UNIVERSITY OF MUMBAI

R. E. SOCIETY'S,
R. P. GOGATE COLLEGE OF ARTS & SCIENCE AND
R. V. JOGALEKAR COLLEGE OF COMMERCE
(AUTONOMOUS), RATNAGIRI

REVISED (2025-26) SYLLABI OF COURSES OFFERED BY DEPARTMENT OF PHYSICS OF THE COLLEGE IN THE SUBJECT PHYSICS (MAJOR) FOR THE THIRD YEAR (SEMESTER V & VI) OF PROGRAM BSc AS PER NEP 2020

UNDER
CHOICE BASED CREDIT SYSTEM (CBCS)

WITH THE EFFECT FROM ACADEMIC YEAR 2025-26

Program Outcomes of BSc with Physics Major

Name of Program	BSc
Level	UG
Number of Semesters	06
Year of Implementation	2025-26
Program Specific Outcomes (PSO)	After successful completion of this program, learners will: PSO1. Understand fundamental physics concepts and will be able to apply physics principles to real world problems. PSO2. Be able to think critically and develop the ability to apply theoretical and mathematical principles to solve complex problems in various areas of physics. PSO3. Acquire hands-on experience in conducting experiments, using laboratory equipments, analyzing experimental data and will be able to draw meaningful conclusions of experiment and to interpret results. PSO4. Recognize the interconnections between physics and other disciplines, such as, mathematics, chemistry and engineering and will be able to work effectively in those interdisciplinary fields. PSO5. Possess basic programming skills, will be introduced to the field of automation and will be equipped with essential knowledge and skills to work with basic automation systems. PSO6. Develop the ability to work individually as well as in collaboration. PSO7. Be able to pursue higher studies and will be able to take research opportunities.
Relevance of PSOs to the local, regional, national and global developmental needs	Science graduates with the subject Physics can go for higher studies and pursue careers directly related to physics, like, research, academics, etc. Other than this, Science graduates with the subject Physics can also pursue careers in other fields, such as, data science, engineering, IT, automation, government jobs, medical physics and healthcare industry, national security, etc., due to their analytical, problem solving and critical thinking abilities.

	BSc program with the subject Physics produces graduates with a diverse skill set capable of addressing various challenges. This can lead to improve research and innovation, economic growth and sustainable development from local to global level. The relevance of BSc program with the subject Physics to developmental needs enhances its overall impact on society and makes it more responsive to the evolving demands of the scientific, technological and societal landscape.

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Scheme of Course Evaluation

Course Evaluation:

Each course of BSc in the subject Physics will be assessed with Continuous Internal Evaluation and Semester End Evaluation. Continuous Internal Evaluation of each course will be of 40% and Semester End Evaluation of each course will be of 60%.

Every 2 credit course will be evaluated on 50 marks scale and every 4 credit course will be evaluated on 100 marks scale. 2 credits courses have maximum 20 marks for Continuous Internal Evaluation and maximum 30 marks for Semester End Evaluation. 4 credits courses have maximum 40 marks for Continuous Internal Evaluation and maximum 60 marks for Semester End Evaluation.

Passing Scheme:

For each course of BSc in the subject Physics, there will be separate head of passing for Continuous Internal Evaluation and for Semester End Evaluation. Course grade points and course grade will be decided by the aggregate marks obtained by a learner.

Aggregate Marks = *Marks Obtained by a learner in Continuous Internal Evaluation* + *Marks obtained by a learner in Semester End Evaluation*

In order to earn credits of this course, a learner is required to secure a minimum of 40% marks in Continuous Internal Evaluation and 40% marks in Semester End Evaluation.

Credit and Grade Scheme:

% of Aggregate Marks Obtained	Course Grade Point	Course Grade	Performance Indicator	Credits Earned
90.0 to 100	10	O	Outstanding	As mentioned in course syllabus
80 to 89.99	9	A+	Excellent	
70 to 79.99	8	A	Very Good	
60 to 69.99	7	B+	Good	
55 to 59.99	6	B	Above Average	
50.0 to 54.99	5	C	Average	
40 to 49.99	4	P	Pass	
Less Than 40	0	F	Fail	0
Absent	0	Ab	Absent	

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Scheme of Courses Offered in the Subject Physics for TYBSc

Semester V				Semester VI			
Course Code	**Nomenclature**	**Credits**		**Course Code**	**Nomenclature**	**Credits**	
Discipline Specific Courses (DSC)				**Discipline Specific Courses (DSC)**			
Major Mandatory				**Major Mandatory**			
25_USPHM501	Mathematical, Thermal and Statistical Physics	**2**		25_USPHM601	Classical Mechanics	**2**	
25_USPHM502	Atomic and Molecular Physics	**2**		25_USPHM602	Solid State Physics	**2**	
25_USPHM503	Electrodynamics	**2**		25_USPHM603	Nuclear Physics	**2**	
25_USPHM504	Physics Lab – V	**2**		25_USPHM604	Physics Lab – VII	**2**	
25_USPHM505	Physics Lab - VI	**2**		25_USPHM605	Physics Lab – VIII	**2**	
Major Electives (Any Two)				**Major Electives (Any Two)**			
25_USPHE506	Electronics	**2**	**4**	25_USPHE606	Special Theory of Relativity	**2**	**4**
25_USPHE507	Electronics Lab	**2**		25_USPHE607	Special Theory of Relativity Lab	**2**	
OR				**OR**			
25_USPHE508	Introduction to Astronomy and Astrophysics	**2**	**4**	25_USPHE608	Analog Circuits, Instruments and Consumer Appliances	**2**	**4**
25_USPHE509	Introduction to Astronomy and Astrophysics Lab	**2**		25_USPHE609	Analog Circuits, Instruments and Consumer Appliances Lab	**2**	
Vocational Skill Course (VSC)				**Vocational Skill Course (VSC)**			
25_USPHV510	Electronic Instrumentation Lab	**4**		25_USPHV610	Digital Electronics, Microprocessor, C++ Lab	**4**	
Field Project				**On Job Training**			
25_USPHF511	Field Project	**4**		25_USPHJ611	On Job Training	**4**	
Total Credits		**22**		**Total Credits**		**22**	

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Syllabi of Courses Offered in the Subject Physics for Semester V

Course Nomenclature	**Mathematical, Thermal and Statistical Physics**
Course Code	25_USPHM501
Class	TYBSc
Semester	V
Number of Credits	2
Nature	Theory
Type	Major Mandatory
Revision of syllabus specific to employability/ entrepreneurship/ skill development	Topics on probability included in the curriculum develop learners' ability to analyze uncertainty, model random events and make informed decisions based on probabilistic reasoning. These skills are valuable for careers in statistics, data analysis, finance, engineering and various fields where uncertainty plays a significant role. The curriculum also equips learners with fundamental concepts of statistical thermodynamics to develop the ability of learner to analyze and predict the behavior of systems of particles. These skills are needed for careers in physics, chemistry, materials science, engineering and other fields where understanding the probabilistic behavior of a system is essential.

Nomenclature: Mathematical, Thermal and Statistical Physics

Eligibility: To be eligible for enrolment in this course, a learner must have appeared for the courses 'USPH101: Classical Physics' and 'USPH301: Mechanics and Thermodynamics' and 'USPH303: Mathematical Methods in Physics'.

Course Outcomes:

On successful completion of this course, a learner will be able to:

CO1. Comprehend the basic concepts of thermodynamics & its applications in physical situations.

CO2. Learn some mathematical techniques required to understand the physical phenomena at the undergraduate level.

CO3. Get exposure to important ideas of statistical mechanics.

CO4. Be able to solve simple problems in probability, understand the concept of independent events and work with standard continuous distributions.

CO5. Understand the concept of statistical mechanics through the concept of microstates, the concept of configurations, Boltzmann distribution and statistical origins of entropy.

CO6. Understand the difference between classical and quantum statistics.

CO7. Demonstrate tentative problem solving skills in all above areas.

Curriculum:

Unit	Title	Learning Points	No. of Lectures (60 min.)
I	Probability	Review of basic concepts, introduction, sample space, events, independent events, conditional probability, probability theorems, methods of counting (derivation of formulae not expected), random variables, continuous distributions (omit joint distributions), binomial distribution, the normal distribution, the Poisson distribution Reference: MB – 15.1-15.9 Expected to cover solved problems from each section and solve at least the following problems: section 2: 1-5, 11-15, section 3: 1, 3, 4, 5, section 4: 1, 3, 5,13, 21, section 5: 1, 10, 13, section 6: 1 to 9, section 8: 1 and 3, section 9: 2, 3, 4, 9	10
II	Statistical Thermodynamics	Microstates and configurations, derivation of Boltzmann distribution, dominance of	10

		Boltzmann distribution, physical meaning of the Boltzmann distribution law, definition of , the canonical ensemble, relating Q to q for an ideal gas, translational partition function, equipartition theorem, energy, entropy Reference: ER	
III	Classical and Quantum Statistics	**1.** The probability of a distribution, The most probable distribution, Maxwell- Boltzmann statistics, Molecular speeds Reference: AB **2.** Bose-Einstein statistics, Black-body radiation, The Rayleigh-Jeans formula, The Planck radiation formula, Fermi-Dirac statistics, Comparison of results Reference: AB	10

Note: A good number of numerical examples on all units (as far as possible) are expected to be covered during the prescribed lectures.

Learning Resources recommended:

Main References:

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

Additional reference:

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

9. PROBABILITY: Schaum's Outlines Series by S. Lipschutz and M. L. Lipson (Mc Graw Hill International)
10. Introduction to Mathematical Methods: Charlie Harper (PHI Learning)

Evaluation Pattern:

A. Continuous Internal Evaluation (20 Marks):

Method	Marks
Unit Test (MCQ / Descriptive – Based on Theory and/or Problems - Online/Offline – 1 unit test of 10 marks / 2 unit tests of 05 marks each / 3 unit tests of 05 marks each and best two out of three will be considered)	10
Assignments / Seminars	05
Attendance and active participation in classroom	05

B. Semester End Evaluation (Paper Pattern) (30 Marks – 1 hour):

Que. No.	Question Type	Unit	Marks
1	A) Long answer based questions with 100% internal option B) Short answer based questions with 100% internal option	I	06 04
2	A) Long answer based questions with 100% internal option B) Short answer based questions with 100% internal option	II	06 04
3	A) Long answer based questions with 100% internal option B) Short answer based questions with 100% internal option	III	06 04

Guidelines for paper pattern for Semester End Evaluation:

1. As far as possible, one fifth weightage of the total marks should be given to numerical examples in above paper pattern.
2. All questions will be compulsory and may be divided into sub-questions.
3. Long and short answer based questions will include descriptive type of questions, derivation-based questions, problem solving / numericals based questions, etc.

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Course Nomenclature	**Atomic and Molecular Physics**
Course Code	25_USPHM502
Class	TYBSc
Semester	V
Number of Credits	2
Nature	Theory
Type	Major Mandatory
Revision of syllabus specific to employability/ entrepreneurship/ skill development	The course is so designed that it includes the study of hydrogen atom and electron spin aims which develops learner's ability to understand and analyze the behavior of atomic systems at the quantum level, including the hydrogen atom and the fundamental concept of electron spin. The curriculum includes topics like, spin-orbit coupling and the effect of magnetic fields on atoms which develops learner's ability to understand and analyze the interactions between electron spin, orbital angular momentum, and external magnetic fields in atomic and molecular systems. The curriculum includes topics like, molecular spectra which develops learner's ability to understand, analyze and interpret the interactions between molecules and electromagnetic radiation, as well as the information obtained from different types of molecular spectra. The curriculum also focuses on topics like, infrared spectrometry and microwave spectrometry which develops learner's ability to understand these spectroscopic techniques, enabling them to study molecular properties and interactions in various applications. The study of Raman Effect aims to develop learner's ability to understand molecular vibrational modes, interactions and properties in Raman spectra. The study of electron and nuclear resonance develops learner's ability to understand principle of operation of ESR and NMR spectrometers, enabling them to study molecular and atomic properties, interactions and dynamics. This foundation will encourage learners for advanced study and pursue careers in the field of atomic physics, quantum mechanics, chemistry, materials science, spectroscopy, spectrometry, analytical laboratories, medical imaging and related fields.

Nomenclature: Atomic and Molecular Physics

Eligibility: To be eligible for enrolment in this course, a learner must have appeared for the courses 'USPH102: Modern Physics' and 'USPH403: Quantum Mechanics'.

Course Outcomes:

On successful completion of this course, a learner will be able to:

CO1. Understand the application of quantum mechanics in atomic physics.
CO2. Understand the importance of electron spin, symmetric and antisymmetric wave functions and vector atom model.
CO3. Understand the effect of magnetic field on atoms.
CO4. Learn Molecular physics and its applications.
CO5. Get an insight into theoretical basics of spectroscopy.
CO6. Demonstrate quantitative problem solving skills in all topics covered.

Curriculum:

Unit	Title	Learning Points	No. of Lectures (60 min.)
I	Hydrogen Atom, Quantum Numbers, Electron Spin, Spin – Orbit Coupling	**1. Hydrogen Atom** Reference: B **2. Quantum Numbers:** Total quantum number, Orbital quantum number, Magnetic quantum number, Angular momentum, Electron probability density (Radial part) Reference: B **3. Electron spin:** The Stern-Gerlach experiment, Pauli's Exclusion Principle, Symmetric and Anti-symmetric wave functions Reference: B **4. Spin – Orbit Coupling:** Spin orbit coupling, L-S and j-j coupling, Origin of spectral lines, Selection rules Reference: B	10
II	Effect of Magnetic Field on Atoms,	**1. Effect of magnetic field on atoms**: the Normal Zeeman effect and its explanation	10

	Molecular Spectra, Spectrometer	(Classical and Quantum), The Lande g-factor, Anomalous Zeeman effect. Reference: B **2. 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 Reference: B **3. Infrared spectrometer:** Introduction, Principle and applications. Reference: B	
III	Raman Effect, Electron Spin Resonance	**1. Raman effect:** Quantum Theory of Raman effect, Pure Rotational Raman spectra: Linear molecules, Symmetric top molecules, Asymmetric top molecules, Vibrational Raman spectra: Raman activity of vibrations, Experimental set-up of Raman Effect Reference: BM **2. Electron Spin Resonance:** Introduction, Principle of ESR, ESR spectrometer Reference: GA	10

Note: A good number of numerical examples on all units (as far as possible) are expected to be covered during the prescribed lectures.

Learning Resources recommended:

Main References:

1. B: Perspectives of Modern Physics: Arthur Beiser, McGraw Hill
2. BM: Fundamentals of Molecular Spectroscopy: C. N. Banwell & E. M. McCash (TMH).(4th Ed.)
3. GA: Molecular structure and spectroscopy: G Aruldhas (2nd Ed) PHI learning Pvt Ltd.

