Rayat Shikshan Sanstha's

Sadguru Gadge Maharaj College, Karad

(Autonomous)

Revised Syllabus As per Maharashtra Gov. GR. dated-20 April, 2023 for Implementing NEP-2020

B.Sc. I (Physics Major) w.e.f. 2023-24

❖ Preamble:

This syllabus of the subject as Major Physics is framed to give sound knowledge with understanding of Physics to undergraduate students at first year of three years of B.Sc. degree course. Students will learn Physics as a separate subject from B.Sc. -I as Major Physics. The aim of the syllabus is to make the study of physics interesting, encouraging and popular to the students for higher studies including research. The new syllabus is based on a basic and applied approach with vigor and depth. At the same time precaution is taken to make the syllabus comparable to the syllabi of other universities and the needs of industries and research. The syllabus is prepared after discussion at length with number of faculty members of the subject and experts from industries and research fields. The units of the syllabus are well defined, taking into consideration the level and capacity of students.

❖ General Objectives of the Program:

1. To nurture academicians with focus and commitment to their subject.
2. To shape good and informed citizens from the students entering into the program.
3. To create a skilled work force to match the requirements of the society.
4. To impart knowledge of science is the basic objective of education.
5. To develop scientific attitude is the major objective to make the students open minded, critical, curious.
6. To develop skill in practical work, experiments and laboratory materials and equipment's along with the collection and interpretation of scientific data to contribute the science.

❖ Program Outcomes:

1. The student will graduate with proficiency in the subject.
2. The student will be eligible to continue higher studies in his subject.
3. The student will be eligible to pursue higher studies abroad.
4. The student will be eligible to appear for the examinations for jobs in government organizations.
5. The student will be eligible to appear for jobs with minimum eligibility as science graduate.
6. The student will be eligible to appear for industrial jobs with minimum eligibility as physics graduate.

❖ Program Specific Objectives:

1. The students are expected to understand the fundamentals, principles, concepts and recent developments in the physics.
2. The practical course is framed in relevance with the theory courses to improve the understanding of the various concepts in physics.
3. It is expected to inspire and boost interest of the students in physics.
4. To develop the power of appreciations, the achievements in science and role in nature and society.
5. To enhance student sense of enthusiasm for science and to involve the intellectually stimulating experience of course in a supportive environment.

❖ Program Specific Outcomes:

1. Understand the basics of physics.
2. Learn, design and perform experiments in the labs to demonstrate the concepts, principles and theories learned in the classrooms.
3. Develop the ability to apply the knowledge acquired in the classroom and laboratories to specific problems in theoretical and experimental Physics.
4. Identify their area of interest in academic, research and development.
5. Perform job in various fields' like science, engineering, education, banking, business and public service, etc. or be an entrepreneur with precision, analytical mind, innovative thinking, clarity of thought, expression, and systematic approach.

❖ Structure of Course:

1. **Name of Course:** B.Sc.
2. **Title:** Physics
3. **Year of Implementation:** The syllabus will be implemented from June, 2023.
4. **Duration:** The course shall be a full time.
5. **Pattern:** Semester examination.
6. **Medium of Instruction:** English

B. Sc. I Semester-I

Sr. No.	Course Title	Theory			Practical		
		Course Code	Lectures per week	Credit	Course Code	Lectures per week	Credit
1.	MECHANICS-I	MJ-BPT23-101	05	02	Physics Practical–I (MJ-BPP23-103)	04	02
2.	ELECTROSTATICS and ELECTRONICS	MJ-BPT23-102		02			

B: B.Sc. P: Physics T: Theory, P: Practical

B. Sc. I Semester-II

Sr. No.	Course Title	Theory			Practical		
		Course Code	Lectures per week	Credit	Course Code	Lectures per week	Credit
1.	MECHANICS-II	MJ-BPT23-201	05	02	Physics Practical–II (MJ-BPP23-203)	04	02
2.	ELECTRICITY and MAGNETISM	MJ-BPT23-202		02			

B: B.Sc. P: Physics T: Theory, P: Practical

Titles of Courses of B.Sc. I

B. Sc. I (Semester-I)

Theory Course: 30 lectures, 30 hours (for each Course)

Paper – I: MJ-BPT23-101: MECHANICS-I

Paper – II: MJ-BPT23-102: ELECTROSTATICS and ELECTRONICS

Physics Practical –I

Practical: 60 lectures: 60 hours (Total)

Practical: MJ-BPP23-103: MECHANICS, ELECTROSTATICS and ELECTRONICS

B. Sc. I (Semester-II)

Theory Course: 30 lectures, 30 hours (for each Course)

Paper – III: MJ-BPT23-201: MECHANICS-II

Paper–IV: MJ-BPT23-202: ELECTRICITY and MAGNETISM

Physics Practical - II

Practical: 60 lectures: 60 hours (Total)

Practical: MJ-BPP23-203: PROPERTIES OF MATTER, ELECTRICITY and MAGNETISM

SYLLABUS

B.Sc. I: Semester-I

MJ-BPT23-101: Mechanics-I (Credits: 02)

Learning Objectives: Students will be able to-

1. learn the vector algebra and basic vector calculus and difference between scalars and vectors.
2. study different types of differential equations.
3. explain Newton's laws of motion, conservation laws for single and system of particles and their applications.
4. corelate linear and angular motions.
5. learn the concept of rotational motion and moment of inertia of various bodies.

