elements stored in an array.
14. String operations for string length , string concatenation, string reverse, string comparison
15. Write a C++ program using class and object Student to print the name of the student, roll no. Display the same.

Course Description: B.Sc. (Physics)	
Semester	V
Course Name	VSC (Experimental Physics)
Course Code	UVSC5EP
Eligibility for the Course	S.Y.B. Sc. pass out
Credit	4
Hours	120 hrs

CO No.	**COs Statement** **After completing the Bachelor of Science Program, students will be able to-**
CO-1	Develop practical skills in electrical wiring, joint connections, and circuit assembly techniques.
CO-2	Understand the principles and applications of modulation techniques, waveform generation, and electronic converters.
CO-3	Analyze the characteristics and performance of solar cells and thermistors under

	various conditions.
CO-4	Synthesize nanomaterials using advanced techniques such as microwave, SILAR, sonication, and CBD methods.

Group	Course Description
A	**VSC I (** Experimental Physics **I)** **Practicals (Any 20)** 1. Study of different types of electrical joints . 2. Identification of different electrical wiring accessories 3. Identification of different components of Solar lamp 4. Series and parallel connection of Bulb 5. To connect different types of components with wires in a junction box. 6. Four way staircase wiring 7. Effect of dust particles on Cell Current / voltage. 8. Effect of shading on Cell Current / voltage 9. Effect of angle of inclination on Cell Current /voltage 10. design and build Square wave generator 11. design and build Triangular wave generator 12. D/A converter 13. Thermistor characteristics - Electrical 14. Build LED flasher circuit on stripboard using soldering iron 15. IV characteristics of solar cell 16. A/D converter 17. Application of IC 555 Timer as Ramp generator 18. Frequency modulation /Demodulation 19. Amplitude modulation / Demodulation 20. Students should carry out Energy Audit in Residential Area. Report that in a journal. **(Equivalent to three experiments)** 21. Students should collect the information of at least five solar energy appliances with their work. Report that in a journal. (**Equivalent to three experiments)** **22.** Students should collect the information of at least two microcontroller with their work. Report that in a journal (**Equivalent to three experiments.)**
B	**VSC II (** Experimental Physics **II)** **Practicals (Any 20)** 1. Introduction of different techniques for synthesis of Nanomaterial by Referring Research papers 2. Introduction and installation of Tinkercad app 3. Use of all electronic components on Tinkercad app 4. Preparation of ZnO nanomaterial using Microwave synthesis 5. Preparation of MnO_2 using SILAR method

	6. Preparation of nanomaterial using Sonication synthesis 7. Preparation of nanomaterial using CBD method 8. Preparation of ZnCuO nanomaterial using Microwave synthesis 9. Soil moisture sensor using arduino Uno 10. LED sequential control using Arduino 11. Potentiometer-Controlled LED Brightness 12. Seven segment display counter 13. Temperature based fan speed control 14. Design Digital clock using Arduino uno 15. Design Digital voltmeter 16. Pulse rate detection using Arduino Uno 17. Design calculator using Arduino uno 18. Students should collect the information of synthesis methods with their work. Report that in a journal. (**Equivalent to three experiments)** 19. Students should carry out society oriented IOT based project **(Equivalent to three experiments)** 20. Study tour. Students participating in the study tour must submit a study tour report. **(Equivalent to three experiment)**

Reference Books:

1. Michael Boxell , Solar Electricity Handbook (2012 Edition), Greenstream publishing.
2. Baiano Reeves , Solar Power DIY Handbook.
3. V. N. Mittal and Arvind Mittal; " Basic Electrical Engineering" McGraw Hill
4. Vincent DelToro, "Electrical engineering Fundamentals", PHI second edition 2011
5. Bolestaad, :"Electronics Devices and Circuits Theory", Pearson Education India
6. A Handbook of Laboratory preparation solutions, M. H. Gabb, W. B. Latchem
7. Synthesis and Applications of Nanoparticles , Atul Thakur, Preeti Thakur, S. M. Paul khaurana.