Additional reference:

1. Atomic Physics (Modern Physics): S. N. Ghoshal. S. Chand Publication (for problems on atomic Physics)

Evaluation Pattern:

A. Continuous Internal Evaluation (20 Marks):

Method	Marks
Unit Test (MCQ / Descriptive – Based on Theory and/or Problems - Online/Offline – 1 unit test of 10 marks / 2 unit tests of 05 marks each / 3 unit tests of 05 marks each and best two out of three will be considered)	10
Assignments / Seminars	05
Attendance and active participation in classroom	05

B. Semester End Evaluation (Paper Pattern) (30 Marks – 1 hour):

Que. No.	Question Type	Unit	Marks
1	A) Long answer based questions with 100% internal option B) Short answer based questions with 100% internal option	I	06 04
2	A) Long answer based questions with 100% internal option B) Short answer based questions with 100% internal option	II	06 04
3	A) Long answer based questions with 100% internal option B) Short answer based questions with 100% internal option	III	06 04

Guidelines for paper pattern for Semester End Evaluation:

1. As far as possible, one fifth weightage of the total marks should be given to numerical examples in above paper pattern.
2. All questions will be compulsory and may be divided into sub-questions.
3. Long and short answer based questions will include descriptive type of questions, derivation-based questions, problem solving / numericals based questions, etc.

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Course Nomenclature	**Electrodynamics**
Course Code	25_USPHM503
Class	TYBSc
Semester	V
Number of Credits	2
Nature	Theory
Type	Major Mandatory
Revision of syllabus specific to employability/ entrepreneurship/ skill development	The curriculum is so designed that it includes topics like, electrostatics which develops learner's ability to understand, analyze and solve problems related to electric fields, potentials and charge distributions in the context of electromagnetic theory. The curriculum includes topics like, electrostatics in matter and magnetostatics which develops learner's ability to understand, analyze and solve problems related to electric and magnetic fields, charges, currents and their interactions with materials. The curriculum includes topics like, magnetostatics in matter and electrodynamics which develops learner's ability to understand, analyze and solve problems related to magnetic properties, materials and electromagnetic interactions. A curriculum also focuses on study of electromagnetic waves within the context of electrodynamics which develop learner's ability to understand, analyze and predict the behavior of electromagnetic waves and their interactions with matter and boundaries. This foundation will encourage learners for advanced study and pursue careers in the field of electrostatics, magnetostatics, electrodynamics, telecommunications, optics, material science and related fields.

Nomenclature: Electrodynamics

Eligibility: To be eligible for enrolment in this course, a learner must have appeared for the courses 'USPH303: Mathematical Methods in Physics'.

Course Outcomes:

On successful completion of this course, a learner will be able to:

CO1. Apply principles of electrostatics to solve problems relating electric field, potential, boundary conditions and energy in the field.
CO2. Analyse electrostatic field in various media.
CO3. Apply principles of magnetostatics to solve problems relating magnetic field, potential, boundary conditions and energy in the field.
CO4. Analyse magnetostatic field in various media.
CO5. Derive electromagnetic wave equation from Maxwell's equations.
CO6. Derive laws in optics from electromagnetic principles.
CO7. Write clear and well-structured solutions to quantitative and qualitative problems.

Curriculum:

Unit	Title	Learning Points	No. of Lectures (60 min.)
I	Electrostatics in vacuum and Electrostatics in matter	Review of Coulomb law, Gauss law and its Applications, The curl of E, Electric potential, Potential of different types of charge distributions, Poisson's equation and Laplace's equation, Solution and properties of Laplace equation, Boundary conditions and Uniqueness theorems, The classic image problems Dielectrics, Induced Dipoles, Alignment of polar molecules, Polarization, Bound charges and their physical interpretation, Gauss' law in presence of dielectrics, Susceptibility, Permittivity, Dielectric constant, Energy in dielectric systems Reference: DG	10
II	Magnetostatics in vacuum and Magnetostatics in matter	Review of Biot-Savart's law, Ampere's law and its applications, Straight-line currents, The Curl of B, Comparison of Magnetostatics and Electrostatics, Magnetic Vector Potential	10

		Magnetization, Bound currents and their physical interpretation, Ampere's law in magnetized materials, Magnetic susceptibility and permeability, Energy in magnetic fields Reference: DG	
III	Electrodynamics and electromagnetic waves	The continuity equation, Electrodynamics before Maxwell, Maxwell's correction to Ampere's law, Maxwell's equations in vacuum and matter, Boundary conditions, Poynting's theorem 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 and at oblique incidence Reference: DG	10

Note: A good number of numerical examples on all units (as far as possible) are expected to be covered during the prescribed lectures.

Learning Resources recommended:

Main References:

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

Additional reference:

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

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Evaluation Pattern:

A. Continuous Internal Evaluation (20 Marks):

Method	Marks
Unit Test (MCQ / Descriptive – Based on Theory and/or Problems - Online/Offline – 1 unit test of 10 marks / 2 unit tests of 05 marks each / 3 unit tests of 05 marks each and best two out of three will be considered)	10
Assignments / Seminars	05
Attendance and active participation in classroom	05

B. Semester End Evaluation (Paper Pattern) (30 Marks – 1 hour):

Que. No.	Question Type	Unit	Marks
1	A) Long answer based questions with 100% internal option B) Short answer based questions with 100% internal option	I	06 04
2	A) Long answer based questions with 100% internal option B) Short answer based questions with 100% internal option	II	06 04
3	A) Long answer based questions with 100% internal option B) Short answer based questions with 100% internal option	III	06 04

Guidelines for paper pattern for Semester End Evaluation:

1. As far as possible, one fifth weightage of the total marks should be given to numerical examples in above paper pattern.
2. All questions will be compulsory and may be divided into sub-questions.
3. Long and short answer based questions will include descriptive type of questions, derivation-based questions, problem solving / numericals based questions, etc.

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Course Nomenclature	**Physics Lab - V**
Course Code	25_USPHM504
Class	TYBSc
Semester	V
Number of Credits	2
Nature	Practical
Type	Major Mandatory
Revision of syllabus specific to employability/ entrepreneurship/ skill development	Restructuring of syllabus has been done to ensure a smooth and logical flow of content throughout the curriculum. It also facilitates the logical progression of subjects which allows students to build their understanding of subject progressively and systematically and to grasp contents more effectively. The curriculum is so designed that it offers hands-on approach to learn the subject. The curriculum also demonstrates how physics principles apply to real world scenarios. Learners will develop the skill to handle - measuring instruments, basic physics laboratory equipments, etc. Learners will also learn to perform basic physics experiments, learn to improve the accuracy of measurements, learn to analyze experimental observations / data, learn to draw meaningful conclusions of experiments and to interpret results.

Nomenclature: Physics Lab - V

Eligibility: --

Course Outcomes:

On successful completion of this course, a learner will be able to:

CO1. Understand & practice the skills while performing experiments.
CO2. Understand the use of apparatus and their use without fear & hesitation.
CO3. Correlate the physics theory concepts to practical application.
CO4. Understand the concept of errors and their estimation.
CO5. Learn scientific method of recording of the data, its analysis and result/conclusion of an experiment.

Instructions for learners:

1. All measurements and readings should be written with proper units.
2. Skill of doing the experiment and understanding physics concepts should be more important than the accuracy of final result.
3. In order to appear for Semester End Practical Examination of this course, minimum 12 experiments from this course should be completed compulsorily and learners are required to report all these experiments in the journal of this course.
4. After completing all required number of experiments for this course and recording them in journal, a learner will have to get their journal certified and produce the certified journal at the time of Semester End Practical Examination of these courses.
5. A learner will be allowed to appear for the Semester End Practical Examination of this course, only if a learner submits a certified journal of this course or a certificate from the head of the Physics department that the learner has completed this practical course as per minimum requirements.
6. For Semester End Practical Examination of this course, the learner will be examined for 1 experiment from this course and experiment will be of two hours duration.
7. Evaluation in viva voce will be based on experiments from this course.
8. While evaluating learner's performance for Semester End Practical Examination for this course, weightage will be given to circuit / ray diagram, observations, tabular representation, experimental skills and procedure, graph, calculation and result, whichever applicable.

Curriculum:

Group	Title	Learning Points	No. of lectures (60 min.)
A	General Physics	1. Estimation of errors from actual experimental data 2. Spectrometer: Optical Leveling and Schuster's Method 3. Laser beam profile 4. Study of Kater's Pendulum 5. Determination of 'g' by Kater's pendulum 6. Study of elastic constants 7. Elastic constants of a rubber tube 8. Logarithmic decrement 9. Searle's Goniometer 10. Study of Rydberg's constant 11. Determination of Rydberg's constant 12. Determination of e/m by Thomson's method 13. Study of R. I. by total internal reflection 14. Determination of R. I. of liquid by total internal reflection	**60**

Learning Resources recommended:

1. Advanced course in Practical Physics D. Chattopadhya, 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 – C. L. Arora (1st Edition) -2001 S. Chand and Co. Ltd.
5. Practical Physics – C. L. Squires (3rd Edition) Cambridge University
6. University Practical Physics – D C Tayal. Himalaya Publication
7. Advanced Practical Physics – Worsnop & Flint

Evaluation Pattern:

A. Continuous Internal Evaluation (20 Marks):

Method	Marks
Performance and engagement during practical sessions: • Skills, precision, accuracy, safety measures, individual and/or collaborative working while performing practical • Ability to record proper observations, to analyze data, to plot graph and to draw meaningful conclusions of experiments • Submission of journal within a week after every practical session Based on above criteria, each experiment of this course will be assessed for 10 marks during regular practical sessions and finally the total marks obtained by a learner will be converted to marks out of 10.	10
Overall performance (attendance, punctuality, sincerity for practical sessions throughout semester)	05
Viva	05

B. Semester End Evaluation (Exam Pattern) (30 Marks – 2 hours):

Question No.	Group	Title	Method	Marks
1	A	General Physics	Experiment performance as per practical slip	30

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Course Nomenclature	**Physics Lab - VI**
Course Code	25_USPHM505
Class	TYBSc
Semester	V
Number of Credits	2
Nature	Practical
Type	Major Mandatory
Revision of syllabus specific to employability/ entrepreneurship/ skill development	Restructuring of syllabus has been done to ensure a smooth and logical flow of content throughout the curriculum. It also facilitates the logical progression of subjects which allows students to build their understanding of subject progressively and systematically and to grasp contents more effectively. The curriculum is so designed that it offers hands-on approach to learn the subject. The curriculum also demonstrates how physics principles apply to real world scenarios. Learners will develop the skill to handle - measuring instruments, basic physics laboratory equipments, etc. Learners will also learn to perform basic physics experiments, learn to improve the accuracy of measurements, learn to analyze experimental observations / data, learn to draw meaningful conclusions of experiments and to interpret results.

Nomenclature: Physics Lab - VI

Eligibility: --

Course Outcomes:

On successful completion of this course, a learner will be able to:

CO1. Understand & practice the skills while performing experiments.
CO2. Understand the use of apparatus and their use without fear & hesitation.
CO3. Correlate the physics theory concepts to practical application.
CO4. Understand the concept of errors and their estimation.
CO5. Learn scientific method of recording of the data, its analysis and result/conclusion of an experiment.

Instructions for learners:

1. All measurements and readings should be written with proper units.
2. Skill of doing the experiment and understanding physics concepts should be more important than the accuracy of final result.
3. In order to appear for Semester End Practical Examination of this course, minimum 12 experiments from this course should be completed compulsorily and learners are required to report all these experiments in the journal of this course.
4. After completing all required number of experiments for this course and recording them in journal, a learner will have to get their journal certified and produce the certified journal at the time of Semester End Practical Examination of these courses.
5. A learner will be allowed to appear for the Semester End Practical Examination of this course, only if a learner submits a certified journal of this course or a certificate from the head of the Physics department that the learner has completed this practical course as per minimum requirements.
6. For Semester End Practical Examination of this course, the learner will be examined for 1 experiment from this course and experiment will be of two hours duration.
7. Evaluation in viva voce will be based on experiments from this course.
8. While evaluating learner's performance for Semester End Practical Examination for this course, weightage will be given to circuit / ray diagram, observations, tabular representation, experimental skills and procedure, graph, calculation and result, whichever applicable.

Curriculum:

Group	Title	Learning Points	No. of lectures (60 min.)
A	Electricity	1. Velocity of sound in air using CRO 2. Mutual inductance by BG 3. L/C by Maxwell's bridge 4. Band gap energy of Ge diode 5. Study of LM 317 as variable voltage source 6. Application of LM-317 as variable voltage source 7. Study LM 317 as constant current source 8. Application of LM 317 as constant current source 9. Study of Hall effect 10. Determination of Hall coefficient 11. Study of dielectric constant 12. Determination of dielectric constant 13. Determination of OPAMP parameters (offset voltage, slew rate, input impedance, output impedance, A_{CM}) 14. Study of transformer (theory, construction and working), types of transformers and energy losses associated with them	**60**

Learning Resources recommended:

1. Advanced course in Practical Physics D. Chattopadhya, 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 – C. L. Arora (1st Edition) -2001 S. Chand and Co. Ltd.
5. Practical Physics – C. L. Squires (3rd Edition) Cambridge University
6. University Practical Physics – D C Tayal. Himalaya Publication
7. Advanced Practical Physics – Worsnop & Flint

Evaluation Pattern:

A. Continuous Internal Evaluation (20 Marks):

Method	Marks
Performance and engagement during practical sessions: • Skills, precision, accuracy, safety measures, individual and/or collaborative working while performing practical • Ability to record proper observations, to analyze data, to plot graph and to draw meaningful conclusions of experiments • Submission of journal within a week after every practical session Based on above criteria, each experiment of this course will be assessed for 10 marks during regular practical sessions and finally the total marks obtained by a learner will be converted to marks out of 10.	10
Overall performance (attendance, punctuality, sincerity for practical sessions throughout semester)	05
Viva	05

B. Semester End Evaluation (Exam Pattern) (30 Marks – 2 hours):

Question No.	Group	Title	Method	Marks
1	A	Electricity	Experiment performance as per practical slip	30

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Course Nomenclature	**Electronics**
Course Code	25_USPHE506
Class	TYBSc
Semester	V
Number of Credits	2
Nature	Theory
Type	Major Electives
Revision of syllabus specific to employability/ entrepreneurship/ skill development	The curriculum describes different semiconductor devices, like, JFET, MOSFET, SCR and UJT. The curriculum equips learners to analyze and design circuits using these semiconductor devices, contributing to various fields of electronics and technology. The curriculum equips learners to analyze and design differential amplifiers using transistors and a variety of OPAMP based circuits, for a wide range of electronic applications and to design, analyze and optimize power supply circuits to meet specific voltage and current requirements. The curriculum also equips learners to analyze and design multivibrators and timer circuits for a variety of electronic applications, ranging from timing and pulse generation to digital logic and control systems. Additionally, some of the topics in this theory course will be covered in following physics lab courses which will reinforce learners' theoretical understanding to real world applications.

Nomenclature: Electronics

Eligibility: To be eligible for enrolment in this course, a learner must have appeared for the courses 'USPH202: Electricity and Electronics' and 'USPH302: Electronics'.

Course Outcomes:

On successful completion of this course, a learner will be able to:

CO1. Understand the basics of semiconductor devices and their applications.

CO2. Understand the basic concepts of operational amplifier: its prototype and applications as instrumentation amplifier, active filters, comparators and waveform generation.