Credits (2)	Semester I :MJ-BPT23-101: Mechanics-I	No. of hours per unit/credit
Unit I	**Vectors Algebra and Elementary Calculus-** Vector algebra, Scalar and vector products, Derivatives of a vector with respect to parameters (velocity and acceleration)	07
Unit II	**Ordinary Differential Equations-** Differential equations; degree, order, linearity and homogeneity of differential equation, ordinary and partial differential equations, Exact differentials, 1st order homogeneous differential equations, 2nd order homogeneous differential equation with constant coefficients, Problems.	08
Unit III	**Dynamics of a system of particles-** Frames of reference, Newton's Laws of motion, Conservation of linear and angular momentum, work and energy theorem, conservation of energy (Single Particle), Dynamics of a system of particles (linear momentum, angular momentum and energy), Centre of mass, Motion of rocket (qualitative treatments only), Problems	08
Unit IV	**Rotational Motion-** Angular velocity and angular momentum, Torque, Analogy between translational and rotational motion, Relation between torque and angular momentum, Kinetic energy of rotation and moment of inertia, Moment of Inertia of spherical shell; solid cylinder (only about the axis of symmetry), Motion of spherical shell and solid cylinder rolling down an inclined plane, Problems	07

❖ REFERENCE BOOKS:

1. Walker, Halliday and Resnick, Fundamentals of Physics (Hoboken, New Jersey: John Wiley & Sons,11th Edition, 2018).
2. Charles Kittel, Knight,Ruderman et al., Mechanics, (New York: Berkeley Physics Course, Vol.1, Tata McGraw Hill Publications,2nd Edition, 2017).
3. K.F.Riley, M.P.Hobson, S.J. Bence, Mathematical Methods for Physics and Engineering, (Cambridge: Cambridge University Press,3rd Edition, 2006).
4. H. C. Verma, Concepts of Physics –Part–I, (Bharati Bhawan Publishers,Revised Edition, 2018).
5. H.K.Das , Dr.Rama Verma, Mathematical Physics,(New Delhi: S.Chand Publication,7th Edition,2014).
6. D.S. Mathur, Mechanics, (New Delhi: S. Chand and Company Ltd.,2007).
7. B.D.Gupta, Mathematical Physics (Mumbai: Vikas Publication House,4th Edition,2010).

❖ Learning Outcomes:

After completion of the course, student should be able to:

1. define scalar, vector and their products.
2. perform the basic algebra operations of scalars and vectors.
3. examine the order, degree, linearity of differential equation and solve 1st and 2nd order homogenous differential equation.
4. distinguish between ordinary and partial differential equations as well as exact and inexact differential equations.
5. state Newton's laws of motion, law of conservation of linear momentum, angular momentum and energy for single and system of particles and describe physical significance of them.
6. describe the concept of center of mass and use it extend conservation laws from single particle to system of particles.
7. describe rotational kinematical variables and relate them to their linear counterparts.
8. calculate the moment of inertia of a spherical shell and solid cylinder about axis of rotation and analyze their rolling motion.

B.Sc. Part-I Semester-I

MJ-BPT23-102: Electrostatics and Electronics (Credits:2)

❖ Learning Objectives:

Students will able to:

1. learn the gradient, divergence and curl of vector fields and various integral calculus.
2. study Gauss's theorem of electrostatics and use it to calculate electric field, electric potential, electric energy density.
3. describe electric polarization of dielectric medium and interrelate different polarization parameters.
4. understand to simplify complex electric circuits using network theorems and study characteristics and different configurations of transistors.

Credits (2)	Semester I: MJ-BPT23-102: Electrostatics and Electronics	No. of hours per unit/credit
Unit I	**Vector Analysis-** Differentiation of vector, Del operator, scalar and vector fields, gradient, divergence,curl operations and their physical significance, Idea of line,surface and volume integrals,Gauss divergence theorem, Stokes' theorem(Statements only)	07
Unit II	**Electrostatics-** Electrostatic field, electric flux, Gauss's theorem of electrostatics, Applications of Gauss theorem –Electric field due to a point charge, uniformly charged spherical shell and solid sphere. Electrostatic potential, Electric potential due to a point charge, Electric field as line Integral of electric potential, Electric field as a gradient of scalar electric potential, Poisson and Laplace equations, Energy density in electrostatic field, Problems.	08
Unit III	**Dielectrics-** Dielectric medium, Concept of electric dipole, polar and non-polar molecules, Polarization, displacement vector, Gauss's theorem in dielectrics, parallel plate capacitor completely filled with dielectrics. Relation between three electric vectors D, E and P, relation between dielectric constant and electric susceptibility, Problems	08
Unit IV	**Network Theorems and Transistors (BJT)-** Review of Ohm's and Kirchhoff's laws, Thevenin's theorem, Norton's theorem, Application of simple networks with D.C. sources. PNP and NPN structure, Transistor characteristics in CB, CE and CC mode. Transistor as an amplifier in CE mode, Comparative study of CB, CE and CC configurations.	