Course Description: B.Sc. (Physics)	
Semester	V
Course Name	Minor (Mechanics, Analog Electronics and Properties of materials)
Course Code	USC5MAEPM
Eligibility for the Course	S.Y.B. Sc. pass out
Credit	2
Hours	30 hrs

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	Discuss basic of Semiconductor and its Application, Transistors, Gradient, Curl, Divergence terms & its applications, laws of conservation of momentum & energy, compound pendulum
CO-3	Interpret the concept of relativistic simultaneity, how events that are simultaneous in one frame of reference may not be simultaneous in another frame.
CO-4	Discuss the concept of mass-energy equivalence as introduced by the Special Theory of Relativity, including the famous equation $E=mc^2$
CO-5	Compare the materials on the basis of Electrical conductivity and relative magnetic permeability.

Unit	Course Description	Hrs
1.1	**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
1.2	**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	
2.1	**ELECTRICAL PROPERTIES OF MATERIALS:** Classical free electron theory of metals, Drawbacks of classical theory, Relaxation time, Collision time and mean free path [SSP] :6.2, 6.3, 6.4, 6.5, 6.14,6.15	15
2.2	**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.	

References:

[MS]:Murray R Spiegel, Schaum's outline of Theory and problems of Vector Analysis, Asian Student Edition
[MLB] :Mathematical Methods in Physical Sciences, 3rd Edition, Mary Ll. Boas
[OSB]: A Textbook of Optics: Dr. N. Subrahmanyam, Brijlal, Dr M. N.Avadhaanulu (S. Chand, 25th Revised edition 2012 Reprint 2013)
[SSP]: Solid State Physics: S. O. Pillai, New Age International, 6th Ed.

Course Description: B.Sc. (Physics)	
Semester	V
Course Name	Minor Practical (Practical of Mechanics, Analog Electronics and Properties of materials)
Course Code	USC5MAEPPM
Eligibility for the Course	S.Y.B. Sc. pass out
Credit	2
Hours	60 hrs

Group	**Course Description**
A	**Skill (3)** 1. Familization with Transistor, resistor, capacitor 2. Familizarition of signal generator 3. Find velocity of ball **Practicals (Any 06)** 1. To verify law of conservation of momentum using two hanging spheres 2. To verify law of conservation in case of elastic collesion 3. To use transistor as switch 4. To study Frequency response of RC circuit 5. To study voltage gain of CC amplifier 6. To apply principle of torque in establishing equilibrium conditions of body
B	**Skill (3)** 1. PC simulation 2. Use of breadboard 3. soldering techniques **Practicals (Any 06)** 1. p-n junction diode as a forward bias. 2. p-n junction diode as a reverse bias 3. Zener diode as a voltage regulator 4. seven segment display 5. Energy band gap of Ge diode 6. Transistorised CE amplifier 7. Thevenin's theorem 8. Photodiode characteristics

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.

Choice Based Credit System (CBCS)
T. Y.B. Sc. Physics Syllabus
To be implemented from the Academic year 2025-2026

SEMESTER VI

Course Code	Course Type	Course Title	Credit
USC6PH11	Major (Physics-I)	Nuclear Physics and Optics	4
USC6PH12	Major (Physics-II)	Electronics and Relativity	4
USC6PHP	Major Practical	Practicals of USC6PH1 & USC6PH2	2
USC5PHE2	Major Elective	Python Programing	3
USC5PHE2P	Major Elective Practical	Practicals of Python Programing	1
USC6FTDEM	Minor	Fluid Mechanics, Thermodynamics II & Digital Electronics	2

USC6FTDEPM	Minor Practical	Practical of Fluid Mechanics, Thermodynamics II & Digital Electronics	2
UOJT6PH1	OJT	On Job Training Physics	4

Course Description: B.Sc. (Physics)	
Semester	VI
Course Name	Physics -I (Nuclear Physics and Optics)
Course Code	USC6PH11
Eligibility for the Course	S.Y.B. Sc. pass out
Credit	4
Hours	60 hrs

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.
CO-4	Elaborate nuclear energy and its accelerators
CO-5	Discuss Interference phenomenon

Unit	**Course Description**	Hrs
	ALPHA & BETA DECAY	15
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.	
	GAMMA DECAY & NUCLEAR MODELS	