CO3. Understand the basic concepts of timing pulse generation and regulated power supplies.

CO4. Develop quantitative problem solving skills in all the topics covered.

Curriculum:

Unit	Title	Learning Points	No. of Lectures (60 min.)
I	Semiconductor Devices	**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, multiplexer, voltage controlled resistor, Current sourcing Reference: MB **2. MOSFET:** Depletion and enhancement mode, MOSFET operation and characteristics, digital switching Reference: MB **3. SCR:** Construction, static characteristics, Analysis of the operation of SCR, Gate Triggering Characteristics, Variable half wave rectifier and Variable full wave rectifier, Current ratings of SCR Reference: AM **4. UJT:** Construction, Operation, characteristics and application as a relaxation oscillator Reference: AM	10

II	Differential Amplifier and OPAMP Applications	**1. Differential Amplifier using transistor:** The Differential Amplifier, DC and AC analysis of a differential amplifier, Input characteristic-effect of input bias, offset current and input offset voltage on output, common mode gain, CMRR Reference: MB **2. OPAMP Applications:** Log amplifier, Instrumentation amplifiers, Voltage controlled current sources (grounded load), First order Active filters, Astable using OPAMP, square wave and triangular wave generator using OPAMP, Wein-bridge oscillator using OPAMP, Comparators with Hysteresis, Window Comparator Reference: MB	10
III	Multivibrators, Timer, Power Supply	**1. Transistor Multivibrators:** Astable, Monostable and Bistable Multivibrators, Schmitt trigger Reference: AM/ KVR/MB **2. 555 Timer:** Review Block diagram, Monostable and Astable operation Voltage Controlled Oscillator, Pulse Width modulator, Pulse Position Modulator, Triggered linear ramp generator Reference: AM/ KVR/MB **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) Reference: AM/ KVR/MB	10

Note: A good number of numerical examples on all units (as far as possible) are expected to be covered during the prescribed lectures.

Learning Resources recommended:

Main References:

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

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Evaluation Pattern:

A. Continuous Internal Evaluation (20 Marks):

Method	Marks
Unit Test (MCQ / Descriptive – Based on Theory and/or Problems - Online/Offline – 1 unit test of 10 marks / 2 unit tests of 05 marks each / 3 unit tests of 05 marks each and best two out of three will be considered)	10
Assignments / Seminars	05
Attendance and active participation in classroom	05

B. Semester End Evaluation (Paper Pattern) (30 Marks – 1 hour):

Que. No.	Question Type	Unit	Marks
1	A) Long answer based questions with 100% internal option B) Short answer based questions with 100% internal option	I	06 04
2	A) Long answer based questions with 100% internal option B) Short answer based questions with 100% internal option	II	06 04
3	A) Long answer based questions with 100% internal option B) Short answer based questions with 100% internal option	III	06 04

Guidelines for paper pattern for Semester End Evaluation:

1. As far as possible, one fifth weightage of the total marks should be given to numerical examples in above paper pattern.
2. All questions will be compulsory and may be divided into sub-questions.
3. Long and short answer based questions will include descriptive type of questions, derivation-based questions, problem solving / numericals based questions, etc.

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Course Nomenclature	**Electronics Lab**
Course Code	25_USPHE507
Class	TYBSc
Semester	V
Number of Credits	2
Nature	Practical
Type	Major Electives
Revision of syllabus specific to employability/ entrepreneurship/ skill development	Restructuring of syllabus has been done to ensure a smooth and logical flow of content throughout the curriculum. It also facilitates the logical progression of subjects which allows students to build their understanding of subject progressively and systematically and to grasp contents more effectively. The curriculum is so designed that it offers hands-on approach to learn the subject. The curriculum also demonstrates how physics principles apply to real world scenarios. Learners will develop the skill to handle - measuring instruments, basic physics laboratory equipments, etc. Learners will also learn to perform basic physics experiments, learn to improve the accuracy of measurements, learn to analyze experimental observations / data, learn to draw meaningful conclusions of experiments and to interpret results.

Nomenclature: Electronics Lab

Eligibility: --

Course Outcomes:

On successful completion of this course, a learner will be able to:

CO1. Understand & practice the skills while performing experiments.
CO2. Understand the use of apparatus and their use without fear & hesitation.
CO3. Correlate the physics theory concepts to practical application.
CO4. Understand the concept of errors and their estimation.
CO5. Learn scientific method of recording of the data, its analysis and result/conclusion of an experiment.

Instructions for learners:

1. All measurements and readings should be written with proper units.
2. Skill of doing the experiment and understanding physics concepts should be more important than the accuracy of final result.
3. In order to appear for Semester End Practical Examination of this course, minimum 12 experiments from this course should be completed compulsorily and learners are required to report all these experiments in the journal of this course.
4. After completing all required number of experiments for this course and recording them in journal, a learner will have to get their journal certified and produce the certified journal at the time of Semester End Practical Examination of these courses.
5. A learner will be allowed to appear for the Semester End Practical Examination of this course, only if a learner submits a certified journal of this course or a certificate from the head of the Physics department that the learner has completed this practical course as per minimum requirements.
6. For Semester End Practical Examination of this course, the learner will be examined for 1 experiment from this course and experiment will be of two hours duration.
7. Evaluation in viva voce will be based on experiments from this course.
8. While evaluating learner's performance for Semester End Practical Examination for this course, weightage will be given to circuit / ray diagram, observations, tabular representation, experimental skills and procedure, graph, calculation and result, whichever applicable.

Curriculum:

Group	Title	Learning Points	No. of lectures (60 min.)
A	Electronics	1. Design and study of transistorized astable multivibrator 2. Design and study of Wien bridge oscillator 3. Design and study of first order active low pass filter Circuit 4. Design and study of first order active high pass filter circuit 5. Counters Mod 2, 5, 10 (2 x 5, 5 x 2) 6. Design and study of transistorized monostable multivibrator 7. Design and study of transistorized bistable multivibrator 8. Application of OPAMP as a window comparator 9. Application of OPAMP as a Log amplifier 10. Application of IC 555 timer as a ramp generator 11. Application of IC 555 as a voltage to frequency converter 12. Shift register 13. Application of IC 555 as a voltage to time converter 14. Use of Digital storage oscilloscope (DSO)	**60**

Learning Resources recommended:

1. Advanced course in Practical Physics D. Chattopadhya, 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 – C. L. Arora (1st Edition) -2001 S. Chand and Co. Ltd.
5. Practical Physics – C. L. Squires (3rd Edition) Cambridge University
6. University Practical Physics – D C Tayal. Himalaya Publication
7. Advanced Practical Physics – Worsnop & Flint

Evaluation Pattern:

A. Continuous Internal Evaluation (20 Marks):

Method	Marks
Performance and engagement during practical sessions: • Skills, precision, accuracy, safety measures, individual and/or collaborative working while performing practical • Ability to record proper observations, to analyze data, to plot graph and to draw meaningful conclusions of experiments • Submission of journal within a week after every practical session Based on above criteria, each experiment of this course will be assessed for 10 marks during regular practical sessions and finally the total marks obtained by a learner will be converted to marks out of 10.	10
Overall performance (attendance, punctuality, sincerity for practical sessions throughout semester)	05
Viva	05

B. Semester End Evaluation (Exam Pattern) (30 Marks – 2 hours):

Question No.	Group	Title	Method	Marks
1	A	Electronics	Experiment performance as per practical slip	30

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Course Nomenclature	**Introduction to Astronomy and Astrophysics**
Course Code	25_USPHE508
Class	TYBSc
Semester	V
Number of Credits	2
Nature	Theory
Type	Major Electives
Revision of syllabus specific to employability/ entrepreneurship/ skill development	Study of astronomy and astrophysics equips learner with a unique combination of technical, analytical, and problem-solving skills. By developing expertise in both theoretical and observational aspects of astrophysics, and refining transferable skills such as data analysis, learners can pursue a wide variety of exciting and impactful careers in research, academics and science communication.

Nomenclature: Introduction to Astronomy and Astrophysics

Eligibility: To be eligible for enrolment in this course, a learner must have appeared for the courses 'USPH101: Classical Physics' and USPH303: Mathematical Methods in Physics'.

Course Outcomes:

On successful completion of this course, a learner will be able to:

CO1: do measurements and understand scales in astronomy
CO2: describe about solar system
CO3: analyze formation of stars and their evolution
CO4: differentiate between various life stages of star
CO5: describe about formation and structure of galaxies
CO6: explore about future of the universe

Curriculum:

Unit	Title	Learning Points	No. of Lectures (60 min.)
I	Introduction to Astronomy and the Solar System	History of astronomy, Night sky from our backyard, Scales and dimensions, distance and measurement, sidereal time The Solar System: Formation of solar system, Terrestrial planets and Jovian planets, Oort cloud, Kuiper belt, asteroid belt, Retrograde Motion of Planets	10
II	The Sun, Star formation and stellar evolution	The Sun: solar atmosphere, sunspot and solar cycle. Early Stage of Star Formation, Evolution on the Main Sequence, Evolution beyond the Main Sequence, White Dwarfs, Neutron stars, supernova, blackholes	10
III	Galaxies and Cosmology	The Milky Way: distribution of matter, differential rotation, formation of spiral arm Galaxies: formation, classification (Hubble tuning fork diagram), Galaxy clusters Active galaxies: Active galactic nuclei, classification of active galaxies Cosmology: Big Bang Cosmology, the early universe, age of the universe, future of the universe	10

Note: A good number of numerical examples on all units (as far as possible) are expected to be covered during the prescribed lectures.

Learning Resources recommended:

Main References:

1. PJ: An Introduction to astronomy and astrophysics: Pankaj Jain, (CRC Press)
2. http://www.youtube.com/@hbcsephysicsandastronomy6788

Evaluation Pattern:

A. Continuous Internal Evaluation (20 Marks):

Method	Marks
Unit Test (MCQ / Descriptive – Based on Theory and/or Problems - Online/Offline – 1 unit test of 10 marks / 2 unit tests of 05 marks each / 3 unit tests of 05 marks each and best two out of three will be considered)	10
Assignments / Seminars	05
Attendance and active participation in classroom	05

B. Semester End Evaluation (Paper Pattern) (30 Marks – 1 hour):

Que. No.	Question Type	Unit	Marks
1	A) Long answer based questions with 100% internal option B) Short answer based questions with 100% internal option	I	06 04
2	A) Long answer based questions with 100% internal option B) Short answer based questions with 100% internal option	II	06 04
3	A) Long answer based questions with 100% internal option B) Short answer based questions with 100% internal option	III	06 04

Guidelines for paper pattern for Semester End Evaluation:

1. As far as possible, one fifth weightage of the total marks should be given to numerical examples in above paper pattern.
2. All questions will be compulsory and may be divided into sub-questions.
3. Long and short answer based questions will include descriptive type of questions, derivation-based questions, problem solving / numericals based questions, etc.

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Course Nomenclature	**Introduction to Astronomy and Astrophysics Lab**
Course Code	25_USPHE509
Class	TYBSc
Semester	V
Number of Credits	2
Nature	Practical
Type	Major Electives
Revision of syllabus specific to employability/ entrepreneurship/ skill development	This course provides learners to gain hands on experience. It also helps to develop technical skills like handling, calibration and maintenance of telescopes. This course enables learners to develop ability of critical observations, scientific communication and collaborative work.

Nomenclature: Introduction to Astronomy and Astrophysics Lab

Eligibility: To be eligible for enrolment in this course, a learner must have appeared for the courses 'USPH101: Classical Physics' and USPH303: Mathematical Methods in Physics' and must have enrolled for 'USPH608: Introduction to Astronomy and Astrophysics'

Course Outcomes:

On successful completion of this course, a learner will be able to:

CO1: differentiate between various astronomical coordinate systems
CO2: locate various celestial bodies in the sky and sky map
CO3: handle telescope for sky observation
CO4: use software for sky observation

Instructions for learners:

1. All measurements and readings should be written with proper units.
2. Skill of doing the experiment and understanding physics concepts should be more important than the accuracy of final result.
3. In order to appear for Semester End Practical Examination of this course, all 12 experiments from this course should be completed compulsorily and learners are required to report all these experiments in the journal of this course.
4. After completing all required number of experiments for this course and recording them in journal, a learner will have to get their journal certified and produce the certified journal at the time of Semester End Practical Examination of these courses.
5. A learner will be allowed to appear for the Semester End Practical Examination of this course, only if a learner submits a certified journal of this course or a certificate from the head of the Physics department that the learner has completed this practical course as per minimum requirements.
6. For Semester End Practical Examination of this course, the learner will be examined for 1 experiment from this course and experiment will be of two hours duration.
7. Evaluation in viva voce will be based on experiments from this course.
8. While evaluating learner's performance for Semester End Practical Examination for this course, weightage will be given to circuit / ray diagram, observations, tabular representation, experimental skills and procedure, graph, calculation and result, whichever applicable.

Curriculum:

Group	Title	Learning Points	No. of lectures (60 min.)
A	Coordinate Systems, sky maps and sky observation	1. Celestial Sphere 2. Astronomical coordinate systems • Horizontal System • Equatorial System • Ecliptic System 3. Use of Sky maps • locating celestial objects like stars, planets, Messier objects on sky maps • locating constellations on sky map • drawing constellations on sky map 4. Naked eye sky observation • identifying and observing visible stars • identifying and observing visible planets • identifying and observing visible constellations • identifying and observing phases of Moon 5. Telescope basics and Types of telescopes 6. Methods of mounting of telescope 7. observing visible stars and planets through telescope 8. observing moon through telescope 9. Stellarium Basics 10. To become familiar with the astronomical objects visible to naked eye in the night sky using the software Stellarium. 11. To become familiar with the Constellations in the night sky using the software Stellarium	**60**

		12. To identify the retrograde motion of Mars with respect to the Background stars	

Learning Resources recommended:

Main References:

1. PJ: An Introduction to astronomy and astrophysics: Pankaj Jain, (CRC Press)
2. http://www.youtube.com/@hbcsephysicsandastronomy6788
3. https://va-iitk.vlabs.ac.in/?page=listexp
4. https://stellarium-labs.com/

Evaluation Pattern:

A. Continuous Internal Evaluation (20 Marks):

Method	Marks
Performance and engagement during practical sessions: • Skills, precision, accuracy, safety measures, individual and/or collaborative working while performing practical • Ability to record proper observations, to analyze data, to plot graph and to draw meaningful conclusions of experiments • Submission of journal within a week after every practical session Based on above criteria, each experiment of this course will be assessed for 10 marks during regular practical sessions and finally the total marks obtained by a learner will be converted to marks out of 10.	10
Overall performance (attendance, punctuality, sincerity for practical sessions throughout semester)	05
Viva	05

B. Semester End Evaluation (Exam Pattern) (30 Marks – 2 hours):

Question No.	Group	Title	Method	Marks
1	A	Coordinate Systems, sky maps and sky observation	Experiment performance as per practical slip	30

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Course Nomenclature	**Electronic Instrumentation Lab**
Course Code	25_USPHV510
Class	TYBSc
Semester	V
Number of Credits	4
Nature	Practical
Type	Vocational Skill Course
Revision of syllabus specific to employability/ entrepreneurship/ skill development	The curriculum is so designed that it offers hands-on approach to learn the subject. The curriculum also demonstrates how physics principles apply to real world scenarios. Learners will develop the skill to handle - measuring instruments, basic physics laboratory equipments, etc. The curriculum is so designed that learners will be well-prepared to apply their theoretical knowledge to practical situations, effectively utilize electronic instruments and confidently work with ac circuits and consumer appliances in a laboratory setting.