❖ REFERENCE BOOKS:

1. D. C. Tayal, Electricity and Magnetism (Mumbai: Himalaya Publishing House, 4th Edition, 2016).
2. B. B. Laud, Electromagnetics, (New Delhi: New age international (P) Ltd.,2nd Edition, 1987).
3. J. Yarwood & J. H. Fewkes, Electricity & Magnetism (London: University Tutorial Press, 2nd Edition,1965).
4. S. Mahajan and Chaudhary, Electricity, Magnetism and Electromagnetic Theory (Tata McGraw Hill, 2012).
5. David J. Griffith, Introduction to Electrodynamics (New Jersey: Prentice Hall Publisher,3rd Edition, 1999).
6. V. K. Mehta, Principles of Electronics, (New Delhi: S. Chand and Co., 11th Edition, 2009).
7. Bagde and Singh, Elements of Electronics, (New Delhi: S. Chand and Co., 18thEdition, 1997).

❖ Learning Outcomes:

After completion of the course, student should able to:

1. compute gradient, divergence, curl and interpret their physical significances.
2. solve practical problems using integral theorems of vector fields, Gauss divergence theorem, Stokes' theorem.
3. state Gauss's law and apply it to calculate electric field for a point charge, uniformly charged spherical shell and solid sphere.
4. interrelate electric field, electric potential, electric potential energy and electric potential difference.
5. describe Gauss law for dielectrics and interrelate three electric vectors E, P, D as well as dielectric constant and electric susceptibility.
6. distinguished between polar and non-polar dielectrics and compute the expression for capacitance of parallel plate capacitor filled with dielectric medium.
7. use Thevenin's and Norton's theorem to simplify an electric circuit.
8. draw and discuss NPN structure, PNP structure, transistor characteristics in CB, CE and CC mode.

B.Sc. Part-I Semester-I

Practical: MJ-BPP23-103: Mechanics and Electrostatics and Electronics (Credits:2)

❖ Course Objectives: students will able to-

1. develop fundamental experimental skills to perform an experiment.
2. learn the experimental setup and procedure to perform given experiment.
3. develop skills in taking readings/observations obtained from these instruments.
4. learn how to analyze and interpret experimental data, including error analysis, graphical representation.
5. perform calculations to obtain the experimental results.
6. test whether the experimental results hold good with theoretical results.
7. acquire knowledge and practice safe laboratory procedures, including proper handling of equipment, electrical, and potential hazards.

Experiments:

Sr. No.	Titles of experiment
1.	Measurements of length/diameter using Vernier caliper, Screw gauge and Travelling Microscope.
2.	To determine the Moment of Inertia of a Flywheel.
3.	To determine Moment of inertia of a disc using auxiliary annular ring.
4.	To determine 'g' by bar pendulum.
5.	To determine 'g' by Kater's pendulum.
6.	To study the motion of a spring and calculate (a) spring constant (b) value of 'g'.
7.	To use a multimeter for measuring (a) Resistance, (b) AC and DC voltages,(c) DC current, and (d) checking electrical fuses.
8.	Input, output and transfer characteristics of CE transistor.
9.	To verify Kirchhoff 's laws.
10.	To verify Thevenin's theorem.
11.	To verify Norton's theorem.
12.	To determine Constants of B.G.

❖ REFERENCE BOOKS:

1. Worsnop B. L. and H. T. Flint., *Advanced practical physics for students*, (London: Methuen & Co., Ltd, 9th Edition, 1951).
2. Gupta S.L. and V. Kumar., *Practical physics*. (Meerut: Pragati Prakashan,29thEdition.2017).
3. Chattopadhyay D. and P. C. Rakshit, *An advanced course in practical physics* (Calcutta: New Central Book,8th Edition,2013).
4. White, Marsh W. and Kenneth V. Manning, *Experimental college physics; a laboratory manual*, (New York: McGraw-Hill Publication,3rd Edition, 1954).
5. I. Prakash and Ramakrishna, *A Textbook of Practical Physics*, (Kitab Mahal,11th Edition ,2011).
6. Singh H. Harnam and Hemne P. S., B.Sc. Practical Physics, (New Delhi, S. Chand & Co. Ltd., 17th Edition, 2011.

