R. E. Society's

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

First Year (Semester I & II)
Bachelor of Science Programme
(NEP 2020 & CBCS)

For Academic Year 2024-25

Program Outcomes of BSc with Physics Major

Name of Program	BSc
Level	UG
Number of Semesters	08
Year of Implementation	2024-25
Program Specific Outcomes (PSO)	After successful completion of this program, learners will be able to: PSO1. Understand fundamental physics concepts and will be able to apply physics principles to real world problems. PSO2. 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. 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 Physics major can go for higher studies and pursue careers directly related to physics, like, research, academics, etc. Other than this, Science graduates with Physics major 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 Physics major 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 Physics major 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 Evaluation

Course Evaluation and Conversion of Marks:

Every course of FYBSc in the subject Physics is evaluated through Continuous Internal Evaluation (40%) and Semester End Evaluation (60%).

Every theory course of FYBSc in the subject Physics will be evaluated on 50 marks scale. These courses have maximum 20 marks for Continuous Internal Evaluation and maximum 30 marks for Semester End Evaluation.

Each practical/lab course of FYBSc in the subject Physics will be evaluated on 100 marks scale. These courses have maximum 40 marks for Continuous Internal Evaluation and maximum 60 marks for Semester End Evaluation. For these courses, the marks obtained by a learner in Continuous Internal Evaluation of a course out of 40, will be converted to marks out of 20 and marks obtained by a learner in Semester End Evaluation of a course out of 60, will be converted to marks out of 30. Converted marks will be reflected in learner's marksheet.

All Major, Minor, Vocational Skill Courses offered in the subject Physics for FYBSc are 2 credit courses and every 2 credit course will either be evaluated on 50 marks scale, or be evaluated on 100 marks scale and finally marks obtained by a learner out of 100 will be converted to 50 marks scale.

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.

$$\text{Aggregate Marks} = \begin{matrix}\text{Marks Obtained by a learner in Continuous Internal Evaluation} \\ + \\ \text{Marks obtained by a learner in Semester End Evaluation}\end{matrix}$$

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	2
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 FYBSc as per NEP

Semester I			Semester II		
Course Code	**Nomenclature**	**Credits**	**Course Code**	**Nomenclature**	**Credits**
Discipline Specific Course (DSC)			***Discipline Specific Course (DSC)***		
Major/Minor			***Major/Minor***		
USPH101	Classical Physics	**02**	USPH201	Optics	**02**
USPH102	Mathematical Methods in Physics	**02**	USPH202	Electricity & Electronics	**02**
USPH103	Physics Lab - I	**02**	USPH203	Physics Lab - II	**02**
Vocational Skill Course (VSC)					
USPHV104	Experimental Skills in Physics	**02**			

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Syllabi of Courses Offered in the Subject Physics for Semester I

Nomenclature of the Course	**Classical Physics**
Course Code	USPH101
Class	FYBSc
Semester	I
Number of Credits	02
Nature	Theory
Type	Major/Minor
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 learners to build their understanding of subject progressively and systematically and to grasp contents more effectively. The course includes topics like, Newton's laws of motion, friction, work and energy, elasticity, viscosity, fluid mechanics, behavior of real gases and thermodynamics. In addition to above, the syllabus also focuses on practical problem-solving exercises that require learner to apply these classical physics theories and principles to real world scenarios. This will emphasize skill development among learners and will encourage learners to think critically and to analyze physics concepts from different perspectives. 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: Classical Physics

Eligibility: --

Course Outcomes:

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

CO1. Apply Newton's laws for the calculation of the motion of simple systems.

CO2. Use Work and Energy equivalence and its applications through suitable numericals.

CO3. Use the concepts of Elasticity, Viscosity and Fluid dynamics in daily life examples.

CO4. Understand the concept of real gases and validity of the laws of thermodynamics.

CO5. Demonstrate quantitative problem-solving skills in all the topics covered.

Curriculum:

Unit	Title	Learning Points	No. of Lectures (60 min)
I	Newton's Laws of Motion, Friction, Work and Energy	**1. Newton's Laws of Motion**: Newton's first, second and third laws of motion, interpretation and applications, pseudo forces, inertial and non-inertial frames of reference, Worked out examples (with friction present) Reference: HCV **2. Friction**: Advantages & disadvantages of friction in daily life, Friction as the component of Contact force, Kinetic Friction, Static friction, laws of friction, Understanding friction at atomic level Reference: HCV **3. Work and Energy**: Kinetic Energy, Work and Work-energy theorem, Potential Energy, Conservative and Non-Conservative Forces, Different forms of Energy, Mass-Energy Equivalence, Worked out Examples Reference: HCV	**10**
II	Elasticity, Viscosity, Fluid Mechanics	**1. Elasticity:** An introduction to Elasticity, Stress, Strain, Hooke's Law and Modulus of Elasticity and relation between them	**10**

		Reference: HCV **2. Viscosity**: An introduction to Viscosity, Flow through a Narrow Tube: Poiseuille's Equation, Stoke's Law, Terminal velocity, Measuring Coefficient of Viscosity by Stoke's method, Critical velocity and Reynolds number Reference: HCV **3. Fluid Mechanics:** Streamline and Turbulent flow, Equation of Continuity, Bernoulli's equation, Applications of Bernoulli's equation Reference: HCV	
III	Behavior of Real Gases and Laws of Thermodynamics	**1. Behavior of Real Gases**: An introduction, Van der Waals equation of state Reference: BSH **2. Laws of Thermodynamics**: Thermodynamic Systems, Zeroth law of thermodynamics, Concept of heat, Thermodynamic Equilibrium, Work: A Path dependent function, Internal energy, First law of Thermodynamics, Internal Energy as a state function, Specific heat of gases, Applications of First Law of thermodynamics, The indicator diagram, Work done during Isothermal and Adiabatic processes Reference: BSH	**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. HCV: H. C. Verma, Concepts of Physics– Part I, Second Reprint of 2020, Bharati Bhavan Publishers and Distributers
2. BSH: Brij Lal, Subrahmanyam and Hemne, Heat Thermodynamics and Statistical Physics, Revised, Multi-coloured Reprint 2019, S. Chand