Nomenclature: Electronic Instrumentation Lab

Eligibility: --

Course Outcomes:

On successful completion of this course, a learner will be able to:

CO1. Understand & practice the skills while performing experiments.
CO2. Understand the use of apparatus and their use without fear & hesitation.
CO3. Correlate the physics theory concepts to practical application.
CO4. Understand the concept of errors and their estimation.
CO5. Learn scientific method of recording of the data, its analysis and result/conclusion of an experiment.

Instructions for learners:

1. All measurements and readings should be written with proper units.
2. Skill of doing the experiment and understanding physics concepts should be more important than the accuracy of final result.
3. In order to appear for Semester End Practical Examination of this course, minimum 24 experiments (minimum 12 experiments from each group) from this course should be completed compulsorily and learners are required to report all these experiments in the journal of this course.
4. After completing all required number of experiments for this course and recording them in journal, a learner will have to get their journal certified and produce the certified journal at the time of Semester End Practical Examination of these courses.
5. A learner will be allowed to appear for the Semester End Practical Examination of this course, only if a learner submits a certified journal of this course or a certificate from the head of the Physics department that the learner has completed this practical course as per minimum requirements.
6. For Semester End Practical Examination of this course, the learner will be examined for 2 experiments from this course and each experiment will be of two hours duration.
7. Evaluation in viva voce will be based on experiments from this course.
8. While evaluating learner's performance for Semester End Practical Examination for this course, weightage will be given to circuit / ray diagram, observations, tabular representation, experimental skills and procedure, graph, calculation and result, whichever applicable.

Curriculum:

Group	Title	Learning Points	No. of lectures (60 min.)
A	Transducers, Optoelectronic Devices	1. Study of temperature sensors – Thermistor, Thermocouple 2. Application of Thermistor as temperature sensor using OPAMP 3. Application of Thermocouple as temperature sensor 4. Study of LVDT operation 5. Study of LVDT characteristics 6. Study of Light Emitting Diode 7. Study of Light Dependent Resistor 8. Study of Liquid Crystal Display 9. Study of Photodiode operation and circuit analysis 10. Study of Photodiode characteristics 11. Study of Phototransistor operation and circuit analysis 12. Study of Phototransistor characteristics 13. Study of seven segment display: CA, CC type 14. BCD to Seven segment decoder/driver (IC 7447)	**60**
B	Measuring Instruments, Data Acquisition Systems, Waveform Shaping Circuits, Current source	1. Study of Cathode Ray Oscilloscope: Block diagram (Single and dual trace CRO), Front panel controls, Probes 1:1 and 10:1 2. Study of Data acquisition Systems: Signal conditioning of inputs, single channel, multi- channel 3. OPAMP D/A Converter: Binary weighted resistors 4. OPAMP D/A Converter: Ladder network 5. Basic Instrumentation Amplifier using 3 OPAMPs coupled to resistance bridge 6. A/D Converter: Successive approximation type 7. A/D Converter: Voltage to time (Single	**60**

		slope, Dual slope) 8. Study of Half wave precision rectifier, Active Peak detector, Active Positive Clamper, Active Positive and Negative Clippers 9. Active Notch Filter (frequency response & phase relation) 10. Square and Triangular wave generator using OPAMPs with concept of duty cycle 11. Half wave precision rectifier using precision OPAMPs 12. Constant Current source using OPAMP and PNP transistor (o/p current less than 50 mA) 13. Simple microphone amplifier using a transistor 14. Low voltage audio amplifier using IC LM386	

Learning Resources recommended:

1. Advanced course in Practical Physics D. Chattopadhya, 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 – C. L. Arora (1st Edition) -2001 S. Chand and Co. Ltd.
5. Practical Physics – C. L. Squires (3rd Edition) Cambridge University
6. University Practical Physics – D C Tayal. Himalaya Publication
7. Advanced Practical Physics – Worsnop & Flint

Evaluation Pattern:

A. Continuous Internal Evaluation (40 Marks):

Method	Marks
Performance and engagement during practical sessions: • Skills, precision, accuracy, safety measures, individual and/or collaborative working while performing practical • Ability to record proper observations, to analyze data, to plot graph and to draw meaningful conclusions of experiments	20

• Submission of journal within a week after every practical session Based on above criteria, each experiment of this course will be assessed for 20 marks during regular practical sessions and finally the total marks obtained by a learner will be converted to marks out of 20.	
Overall performance (attendance, punctuality, sincerity for practical sessions throughout semester)	10
Viva	10

B. Semester End Evaluation (Exam Pattern) (60 Marks – 4 hours):

Question No.	Group	Title	Method	Marks
1	A	Transducers, Optoelectronic Devices	Experiment performance as per practical slip	30
2	B	Measuring Instruments, Data Acquisition Systems, Waveform Shaping Circuits, Current source	Experiment performance as per practical slip	30

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Course Nomenclature	**Field Project**
Course Code	25_USPHF511
Class	TYBSc
Semester	V
No of Credits	4
Nature	Project
Type	Field Project
Revision of syllabus specific to employability/ entrepreneurship/ skill development	Incorporating a field project into syllabus helps to bridge the gap between academic learning and professional field expectations, fostering holistic development and practical exposure for students.

Nomenclature: Field Project

Eligibility: --

Course Outcomes:

On successful completion of this course, a learner will be able to:

CO1. Understand the ethics and research methodology.
CO2. Do a literature review.
CO3. Do research.
CO4. Analyze the research work data.
CO5. Write research thesis.
CO6. Design, build and test necessary experimental setup.

Course Outline:

1. Identifying problem for project work (20 Hours).
2. Literature survey (20 Hours).
3. Designing and implementing the project through necessary experimental work (30 Hours).
4. Data collection and its analysis and interpretation. (20 Hours).
5. Report writing and presentation (30 Hours).

Evaluation Pattern:

A. Continuous Internal Evaluation (40 Marks):

Method	Marks
Project Proposal	20
Project Proposal Presentation	10
Attendance and behavior	10

B. Semester End Evaluation (60 Marks):

Sr. No.	Criteria	Marks
1	Quality of the project, Significance of study and Society application	10
2	Experimental / Theoretical Methodology, Working of the project	15

3	Documentation / Complete Project Report	10
4	Project Presentation	10
5	Viva based on in depth knowledge in the subject and results	10
6	Presentation in conference, symposia	05

The evaluation of the project will assess the project based on the following parameters:

- **Project Proposal - 20 Marks:** Submit a detailed two to three-page proposal outlining the project's objectives, timeline, resources needed, expected outcomes and a plan for assessment.
- **Project proposal Presentation – 10 Marks:** Present a clear, concise overview of your project, including objectives, methodology, timeline, and expected outcomes, while engaging your audience with professional delivery, visual aids, and confident communication.
- **Attendance and Behavior - 10 Marks:** Students are expected to attend all scheduled sessions, and project-related activities. It is crucial to be present unless there is an unavoidable conflict (e.g., illness or emergency).
- **Quality of the Project, Significance of study and Society application – 10 Marks:** The overall quality of the project, including its design, implementation, and user experience, will be evaluated.
- **Experimental / Theoretical Methodology, Working of the Project – 15 Marks:** The functionality and performance of the project will be assessed to determine how well it meets the specified requirements and objectives.
- **Documentation / Project Report – 10 Marks:** The completeness, accuracy, and professionalism of the project documentation, including the project report and supporting materials, will be considered.
- **Project Presentation – 10 Marks:** The clarity, organization, and effectiveness of the project presentation will be evaluated.
- **Viva – 10 Marks:** The viva voce session will provide an opportunity for the student to demonstrate their knowledge and understanding of the project, as well as to answer questions and engage in a discussion with the evaluators.
- **Presentation in conference, symposia – 05 Marks:** Learners are expected to present their work in conference, symposia, competitions and should submit the details regarding this for the evaluation.

Project Guidelines:

- The project can be a theoretical or experimental, related to core subject.
- Maximum three learners can do a joint project. Each one of them will submit a separate hard bound project report along with one hard bound department copy.

Report Structure:

a) Project Proposal:

The project proposal will be considered for internal evaluation. The project proposal is a mandatory document that serves as a foundation for the project. It helps students define their project idea, receive early evaluation and feedback, establish clear communication with the project guide, and take ownership of the project's successful execution. A formal proposal ensures systematic and professional project planning, fostering critical thinking, effective communication, and project management skills. The proposal provides a roadmap and increases the chances of a successful outcome. Before initiating a project, it is mandatory to submit a project proposal for approval. The original duly approved project proposal should be attached to the final project report. The project proposal for UG Physics projects should include the following contents:

a) **Title:** It should be clear, concise, and reflect the core objective or theme of the project.
b) **Introduction:** Introduces the project topic with general area of interest (field, industry, or problem the project addresses) and relevance or importance of the topic in the current scenario.
c) **Objectives:** It should explain the goals and desired outcomes of the project.
d) **Scope:** It should define the boundaries of the project, explaining what will and won't be covered.
e) **Methodology:** Briefly introduces a high-level overview of the theoretical, experimental and computational methods, techniques, or tools used to achieve the objectives of project.
f) **Timeline:** The Project Timeline should outline the key milestones, tasks, and deadlines, providing a clear schedule for project activities and ensuring timely completion of objectives.
g) **Resources:** Mention different stakeholders, equipment, materials, and budget required to complete a project successfully.
h) **Expected Outcomes:** Outline specific outcomes of a project, measurable results or benefits that the project aims to achieve upon completion.
i) **References:** Mention Name of the books, journal, or websites referenced for project development throughout the development.

b) Complete Project Report:

The Certified Copy of Hard Bound Project Report must adhere to the following guidelines:

a) **Title Page:** Mentioning the title of the report, name of the learner, program, institution and the project.
b) **Certificate of Completion:** A certificate issued by guide confirming the successful completion of the project.
c) **Declaration:** A statement by the learner declaring that the report is the original work and acknowledging any assistance or references used.

d) **Acknowledgments:** Recognizing individuals or organizations that provided support, guidance, or resources during the training/project.
e) **Table of Contents:** Providing a clear outline of the report's sections and page numbers.
f) **Abstract:** A bird's eye view of learner's entire presentation has to be precisely offered under this category. A brief overview of the projecta+, its objectives and key findings should be mentioned.
g) **Introduction:** Background information about the project and its significance. Objectives and scope of the project.
h) **Literature Review:** Overview of relevant literature and studies related to the chosen field and development issues.
i) **Methodology:** Description of: Planning of experimental procedure as per the need of the project. Designing and implementation of the project as per the objectives through theoretical, experimental or computational methods.
j) **Observations and data analysis:** Details of Testing, debugging, troubleshooting as per the need. Data collection and analysis.
k) **Individual contribution:** Details of individual contribution of learner in project work
l) **Conclusion:** Summary of the key findings and outcomes of the project.
m) **References & Appendices:** List of all sources cited in the project report. Additional supporting materials.
n) **Future work:** Suggestions for further development or research. It serves to wrap up the project and point to areas that could benefit from future improvements or further investigation.

Formatting Options:

- The text of the report should be set in 12 pt, Times New Roman font, and single-spaced.
- Chapter headings should be centered, written in 20pt, Times New Roman font, bold, and in all caps.
- These guidelines ensure a standardized format for the project report, promoting clarity and readability.

Annexure A

(Proforma for the Field Project Proposal in Field Project Report)

R. E. Society's

Gogate- Jogalekar College (Autonomous), Ratnagiri.

Department of Physics

Field Project Proposal

Academic Year: 20_ - 20_

Semester: V

Date of submission:
Name of the learner:
Academic seat number:

- **Title of the project:**
- **Introduction of project topic:**
- **Objectives:**
- **Scope:**
- **Methodology:**
- **Tools and Technology:**
- **Timeline:**
- **Resources:**
- **Expected Outcomes:**
- **References:**

Signature of Student **Signature of Internal Guide**

Roll Number:

Annexure B

(Proforma for the Sample Title Page Format in Field Project Report)

<Title of the problem of the Project>

A Project Submitted

to

R. P. Gogate College of Arts & Science and

R. V. Jogalekar College of Commerce (Autonomous), Ratnagiri

under

University of Mumbai

for partial completion of the degree

of

Bachelor of Science in Physics

Under the Faculty of science

By

<Name of Student>

Under the Guidance of

<Name of the Guiding Teacher>

R. P. Gogate College of Arts & Science and

R. V. Jogalekar College of Commerce (Autonomous), Ratnagiri

<Month and Year>

Annexure C

(Proforma for the Certificate in Field Project Report)

R. E. Society's,

R. P. Gogate College of Arts and Science and R. V. Jogalekar College of Commerce (Autonomous), Ratnagiri

Department of Physics

CERTIFICATE

This is to certify that Mr. /Ms. _____ of TYBSc (Sem V) class bearing examination seat no. _____ has satisfactorily carried out Project on _____, as laid by the Board of Studies in Physics Major for the year 202_-__. His/Her bonafide work was completed under the guidance of _____.

Signature of Guide **Examiner** **Head**

Department Physics

Date:

Place:

Annexure D

(Proforma for the Table of Contents in Field Project Report)

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Syllabi of Courses Offered in the Subject Physics for Semester VI

Course Nomenclature	**Classical Mechanics**
Course Code	25_USPHM601
Class	TYBSc
Semester	VI
Number of Credits	2
Nature	Theory
Type	Major Mandatory
Revision of syllabus specific to employability/ entrepreneurship/ skill development	The curriculum is so designed that, learners will understand and analyze the behavior of objects under the influence of central force. Learners will also be equipped to analyze complex motion scenarios under central force and understand the dynamics of systems in moving and rotating coordinate frames, which will enhance their ability to address advanced problems in physics and related fields. The curriculum focuses on Lagrangian Formulation which is powerful mathematical formalism for analyzing and solving complex problems in classical mechanics and learners will develop the ability to apply Lagrange's equations to a diverse set of mechanical systems, including rigid bodies, oscillators, coupled systems and systems with constraints. The curriculum equips learners to analyze, interpret and solve problems on complex fluid dynamics and rotational motion, which will provide foundation to learners to work in various engineering and scientific contexts. The curriculum also equips learners to analyze and interpret nonlinear dynamics, predict chaotic behavior and understand the underlying principles governing complex systems, enabling them to contribute to various scientific, engineering and interdisciplinary applications.

Nomenclature: Classical Mechanics

Eligibility: To be eligible for enrolment in this course, a learner must have appeared for the courses 'USPH101: Classical Physics' and 'USPH301: Mechanics and Thermodynamics'.

Course Outcomes:

On successful completion of this course, a learner will be able to:

CO1. Understand the kinds of motions that can occur under a central potential and their applications to planetary orbits.