❖ Course Outcomes: **After completion of the course, students should be able to:**

1. demonstrate basic experimental skills by setting up laboratory equipment/ experiment set up safely and efficiently, instruments calibration, carry out experimental procedure, data collection, analysis and report it in a written sheet manner.
2. Exhibit practical skills in using various measuring instruments (vernier caliper, micrometer screw gauge, travelling microscope, multimeter, stopwatch etc.) and learn to select and use the appropriate instrument for a given measuring task.
3. Display practical skills in measuring moment of inertia using various experimental setups such as flywheel, torsional oscillating annular disk.
4. exhibit practical skills in measuring time period of oscillation for Katers and bar pendulum.
5. Demonstrate electronics practical skills by measuring various electronic components and verification of network theorems (Kirchhoff's laws, Thevenin's theorem, Norton's theorem)
6. Demonstrate problem solving skills by encountering and resolving technical challenges that may arise during experiments.
7. Develop skills in taking precise and accurate measurement to minimize errors.
8. Analyzing experimental observations/readings using numerical calculations, graphical representation to interpret and draw conclusion.
9. Discuss and correlate their physics theory concepts and theoretical values with practical and experimental values.
10. Exhibit collaborative skills in working as part of a group to perform experiment.
11. Exhibit strong awareness of laboratory safety practices (proper handling of equipment, following dos and don'ts laboratory protocol

B.Sc. Part-I Semester-II
MJ-BPT23-201: Mechanics-II (Credits: 2)

❖ **Learning Objectives: Students will be able to:**

1. learn about the motion of a particle under central force field, Newton's Law of Gravitation, Kepler's laws of planetary motion and their applications.
2. study flow of liquid using concept of viscosity and various physical parameters affecting it.
3. understand basic behavior of beam under different types loading, torsional pendulum and correlation between elastic constants.
4. know the concept of surface tension, angle of contact and wettability of the liquid, excess pressure under a bubble and its experimental determination and application.

Credit (2)	Semester II MJ-BPT23-201: Mechanics-II	No. of hours per unit/credit
Unit I	**Gravitation-** Newton's Law of Gravitation, Motion of particle in central force field (motion in a plane, angular momentum isconserved, areal velocity is constant), Kepler's laws of planetary motion (statements only), Satellite in circular orbit and its applications, Geosynchronous orbits, Weightlessness, Basic idea of global positioning system (GPS), Problems.	**08**
Unit II	**Viscosity-** Introduction, rate of flow of liquid in a capillary tube, tubes offlow (streamline and turbulent), Poiseuille's formula (derivation) and determination of coefficient of viscosity of liquid by Poiseuille's method, Variation of viscosity of liquid with temperature and pressure, Problems.	**07**
Unit III	**Elasticity-** Bending of beam, Bending moment, Cantilever (without considering weight of cantilever), Beam supported at both ends (without considering weight of beam), Torsional pendulum, Work done in twisting a wire, Twisting couple on a cylinder, Determination of modulus of rigidity, Determination of Y, n and σ by Searle's method, Problems.	**07**
Unit IV	**Surface Tension-** Surface tension (definition), concept of surface, Angle ofcontact and wettability, Relation between surface tension, excess pressure and radius of curvature, Experimental determination of surface tension by Jaeger's method, Effect oftemperature, impurity on surface tension, Applications of surface tension, Problems	**08**

❖ REFERENCE BOOKS:

1. S. G. Sterling and A. J. Woodal, *Physics* (London: Longman's & Green Co. Ltd.,2nd Edition,1963).
2. Walker, Halliday and Resnick, *Fundamentals of Physics* (Hoboken, New Jersey: John Wiley & Sons, 11th Edition, 2018).
3. D.S.Mathur, *Elements of Properties of Matter*, (New York: S. Chand & Company, 2010).
4. Brij Lal and N. Subrahmanyam, *Properties of Matter*, (New Delhi: Eurasia Publishing House Limited, 1993).
5. R. Murugeshan, Properties *of Matter*, (New Delhi: S Chand & Company, 2017).
6. J.C. Upadhyaya, *General Properties of Matter*, (Agra: Ram Prasad Publication,3rd Edition,2017).

❖ Learning Outcomes: After completion of the course, student should be able to

1. state and explain Newton's law of gravitation and Kepler's laws of planetary motion,geosynchronous orbits and global positioning system (GPS).
2. enlist and prove the properties of the particle moving in central force field.
3. interpret the motion of satellite in circular orbit, its applications and geosynchronous orbits,basic idea of global positioning system (GPS)
4. distinguished between streamline and turbulent flow and explain the effect of temperatureand pressure on viscosity of liquid.
5. derive Poiseuillie's formula for flow of liquid through a capillary tube and apply it tocalculate coefficient of viscosity.
6. define beam, cantilever and formulate the expression of depression under various types ofloading.
7. describe torsional pendulum, twisting behavior of wire and corelate Y, η and σ.
8. define and corelate surface tension, angle of contact and wettability of the liquid.
9. formulate the relation between surface tension, excess pressure and radius of curvature ofliquid bubble
10. describe experimental determination of surface tension by Jaeger's method and effect oftemperature, impurity on it.