Additional References:

1. Halliday, Resnick and Walker, Fundamental of Physics (extended), 2007, 6th

Edition, John Wiley & Sons
2. D. S. Mathur, P. S. Hemne, Mechanics, 2012, S. Chand
3. M. W. Zemansky and R. H. Dittman, Heat and Thermodynamics, 8th Edition, McGraw Hill
4. Thornton and Marion, Classical Dynamics, 5th Edition, 2007, Brooks/Cole, Cengage Learning
5. D. S. Mathur, Element of Properties of Matter, S. Chand & Co.
6. R. Murugeshan and K. Shivprasath, Properties of Matter and Acoustics, S. Chand
7. D. K. Chakrabarti, Theory and Experiments on Thermal Physics, 2006 Edition, Central books
8. Hans and Puri, Mechanics, 2nd Edition, Tata McGraw Hill

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):

Question 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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Nomenclature of the Course	**Mathematical Methods in Physics**
Course Code	USPH102
Class	FYBSc
Semester	I
Number of Credits	02
Nature	Theory
Type	Major/Minor
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 focuses on providing basic understanding of various mathematical methods to learners that are essential for solving complex problems in physics. Curriculum covers various mathematical methods commonly used in physics, such as, vector algebra, vector calculus, differential equations, etc. This will empower learners to contribute effectively to the field of experimentation, research and theoretical developments. The curriculum is so designed that along with learning various mathematical methods, learners are also introduced to some of the real world examples, where they can find direct applications of these methods to analyze real world scenarios, e.g., the curriculum equips learners to analyze transient response of series LR, CR, LCR circuits. The curriculum also equips learners with basic understanding of curvilinear coordinate systems, particularly cylindrical and spherical coordinates and this will help learners to visualize systems geometrically.

Nomenclature: Mathematical Methods in Physics

Eligibility: --

Course Outcomes:

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

CO1. Understand the basic concepts of mathematical physics and applications of them in physical situations.

CO2. Understand various mathematical skills and tools for studying physics.

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

Curriculum:

Unit	Title	Learning Points	No. of Lectures (60 min.)
I	Vector Algebra	**1.** Vectors, Scalars, Vector algebra, Laws of vector algebra, Unit vector, Rectangular unit vectors, Components of a vector, Scalar fields, Vector fields, Problems based on vector algebra, Dot or scalar product, Cross or vector product, Commutative and distributive laws, Scalar triple product (omit proof), Vector triple product (omit proof), Problems and applications based on dot, cross and triple products Reference: DJG **2.** The ∇ operator, Definition and physical significance of gradient, divergence and curl (omit proofs), Problems based on gradient, divergence and curl Reference: DJG	10
II	Vector Calculus	**1.** Line, Surface and Volume Integrals, The Fundamental Theorem of Calculus, The Fundamental Theorem of Gradient, The Fundamental Theorem of Divergence, The Fundamental Theorem of Curl (Statement and Geometrical interpretation is included, Proof of these theorems are omitted). Problems based on these theorems are required to be done Reference: DJG	10

		2. Curvilinear Coordinates: Cylindrical Coordinates, Spherical Coordinates Reference: DJG	
III	Differential Equations	**1.** Introduction, ordinary differential equations, First order homogeneous and non-homogeneous equations with variable coefficients, Exact differentials, General first order Linear Differential Equation, Second order homogeneous equation with constant coefficients, Problems, depicting physical situations like LC and LR circuits, Simple harmonic motion (Spring mass system) Reference: CH **2. Transient response of circuits:** Series LR, CR, LCR circuits (Growth and decay of current/charge) Reference: CR	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. DJG: D. J. Griffith, Introduction to Electrodynamics, 3rd Ed
2. CH: Charlie Harper, Introduction to Mathematical Physics, 2009 (EEE) PHI Learning Pvt. Ltd.
3. CR: D. Chattopadhyay, P. C. Rakshit, Electricity and Magnetism, 7th Edition, New Central Book Agency

Additional References:

1. Brij Lal, N. Subrahmanyam, Jivan Seshan, Mechanics and Electrodynamics, S. Chand (Revised and Enlarged Edition 2005)
2. A. K. Ghatak, Chua, Mathematical Physics, 1995, MacMillan India Ltd.
3. Ken Riley, Michael Hobson and Stephan Bence, Mathematical methods for Physics and Engineering, Cambridge (Indian Edition)
4. H. K. Dass, Mathematical Physics, S. Chand & Co.
5. Jon Mathews & R. L. Walker, Mathematical Methods of Physics, W. A. Benjamin Inc.

6. Murray R. Spiegel, Schaum's ouline of theory and problems of vector analysis, Asian Student Edition

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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):

Question 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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Nomenclature of the Course	**Physics Lab – I**
Course Code	USPH103
Class	FYBSc
Semester	I
Number of Credits	02
Nature	Practical
Type	Major/Minor
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 learners 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. After completion of this course, 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 – I