CO2. Understand the effect of moving coordinate system, rectilinear as well as rotating.

CO3. Learn the concepts needed for the important formalism of Lagrange's equations and derive the equations using D'Alembert's principle and able to solve simple examples using this formalism.

CO4. Understand simple concepts from fluid mechanics.

CO5. Understand the dynamics of rigid bodies.

CO6. Understand the drastic effect of adding nonlinear corrections to usual problems of mechanics and nonlinear mechanics which will help to understand the irregularity we observe around us in nature.

CO7. Be able to solve simple mathematical problems in all above areas.

Curriculum:

Unit	Title	Learning Points	No. of Lectures (60 min.)
I	Central Force	**1.** Motion under a central force, the central force inversely proportional to the square of the distance, Elliptic orbits, The Kepler problem, Classical Scattering Reference: KRS **2.** Moving origin of coordinates, Rotating coordinate systems, Laws of motion on the rotating earth, The Foucault pendulum, Larmor's theorem Reference: KRS	10
II	Lagrange's Equations and	**1.** D'Alembert's principle, Constraints, Examples of holonomic constraints, Examples of	10

	Rigid Body Dynamics	nonholonomic constraints, Degrees of freedom and generalized coordinates, Virtual displacement, Virtual work, D'Alembert's principle, Illustrative problems Reference: PVP **2.** Lagrange's equations (using D'Alembert's principle), Properties of Lagrange's equations, Illustrative problems, Canonical momentum, cyclic or ignorable coordinates Reference: PVP **3. Rigid Body Dynamics:** introduction, degrees of freedom, rotation about an axis: orthogonal matrix, Euler's theorem, Eulerian angles, inertia tensor, angular momentum of rigid body, Euler's equation of motion of rigid body, free motion of rigid body, motion of symmetric top (without notation) Reference: KRS	
III	Fluid Dynamics and Non-linear Mechanics	**1. Fluid Dynamics:** Kinematics of moving fluids, Equation of motion for an ideal fluid, Conservation laws for fluid motion, Steady flow Reference: KRS **2. Nonlinear Mechanics:** Qualitative approach to chaos, The anharmonic oscillator, Numerical solution of Duffing's equation Reference: BO **3. Transition to chaos:** Bifurcations and strange attractors, Aspects of chaotic behavior (Logistic map) Reference: BO	10

Note: A good number of numerical examples on all units (as far as possible) are expected to be covered during the prescribed lectures.

Learning Resources recommended:

Main References:

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

Additional reference:

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

Evaluation Pattern:

A. Continuous Internal Evaluation (20 Marks):

Method	Marks
Unit Test (MCQ / Descriptive – Based on Theory and/or Problems - Online/Offline – 1 unit test of 10 marks / 2 unit tests of 05 marks each / 3 unit tests of 05 marks each and best two out of three will be considered)	10
Assignments / Seminars	05
Attendance and active participation in classroom	05

B. Semester End Evaluation (Paper Pattern) (30 Marks – 1 hour):

Que. No.	Question Type	Unit	Marks
1	A) Long answer based questions with 100% internal option B) Short answer based questions with 100% internal option	I	06 04
2	A) Long answer based questions with 100% internal option B) Short answer based questions with 100% internal option	II	06 04
3	A) Long answer based questions with 100% internal option B) Short answer based questions with 100% internal option	III	06 04

Guidelines for paper pattern for Semester End Evaluation:

1. As far as possible, one fifth weightage of the total marks should be given to numerical examples in above paper pattern.
2. All questions will be compulsory and may be divided into sub-questions.
3. Long and short answer based questions will include descriptive type of questions, derivation-based questions, problem solving / numericals based questions, etc.

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Course Nomenclature	**Solid State Physics**
Course Code	25_USPHM602
Class	TYBSc
Semester	VI
Number of Credits	2
Nature	Theory
Type	Major Mandatory
Revision of syllabus specific to employability/ entrepreneurship/ skill development	The course is so designed that it develops learner's ability to analyze, understand and predict structure, properties and behavior of crystalline materials at the atomic and subatomic level. The curriculum includes topics like, electrical properties of metals which develops learner's ability to understand and analyze the behavior of metallic materials for electrical and electronic applications. The curriculum also includes topics like, band theory of solids and conduction in semiconductors which develops learner's ability to understand and analyze the electronic properties of solid materials, particularly semiconductors. The curriculum also equips learners with the ability to understand, analyze and apply the principles of diode operation and superconductivity. All these skills are valuable for learners which make foundation to pursue careers in the field of material science, condensed matter physics, electrical engineering, electronics, semiconductor device engineering and related fields.

Nomenclature: Solid State Physics

Eligibility: --

Course Outcomes:

On successful completion of this course, a learner will be able to:

CO1. Understand the basics of crystallography, electrical properties of metals, band theory of solids, demarcation among the types of materials, semiconductor physics and superconductivity.

CO2. Understand the application of Fermi - Dirac distribution function, density of states, conduction in semiconductors and BCS theory of superconductivity.

CO3. Demonstrate quantitative problem solving skills in all the topics covered.

Curriculum:

Unit	Title	Learning Points	No. of Lectures (60 min.)
I	Crystal Physics	**1.** The crystalline state, Basic definitions of crystal lattice, basis vectors, unit cell, primitive and non-primitive cells, The fourteen Bravais lattices and the seven crystal systems, Elements of symmetry, nomenclature of crystal directions and crystal planes, Miller Indices, spacing between the planes of the same Miller indices, examples of simple crystal structures, The reciprocal lattice and X-ray diffraction Reference: AO **2.**Classical free electron theory of metals, Drawbacks of classical theory, Relaxation time, Collision time and mean free path Reference: SOP	10
II	Electrical Properties of Metals Band Theory of Solids	**1.** Quantum theory of free electrons, Fermi Dirac statistics and electronic distribution in solids, Density of energy states and Fermi energy, The Fermi distribution function, Heat capacity of the Electron gas, Mean energy of electron gas at 0 K, Electrical conductivity from quantum mechanical considerations, Failure of	10

		Sommerfeld's free electron Theory, Thermionic emission Reference: SOP **2.** Band theory of solids, The Kronig- Penney model (Omit eq. 6.184 to 6.188), Allowed energy spectrum for electron in a solid, E(K) curve, Brillouin zones, Number of wave functions in a band, Motion of electrons in a one-dimensional periodic potential, Effective mass of an electron in a solid, Effective number of free electrons in a band, Distinction between metals, insulators and intrinsic semiconductors Reference: SOP	
III	Band Theory of Conduction in Semiconductors Diode Theory and Superconductivity	**1.** 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 Reference: MHS **2. 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 Reference: MHS **3. 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 Reference: CK	10

Note: A good number of numerical examples on all units (as far as possible) are expected to be covered during the prescribed lectures.

Learning Resources recommended:

Main References:

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

Additional reference:

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

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Evaluation Pattern:

A. Continuous Internal Evaluation (20 Marks):

Method	Marks
Unit Test (MCQ / Descriptive – Based on Theory and/or Problems - Online/Offline – 1 unit test of 10 marks / 2 unit tests of 05 marks each / 3 unit tests of 05 marks each and best two out of three will be considered)	10
Assignments / Seminars	05
Attendance and active participation in classroom	05

B. Semester End Evaluation (Paper Pattern) (30 Marks – 1 hour):

Que. No.	Question Type	Unit	Marks
1	A) Long answer based questions with 100% internal option B) Short answer based questions with 100% internal option	I	06 04
2	A) Long answer based questions with 100% internal option B) Short answer based questions with 100% internal option	II	06 04
3	A) Long answer based questions with 100% internal option	III	06

	B) Short answer based questions with 100% internal option		04

Guidelines for paper pattern for Semester End Evaluation:

1. As far as possible, one fifth weightage of the total marks should be given to numerical examples in above paper pattern.
2. All questions will be compulsory and may be divided into sub-questions.
3. Long and short answer based questions will include descriptive type of questions, derivation-based questions, problem solving / numericals based questions, etc.

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Course Nomenclature	**Nuclear Physics**
Course Code	25_USPHM603
Class	TYBSc
Semester	VI
No of Credits	2
Nature	Theory
Type	Major Mandatory
Revision of syllabus specific to employability/ entrepreneurship/ skill development	The curriculum is so designed that, learners will develop a basic understanding of alpha, beta and gamma decay processes, including their principles, characteristics and decay equations. Learners will also develop a basic understanding of various nuclear models, including liquid drop model and shell model. The curriculum focuses on understanding and analyzing nuclear energy processes, their applications and challenges. The curriculum also focuses on design, operation and advancement of particle accelerators. The curriculum also develops conceptual understanding about nuclear forces, deuteron problem and the meson theory as fundamental aspects of nuclear physics. This will help learners to evaluate properties of deuteron and to analyze potential energy curves. All this content will encourage learners to work in the field of research and applications related to elementary particles, contribute to advancements in nuclear and particle physics and potentially pursue further studies or careers in nuclear and particle physics research, medical applications, industrial applications and related fields.

Nomenclature: Nuclear Physics

Eligibility: To be eligible for enrolment in this course, a learner must have appeared for the courses 'USPH102: Modern Physics'.

Course Outcomes:

On successful completion of this course, a learner will be able to:

CO1. Understand the fundamental principles and concepts governing classical nuclear and particle physics and will get a knowledge of their applications - interactions of ionizing radiation with matter, the key techniques for particle accelerators, the physical processes involved in nuclear power generation.

CO2. Understand the concept of elementary particles, the fundamental constituents of matter and lay foundation for the understanding of unsolved questions about dark matter, antimatter and other research oriented topics.

CO3. Demonstrate quantitative problem solving skills in all the topics covered.

Curriculum:

Unit	Title	Learning Points	No. of Lectures (60 min.)
I	Radioactive Decay	**1. Alpha decay:** Velocity, energy and Absorption of alpha particles: Range, Ionization and stopping power, Nuclear energy levels. Range of alpha particles, alpha particle spectrum, Fine structure, long range alpha particles, Alpha decay paradox: Barrier penetration (Gamow's theory of alpha decay and Geiger- Nuttal law) Reference: IK, SBP, SNG **2. Beta decay:** Introduction, Velocity and energy of beta particles, Energy levels and decay schemes, Continuous beta ray spectrum-Difficulties encountered to understand it, Pauli's neutrino hypothesis, Detection of neutrino, Energetics of beta decay Reference: IK, SBP, SNG **3. Gamma decay:** Introduction, selection rules, Internal conversion, nuclear isomerism, Mossbauer effect Reference: SBP, AB	10

II	Nuclear Models, Nuclear Energy and Nuclear Force	**1. Nuclear Models:** Liquid drop model, Weizsacker'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 Reference: SBP, AB **2. 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), Nuclear power and breeder reactors, Natural fusion Possibility of controlled fusion Reference: SBP, AB **3. Nuclear force:** Introduction, Deuteron problem, Meson theory of Nuclear Force- A qualitative discussion Reference: SBP, DCT, AB	10
III	Particle Accelerators and Elementary Particles	**1. Particle Accelerators:** Van de Graaff Generator, Cyclotron, Synchrotron, Betatron and Idea of Large Hadron Collider Reference: SBP, AB **2. Elementary Particles:** Introduction, Classification of elementary particles, Particle interactions, Conservation laws (linear &angular momentum, energy, charge, baryon number & lepton number), particles and antiparticles (Electrons and positrons, Protons and anti-protons, Neutrons and anti- neutrons, Neutrinos and anti-neutrinos), Photons, Mesons, Quark model (Qualitative) Reference: SBP, DCT, AB	10

Note: A good number of numerical examples on all units (as far as possible) are expected to be covered during the prescribed lectures.

Learning Resources recommended:

Main References:

1. AB: Concepts of Modern Physics: Arthur Beiser, Shobhit Mahajan, S Rai Choudhury (6th Ed.) (TMH)
2. SBP: Nuclear Physics, S.B. Patel (Wiley Eastern Ltd.)
3. IK: Nuclear Physics, Irving Kaplan (2nd Ed.) (Addison Wesley)
4. SNG: Nuclear Physics, S. N. Ghoshal (S. Chand & Co.)
5. DCT: Nuclear Physics, D. C. Tayal (Himalayan Publishing House) 5th ed

Additional reference:

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

Evaluation Pattern:

A. Continuous Internal Evaluation (20 Marks):

Method	Marks
Unit Test (MCQ / Descriptive – Based on Theory and/or Problems - Online/Offline – 1 unit test of 10 marks / 2 unit tests of 05 marks each / 3 unit tests of 05 marks each and best two out of three will be considered)	10
Assignments / Seminars	05
Attendance and active participation in classroom	05

B. Semester End Evaluation (Paper Pattern) (30 Marks – 1 hour):

Que. No.	Question Type	Unit	Marks
1	A) Long answer based questions with 100% internal option B) Short answer based questions with 100% internal option	I	06 04
2	A) Long answer based questions with 100% internal option B) Short answer based questions with 100% internal option	II	06 04
3	A) Long answer based questions with 100% internal option B) Short answer based questions with 100% internal option	III	06 04

Guidelines for paper pattern for Semester End Evaluation:

1. As far as possible, one fifth weightage of the total marks should be given to numerical examples in above paper pattern.
2. All questions will be compulsory and may be divided into sub-questions.
3. Long and short answer based questions will include descriptive type of questions, derivation-based questions, problem solving / numericals based questions, etc.

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Course Nomenclature	**Physics Lab - VII**
Course Code	25_USPHM604
Class	TYBSc
Semester	VI
Number of Credits	2
Nature	Practical
Type	Major Mandatory
Revision of syllabus specific to employability/ entrepreneurship/ skill development	Restructuring of syllabus has been done to ensure a smooth and logical flow of content throughout the curriculum. It also facilitates the logical progression of subjects which allows students to build their understanding of subject progressively and systematically and to grasp contents more effectively. The curriculum is so designed that it offers hands-on approach to learn the subject. The curriculum also demonstrates how physics principles apply to real world scenarios. Learners will develop the skill to handle - measuring instruments, basic physics laboratory equipments, etc. Learners will also learn to perform basic physics experiments, learn to improve the accuracy of measurements, learn to analyze experimental observations / data, learn to draw meaningful conclusions of experiments and to interpret results.

Nomenclature: Physics Lab - VII

Eligibility: --

Course Outcomes:

On successful completion of this course, a learner will be able to:

CO1. Understand & practice the skills while performing experiments.
CO2. Understand the use of apparatus and their use without fear & hesitation.
CO3. Correlate the physics theory concepts to practical application.
CO4. Understand the concept of errors and their estimation.
CO5. Learn scientific method of recording of the data, its analysis and result/conclusion of an experiment.