2.1	Gamma decay: Introduction, selection rules, Internal conversion, nuclear isomerism, Mossbauer effect.	15
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).	
	NUCLEAR ENERGY & PARTICLE ACCELERATORS	15
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	
	INTERFERENCE	**15**
4.1	Coherent sources and their production; Conditions for observing interference (mention); Conditions for constructive and destructive interference (mention)	
4.2	**Coherent sources by division of wavefront :** Biprism-theory and working, experiment to determine wavelength; Effect of thin film in the path of one of the beams; Calculation of thickness of the film	
4.3	**Coherent sources by division of amplitude:** Interference at thin films - reflected and transmitted light, Colours of thin films; Theory of air wedge; Theory of Newton's rings (Only reflected System). Determination of refractive index of liquid [NSB]8.1,8.3,8.4, 8.6,8.15,8.16,8.17,8.188.21,	

References

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.
[NSB]: Textbook of Optics, Subramanyam Brijlal

Course Description: B.Sc. (Physics)	
Semester	VI
Course Name	Physics -II (Electronics and Relativity)
Course Code	USC6PH12
Eligibility for the Course	S.Y.B. Sc. pass out
Credit	4
Hours	60 hrs

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 structure, working, and types (enhancement and depletion mode) of MOSFETs.
CO-3	Derive and apply Lorentz transformations to solve problems involving length contraction, time dilation, and simultaneity.
CO-4	Apply conservation laws of relativistic momentum and energy in collision and decay processes.

Unit	**Course Description**	Hrs
	JFET, MOSFET	15
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.	15
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	
	Multivibrators & 555 Timer	

2.1	Transistor Multivibrators: Astable, Monostable and Bistable Multivibrators, Schmitt trigger.	
2.2	555 Timer: Review Block diagram, Monostable operation Voltage Controlled Oscillator, Triggered linear ramp generator.	
2.3	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	15
	Relativistic Kinematics - II	
3.1	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	
	Relativistic Dynamics	**15**
4.1	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	

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.RR: Introduction to Special Relativity: Robert Resnick (Wiley Student Edition).

:

Course Description: B.Sc. (Physics)	
Semester	VI
Course Name	**Practicals of Nuclear Physics and Optics & Electronics and Relativity**
Course Code	USC6PHP
Eligibility for the Course	S.Y.B. Sc. pass out
Credit	2
Hours	60 hrs

Group	**Course Description**
A	**DEMONSTRATION EXPERIMENTS** 1. Optical Levelling of Spectrometer 2. Schuster's method 3. Laser beam profile **Experiment (optics)** 1. Dispersive power of Prism 2. R. P. of Telescope 3. Resolving power of Prism 4. Determination of slit width by Step slit 5. Determination of e/m by Thomson's method 6. R. I. by total internal reflection 7. Brester law 8. Double refraction 9. Lloyd's single mirror: determination of wavelength 10. Surface tension of mercury by Quincke's method 11. Thermal conductivity by Lee's method
B	**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** 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	Major Elective (Python Programing)
Course Code	USC5PHE2
Eligibility for the Course	S.Y.B. Sc. pass out
Credit	3
Hours	45 hrs

CO No.	**COs Statement** **After completing the Bachelor of Science Program, students will be able to-**
CO-1	Understand Python programming fundamentals, including variables, expressions, conditionals, loops, and recursion for effective problem-solving.
CO-2	Develop skills in string and list manipulation, including slicing, methods, and functional programming concepts like map, filter, and reduce.
CO-3	Utilize Python's advanced data structures, such as dictionaries and sets, along with their methods, to create efficient and modular programs.