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 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, all 4 skill experiments and minimum 8 experiments (4 from 'General Physics' group and 4 from 'Electricity and Electronics' group) should be completed compulsorily and learners are required to report all these experiments in the journal of this course (Physics practical journal of first semester).
4. After completing all required number of experiments of this course and recording them in journal, learner will have to get their journal certified from the head of the Physics department and produce the certified journal at the time of Semester End Practical Examination of this course.
5. A learner will be allowed to appear for the Semester End Practical Examination of this course, only if 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, the learner will be examined in 2 experiments (1 from 'General Physics' group and 1 from 'Electricity and Electronics' group) from this course and each experiment will be of two hours duration.
7. Evaluation in viva voce will be based on all skill experiments, experiments done from 'General Physics' group and experiments done from 'Electricity and Electronics' group, from this course.
8. While evaluating learner's performance at Semester End Practical Examination of 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 clock hours
A	Skill Experiments	1. Use of Vernier Callipers, Micrometer Screw Gauge and Travelling Microscope 2. Graph plotting (straight line, curve) 3. Preliminary adjustments and use of spectrometer 4. To determine the resistance using colour code and capacitance using number code and use of digital multimeter for voltage and resistance measurement	10
B	General Physics	1. Torsional Oscillation: To determine modulus of rigidity η of a material of wire by torsional oscillations 2. Moment of inertia of Flywheel 3. Constant volume air thermometer 4. Spectrometer: To determine angle of prism 5. Bifilar Pendulum: Determination of moment of inertia of rectangular and cylindrical bar about an axis passing through its centre of gravity 6. J By electrical method: To determine mechanical equivalent of heat (Radiation correction by graph method) 7. To determine coefficient of viscosity of a given liquid by Poisseuli's method 8. Constant pressure air thermometer	25
C	Electricity and Electronics	1. To study Ex-OR Gate and verification of its truth table 2. To study NOR Gate and verification of its truth table 3. To study Thermistor characteristics: Resistance vs. Temperature 4. To study load regulation of a Bridge Rectifier 5. To study Zener Diode as Regulator 6. To determine frequency of AC mains (Sonometer wire) 7. To verify De Morgan's theorems	25

		8. Transistor configuration: CE (study of input – output characteristics)	

Learning Resources recommended:

1. D. Chattopadhya, P. C. Rakshit & B. Saha, Advanced course in Practical Physics, 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 • 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 session and finally the total marks obtained by a learner will be converted to marks out of 30.	30
Overall performance (attendance, punctuality, sincerity for practical sessions throughout semester)	05
Viva	05

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

Question No.	Group	Title	Method	Marks
1	B	General Physics	Experiment performance as per practical slip	30
2	C	Electricity and Electronics	Experiment performance as per practical slip	30

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Nomenclature of the Course	**Experimental Skills in Physics**
Course Code	USPHV104
Class	FYBSc
Semester	I
Number of Credits	02
Nature	Practical
Type	Vocational Skill Course
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 learners 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. After completion of this course, learners will enhance their ability to apply physics principles to real world scenarios, especially in the field of mechanics, electricity and electronics. The course also equips learners the necessary skills to use measuring instruments and basic physics laboratory equipments effectively. The course also encourages learners 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: Experimental Skills in Physics

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 scientific method of recording of the data, its analysis and result/conclusion of an experiment.
CO5. Apply skills, knowledge, physics principles effectively to real world situations.

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 4 skill experiments and minimum 8 experiments (4 from 'Applied Physics - I' group and 4 from 'Applied Physics - II' group) 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 of this course and recording them in journal, learner will have to get their journal certified from the head of the Physics department and produce the certified journal at the time of Semester End Practical Examination of this course.
5. A learner will be allowed to appear for the Semester End Practical Examination of this course, only if 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 the minimum requirements.
6. For Semester End Practical Examination, the learner will be examined in 2 experiments (1 from 'Applied Physics - I' group and 1 from 'Applied Physics - II' group) from this course and each experiment will be of two hours duration.
7. Evaluation in viva voce will be based on all skill experiments, experiments done from 'Applied Physics - I' group and experiments done from 'Applied Physics - II' group, from this course.
8. While evaluating learner's performance at Semester End Practical Examination of 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 clock hours
A	Skill Experiments	1. Use of Vernier Calliper, Micrometer Screw Gauge and Travelling Microscope 2. Graph plotting (straight line, curve) 3. Preliminary adjustments and use of spectrometer 4. To determine the resistance using colour code and capacitance using number code and use of digital multimeter for voltage and resistance measurement	10
B	Applied Physics – I	1. Helmholtz resonator 2. Young's modulus of metal bar by the method of vibration 3. Torsional Oscillation: To determine modulus of rigidity η of a material of wire by torsional oscillations 4. Spectrometer: To determine angle of prism 5. Flat spiral spring: Determination of Young's modulus 6. Flat spiral spring: Determination of modulus of rigidity 7. Moment of inertia of flywheel 8. Constant volume air thermometer	25
C	Applied Physics – II	1. To study NAND Gate and verification of its truth table 2. To study Ex-OR Gate and verification of its truth table 3. To study Thermistor characteristics: Resistance vs. Temperature 4. Transistor configuration: CC (study of input – output characteristics) 5. UJT characteristics 6. To study load regulation of a Bridge Rectifier 7. To study Zener Diode as Regulator 8. Frequency of ac mains: To determine frequency of ac mains (Sonometer wire)	25

Learning Resources recommended:

1. D. Chattopadhya, P. C. Rakshit & B. Saha, Advanced course in Practical Physics, 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 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 10 marks during regular practical session and finally the total marks obtained by a learner will be converted to marks out of 30.	30
Overall performance (attendance, punctuality, sincerity for practical sessions throughout semester)	05
Viva	05

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

Question No.	Group	Title	Method	Marks
1	B	Applied Physics - I	Experiment performance as per practical slip	30
2	C	Applied Physics - II	Experiment performance as per practical slip	30

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Syllabi of Courses Offered in the Subject Physics for Semester II