Instructions for learners:

1. All measurements and readings should be written with proper units.
2. Skill of doing the experiment and understanding physics concepts should be more important than the accuracy of final result.
3. In order to appear for Semester End Practical Examination of this course, minimum 12 experiments from this course should be completed compulsorily and learners are required to report all these experiments in the journal of this course.
4. After completing all required number of experiments for this course and recording them in journal, a learner will have to get their journal certified and produce the certified journal at the time of Semester End Practical Examination of these courses.
5. A learner will be allowed to appear for the Semester End Practical Examination of this course, only if a learner submits a certified journal of this course or a certificate from the head of the Physics department that the learner has completed this practical course as per minimum requirements.
6. For Semester End Practical Examination of this course, the learner will be examined for 1 experiment from this course and experiment will be of two hours duration.
7. Evaluation in viva voce will be based on experiments from this course.
8. While evaluating learner's performance for Semester End Practical Examination for this course, weightage will be given to circuit / ray diagram, observations, tabular representation, experimental skills and procedure, graph, calculation and result, whichever applicable.

Curriculum:

Group	Title	Learning Points	No. of lectures (60 min.)
A	General Physics	1. Study of Surface tension of mercury by Quincke's method 2. Determination of Surface tension of mercury by Quincke's method 3. Study of Thermal conductivity by Lee's method 4. Determination of Thermal conductivity by Lee's method 5. Study of resolving power of optical instruments 6. Determination of RP of Prism 7. Study of positive and negative double refracting crystal 8. Identification of positive and negative double refracting crystal 9. Study of Lloyd's single mirror 10. Determination of wavelength using Lloyd's single mirror 11. Michelson's interferometer 12. Constant deviation spectrometer (CDS) 13. Zeeman Effect 14. Edser's 'A' pattern	**60**

Learning Resources recommended:

1. Advanced course in Practical Physics D. Chattopadhya, 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 – C. L. Arora (1st Edition) -2001 S. Chand and Co. Ltd.
5. Practical Physics – C. L. Squires (3rd Edition) Cambridge University
6. University Practical Physics – D C Tayal. Himalaya Publication
7. Advanced Practical Physics – Worsnop & Flint

Evaluation Pattern:

A. Continuous Internal Evaluation (20 Marks):

Method	Marks
Performance and engagement during practical sessions: • Skills, precision, accuracy, safety measures, individual and/or collaborative working while performing practical • Ability to record proper observations, to analyze data, to plot graph and to draw meaningful conclusions of experiments • Submission of journal within a week after every practical session Based on above criteria, each experiment of this course will be assessed for 10 marks during regular practical sessions and finally the total marks obtained by a learner will be converted to marks out of 10.	10
Overall performance (attendance, punctuality, sincerity for practical sessions throughout semester)	05
Viva	05

B. Semester End Evaluation (Exam Pattern) (30 Marks – 2 hours):

Question No.	Group	Title	Method	Marks
1	A	General Physics	Experiment performance as per practical slip	30

****

Course Nomenclature	**Physics Lab - VIII**
Course Code	25_USPHM605
Class	TYBSc
Semester	VI
Number of Credits	2
Nature	Practical
Type	Major Mandatory
Revision of syllabus specific to employability/ entrepreneurship/ skill development	Restructuring of syllabus has been done to ensure a smooth and logical flow of content throughout the curriculum. It also facilitates the logical progression of subjects which allows students to build their understanding of subject progressively and systematically and to grasp contents more effectively. The curriculum is so designed that it offers hands-on approach to learn the subject. The curriculum also demonstrates how physics principles apply to real world scenarios. Learners will develop the skill to handle - measuring instruments, basic physics laboratory equipments, etc. Learners will also learn to perform basic physics experiments, learn to improve the accuracy of measurements, learn to analyze experimental observations / data, learn to draw meaningful conclusions of experiments and to interpret results.

Nomenclature: Physics Lab - VIII

Eligibility: --

Course Outcomes:

On successful completion of this course, a learner will be able to:

CO1. Understand & practice the skills while performing experiments.
CO2. Understand the use of apparatus and their use without fear & hesitation.
CO3. Correlate the physics theory concepts to practical application.
CO4. Understand the concept of errors and their estimation.
CO5. Learn scientific method of recording of the data, its analysis and result/conclusion of an experiment.

Instructions for learners:

1. All measurements and readings should be written with proper units.
2. Skill of doing the experiment and understanding physics concepts should be more important than the accuracy of final result.
3. In order to appear for Semester End Practical Examination of this course, minimum 12 experiments from this course should be completed compulsorily and learners are required to report all these experiments in the journal of this course.
4. After completing all required number of experiments for this course and recording them in journal, a learner will have to get their journal certified and produce the certified journal at the time of Semester End Practical Examination of these courses.
5. A learner will be allowed to appear for the Semester End Practical Examination of this course, only if a learner submits a certified journal of this course or a certificate from the head of the Physics department that the learner has completed this practical course as per minimum requirements.
6. For Semester End Practical Examination of this course, the learner will be examined for 1 experiment from this course and experiment will be of two hours duration.
7. Evaluation in viva voce will be based on experiments from this course.
8. While evaluating learner's performance for Semester End Practical Examination for this course, weightage will be given to circuit / ray diagram, observations, tabular representation, experimental skills and procedure, graph, calculation and result, whichever applicable.

Curriculum:

Group	Title	Learning Points	No. of lectures (60 min.)
A	Electricity	1. C1/C2 by BG 2. Internal resistance of voltage and current source 3. Dual trace CRO: Phase shift measurement 4. Study of JFET characteristics 5. JFET as a common source amplifier 6. JFET as switch (series and shunt) 7. UJT characteristics and relaxation oscillator 8. Study of h/e by photocell 9. Determination of h/e by photocell 10. Open CRO, Power Supply and Signal Generator: block diagram study 11. Study of M/C by using BG 12. Determination of M/C by using BG 13. Study of variable dual power supply using LM 317 & LM 337 (± 3V to ± 15V) 14. Application of variable dual power supply using LM 317 & LM 337 (± 3V to ± 15V)	**60**

Learning Resources recommended:

1. Advanced course in Practical Physics D. Chattopadhya, 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 – C. L. Arora (1st Edition) -2001 S. Chand and Co. Ltd.
5. Practical Physics – C. L. Squires (3rd Edition) Cambridge University
6. University Practical Physics – D C Tayal. Himalaya Publication
7. Advanced Practical Physics – Worsnop & Flint

Evaluation Pattern:

A. Continuous Internal Evaluation (20 Marks):

Method	Marks
Performance and engagement during practical sessions: • Skills, precision, accuracy, safety measures, individual and/or collaborative working while performing practical • Ability to record proper observations, to analyze data, to plot graph and to draw meaningful conclusions of experiments • Submission of journal within a week after every practical session Based on above criteria, each experiment of this course will be assessed for 10 marks during regular practical sessions and finally the total marks obtained by a learner will be converted to marks out of 10.	10
Overall performance (attendance, punctuality, sincerity for practical sessions throughout semester)	05
Viva	05

B. Semester End Evaluation (Exam Pattern) (30 Marks – 2 hours):

Question No.	Group	Title	Method	Marks
1	A	Electricity	Experiment performance as per practical slip	30

****

Course Nomenclature	**Special Theory of Relativity**
Course Code	25_USPHE606
Class	TYBSc
Semester	VI
Number of Credits	2
Nature	Theory
Type	Major Electives
Revision of syllabus specific to employability/ entrepreneurship/ skill development	The curriculum includes basic principles and concepts of special relativity like Lorentz transformations, time dilation and length contraction. It also covers study of mathematical equations to calculate relativistic effects, such as time dilation, length contraction and relativistic momentum. The curriculum helps learners to visualize and interpret relativistic effects using space-time diagrams, enhancing the ability to understand the geometry of space-time. Learners will also be able to apply critical thinking to evaluate the implications of special relativity on concepts like simultaneity, mass-energy equivalence and relativistic dynamics. All this knowledge will encourage learners to pursue higher study in the field of research, specifically in the field of theoretical physics.

Nomenclature: Special Theory of Relativity

Eligibility: To be eligible for enrolment in this course, a learner must have appeared for the courses 'USPH101: Classical Physics' and USPH303: Mathematical Methods in Physics'.

Course Outcomes:

On successful completion of this course, a learner will be able to:

CO1. Describe the significance of Michelson Morley experiment
CO2. State and explain postulates of special theory of relativity.
CO3. Derive and apply the Lorentz transformation equations for space time.
CO4. Derive and apply the other transformation equations for: velocity, mass, momentum, force, energy, charge and current density, electric and magnetic fields.
CO5. Establish the connection between electrodynamics and relativity.

Curriculum:

Unit	Title	Learning Points	No. of Lectures (60 min.)
I	Introduction to Special Theory of Relativity	Galilean Relativity: Inertial and Non-inertial frames of reference, Galilean transformations, Newtonian relativity, Electromagnetism and Newtonian relativity, Michelson- Morley experiment, Attempts to preserve Ether frame: Lorentz Fitzgerald contraction and Ether drag hypothesis, Stellar aberration, Attempt to modify electrodynamics Reference: RR	10
II	Relativistic Kinematics	Postulates of the special theory of relativity, Relativity of Simultaneity, Lorentz transformation equations. The relativistic addition of velocities, acceleration transformation equations, Aberration and Doppler effect in relativity, The common sense of special relativity Reference: RR	10
III	Relativistic Dynamics and	Relativistic linear momentum, Relativistic kinetic energy, The equivalence of mass and energy,	10

	Relativity & Electromagnetism	Relation between energy and momentum, The transformation properties of momentum, The interdependence of Electric and Magnetic fields, The Transformation for E and B, The field of a uniformly moving point charge, Force and fields near a current-carrying wire, Force between moving charges, The invariance of Maxwell's equations Reference: RR	

Note: A good number of numerical examples on all units (as far as possible) are expected to be covered during the prescribed lectures.

Learning Resources recommended:

Main References:

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

Additional reference:

1. Special theory of Relativity: A. P. French
2. Very Special Relativity – An illustrated guide: by Sander Bais - Amsterdam University Press
3. Chapter 1: Concepts of Modern Physics by Arthur Beiser
4. Chapter 2: Modern Physics by Kenneth Krane

Evaluation Pattern:

A. Continuous Internal Evaluation (20 Marks):

Method	Marks
Unit Test (MCQ / Descriptive – Based on Theory and/or Problems - Online/Offline – 1 unit test of 10 marks / 2 unit tests of 05 marks each / 3 unit tests of 05 marks each and best two out of three will be considered)	10
Assignments / Seminars	05
Attendance and active participation in classroom	05

B. Semester End Evaluation (Paper Pattern) (30 Marks – 1 hour):

Que. No.	Question Type	Unit	Marks
1	A) Long answer based questions with 100% internal option B) Short answer based questions with 100% internal option	I	06 04
2	A) Long answer based questions with 100% internal option B) Short answer based questions with 100% internal option	II	06 04
3	A) Long answer based questions with 100% internal option B) Short answer based questions with 100% internal option	III	06 04

Guidelines for paper pattern for Semester End Evaluation:

1. As far as possible, one fifth weightage of the total marks should be given to numerical examples in above paper pattern.
2. All questions will be compulsory and may be divided into sub-questions.
3. Long and short answer based questions will include descriptive type of questions, derivation-based questions, problem solving / numericals based questions, etc.

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Course Nomenclature	**Special Theory of Relativity Lab**
Course Code	25_USPHE607
Class	TYBSc
Semester	VI
Number of Credits	2
Nature	Practical
Type	Major Electives
Revision of syllabus specific to employability/ entrepreneurship/ skill development	This course enables learners to gain abilities like critical thinking and problem solving. It helps to develop mathematical skills, and an understanding of the nature of space and time that extends beyond the theory. It also helps in abstract thinking about the universe in higher dimensions.

Nomenclature: Special Theory of Relativity Lab

Eligibility: -- To be eligible for enrolment in this course, a learner must have appeared for the courses 'USPH101: Classical Physics' and USPH303: Mathematical Methods in Physics' and must have enrolled for '25_USPH606: Special theory of Relativity'.

Course Outcomes:

On successful completion of this course, a learner will be able to:

CO1. Make the geometrical representation of space time.

CO2. Draw space time diagrams to explain relativity of simultaneity, length contraction, time dilation

CO3. Solve problems based on length contraction, time dilation, velocity addition, mass energy and momentum relation

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Instructions for learners:

1. All measurements and readings should be written with proper units.
2. Skill of doing the experiment and understanding physics concepts should be more important than the accuracy of final result.
3. In order to appear for Semester End Practical Examination of this course, all 12 experiments from this course should be completed compulsorily and learners are required to report all these experiments in the journal of this course.
4. After completing all required number of experiments for this course and recording them in journal, a learner will have to get their journal certified and produce the certified journal at the time of Semester End Practical Examination of these courses.
5. A learner will be allowed to appear for the Semester End Practical Examination of this course, only if a learner submits a certified journal of this course or a certificate from the head of the Physics department that the learner has completed this practical course as per minimum requirements.
6. For Semester End Practical Examination of this course, the learner will be examined for 1 experiment from this course and experiment will be of two hours duration.
7. Evaluation in viva voce will be based on experiments from this course.
8. While evaluating learner's performance for Semester End Practical Examination for this course, weightage will be given to circuit / ray diagram, observations, tabular representation, experimental skills and procedure, graph, calculation and result, whichever applicable.

Curriculum:

Group	Title	Learning Points	No. of lectures (60 min.)
A	The Geometric Representation of Space-Time and Problem Solving Using Simulations	1. Minkowski Space-Time Diagram 2. Representation of relativity of simultaneity on space time diagram 3. Representation of Length contraction on space time diagram 4. Representation of Time dilation on space time diagram 5. Representation of the time order and space separation of events on space time diagram 6. Understanding the twin paradox with space time diagram 7. Study of length contraction using a software tool and problem solving on it. 8. Study of time dilation using a software tool and problem solving on it. 9. Calculation of relativistic velocity for objects in relative motion, moving at significant fractions of the speed of light. 10. Calculation of relativistic mass for object moving at significant fractions of the speed of light. 11. Calculation of relativistic energy for object moving at significant fractions of the speed of light. 12. Calculation of relativistic momentum for object moving at significant fractions of the speed of light.	**60**

Learning Resources recommended:

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

Evaluation Pattern:

A. Continuous Internal Evaluation (20 Marks):

Method	Marks
Performance and engagement during practical sessions: • Skills, precision, accuracy, safety measures, individual and/or collaborative working while performing practical • Ability to record proper observations, to analyze data, to plot graph and to draw meaningful conclusions of experiments • Submission of journal within a week after every practical session Based on above criteria, each experiment of this course will be assessed for 10 marks during regular practical sessions and finally the total marks obtained by a learner will be converted to marks out of 10.	10
Overall performance (attendance, punctuality, sincerity for practical sessions throughout semester)	05
Viva	05

B. Semester End Evaluation (Exam Pattern) (30 Marks – 2 hours):

Question No.	Group	Title	Method	Marks
1	A	The Geometric Representation of Space-Time and Problem Solving Using Simulations	Experiment performance as per practical slip	30

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Course Nomenclature	**Analog Circuits, Instruments and Consumer Appliances**
Course Code	25_USPHE608
Class	TYBSc
Semester	VI
Number of Credits	2
Nature	Theory
Type	Major Electives
Revision of syllabus specific to employability/ entrepreneurship/ skill development	The curriculum is so designed that learner will understand the construction and operating principle of transducers, sensors. This will equip learners with the knowledge and skills necessary to work in the field of instrumentation. The curriculum equips learners with understanding of fundamental concepts of signal conditioning and applications of these techniques to enhance the quality of analog and digital signals. The curriculum empowers learners with comprehensive understanding of design and operation of SMPS and its application in converting and regulating electrical power for electronic systems. Curriculum develops learner's understanding about principle and characteristics of measuring instruments, such as, multimeter. The curriculum also develops learner's understanding about operating principle of microphones and loud speakers. All this content will provide the foundation to learner to work with signals, power supplies and measuring instruments in various industries, contributing to the design, optimization and maintenance of electronic systems and applications. The curriculum includes study of PCB components, layers, materials and its manufacturing processes, which will help learner for the development of reliable and efficient electronic circuits. Learners will also gain the comprehensive understanding of microwave oven technology and learners will be well-prepared to utilize the full range of features offered by microwave ovens. The curriculum also provides basics of various methods used in the field of medical diagnostics, such as, ECG, EEG, EMG, CT Scan, MRI and Ultrasonography which will provide the foundation to learner to work in the field of medical diagnostics. Additionally, some of the topics in this theory course will be covered in following physics lab courses which will reinforce learner's theoretical understanding to real world applications.