Unit	**Course Description**	Hrs

	INTRODUCTION TO PYTHON	15
1.1	The way of the program, What is a program?, Running Python, The first program,, Values and types Variables, expressions and statements, Assignment statement, Variable names, Expressions and statement, Script mode, Order of operations, String operations, Comments, Debugging.	
1.2	Conditionals and recursion, Floor division and modulus,Arithmetic operators, Assignment operator, Boolean expressions, Logical operators, Conditional execution, Alternative execution, if -elif-else condition, Chained conditionals, Nested conditionals, Stack diagrams for recursive functions, Infinite recursion, Keyboard input.	
	PYTHON PROGRAMING	15
2.1	Function , Math functions, Composition, Adding new functions, Definitions and uses, Flow of execution, Parameters and arguments, Strings , String slices, Strings are immutable, Searching String methods, The in operator, String comparison, A list is a sequence, List slices, List methods, Map, filter and reduce ,Deleting elements, Lists and strings, List argınnents	
2.2	loop, Looping and counting, break and continue, range Dictionary in python, A dictionary is a mapping, Looping and dictionary, and lists, set in python , set method - union, intersection, pop, remove, clear, add .	
	DICTIONARIES	**15**
3.1	Dictionaries: Creating Dictionaries; Operations on Dictionaries; Built-in Functions on Dictionaries; Dictionary Methods; Populating and Traversing Dictionaries.	
3.2	Tuples and Sets: Creating Tuples; Operations on Tuples; Built-in Functions on Tuples; Tuple Methods; Creating Sets; Operations on Sets; Built-in Functions on Sets; Set Methods	

Reference books :

1. Python Programming: An Introduction to Computer Science" by John Zelle
2. "Think Python: How to Think Like a Computer Scientist" by Allen B. Downey
3. "Introduction to Computing and Problem Solving with Python" by Jeeva Jose

Course Description: B.Sc. (Physics)	
Semester	VI
Course Name	Practicals of Practicals USC5PH6PH3
Course Code	USC6PHP2
Eligibility for the Course	S.Y.B. Sc. pass out
Credit	1

Hours	15 hrs

Practicals (Any 06)

1. Write a program to Find the sum of n natural numbers.
2. Write a program to check Largest Numbers
3. Python Program to Solve Quadratic Equation
4. Python Program to Convert:
   (i) Kilometers to Miles,
   (ii) Celsius To Fahrenheit,
5. Python Program to find:
   (i) Square Root of a Number
   (ii) Area of a Triang**le**
6. Check if a number belongs to the Fibonacci Sequence
7. Check if a given number is a Prime Number or not
8. Python Program to find:
   (i) factorial of a numbers
   (ii) display multiplication table
9. Demonstrate use of List
10. Check if a number belongs to the Fibonacci Sequence
11. Find the ASCII value of character
12. Write a program to check leap year
13. Demonstrate use of Tuple & Set
14. Write a program to convert Decimal to Binary, octal and Hexadecimal
15. Write a program to display Calendar
16. Write a program to transpose matrix

Course Description: B.Sc. (Physics)	
Semester	VI
Course Name	Minor (Fluid Mechanics, Thermodynamics II & Digital Electronics)
Course Code	USC6FTDEM
Eligibility for the Course	S.Y.B. Sc. pass out
Credit	2
Hours	30 hrs

CO No.	**COs Statement**
	After completing the Bachelor of Science Program, students will be able to-
CO-1	summarize the thermodynamics law,surface Tension, Microprocessor
CO-2	Elaborate the physical property of liquid and real gas with its application
CO-3	Explain the architecture, pin configuration, and instruction set of the 8085 microprocessor.

CO-4	Develop a programme using 8085 microprocessor.

Unit	Course Description	Hrs
1.1	**SURFACE TENSION** Introduction, Tendency to decrease surface area, surface energy, excess pressure inside a drop, in a soap bubble, contact angle, rise of liquid in capillary tube [HCV] :14.9 -14. 14	15
1.2	**BEHAVIOUR OF REAL GASES:** Behaviour of real gases and real gas equation, Van der Waal equation [BSH]: 2.1 to 2.12	
2.1	**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, 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	15
2.2	**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	

References

[HCV]:H. C. Verma :concept of Physics I
[BMC] :Concepts of Modern Physics – A. Beiser, Mahajan, Choudhary (6th Ed.) Tata McGraw Hill.vh
[SBS] :Quantum Mechanics – S P Singh, M K Bagade, Kamal Singh, - S. Chand : 2004 Ed.
[LMS]: Digital Principles and Applications by Leach, Malvino, Saha Seventh edition.
[VB] : 8-bit microprocessor, V. J. Vibhute, P. B. Borole, TechMax publication, Revised 5th Edition.

.