B.Sc. Part-I Semester-II

MJ-BPT23-202: Electricity & Magnetism (Credits:2)

❖ Learning Objectives: Students will be able to:

1. use complex number to study the concept of resonance phenomenon, sharpness and quality factor for a series LCR circuit.
2. study the concepts of magnetostatics using Biot - Savart's law and apply it to calculate magnetic field for various current carrying elements.
3. know various magnetization entities with their interrelations and different types of magnetic materials.
4. impart knowledge on concepts of Faraday's law, Lenz law, electromagnetic induction and Ballistic galvanometer.
5. interpret importance of Maxwell's equations and electromagnetic Wave propagation.

Credit (2)	B.Sc. Part-I Semester-II MJ-BPT23-202: Electricity & Magnetism	No. of hours per unit/credit
Unit I	**AC Circuits-** Complex numbers and their application in solving AC series LCR circuit, Complex impedance, Reactance, Admittance andSusceptance, Resonance in LCR series circuit, Sharpness of resonance, (qualitative treatment only), Q-factor (definition only), AC Bridge- Owen's Bridge, Problems.	**08**
Unit II	**Magnetostatics and Magnetism-** **Magnetostatics:** Biot - Savart's law & its applications – straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field, Ampere's circuitallaw, **Magnetism:** Properties of magnetic materials –Magnetic intensity (H), magnetic induction (B), permeability, susceptibility, brief introduction of dia, para, and ferro magnetic materials, Problems.	**07**
Unit III	**Electromagnetic Induction-** Faraday's laws of electromagnetic induction, Lenz's law, self and mutual induction, Ballistic Galvanometer, construction and working (Revision), expression for charge flowing through ballistic galvanometer, correction for damping in galvanometer, Constants of ballistic galvanometer.	**07**
Unit IV	**Maxwell's equations and Electromagnetic Wave propagation-** Equation of continuity of current, Maxwell's correction to Ampere's law (displacement current), Maxwell's equations and its physical interpretation, Poynting vector, electromagnetic wave propagation through vacuum and isotropic dielectric medium.	**08**

❖ REFERENCE BOOKS:

1. D.C.Tayal, *Electricity and Magnetism* (Mumbai: Himalaya Publishing House, 4th Edition, 2016).
2. B. B. Laud, *Electromagnetics,* (New Delhi: New age international (P) Ltd.,2nd Edition, 1987).
3. David J. Griffith, *Introduction to Electrodynamics* (New Jersey: Prentice Hall Publisher,3rd Edition, 1999).
4. J. Yarwood& J. H. Fewkes, *Electricity & Magnetism* (London: University Tutorial Press, 2nd Edition,1965).
5. N. Subramanyam, BrijLal, *Textbook of Electricity and Magnetism,* (Agra: Ratan Prakashan,1966).
6. Matthew N. O. Sadiku, *Elements of Electromagnetism* (New York: Oxford University Press 7th Edition, 2018).
7. S. Mahajan and Chaudhary, Electricity, Magnetism and Electromagnetic Theory (Tata McGraw Hill,2012)

❖ Learning Outcomes:

After completion of the course, student should be able to

1. state and explain Newton's law of gravitation and Kepler's laws of planetary motion, geosynchronous orbits and global positioning system (GPS).
2. enlist and prove the properties of the particle moving in central force field.
3. interpret the motion of satellite in circular orbit, its applications andgeosynchronous orbits, basic idea of global positioning system (GPS).
4. distinguished between streamline and turbulent flow and explain the effect of temperature and pressure on viscosity of liquid.
5. derive Poiseuillie's formula for flow of liquid through a capillary tube and apply it to calculate coefficient of viscosity.
6. define beam, cantilever and formulate the expression of depression under various types of loading.
7. describe torsional pendulum, twisting behavior of wire and corelate Y, n and σ.
8. define and corelate surface tension, angle of contact and wettability of the liquid.
9. formulate the relation between surface tension, excess pressure and radius of curvature of liquid bubble
10. describe experimental determination of surface tension by Jaeger's methodand effect of temperature, impurity on it.

B.Sc. Part-I Semester-II

Practical: MJ-BPP23-203: Mechanics-II, Electricity and Magnetism (Credits:2)

❖ Course Objectives: students will able to-

1. develop fundamental experimental skills to perform an experiment.
2. learn the experimental setup and procedure to perform given experiment.
3. develop skills in taking readings/observations obtained from these instruments.
4. learn how to analyze and interpret experimental data, including error analysis, graphical representation.
5. perform calculations to obtain the experimental results.
6. test whether the experimental results hold good with theoretical results.
7. acquire knowledge and practice safe laboratory procedures, including proper handling of equipment, electrical, and potential hazards.