Nomenclature of the Course	**Optics**
Course Code	USPH201
Class	FYBSc
Semester	II
Number of Credits	02
Nature	Theory
Type	Major/Minor
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 learners to build their understanding of subject progressively and systematically and to grasp contents more effectively. The curriculum is so designed that along with learning basic concepts in optics, learners will develop the skill - to predict the characteristics of image formed by lens and to apply lens formula to calculate focal length, object distance, image distance, etc., for various lens configurations. Learners will also develop skill to identify various lens aberrations that can affect image quality and will be able to use different methods to reduce them. Learners will also become familiar with basic principles of common optical instruments and will be able to draw and interpret ray diagrams for those systems and will learn the skill to use these instruments. The curriculum equips learners with a comprehensive understanding of interference in thin films and its wide ranging applications in science and technology. This will provide a basic foundation for further research and practical work related to thin films and their optical properties. The curriculum also equips learners with necessary knowledge to work with lasers safely and effectively in various industries and research fields. Learners will also be equipped with foundational understanding of fibre optics, including basic principles of light propagation through optical fibres and will develop a skill to use the optical fibre for the applications like, communication and temperature measurement. Learners will also gain comprehensive understanding of how

	sound interacts with buildings and how to create acoustically comfortable and functional spaces. 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: Optics

Eligibility: --

Course Outcomes:

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

CO1. Understand the concept of lens, lens defects and their minimization.

CO2. Understand the significance of combination of lenses implied to eyepiece of optical instrument.

CO3. Understand interference of light with few well known daily life examples.

CO4. Understand Lasers and Optical fibers, their applications in day to day life.

Curriculum:

Unit	Title	Learning Points	No. of Lectures (60 min.)
I	Geometrical Optics	**1. Lenses and Lens Maker's Equation:** Introduction to lenses, Terminology and sign conventions, Introduction to Thin lenses and Lens equation for single convex lens, Lens maker's equation: Positions of the Principal Foci and Newton's Lens equation Reference: SBA **2. Magnification by a lens and power of lens**: Lateral, Longitudinal and Angular magnification, Deviation by a thin lens and its power, Necessity to combine the lenses & equivalent focal length & power of two thin lenses, Concept of cardinal points and their significance Reference: SBA **3. Introduction to Aberration in lenses**: Spherical aberration & reduction, chromatic aberration & reduction Reference: SBA	10
II	Introduction to Optical Instruments and Interference in Thin	**1. Optical Instruments and Eyepieces:** Human Eye as an optical instrument, Camera and Lenses of Camera, Simple Microscope & Compound Microscope, Concept of eyepiece & its significance: Huygens' Eyepiece and Ramsden Eyepiece (Principle,	10

	Films	Construction, Expression for Equivalent Focal Length, Merits and Demerits), Comparison of Huygens' Eyepiece and Ramsden Eyepiece, Gauss Eyepiece, Refracting Astronomical Telescope (Construction and Working), Reflecting Telescope (Qualitative) Reference: SBA **2. Interference in Thin Films:** Interference due to reflected and transmitted light in plane thin films, Conditions for Maxima and Minima, Interference pattern in wedge shaped film & Newton's rings Reference: SBA	
III	Lasers and Fiber Optics	**1. An Introduction to LASERS:** Absorption and Emission, Spontaneous and Stimulated Emission, Components of laser, Laser beam properties, Ruby laser, He-Ne Laser, Applications of Laser Reference: SBA **2. An Introduction to Optical Fiber**: Fiber geometry, Total Internal Reflection, Propagation of light through an Optical fiber, Numerical Aperture, Classification of Optical fibers, Single Mode Step Index Fiber, Multimode Step Index Fiber, Graded Index Fiber, Optical Fiber applications: Optical fiber-based communication system & Optical Fiber based Temperature sensor Reference: SBA	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. SBA: Dr. N. Subrahmanyam, Brij lal and Dr. M. N. Avadhanulu, A Textbook of Optics, 25th Revised Edition 2012 (Reprint 2016), S. Chand & Company Pvt. Ltd.

Additional References:

1. Jenkins and White, Fundamentals of Optics by (4th Ed.), McGraw Hill International

2. Ajoy Ghatak, Optics, 6th Edition, McGraw Hill Education (India) Private Limited

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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):

Question 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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Nomenclature of the Course	**Electricity and Electronics**
Course Code	USPH202
Class	FYBSc
Semester	II
Number of Credits	02
Nature	Theory
Type	Major/Minor
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 learners to build their understanding of subject progressively and systematically and to grasp contents more effectively. Learners will understand the principles, concepts and applications related to alternating current electrical circuits including resistors, capacitors and inductors, will learn the skill to analyze these circuits and will be able to apply them to actual ac circuits. Learners will also develop skill to analyze various ac bridges and will be able to use them to determine unknown electrical parameters. Learners will also develop skill to effectively apply and simplify electrical circuits using various circuit theorems. Learners will understand different types of power supply configurations and their respective advantages and limitations and learners will develop a skill to design, operate and troubleshoot dc power supplies for variety of applications. Learners will understand various number systems and their representations and will develop skill to convert them from one form to another and will be able to perform their arithmetic operations. Learners will also gain knowledge to use NAND and NOR gates to implement all other logic gates and will also develop a skill to design and analyze logic circuits using derived gates. Additionally, most 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: Electricity and Electronics

Eligibility: --

Course Outcomes:

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

CO1. Understand the basic concepts of Alternating current theory, AC bridges and Circuit theorems and apply them in real life situations.

CO2. Understand the basics of Analog and Digital Electronics and apply them in real life situations.