Course Description: B.Sc. (Physics)	
Semester	VI
Course Name	Minor practical (Practical of Fluid Mechanics, Thermodynamics II & Digital Electronics)
Course Code	USC6FTDEPM
Eligibility for the Course	S.Y.B. Sc. pass out
Credit	2
Hours	60 hrs

Group	Course Description
A	**Skill Experiment (2)** 1. Focussing the Travelling microscope 2. use of stop watch **Practicals (6)** 1. To find the radius of water capillary tube of uniform bore using mercury 2. To determine the capillary rise in two glass capillary tubes having bores 3. To determine the coefficient of viscosity by stokes method. 4. To determine specific heat of media 5. To determine the angle of contact 6. To determine surface tension of soap water 7. Heat transfer by conduction 8. Exponential decay of water.
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. Half adder and full adder using EX-OR gate (IC7486, IC 7408) 3. Study of MS-JK flip flop (IC 7476) 4. Study of Latch (IC 7400/ IC 7402) 5. Study of 8:3 Priority Encoder (IC 74LS148) 6. Study of 3:8 Decoder (IC 74LS138) 7. Shift Register (IC 74194
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.

EXAMINATION EVALUATION PATTERN

T. Y. B.Sc. Physics (Sem. V& VI)

PHYSICS MAJOR

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 (Examination Cell)	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.

Theory	All questions are compulsory and will have internal options.		
	Q-1 (Unit-I, II, III, IV)	Multiple Choice Questions	12 Marks (14)
		Answer in one line/ True or False	04 Marks (6)
	Q-2 (Unit – I)	Attempt any one out of two.	07 Marks (04+3)
		Attempt any one out of two.	04 Marks
	Q-3 (Unit – II)	Attempt any one out of two.	07 Marks
		Attempt any one out of two.	04 Marks
	Q-4 (Unit III)	Attempt any one out of two.	07 Marks
		Attempt any one out of two.	04 Marks
	Q-5 (Unit IV)	Attempt any one out of two.	07 Marks
		Attempt any one out of two.	04 Marks
	TOTAL		60 Marks

Practical	**The External examination for practical courses will be conducted as per the following scheme.**		
	Sr. No.	External Practical Examination	Marks
	1	Laboratory Work	80

	2	Journal	10
	3	Viva	10
	TOTAL		100 Marks

PHYSICS MAJOR ELECTIVE

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 (Examination Cell)	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.

Theory	All questions are compulsory and will have internal options.		
	Q-1 (Unit-I, II, III)	Multiple Choice Questions	12 Marks (14)
		Answer in one line/ True or False	03 Marks (6)
	Q-2 (Unit – I)	Attempt any one out of two.	08 Marks (04+3)
		Attempt any one out of two.	07 Marks
	Q-3 (Unit – II)	Attempt any one out of two.	08 Marks (04+3)
		Attempt any one out of two.	07 Marks
	Q-4 (Unit III)	Attempt any one out of two.	08 Marks (04+3)
		Attempt any one out of two.	07 Marks
	TOTAL		60 Marks

Practical	**The External examination for practical courses will be conducted as per the following scheme.**		
	Sr. No.	External Practical Examination	Marks
	1	Laboratory Work	40
	2	Journal	05

	3	Viva	05
	TOTAL		50 Marks

VSC

A) Semester End Examination: 60 % 100 Marks

Duration: The examination shall be of 3 hours duration.

Practical	**The External examination for practical courses will be conducted as per the following scheme.**		
	Sr. No.	External Practical Examination	Marks
	1	Laboratory Work	80
	2	Journal	10
	3	Viva	10
	TOTAL		100 Marks

PHYSICS MINOR

30: External & 20: Internal

A) Internal Assessment: 40 % 20 Marks

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

B) Semester End Examination: 60 % 30 Marks

Duration: The examination shall be of 2 hours duration.

Theory	All questions are compulsory and will have internal options.		
	Q-1 (Unit-I)	Multiple Choice Questions	05 Marks (07)
		Attempt any two out of three.	10 Marks (03)
	Q-2 (Unit –II)	Multiple Choice Questions	05 Marks (07)
		Attempt any two out of three.	10 Marks (03)
	TOTAL		30 Marks
Practical	**The External examination for practical courses will be conducted as per the following scheme.**		
	Sr. No.	External Practical Examination	Marks

	1	Laboratory Work	40
	2	Journal	05
	3	Viva	05
	TOTAL		50 Marks