Nomenclature: Analog Circuits, Instruments and Consumer Appliances

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Eligibility: --

Course Outcomes:

On successful completion of this course, a learner will be able to:

CO1. Understand the difference between a transducer and a sensor.

CO2. Understand the construction, working and uses of different types of transducers.

CO3. Understand the concept of signal conditioning, devices used and their operations.

CO4. Get acquainted with the measuring instruments used in laboratory.

CO5. Get the insight of the modern medical instruments in principle, which are used in day to day life.

Curriculum:

Unit	Title	Learning Points	No. of Lectures (60 min.)
I	Transducers	**1. Transducers:** Definition, Classification, Selection of transducer Reference: R3 **2. Electrical transducers:** Pressure Transducer: Strain gauges (wire, foil, & semiconductor), Peizo-electric Transducer Reference: R2, R3, R6, R9 **3. Chemical sensors**: PH sensor, Gas sensor (Fundamental aspects), Humidity sensor (Resistive) Reference: R6, R7 **4. Electronic Weighing Systems:** Operating principle, Block diagram, features Reference: R12, R13	10
II	Sensors, Actuators,	**1. Microphones:** characteristics, types (list only), carbon microphone and dynamic type	10

	Switching Regulators and Measuring Instruments	microphone (principle, construction and working) **Loud speakers:** Characteristics, Dynamic (Moving coil type) speaker, Multi-way speaker system (woofer and tweeter) Reference: R4 **2. Switching Regulators:** Basic and Monolithic Switching regulators (buck, boost and buck – boost) (Only basic Configurations) Reference: R19 **3. DMM:** 3 ½ Digit display, resolution and sensitivity, general specifications Reference: R3	
III	Modern Techniques and Appliances	**1. Printed Circuit Board:** Idea of PCB, advantages, copper clad, Etching processes, Principle of Photolithography (For PCB) Reference: R4, R14, R15 **2. Microwave Oven:** Operating principle, block diagram, features Reference: R12, R13 **3. Medical instruments:** Bio-Potential, Types of electrodes, ECG, EEG, EMG, CT Scan and MRI (principle, block diagram and features), Ultrasonography: working principle Reference: R16, R17, R18	10

Learning Resources recommended:

1. R1: A Textbook of Applied Electronics – R S Sedha, S Chand & Company, New Delhi
2. R2: Basic Electronics Solid state - B. L. Thereja, S Chand & Company, New Delhi
3. R3: Electronic Instrumentation – H. S. Kalsi, Tata McGraw Hill Publishing Company Limited, New Delhi
4. R4: Electronic components and materials: Principles, Manufacture and Maintenance- S. M. Dhir, Tata McGraw-Hill Publishing Company Limited,

New Delhi
5. R5: Measurement and Instrumentation Principles: Alan S. Morris, Butterworth-Heinemann
6. R6: Transducers and display systems: B. S. Sonde, Tata McGraw-Hill Publishing Company Limited, New Delhi
7. R7: Digital principles and applications: A. P. Malvino and D. P. Leach, Tata McGraw-Hill
8. R8: Data Converters– B. S. Sonde, Tata McGraw-Hill Publishing Company Limited, New Delhi
9. R9: Modern Electronic Instruments and Measurement techniques- Albert D. Helfrick, Willam D. Cooper, Prentice Hall India Pvt. Ltd, New Delhi
10. R10: A course in electrical and electronic Measurements and Instrumentation: A. K. Sawhney, Dhanpat Rai and Sons.
11. R11: Instrumentation Devices & Systems, 2nd Edition Tata McGraw Hill, C. S. Rangan, G. R. Sarma, V. S. Mani
12. R12: Consumer Electronics R. P. Bali, Pearson Education (2008)
13. R13: S.P Bali, "Consumer Electronics", Pearson Education Asia Pvt., Ltd., 2008 Edition
14. R14: Printed Circuits Handbook pdf, Clyde F. Coombs. Jr., McGraw Hill Handbooks, 6th ed.
15. R15: PCB design basics, Mahmoud Wahby, EDN Networks, Nov 2013
16. R16: Introduction to Bio-medical Electronics: Joseph-Du-bary, McGraw Hill Co. Ltd.
17. R17: Medical instrumentation Application and design- J. C. Wobster
18. R18: Biomedical instruments and measurements – L. Cromwell, F. J. Weibell, Printice hall of India of India Pvt. Ltd, New Delhi
19. R19: Electronic Principles, Malvino
20. R20: Operational Amplifier and Linear integrated Circuits – Ramakant Gaikawad

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Evaluation Pattern:

A. Continuous Internal Evaluation (20 Marks):

Method	Marks
Unit Test (MCQ / Descriptive – Based on Theory and/or Problems - Online/Offline – 1 unit test of 10 marks / 2 unit tests of 05 marks each / 3 unit tests of 05 marks each and best two out of three will be considered)	10
Assignments / Seminars	05
Attendance and active participation in classroom	05

B. Semester End Evaluation (Paper Pattern) (30 Marks – 1 hour):

Que. No.	Question Type	Unit	Marks
1	A) Long answer based questions with 100% internal option B) Short answer based questions with 100% internal option	I	06 04
2	A) Long answer based questions with 100% internal option B) Short answer based questions with 100% internal option	II	06 04
3	A) Long answer based questions with 100% internal option B) Short answer based questions with 100% internal option	III	06 04

Guidelines for paper pattern for Semester End Evaluation:

1. As far as possible, one fifth weightage of the total marks should be given to numerical examples in above paper pattern.
2. All questions will be compulsory and may be divided into sub-questions.
3. Long and short answer based questions will include descriptive type of questions, derivation-based questions, problem solving / numericals based questions, etc.

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Course Nomenclature	**Analog Circuits, Instruments and Consumer Appliances Lab**
Course Code	25_USPHE609
Class	TYBSc
Semester	VI
Number of Credits	2
Nature	Practical
Type	Major Electives
Revision of syllabus specific to employability/ entrepreneurship/ skill development	The curriculum is so designed that it offers hands-on approach to learn the subject. The curriculum also demonstrates how physics principles apply to real world scenarios. Learners will develop the skill to handle - measuring instruments, basic physics laboratory equipments, etc. The curriculum is so designed that learners will be well-prepared to apply their theoretical knowledge to practical situations, effectively utilize electronic instruments and confidently work with ac circuits and consumer appliances in a laboratory setting.

Nomenclature: Analog Circuits, Instruments and Consumer Appliances Lab

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Eligibility: --

Course Outcomes:

On successful completion of this course, a learner will be able to:

CO1. Understand & practice the skills while performing experiments.
CO2. Understand the use of apparatus and their use without fear & hesitation.
CO3. Correlate the physics theory concepts to practical application.
CO4. Understand the concept of errors and their estimation.
CO5. Learn scientific method of recording of the data, its analysis and result/conclusion of an experiment.

Instructions for learners:

1. All measurements and readings should be written with proper units.
2. Skill of doing the experiment and understanding physics concepts should be more important than the accuracy of final result.
3. In order to appear for Semester End Practical Examination of this course, minimum 12 experiments from this course should be completed compulsorily and learners are required to report all these experiments in the journal of this course.
4. After completing all required number of experiments for this course and recording them in journal, a learner will have to get their journal certified and produce the certified journal at the time of Semester End Practical Examination of these courses.
5. A learner will be allowed to appear for the Semester End Practical Examination of this course, only if a learner submits a certified journal of this course or a certificate from the head of the Physics department that the learner has completed this practical course as per minimum requirements.
6. For Semester End Practical Examination of this course, the learner will be examined for 1 experiment from this course and experiment will be of two hours duration.
7. Evaluation in viva voce will be based on experiments from this course.
8. While evaluating learner's performance for Semester End Practical Examination for this course, weightage will be given to circuit / ray diagram, observations, tabular representation, experimental skills and procedure, graph, calculation and result, whichever applicable.

Curriculum:

Group	Title	Learning Points	No. of lectures (60 min.)
A	Transducers, Consumer appliances	1. Simple microphone amplifier using a transistor 2. Low voltage audio amplifier using IC LM386 3. Study of strain gauge 4. Use of Strain gauge for pressure measurement 5. Study of piezoelectric effect using piezoelectric transducer 6. Lime water pH measurement using pH sensor 7. Study of MQ-2 gas sensor 8. Study of DHT11 Humidity sensor 9. Study of Buck regulator (Basic) 10. Study of Boost regulator (Basic) 11. Study of Buck-Boost regulator (Basic) 12. Construction of given circuit on PCB 13. Study visit report on medical instrument: ECG 14. Study visit report on medical instrument: MRI	**60**

Evaluation Pattern:

A. Continuous Internal Evaluation (20 Marks):

Method	Marks
Performance and engagement during practical sessions: • Skills, precision, accuracy, safety measures, individual and/or collaborative working while performing practical • Ability to record proper observations, to analyze data, to plot graph and to draw meaningful conclusions of experiments • Submission of journal within a week after every practical session	10

Based on above criteria, each experiment of this course will be assessed for 10 marks during regular practical sessions and finally the total marks obtained by a learner will be converted to marks out of 10.	
Overall performance (attendance, punctuality, sincerity for practical sessions throughout semester)	05
Viva	05

B. Semester End Evaluation (Exam Pattern) (30 Marks – 2 hours):

Question No.	Group	Title	Method	Marks
1	A	Transducers, Consumer appliances	Experiment performance as per practical slip	30

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Course Nomenclature	**Digital Electronics, Microprocessor, C++ Lab**
Course Code	25_USPHV610
Class	TYBSc
Semester	VI
Number of Credits	4
Nature	Practical
Type	Vocational Skill Course
Revision of syllabus specific to employability/ entrepreneurship/ skill development	The curriculum is so designed that learners will be well-prepared to work with specific ICs and components commonly used in digital electronics, understand their operation and applications, and apply their knowledge to designing, building and troubleshooting digital circuits. Learners will be proficient in advanced 8085 microprocessor programming techniques, memory/IO interfacing and interfacing with the 8255 Programmable Peripheral Interface (PPI), enabling them to develop and optimize microprocessor-based systems and applications. Learners will develop the skill to write and execute basic assembly language programming with microcontroller 8051. Learners will also develop the skill to write and execute basic C++ program. The curriculum is so designed that learners will apply their theoretical knowledge to practical situations. All this content and skills developed by this course will provide foundation to learners to work in the field of digital electronics, embedded systems, IT, automation and related fields.

Nomenclature: Digital Electronics, Microprocessor, C++ Lab

Eligibility: --

Course Outcomes:

On successful completion of this course, a learner will be able to:

CO1. Understand & practice the skills while performing experiments.
CO2. Understand the use of apparatus and their use without fear & hesitation.
CO3. Correlate the physics theory concepts to practical application.
CO4. Understand the concept of errors and their estimation.
CO5. Learn scientific method of recording of the data, its analysis and result/conclusion of an experiment.
CO6. Understand basic principles and concepts of digital electronics and become familiar with various digital components commonly used in computer.
CO7. Implement digital circuits and develop skills in troubleshooting, identifying and fixing issues in digital circuits.
CO8. Understand architecture, operation and basic assembly language programming of 8085 microprocessor
CO9. Write and perform basic assembly language programming with 8085 microprocessor
CO10. Gain proficiency in writing assembly language programs for microprocessor 8085 to control and communicate with interfaced devices, reinforcing the theoretical concepts learned in this course and gain hands-on experience through practical exercises.

Instructions for learners:

1. All measurements and readings should be written with proper units.
2. Skill of doing the experiment and understanding physics concepts should be more important than the accuracy of final result.
3. In order to appear for Semester End Practical Examination of this course, minimum 24 experiments (minimum 12 experiments from each group) from this course should be completed compulsorily and learners are required to report all these experiments in the journal of this course.
4. After completing all required number of experiments for this course and recording them in journal, a learner will have to get their journal certified and produce the certified journal at the time of Semester End Practical Examination of these courses.
5. A learner will be allowed to appear for the Semester End Practical Examination of this course, only if a learner submits a certified journal of this course or a certificate from the head of the Physics department that the learner has completed this practical course as per minimum requirements.
6. For Semester End Practical Examination of this course, the learner will be

examined for 2 experiments from this course and each experiment will be of two hours duration.

7. Evaluation in viva voce will be based on experiments from this course.
8. While evaluating learner's performance for Semester End Practical Examination for this course, weightage will be given to circuit / ray diagram, observations, tabular representation, experimental skills and procedure, graph, calculation and result, whichever applicable.