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

Curriculum:

Unit	Title	Learning Points	No. of Lectures (60 min.)
I	Electricity	**1. Alternating current theory:** (Review: Concept of L, R and C) AC circuit containing pure R, pure L and pure C, Representation of sinusoids by complex numbers, Series LR, CR and LCR circuits, Resonance in LCR circuit (both series and parallel), Power in ac circuit, Q-Factor Reference: CR **2. AC bridges**: General AC Bridge, Inductance Comparison Bridge, Maxwell's L/C Bridge, De Sauty's Bridge, Wien Bridge (Bridge diagram, balancing condition derivation, applications) Reference: CR	10
II	Analog Electronics	**1. Circuit Theorems**: (Review: Ohm's law, Kirchhoff's laws) Ideal Current and Voltage Sources, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Problems related to circuit analysis using the above theorems Reference: TT **2. DC Power Supply**: Block diagram of a dc power supply– Concept of a transformer, (Review: Half wave rectifier, Full wave rectifier) Bridge rectifier, PIV, Efficiency and Ripple factor of full wave rectifier,	10

		Capacitor Filter, Need for voltage regulation - Zener diode as voltage stabilizer, Clipper and Clampers (Basic diode based circuits) Reference: BN, AD	
III	Digital Electronics	**1. Number Systems** – Binary number system: Binary to decimal and Decimal to binary conversion, Hexadecimal number system: Hexadecimal to decimal Conversion, Decimal to hexadecimal conversion, Hexadecimal to binary conversion, Binary to hexadecimal conversion Reference: LMS **2. Derived Gates:** (Review: Basic logic gates) NAND and NOR as Universal Building blocks, Ex-OR gate: logic expression, logic symbol, truth table, Implementation using basic gates and its applications– Parity generator and checker, Half adder and Full adder Reference : LMS, T	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. CR: D. Chattopadhyay and P. C. Rakshit, Electricity and Magnetism, New Central Book Agency (P) Ltd.
2. LMS: Leach, Malvino, Saha, Digital Principles and Applications – 6th Edition.Tata McGraw Hill
3. AD: Albert Malvino, David Bates, Electronic Principles, 8th Edition,Tata McGraw Hill
4. TT: B. L. Theraja and A. K. Theraja, A Textbook of Electrical Technology Vol. I, S. Chand Publication
5. T: Tokheim, Digital Electronics, Principles and Applications, 6th Edition, McGraw Hill Edition
6. BN: R. L. Boylestad and L. Nashelsky, Electronic devices and Circuit Theory-10th Edition, Pearson

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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):

Question 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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Nomenclature of the Course	**Physics Lab – II**
Course Code	USPH203
Class	FYBSc
Semester	II
Number of Credits	02
Nature	Practical
Type	Major/Minor
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 learners 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. After completion of this course, 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 - II

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 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, 4 demonstration experiments and minimum 8 experiments (4 from 'General Physics' group and 4 from 'Electricity and Electronics' group) should be completed compulsorily and learners are required to report all these experiments in the journal of this course (Physics practical journal of second semester).
4. After completing all required number of experiments of this course and recording them in journal, learner will have to get their journal certified from the head of the Physics department and produce the certified journal at the time of Semester End Practical Examination of this course.
5. A learner will be allowed to appear for the Semester End Practical Examination of this course, only if learner submits a certified journal of this course or a certificate from the head of the Physics department that the learner has completed this course as per the minimum requirements.
6. For Semester End Practical Examination, the learner will be examined in 2 experiments (1 from 'General Physics' group and 1 from 'Electricity and Electronics' group) from this course and each experiment will be of two hours duration.
7. Evaluation in viva voce will be based on demonstration experiments, experiments done from 'General Physics' group and experiments done from 'Electricity and Electronics' group, from this course.
8. While evaluating learner's performance at Semester End Practical Examination of 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 clock hours
A	General Physics	1. LDR Characteristics: To study the dependence of LDR resistance on intensity of light 2. Spectrometer: To determine refractive index of prism material 3. Combination of Lenses: To determine equivalent focal length of a lens system by magnification method 4. Newton's Rings: To determine radius of curvature of a given convex lens using Newton's rings 5. Determination of diameter of thin wire using Wedge Shaped Film	25
B	Electricity and Electronics	1. To study NAND/NOR gates as Universal Building Blocks 2. LR Circuit: To determine the value of given inductance and phase angle 3. CR Circuit: To determine value of given capacitor and Phase angle 4. LCR series Resonance: To determine resonance frequency of LCR series circuit 5. Transistor configurations: CE (study of input-output characteristics) 6. To study half adder and full adder and verification of their truth table	25
C	Demonstration Experiments	1. Use of software for graph plotting 2. Study of I-V Characteristics of LED 3. Study of I-V characteristics of solar cell 4. Angular momentum conservation (Rotating platform) 5. Clipper and clamper circuits 6. Use of Oscilloscope: Observation of Waveforms at output of half wave, bridge rectifiers with and without capacitor filter, ripple	10

Learning Resources recommended:

1. Advanced course in Practical Physics D. Chattopadhya, P. C. 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 • 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 session and finally the total marks obtained by a learner will be converted to marks out of 30.	30
Overall performance (attendance, punctuality, sincerity for practical sessions throughout semester)	05
Viva	05

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

Question No.	Group	Title	Method	Marks
1	A	General Physics	Experiment performance as per practical slip	30
2	B	Electricity and Electronics	Experiment performance as per practical slip	30

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R. E. Society's

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

Syllabus of Skill Enhancement Course Offered by Department of Physics for First Year (Semester II) of B Sc Programme (NEP 2020 & CBCS)

From Academic Year 2023-24

Nomenclature of the Course	**Basic Measurement Skills and Data Analysis**
Class	F Y B Sc
Semester	II
Course Code	USPH204
No. of Credits	02
Nature	Theory
Type	Skill Enhancement Course

Course Outcomes:

On successful completion of this course a learner will be able to:
CO1: do measurements.
CO2: use systems of units.
CO3: calculate uncertainty in measurements.
CO4: do basic statistical calculations.
CO5: plot graphs.
CO6: use graph for uncertainty calculations.