Experiments:

Sr. No.	Titles of experiment
1.	Young's modulus of material of bar by vibration.
2.	Modulus of rigidity of material of wire by torsional oscillations
3.	Y and n of wire by Searle's method.
4.	Poisson's ratio for rubber using rubber tube
5.	Surface Tension by Jaegar's method.
6.	To study a series LCR circuit and determine its (a) resonant frequency (b) quality factor Q.
7.	To study a parallel LCR circuit and determine its (a) anti-resonant frequency (b) quality factor Q.
8.	Frequency of AC mains by sonometer
9	Coefficient of viscosity Poiseiulle's Method
10	Measurement of field strength B and its variation in a solenoid ( )
11	To verify maximum power theorem
12	To study Half wave & Full wave rectifier

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1. Worsnop B. L. and H. T. Flint., *Advanced practical physics for students*, (London: Methuen & Co., Ltd, 9th Edition, 1951).
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1. Demonstrate basic experimental skills by setting up laboratory equipment/ experiment set up safely and efficiently, instruments calibration, carry out experimental procedure, data collection, analysis and report it in a written sheet manner.
2. Exhibit practical skills in using various measuring instruments (vernier caliper, micrometer screw gauge, travelling microscope, multimeter, stopwatch etc.) and learn to select and use the appropriate instrument for a given measuring task.
3. Display practical skills in measuring moment of inertia using various experimental setups such as flywheel, torsional oscillating annular disk.
4. exhibit practical skills in measuring time period of oscillation for Katers and bar pendulum.
5. Demonstrate electronics practical skills by measuring various electronic components and verification of network theorems (Kirchhoff's laws, Thevenin's theorem, Norton's theorem)
6. Demonstrate problem solving skills by encountering and resolving technical challenges that may arise during experiments.
7. Develop skills in taking precise and accurate measurement to minimize errors.
8. Analyzing experimental observations/readings using numerical calculations, graphical representation to interpret and draw conclusion.
9. Discuss and correlate their physics theory concepts and theoretical values with practical and experimental values.
10. Exhibit collaborative skills in working as part of a group to perform experiment.

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Rayat Shikshan Sanstha's

Sadguru Gadge Maharaj College, Karad

(Autonomous)

Revised Syllabus As per Maharashtra Gov. GR. dated-20 April, 2023 for Implementing NEP-2020

B.Sc. I (Physics Minor) w.e.f. 2023-24

❖ Preamble:

This syllabus of the subject as Minor Physics is framed to give sound knowledge with understanding of Physics to undergraduate students at first year of three years of B.Sc. degree course. Students will learn Physics as a separate subject from B.Sc. -I as Minor Physics. The aim of the syllabus is to make the study of physics interesting, encouraging and popular to the students for higher studies including research. The new syllabus is based on a basic and applied approach with vigor and depth. At the same time precaution is taken to make the syllabus comparable to the syllabi of other universities and the needs of industries and research. The syllabus is prepared after discussion at length with number of faculty members of the subject and experts from industries and research fields. The units of the syllabus are well defined, taking into consideration the level and capacity of students.

❖ General Objectives of the Program:

1. To nurture academicians with focus and commitment to their subject.
2. To shape good and informed citizens from the students entering into the program.
3. To create a skilled work force to match the requirements of the society.
4. To impart knowledge of science is the basic objective of education.
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❖ Program Outcomes:

1. The student will graduate with proficiency in the subject.
2. The student will be eligible to continue higher studies in his subject.
3. The student will be eligible to pursue higher studies abroad.
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6. The student will be eligible to appear for industrial jobs with minimum eligibility as physics graduate.

❖ Program Specific Objectives:

1. The students are expected to understand the fundamentals, principles, concepts and recent developments in the physics.
2. The practical course is framed in relevance with the theory courses to improve the understanding of the various concepts in physics.
3. It is expected to inspire and boost interest of the students in physics.
4. To develop the power of appreciations, the achievements in science and role in nature and society.
5. To enhance student sense of enthusiasm for science and to involve the intellectually stimulating experience of course in a supportive environment.

❖ Program Specific Outcomes:

1. Understand the basics of physics.
2. Learn, design and perform experiments in the labs to demonstrate the concepts, principles and theories learned in the classrooms.
3. Develop the ability to apply the knowledge acquired in the classroom and laboratories to specific problems in theoretical and experimental Physics.
4. Identify their area of interest in academic, research and development.
5. Perform job in various fields' like science, engineering, education, banking, business and public service, etc. or be an entrepreneur with precision, analytical mind, innovative thinking, clarity of thought, expression, and systematic approach.

❖ Structure of Course:

1. **Name of Course:** B.Sc.
2. **Title:** Physics
3. **Year of Implementation:** The syllabus will be implemented from June, 2023.
4. **Duration:** The course shall be a full time.
5. **Pattern:** Semester examination.
6. **Medium of Instruction:** English

B. Sc. I Semester-I

Sr. No.	Course Title	Theory			Practical		
		Course Code	Lectures per week	Credit	Course Code	Lectures per week	Credit
1.	Mechanics-I	MN-BPT23-101	05	02	Physics Practical –I (MN-BPP23-103)	04	02
2.	Electrostatics and Electronics	MN-BPT23-102		02			