Curriculum:

Group	Title	Learning Points	No. of lectures (60 min.)
A	Digital Electronics, Basic Microprocessor 8085 Programming	1. Code conversion (Binary, BCD, Gray, Excess-3) 2. Simplification of Boolean equation using K-map (SOP) 3. Simplification of Boolean equation using K-map (POS) 4. Study of unidirectional buffer (74LS244) 5. Study of bidirectional buffer (74LS245) 6. Study of 8:1 Multiplexer (74LS151) 7. Study of 1:4 De-multiplexer (74LS155) 8. Combinational logic design using decoders, encoders, multiplexers and de-multiplexers 9. Study of Advanced Instruction set of Microprocessor 8085 10. Microprocessor 8085: Study of monitor utilities 11. Microprocessor 8085: Rolling display 12. Microprocessor 8085: Addition of two 16-bit numbers and to display result on Address field 13. Microprocessor 8085: Subtraction of one 16-bit number from the other and to display result on Address field 14. Microprocessor 8085: Addition/ Subtraction/Multiplication of two, 8-bit hex, numbers. (Note: Use Read Keyboard Utility for inputting the hex numbers and display the result on the Address field.)	**60**

B	Advanced Microprocessor 8085 Programming, PPI 8255, C++ Programming	1. Study of Simple I/O Mode and I/O of data with handshake mode 2. Study of programmable peripheral interface (PPI 8255) 3. Microprocessor 8085 and PPI 8255: Design a system (both Software and Hardware) to control ON/OFF operation of 4 electrical loads (appliances) 4. Microprocessor 8085 and PPI 8255: To design a system (both Software and Hardware) using 8 LED display to demonstrate binary - up, down and ring counters 5. Microprocessor 8085 and PPI 8255: To design a system (both Software and Hardware) using 8 LED display to demonstrate flashing display 6. Study of basics of OOP 7. Study of basic C++ statements and structure of C++ program 8. Study of tokens (character set, keywords, identifiers, constants and variables, basic data types, operators – arithmetic, comparison, logical, assignment, bit manipulation), escape sequences in C++ 9. C++ program to display message on console 10. Study of control structures- if – else, nested if –else, loops (while, for, do while) 11. C++ program based on if-else statement and nested if – else statement 12. C++ program based on while loop 13. C++ program based on for loop 14. C++ program based on do - while loop	**60**

Learning Resources recommended:

1. Microprocessor Architecture, Programming and Applications with the 8085, Ramesh Gaonkar, 5th Edition
2. Digital Electronics and Logic design by N. G. Palan
3. R. P. Jain, Modern Digital Electronics, Tata McGraw Hill, 4th Edition
4. Object Oriented Programming with C++ by E Balagurusamy, Third/Fourth Edition, Tata McGraw-Hill Publishing Company Limited
5. Microprocessor and Applications by Vibhute and Borole, Techmax Publications
6. Microprocessor, Principles & Applications by Gilmore (2nd Ed) TMH
7. Programming with C++ by D. Ravichandran, Tata McGraw Hill Publishing Company Limited
8. Starting out with C++ by Tony Gaddis, Third Edition, Addison Wesley Publishing Company
9. Digital Electronics - by A. P. Godse & D. A. Godse Technical publications, Pune, Revised third edition, 2008
10. 8085 Kit User Manual

Evaluation Pattern:

A. Continuous Internal Evaluation (40 Marks):

Method	Marks
Performance and engagement during practical sessions: • Skills, precision, accuracy, safety measures, individual and/or collaborative working while performing practical • Ability to record proper observations, to analyze data, to plot graph and to draw meaningful conclusions of experiments • Submission of journal within a week after every practical session Based on above criteria, each experiment of this course will be assessed for 20 marks during regular practical sessions and finally the total marks obtained by a learner will be converted to marks out of 20.	20
Overall performance (attendance, punctuality, sincerity for practical sessions throughout semester)	10
Viva	10

B. Semester End Evaluation (Exam Pattern) (60 Marks – 4 hours):

Question No.	Group	Title	Method	Marks
1	A	Digital Electronics, Basic Microprocessor 8085 Programming	Experiment performance as per practical slip	30
2	B	Advanced Microprocessor 8085 Programming, PPI 8255, C++ Programming	Experiment performance as per practical slip	30

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Course Nomenclature	**On Job Training**
Course Code	25_USPHJ611
Class	TYBSc
Semester	VI
Number of Credits	4
Nature	Practical
Type	On Job Training
Revision of syllabus specific to employability/ entrepreneurship/ skill development	Incorporating an On Job Training into syllabus can provide students with practical, hands-on learning experiences, fostering employability, entrepreneurial thinking and holistic skill development.

Nomenclature: On Job Training

Eligibility: --

Introduction:

Inclusion of On Job Training in the course curriculum of the BSc program is one of the ambitious aspects in the program structure. The main objective of inclusion of On Job Training is to inculcate ability to interpret particular aspect of the study in learner's own words.

Course Objectives:

By the end of the course, learners should be able to:

1. Gain exposure to real-world insights and apply theoretical knowledge to practical situations.
2. Enhance skills regarding problem-solving, decision-making, and communication skills.
3. Understand organizational dynamics and work culture.
4. Build industry connections and networking opportunities.

Course Outcomes:

On successful completion of this course, a learner will be able to:

CO1. Apply theoretical knowledge and concepts acquired during the academic program to real-world work scenarios.

CO2. Develop practical skills and competencies necessary for successful professional engagement.

CO3. Demonstrate effective problem-solving, decision-making, and critical thinking abilities in a work environment.

CO4. Adapt to and navigate organizational dynamics and work culture in the chosen industry.

CO5. Prepare a comprehensive report documenting the training/project experience, findings and recommendations.

Guidelines for On Job Training:

- Learners will be required to undertake a designated project or tasks in an organization or industry relevant to their field of study. The course aims to provide learners with practical exposure and hands-on experience in a professional work environment related to their field of study.
- The theme of the Internship should be based on any study area of the Major course.
- Systematic Report of the work should be submitted.
- Work completion certificate is mandatory.

Course Duration:

Minimum 20 days / 120 hours of On Job Training and hour distribution should be as follows:

Title	Nature of Work	Total No. of hours
Identifying Job Nature relevant subject	Discussion, Job survey	30
Actual training	Actual work	60
Preparing report	Presentation and discussion	30

Evaluation Pattern:

A. Continuous Internal Evaluation (40 Marks):

Method	Marks
Mid-term report	30
Presentation	10

B. Semester End Evaluation (60 Marks):

Sr. No	Criteria	Marks
1	On Job Training Report as per report structure (End-term report)	20
2	Working Module	30
3	Presentation/Viva	10

Report Structure:

a) Mid-Term Report:

Mid-Term Report will be utilized for internal evaluation. The presentation of work done so far will be presented up to 10 minutes in the form of power point presentation which will include only introduction slide and working module/work done/skills earned so far. Mid-Term report will be submitted at the time of presentation. Please find the format of Mid-Term Report in Annexure A.

b) End-term Report:

The Certified Copy of Hard Bound Project Report must adhere to the following guidelines:

- No of Copies: 1 Hard copy + Soft copy (College / Department)

The learners will be required to submit a comprehensive report at the end of the On Job Training. A project report has to be brief in content and must include the following aspects:

a) **Title Page:** Mentioning the title of the report, name of the learner, program, institution and the period of training.
b) **Certificate of Completion:** A certificate issued by the organization or supervisor confirming the successful completion of the training.
c) **Declaration:** A statement by the learner declaring that the report is their original work and acknowledging any assistance or references used.
d) **Acknowledgments:** Recognizing individuals or organizations that provided support, guidance or resources during the training.
e) **Table of Contents:** Providing a clear outline of the report's sections and page numbers.
f) **Executive Summary:** A bird's eye view of learner's entire presentation has to be precisely offered under this Category.
g) **Introduction on the Company:** A concise representation of company/organization defining its scope, products/ services, etc.
h) **Your Role in the Organization during the On Job Training:** The key aspects handled, the department under which learner were deployed and brief Summary report duly acknowledged by the reporting head.
i) **Challenges**: The challenges confronted while churning out theoretical knowledge into practical world.
j) **Conclusion:** A brief overview of learner experience and suggestions to bridge the gap between theory and practice.

Formatting Options:

- The text of the report should be set in 12 pt, Times New Roman font, and single-spaced.
- Chapter headings should be centered, written in 20pt, Times New Roman font, bold, and in all caps.
- These guidelines ensure a standardized format for the project report, promoting clarity and readability.

Annexure A

(Proforma for Mid Term Report)

1. Name of the Trainee:
2. Academic Roll No.:
3. Position (If Any):
4. Name of the Company / Organization in which OJT is performed:
5. Name of Guide from the Company / Organization:
6. No of Weeks / Hours for which mid-term Report is submitted:
7. Duration: From / / to / /
8. Submission date:

Signature of Learner:

Signature of Internal Guide:

Internship Letter (If Given)

(Proforma for the certificate for On Job Training on official letter head)

This is to certify that Mr/Ms _____of _____College/Institution worked as an intern as part of his/her BSc course in Physics of University of Mumbai. The particulars of On Job Training are given below:

On Job Training starting date:

On Job Training ending date:

Actual number of days worked:

Tentative number of hours worked: Hours

Broad area of work:

A small description of work done by the learner during the period:

Signature:

Name:

Designation:

Contact number:

Email:

Tasks & Actions Taken (So-far)

1. Assigned Task:
2. Work performed so far:
3. Any new skills learned:
4. Action taken on assigned task:
   (Note: Mention in points. Do not mention module / working script.)

Annexure B

(Proforma for the Title Page of OJT End Term Report)

On Job Training Report

Learner Information

Full Name:
Course/Program Name: BSc (Physics - Major)
Student Exam Seat Number:
Contact Information (Mobile Number):

OJT Details

Company / Organization Name:
Company / Organization Address:
OJT Department/Division:
OJT Supervisor Name and Position:
Duration of OJT:

Academic Information

Institution Name:
Department/Faculty Name:
Instructor/Advisor Name:
Course Code:
Date of Submission (Month, Year):

Annexure C

(Proforma for the certificate for OJT End Term Report on official letter head of Company / Organization)

Certificate

This is to certify that Mr/Ms _____ of _____ College / Institution worked as an intern as part of his/her BSc course in Physics of R. P. Gogate College of Arts and Science & R. V. Jogalekar College of Commerce (Autonomous), Ratnagiri. The particulars of On Job Training are given below:

On Job Training starting date:

On Job Training ending date:

Actual number of days worked:

Tentative number of hours worked: Hours

Broad area of work:

A small description of work done by the Learner during the period:

Signature:

Name:

Designation:

Contact number:

Email:

(Seal of the Organization)

Annexure D

(Proforma for Professional Evaluation of Intern)

Professional Evaluation of Learner

Name of Learner:

College/institution:

[Note: Give a score in the 1 to 5 scale by putting ✓ in the applicable particulars]

Sr. No.	Particular	Excellent	Very Good	Good	Moderate	Satisfactory
1	Attendance & Punctuality					
2	Ability to work in a team					
3	Written and oral communication skills					
4	Problem solving skills					
5	Ability to grasp new concepts					
6	Technical skill in terms of technology, etc.					
7	Ability to complete the task					
8	Quality of overall work done					

Comments:

Name:

Designation:

Contact number:

Email:

Signature:

(Seal of the organization)

Annexure E

(Proforma for the Certificate issued by the institution)

R. E. Society's,

R. P. Gogate College of Arts and Science and R. V. Jogalekar College of Commerce (Autonomous), Ratnagiri

Department of Physics

CERTIFICATE

This is to certify that Mr. /Ms _____ of TYBSc (Sem VI) class bearing examination seat no. _____ has satisfactorily carried out On Job Training as laid by the Board of Studies in Physics Major for the year 202_-__. His/Her bonafide work was completed under the guidance of _____.

Signature of Guide **Examiner** **Head**

Department Physics

Date:

Place:

Annexure F

(Proforma for the Declaration in OJT End Term Report)

DECLARATION BY LEARNER

I, [Full Name], hereby declare that this On Job Training (OJT) report titled "[Title of the Report]" is my own work and has been written and prepared in compliance with the guidelines and requirements set by [Institution Name]. All information and references from external sources have been properly cited and acknowledged.

This report has not been submitted for any other academic or professional purpose, and no part of it has been plagiarized or copied from other sources without appropriate citations. I understand the consequences of academic dishonesty, and I assure the authenticity of the content presented in this report.

I further declare that I have completed the OJT at [Company Name] during the period from [Start Date] to [End Date], under the supervision of [OJT Supervisor's Name], and the activities and experiences discussed in this report accurately reflect my involvement during the training.

Signed:
[Full Name of Learner]
Date: [Month, Year]

Annexure G

(Proforma for the table of contents of OJT End Term Report)

TABLE OF CONTENTS

Sr. No.	Section Title	Page No.
1	Introduction	
2	Acknowledgement	
3	Objectives of OJT	
4	Company / Organization Profile	
5	OJT Activities and Responsibilities	
6	Skills and Knowledge Gained	
7	Conclusion	

Annexure H

(Proforma for Company / Organization Introduction for OJT End Term Report)

Company / Organization Introduction

- Company / Organization Name: [Insert the full name of the company]
- Location: [Where is the Company / Organization based? Include main offices or branches, if relevant.]
- Year Established: [When was the Company / Organization founded?]
- Founders: [If applicable, mention who founded the Company / Organization.]
- Mission Statement (If Any): [Include the Company's / Organization's mission or vision statement if available. This provides insight into the company's / Organization's core values and objectives.]
- Company / Organization Structure: Explain the organizational structure of the Company / Organization, particularly highlighting the departments or divisions where you worked or interacted.
- Products/Services Offered: [List the key products or services offered by the Company / Organization. Focus on what was relevant to your training.]
- Target Market: [Who are the Company's / Organization's primary customers? For example, businesses, consumers, governments, etc.]
- Clients: [If relevant, mention some key clients or partners the company works with.]

Annexure I

(Proforma for role of a learner in company / organization during OJT for OJT End Term Report)

Role of a Learner in the Company / Organization during On Job Training

Position/Title:

- Position/Title: [Your official position or title during the OJT, e.g., OJT Trainee, Marketing Assistant, IT Intern, etc.]
- Department/Division: [The department where you were assigned, e.g., Marketing, HR, IT, Production, etc.]
- Supervisor: [Name of your OJT supervisor, position, and department]

Primary Responsibilities and Tasks:

Provide a detailed description of the key tasks and responsibilities you were given during your OJT. Mention any specific projects or activities you worked on, and describe how these contributed to the organization's objectives.

- Task 1: [Description of the first key responsibility or task. Explain what you did, how you did it, and why it was important.]
- Task 2: [Description of the second responsibility, and so on.]

Skills and Knowledge Applied:

Explain the specific skills and knowledge you applied during your OJT, and how your academic background helped you in your role. This shows the connection between theory and practice.

- Skills Applied: [Mention the technical, professional, and soft skills you utilized. For example, communication skills, data analysis, project management, technical skills, etc.]
- Knowledge Applied: [Describe the theoretical knowledge you applied, such as principles from your coursework in marketing, engineering, business management, etc.]

Challenges and Problem-Solving:

Briefly mention any challenges or problems you faced in your role and how you addressed or overcame them. This demonstrates your ability to adapt and problem-solve in a professional environment.

Contribution to the Company / Organization:

Highlight how your work and efforts contributed to the success of the company / organization during your OJT. This could include improvements in processes, successful projects, or other positive outcomes as a result of your involvement.

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University of Mumbai
R. E. Society's,
R. P. Gogate College of Arts & Science and
R. V. Jogalekar College of Commerce (Autonomous),
Ratnagiri

Syllabus for Approval

Sr. No.	Headings	Particulars
1	Title of the syllabus	**TYBSc Physics Semester V and VI**
2	Eligibility for admission	---
3	Passing Marks	---
4	Ordinances / Regulations (if any)	---
5	Number of years/ semesters	**Number of years: 01** **Number of semester: 02**
6	Level	**Undergraduate**
7	Pattern	**Semester (CBCS)**
8	Status	**Approved**
9	BoS meeting held on	**16th April 2025**
10	Mode of conduction of meeting	**Hybrid**
11	Syllabus to be implemented from academic year	**2025-26**

Date: 04/06/2025

Name: Dr Dhale B.B

Signature:

Chairman

Board of Studies in Physics

HEAD OF THE
Physics Department
R.P.Gogate College of Arts & Science & R.V.Jogalekar
College of Commerce (Autonomous) Ratnagiri.