Syllabus:

Unit No.	Unit Title	Sub titles (Learning Points)
I	Introduction to Measurement and Uncertainties in Measurements	Measurements and systems of units, Uncertainty in measurement, expressing uncertainty in measurement, Error vs uncertainty, Importance of study of uncertainty in measurement, Origins of errors and uncertainties Error analysis- Experiment I Error analysis- Experiment II
II	Basic Statistics, Distributions and Uncertainty Calculation	Basic statistical calculations- mean, median, mode, standard deviation, Types of Distributions: Normal, rectangular and other, The general kinds of uncertainty in any measurement**:** Random or systematic, Calculation of uncertainty in measurements Error analysis- Experiment III Error analysis- Experiment IV
III	Graphing Technique & Uncertainty	Basic layout of graph, Essential elements of good graph, Curve fitting, Uncertainties and graph Plotting of graph with uncertainties

Prescribed Text:

Measurement Good Practice Guide No. 11 (Issue 2), A Beginner's Guide to Uncertainty of Measurement: Stephanie Bell, Centre for Basic, Thermal and Length Metrology, National Physical Laboratory

Reference:

An Introduction to Error Analysis The Study of Uncertainties in Physical Measurements, John R Taylor, University Science Books

Teaching Plan:			
Unit No.	**Unit Title**	**Teaching Methods**	**No. of Lectures**
I	Introduction to Measurement and Uncertainties in Measurements	Chalk & Board, Engaging Activities, Use of PPT	12
II	Basic Statistics, Distributions and Uncertainty Calculation	Chalk & Board, Engaging Activities , Use of PPT	12
III	Graphing Technique & Uncertainty	Chalk & Board, Engaging Activities, Use of PPT	06

Evaluation Pattern

A) Continuous Internal Evaluation: Maximum Marks (20):

Method	Marks
Class test	10
Home Assignment	10

B) Semester End Examination: Maximum Marks (30):

Question No. and Sub questions	Unit and sub unit	Type of Question	Marks
Q. 1 A Any Two out of Four	I- Introduction to Measurement and Uncertainties in Measurements	Numerical Problem/ Long Note	10
Q. 1 B Any One out of Two	I- Introduction to Measurement and Uncertainties in Measurements	Short Note	02
Q. 2 A Any Two out of Four	II- Basic Statistics, Distributions and Uncertainty Calculation	Numerical Problem/ Long Note	10
Q. 2 B Any One out of Two	II- Basic Statistics, Distributions and Uncertainty Calculation	Short Note	02
Q.3 A Any Two out of Four	III- Graphing Technique & Uncertainty	Graph Plotting	04
Q.3 B Any One out of Two	III- Graphing Technique & Uncertainty	Short Note	02

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R. E. Society's

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

Syllabus of Open Elective Courses Offered by Department of Physics for First Year (Semester I & II) Bachelor's Programme (NEP 2020 & CBCS)

For Academic Year 2024-25

Open Elective Courses for FYBA / FYBCom / FYBMS / FYBAF

Nomenclature of the Course	Introduction to Basic Astronomy /मूलभूत खगोलशास्त्र परिचय
Class	FYBA / FYBCom / FYBMS / FYBAF
Semester	I
Course Code	USOEPH101
No. of Credits	04
Nature	Theory
Type	Open Elective Course

Course Outcomes:

On successful completion of this course a learner will be able to / सदर अभ्यासक्रम पूर्ण केल्यानंतर विद्यार्थ्याला:

CO1**:** explore history of astronomy and archeoastronomy and their interconnection / खगोलशास्त्र आणि पुराखगोलशास्त्र यांचा इतिहास आणि परस्पर संबंध यांची माहिती होईल.

CO2: understand measurements and scales in astronomy / खगोलशास्त्रातील मोजमापे आणि परिमाणे समजतील.

CO3: describe about solar system/ सूर्यमालेचे वर्णन करता येईल.

CO4: understand the origin of solar system / सूर्यमालेची उत्पत्ती कशी झाली हे समजेल.

CO5: identify and classify objects in the solar system / सूर्यमालेतील घटक ओळखून त्यांचे वर्गीकरण करता येईल.

CO6: identify and classify stars/ ताऱ्याचा प्रकार ओळखून वर्गीकरण करता येईल.

CO7: understand the life cycle of stars / ताऱ्यांच्या जीवनचक्राविषयी आकलन होईल.

CO8: identify the structure of galaxy and classify galaxies / दीर्घिकांची रचना ओळखता येईल आणि दीर्घिकांची वर्गवारी करता येईल.

CO9: analyze the structure of universe / विश्वरचनेचे विश्लेषण करता येईल.

CO10: describe history of the universe and future of the universe / विश्वाच्या इतिहासाबद्दल आणि भवितव्याबद्दल वर्णन करता येईल.

Syllabus:

Unit No.	Unit Title	Sub titles (Learning Points)
I	Introduction to Astronomy and Archeoastronomy / खगोलशास्त्र आणि पुरा खगोलशास्त्राची ओळख	History of Astronomy/ खगोलशास्त्राचा इतिहास Ancient Observatories/ प्राचीन वेधशाळा Astronomy in different places and cultures in the world: Greek Astronomy, Arab Astronomy, Indian Astronomy, Chinese Astronomy, Mayan Astronomy/ जगभरातील विविध संस्कृतीमधील खगोलशास्त्र - ग्रीक खगोलशास्त्र, अरबी खगोलशास्त्र, भारतीय खगोलशास्त्र , माया खगोलशास्त्र आणि चीनी खगोलशास्त्र Archeoastronomy/ पुराखगोलशास्त्र, Measurements and scales in Astronomy: Distance and Time / खगोलशास्त्रातील मोजमापे आणि परिमाणे- अंतर आणि वेळ *Activity: Preparing timeline of astronomy (ancient to modern)/ खगोलशास्त्राची कालरेखा (प्राचीन ते आधुनिक) तयार करणे*