B: B.Sc. P: Physics T: Theory, P: Practical

B. Sc. I Semester-II

Sr. No.	Course Title	Theory			Practical		
		Course Code	Lectures per week	Credit	Course Code	Lectures per week	Credit
1.	Mechanics-II	MN-BPT23-201	05	02	Physics Practical–II (MN-BPP23-203)	04	02
2.	Electricity and Magnetism	MN-BPT23-202		02			

B: B.Sc. P: Physics T: Theory, P: Practical

Titles of Courses of B.Sc. I

B. Sc. I (Semester-I)

Theory Course: 30 lectures, 30 hours (for each Course)

Paper – I: MN-BPT23-101: MECHANICS-I

Paper–II: MN-BPT23-102: ELECTROSTATICS and ELECTRONICS

Practical Course –I

Practical: 60 lectures: 60 hours (Total)

Practical: MN-BPP23-103: MECHANICS, ELECTROSTATICS and ELECTRONICS

B. Sc. I (Semester-II)

Theory Course: 30 lectures, 30 hours (for each Course)

Paper –III: MN-BPT23-201: MECHANICS-II

Paper–IV: MN-BPT23-202: ELECTRICITY and MAGNETISM

Practical Course - II

Practical: 60 lectures: 60 hours (Total)

Practical: MN-BPP23-203: PROPERTIES OF MATTER, ELECTRICITY and MAGNETISM

SYLLABUS

B.Sc. I: Semester-I

MN-BPT23-101: Mechanics- I (Credits: 02)

Learning Objectives: Students will be able to-

1. learn the vector algebra and basic vector calculus and difference between scalars and vectors.
2. study different types of differential equations.
3. explain Newton's laws of motion, conservation laws for single and system of particles and their applications.
4. corelate linear and angular motions.
5. learn the concept of rotational motion and moment of inertia of various bodies.

Credits (2)	Semester I: MN-BPT23-101: Mechanics-I	No. of hours per unit/credit
Unit I	**Vectors Algebra and Elementary Calculus-** Vector algebra, Scalar and vector products, Derivatives of a vector with respect to parameters (velocity and acceleration)	07
Unit II	**Ordinary Differential Equations-** Differential equations; degree, order, linearity and homogeneity of differential equation, ordinary and partial differential equations, Exact differentials, 1st order homogeneous differential equations, 2nd order homogeneous differential equation with constant coefficients, Problems.	08
Unit III	**Dynamics of a system of particles-** Frames of reference, Newton's Laws of motion, Conservation of linear and angular momentum, work and energy theorem, conservation of energy (Single Particle), Dynamics of a system of particles (linear momentum, angular momentum and energy), Centre of mass, Motion of rocket (qualitative treatments only), Problems	08
Unit IV	**Rotational Motion-** Angular velocity and angular momentum, Torque, Analogy between translational and rotational motion, Relation between torque and angular momentum, Kinetic energy of rotation and moment of inertia, Moment of Inertia of spherical shell; solid cylinder (only about the axis of symmetry), Motion of spherical shell and solid cylinder rolling down an inclined plane, Problems	07

❖ REFERENCE BOOKS:

1. Walker, Halliday and Resnick, Fundamentals of Physics (Hoboken, New Jersey: John Wiley & Sons,11th Edition, 2018).
2. Charles Kittel, Knight,Ruderman et al., Mechanics, (New York: Berkeley Physics Course, Vol.1, Tata McGraw Hill Publications,2nd Edition, 2017).
3. K.F.Riley, M.P.Hobson, S.J. Bence, Mathematical Methods for Physics and Engineering, (Cambridge: Cambridge University Press,3rd Edition, 2006).
4. H. C. Verma, Concepts of Physics –Part–I, (Bharati Bhawan Publishers,Revised Edition, 2018).
5. H.K.Das , Dr.Rama Verma, Mathematical Physics,(New Delhi: S.Chand Publication,7th Edition,2014).
6. D.S. Mathur, Mechanics, (New Delhi: S. Chand and Company Ltd.,2007).
7. B.D.Gupta, Mathematical Physics (Mumbai: Vikas Publication House,4th Edition,2010).

❖ Learning Outcomes:

After completion of the course, student should be able to:

1. define scalar, vector and their products.
2. perform the basic algebra operations of scalars and vectors.
3. examine the order, degree, linearity of differential equation and solve 1st and 2nd order homogenous differential equation.
4. distinguish between ordinary and partial differential equations as well as exact and inexact differential equations.
5. state Newton's laws of motion, law of conservation of linear momentum, angular momentum and energy for single and system of particles and describe physical significance of them.
6. describe the concept of center of mass and use it extend conservation laws from single particle to system of particles.
7. describe rotational kinematical variables and relate them to their linear counterparts.
8. calculate the moment of inertia of a spherical shell and solid cylinder about axis of rotation and analyze their rolling motion.