		Activity: Power of Ten- Problem solving/ कमाल दहाची – उदाहरणे सोडवणे
II	The Solar system/ सूर्यमाला	The Solar System/ सूर्यमाला, The Origin of the Solar System / सूर्यमालेची उत्पत्ती, Small Bodies in Solar System- Asteroid belt, Comets, Meteoroids, Meteors, Meteorites, Dwarf planets, Kuiper belt, Oort Cloud/सूर्यमालेतील छोटे घटक – लघुग्रह पट्टा, धुमकेतू, उल्काश्म, उल्का, अशनी, बटू ग्रह, कुइपर बेल्ट , उर्ट मेघ
III	Stars and Galaxies / तारे आणि दीर्घिका	The Sun: Our closest Star/ सूर्य: आपल्या सर्वात जवळचा तारा Classifying Stars / ताऱ्यांचे वर्गीकरण, Life Cycle of Low Mass Stars / कमी वस्तुमान असलेल्या ताऱ्यांचे जीवनचक्र, Life Cycle of High Mass Stars/ जास्त वस्तुमान असलेल्या ताऱ्यांचे जीवनचक्र. Galaxies: The Milky way Galaxy/ दीर्घिका: मंदाकिनी आकाशगंगा, Classification of Galaxies/ दीर्घिका वर्गीकरण, The Local Group and Local Supercluster/ स्थानिक गट आणि स्थानिक समूह *Activity: Galaxy classification / दीर्घिका वर्गीकरण* *Activity: Preparing HR Diagram / HR Diagram तयार करणे*
IV	The Universe/ विश्व	The Structure of Universe/ विश्वाची रचना, The Big Bang / बिग बँग, The Age of the Universe/ विश्वाचे वय The Future of the Universe / विश्वाचे भवितव्य

Prescribed Text/s:

An Introduction to Physical Science: Shipman, Wilson, Higgins, 13th Edition, BOOKS/COLE CENGAGE Learning

ओळख नभांगणाची उत्तरे तुमच्या प्रश्नांची: हेमंत मोने, मधुश्री पब्लिकेशन

मला उत्तर हवंय ! : खगोलशास्त्र, मोहन आपटे, राजहंस प्रकाशन

https://avakashvedh.com/

https://www.youtube.com/@hbcsephysicsandastronomy6788

Other Learning Resources recommended:

A Textbook of Astronomy and Astrophysics: Suresh Chandra, Mohit Kumar Sharma, Dream tech Press, Distributed by WILEY

https://csa.pkc.org.in/

आकाशाशी जडलेनाते: डॉ. जयंत नारळीकर, राजहंस प्रकाशन

सूर्यमालेतील सृष्टी चमत्कार: मोहन आपटे, राजहंस प्रकाशन

Teaching Plan:			
Unit No.	**Unit Title**	**Teaching Methods**	**No. of Lectures**
I	Introduction to Astronomy and Archeoastronomy / खगोलशास्त्र आणि पुरा खगोलशास्त्राची ओळख	Chalk & Board, Flipped Classroom, Engaging Activities	20
II	The Solar system/ सूर्यमाला	Chalk & Board, Flipped Classroom, Engaging Activities	15
III	Stars and Galaxies / तारे आणि दीर्घिका	Chalk & Board, Flipped Classroom, Engaging Activities	15
IV	The Universe / विश्व	Chalk & Board, Flipped Classroom, Engaging Activities	10

Evaluation Pattern

A) Continuous Internal Evaluation: Maximum Marks (40):

Method	**Marks**
Class Test	20
Activity	15
Attendance and Active Participation	05

B) Semester End Examination: Maximum Marks (60):

Question No. and Sub questions	**Unit and sub unit**	**Type of Question**	**Marks**
Q.1A	I	Long Note - 2 out of 4	12
Q.1B	I	Short Note / Numerical Problem- 2 out of 4	08
Q.2A	II	Long Note – 2 out of 4	12
Q.2B	II	Short Note/ Diagram – 2 out of 4	03
Q.3A	III	Long Note /Diagram – 2 out of 4	12
Q.3B	III	Short Note/ Diagram – 2 out of 4	03
Q. 4	IV	Long Note – 2 out of 4	10

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Nomenclature of the Course	Observational Astronomy/ निरीक्षणात्मक खगोलशास्त्र
Class	FYBA / FYBCom / FYBMS / FYBAF
Semester	II
Course Code	USOEPH201
No. of Credits	04
Nature	Theory
Type	Open Elective Course

Course Outcomes:

On successful completion of this course a learner will be able to / सदर अभ्यासक्रम पूर्ण केल्यानंतर विद्यार्थ्याला:

CO1**:** understand celestial sphere and use of various astronomical coordinate systems / अवकाश-गोलाविषयी आकलन होईल आणि वेगवेगळ्या खगोलीय निर्देशक पद्धती समजून घेऊन वापरता येतील.

CO2: trace solar path and motion of the Sun on Celestial Sphere /खगोलावर सूर्याचा भ्रमण मार्ग रेखाटता येईल आणि सूर्याच्या गतीचा अभ्यास करता येईल

CO3: use the sky map and locate positions of stars, planets and constellations on sky map / आकाशाचा नकाशा वापरता येऊन ग्रह आणि तारे यांचे स्थान शोधता येईल.

CO4: locate positions of stars, planets and constellations in the sky/ आकाशात तारे, ग्रह आणि तारकासमूह यांची जागा ठरवता येईल.

CO5: analyze phases of moon / चंद्राच्या कलांचे विश्लेषण करता येईल.

CO6: understand eclipses and their types / ग्रहणे आणि त्यांचे प्रकार यांचे आकलन होईल.

CO7: differentiate between various astronomical events / विविध खगोलीय घटनातील फरक ओळखता येईल.

CO8: select appropriate telescope for sky observation / आकाश निरीक्षणासाठी योग्य दुर्बिणीची निवड करता येईल.

CO9: use software for sky observation / आकाश निरीक्षणासाठी software वापरता येईल.

Syllabus:

Unit No.	Unit Title	Sub titles (Learning Points)
I	Astronomical Coordinate Systems and Sky Maps / खगोलीय निर्देश पद्धत आणि आकाशाचा नकाशा	The Celestial Sphere/ खगोल Daily and yearly motion of Sun/ सुर्याची दैनदिन आणि वार्षिक गती, The Ecliptic: The annual path of Sun/ सुर्याचा वार्षिक भ्रमण मार्ग, Celestial Points/ खगोलीयबिंदू :Equinox (Vernal, Autumnal)/ संपात बिंदू(वसंत, शरद), Summer Solstice, Winter Solstice/ उत्तर विष्टंभ, दक्षिण विष्टंभ Seasons / ऋतु Introduction to astronomical coordinates/खगोलीय सहनिर्देशकांची ओळख 1. Horizon system / क्षितिज पद्धत 2. Equatorial system / वैषुविक वृत्त पद्धत

		Use of Sky map / आकाशाच्या नकाशाचा वापर, Methods of determining the position of planets and stars / ग्रह आणि तारे यांचे स्थान निश्चित करण्याच्या पद्धती, Locating Pole star and identifying geographical directions on the map (East/West/North/South) using Pole star / नकाशात ध्रुव ताऱ्याचे स्थान निश्चित करणे आणि त्यावरून भौगोलिक दिशा निश्चित करणे, Identifying star patterns: constellations /नकाशामध्ये ताऱ्यांच्या रचनाकृती: तारकासमुह ओळखणे
II	Astronomical Events / अवकाशीय घटना	Eclipses and Types of Eclipses / ग्रहणे आणि ग्रहणांचे प्रकार, Retrograde, Conjunction, Opposition, Occultation, Transits ग्रहांचे वक्री होणे, युती, प्रतियुती, पिधान, अधिक्रमण
III	Introduction to Sky Observation / आकाश निरीक्षणाची ओळख	Introduction to naked eye sky observation/ उघड्या डोळयांनी केल्या जाणाऱ्या आकाश निरीक्षणाची ओळख, Phases of Moon / चंद्राच्या कला, *Activity: Locating Pole Star in the sky / आकाशात ध्रुव ताऱ्याचे स्थान ओळखणे,* *Activity: Locating constellations such as Ursa Major / Cassiopeia in the sky /आकाशातील सप्तर्षी / शर्मिष्ठा यासारखे तारकासमूह ओळखणे,* *Activity: Locating other constellation in the sky like Orion, Pleiades / आकाशातील अन्य तारकासमूह ओळखणे उदा. मृग, कृत्तिका,* *Activity: Observing and recording Phases of Moon /चंद्राच्या कलांचे निरीक्षण करून नोंदी करणे*
IV	Tools for Sky Observation/ आकाश निरीक्षणाची साधने	Telescopes and types of telescopes / दुर्बिणी आणि दुर्बिणीचे प्रकार, Use of telescope for sky observation / आकाश निरीक्षणासाठी दुर्बिणीचा वापर Use of astronomy software *Stellarium* for sky observation/ *Stellarium* software चा आकाश निरीक्षणासाठी वापर *Activity: Handling of telescope / दुर्बीण हाताळणे.* *Activity: Observing sun and sunspots through telescope (with filter) / दुर्बिणीतून सूर्य आणि सौरडागांचे निरीक्षण* *Activity: Observing moon through telescope / दुर्बिणीतून चंद्राचे निरीक्षण* *Activity: Observing planets through telescope/ दुर्बिणीतून ग्रहांचे निरीक्षण*

Prescribed Text/s:

ओळख नभांगणाची उत्तरे तुमच्या प्रश्नांची: हेमंत मोने, मधुश्री पब्लिकेशन

मला उत्तर हवंय ! : खगोलशास्त्र, मोहन आपटे, राजहंस प्रकाशन

https://avakashvedh.com/

https://www.youtube.com/@hbcsephysicsandastronomy6788

https://stellarium.org/

http://www.skymaponline.net/

A Handbook on Telescope: Dr. Sarmistha Basu, First edition, B K Publications Private Limited

EDMUND MAG 5 STAR ATLAS: Edmund Scientific

Other Learning Resources recommended:

आकाशाशी जडले नाते: डॉ. जयंत नारळीकर, राजहंस प्रकाशन

सूर्यमालेतील सृष्टी चमत्कार: मोहन आपटे, राजहंस प्रकाशन

Joy of Starwatching,: Biman Basu, National Book Trust, India

Teaching Plan:

Unit No.	Unit Title	Teaching Methods	No. of Lectures
I	Astronomical Coordinate Systems and Sky Maps / खगोलीय निर्देश पद्धत आणि आकाशाचा नकाशा	Chalk & Board, Flipped Classroom, Engaging Activities with sky maps	24
II	Astronomical Events / अवकाशीय घटना	Chalk & Board, Flipped Classroom, Engaging Activities, Simulations	10
III	Introduction to Sky Observation / आकाश निरीक्षणाची ओळख	Chalk & Board, Engaging Activities & Field work- Sky Observation	12
IV	Tools for Sky Observation/ आकाश निरीक्षणाची साधने	Chalk & Board, Flipped Classroom, Field work- Sky observation, Use of telescopes, Apps & Softwares	14

Evaluation Pattern

A) Continuous Internal Evaluation: Maximum Marks (40):

Method	Marks
Activity	35
Attendance and Active Participation	05

B) Semester End Examination: Maximum Marks (60):

Question No. and Sub questions	Unit and sub unit	Type of Question	Marks
Q.1A	I	Long Note – 2 out of 4	20
Q.1B	I	Diagrams / Maps- 2 out of 4	10
Q.2A	II	Long Note – 2 out of 4	12
Q.2B	II	Short Note / Diagram – 2 out of 4	03
Q.3A	IV	Long Note – 2 out of 4	12
Q.3B	IV	Short Note / Diagram – 2 out of 4	03

Chairperson
BoS Physics