B.Sc. Part-I Semester-I

MN-BPT23-102: Electrostatics and Electronics (Credits:2)

❖ Learning Objectives:

Students will able to:

1. learn the gradient, divergence and curl of vector fields and various integral calculus.
2. study Gauss's theorem of electrostatics and use it to calculate electric field, electric potential, electric energy density.
3. describe electric polarization of dielectric medium and interrelate different polarization parameters.
4. understand to simplify complex electric circuits using network theorems and study characteristics and different configurations of transistors.

Credits (2)	**Semester I: MN-BPT23-102: Electrostatics and Electronics**	No. of hours per unit/credit
Unit I	**Vector Analysis-** Differentiation of vector, Del operator, scalar and vector fields, gradient, divergence,curl operations and their physical significance, Idea of line,surface and volume integrals,Gauss divergence theorem, Stokes' theorem(Statements only)	07
Unit II	**Electrostatics-** Electrostatic field, electric flux, Gauss's theorem of electrostatics, Applications of Gauss theorem –Electric field due to a point charge, uniformly charged spherical shell and solid sphere. Electrostatic potential, Electric potential due to a point charge, Electric field as line Integral of electric potential, Electric field as a gradient of scalar electric potential, Poisson and Laplace equations, Energy density in electrostatic field, Problems.	08
Unit III	**Dielectrics-** Dielectric medium, Concept of electric dipole, polar and non-polar molecules, Polarization, displacement vector, Gauss's theorem in dielectrics, parallel plate capacitor completely filled with dielectrics. Relation between three electric vectors D, E and P, relation between dielectric constant and electric susceptibility, Problems	08
Unit IV	**Network Theorems and Transistors (BJT)-** Review of Ohm's and Kirchhoff's laws, Thevenin's theorem, Norton's theorem, Application of simple networks with D.C. sources. PNP and NPN structure, Transistor characteristics in CB, CE and CC mode. Transistor as an amplifier in CE mode, Comparative study of CB, CE and CC configurations.	

❖ REFERENCE BOOKS:

1. D. C. Tayal, Electricity and Magnetism (Mumbai: Himalaya Publishing House, 4th Edition, 2016).
2. B. B. Laud, Electromagnetics, (New Delhi: New age international (P) Ltd.,2nd Edition, 1987).
3. J. Yarwood & J. H. Fewkes, Electricity & Magnetism (London: University Tutorial Press, 2nd Edition,1965).
4. S. Mahajan and Chaudhary, Electricity, Magnetism and Electromagnetic Theory (Tata McGraw Hill, 2012).
5. David J. Griffith, Introduction to Electrodynamics (New Jersey: Prentice Hall Publisher,3rd Edition, 1999).
6. V. K. Mehta, Principles of Electronics, (New Delhi: S. Chand and Co., 11th Edition, 2009).
7. Bagde and Singh, Elements of Electronics, (New Delhi: S. Chand and Co., 18thEdition, 1997).

❖ Learning Outcomes:

After completion of the course, student should able to:

1. compute gradient, divergence, curl and interpret their physical significances.
2. solve practical problems using integral theorems of vector fields, Gauss divergence theorem, Stokes' theorem.
3. state Gauss's law and apply it to calculate electric field for a point charge, uniformly charged spherical shell and solid sphere.
4. interrelate electric field, electric potential, electric potential energy and electric potential difference.
5. describe Gauss law for dielectrics and interrelate three electric vectors E, P, D as well as dielectric constant and electric susceptibility.
6. distinguished between polar and non-polar dielectrics and compute the expression for capacitance of parallel plate capacitor filled with dielectric medium.
7. use Thevenin's and Norton's theorem to simplify an electric circuit.
8. draw and discuss NPN structure, PNP structure, transistor characteristics in CB, CE and CC mode.

B.Sc. Part-I Semester-I

Practical: MN-BPP23-103: Mechanics, Electrostatics and Electronics (Credits:2)

❖ Course Objectives: students will able to-

1. develop fundamental experimental skills to perform an experiment.
2. learn the experimental setup and procedure to perform given experiment.
3. develop skills in taking readings/observations obtained from these instruments.
4. learn how to analyze and interpret experimental data, including error analysis, graphical representation.
5. perform calculations to obtain the experimental results.
6. test whether the experimental results hold good with theoretical results.
7. acquire knowledge and practice safe laboratory procedures, including proper handling of equipment, electrical, and potential hazards.

Experiments:

Sr. No.	Titles of experiment
1.	Measurements of length/diameter using Vernier caliper, Screw gauge and Travelling Microscope.
2.	To determine the Moment of Inertia of a Flywheel.
3.	To determine Moment of inertia of a disc using auxiliary annular ring.
4.	To determine 'g' by bar pendulum.
5.	To determine 'g' by Kater's pendulum.
6.	To study the motion of a spring and calculate (a) spring constant (b) value of 'g'.
7.	To use a multimeter for measuring (a) Resistance, (b) AC and DC voltages,(c) DC current, and (d) checking electrical fuses.
8.	Input, output and transfer characteristics of CE transistor.
9.	To verify Kirchhoff 's laws.
10.	To verify Thevenin's theorem.
11.	To verify Norton's theorem.
12.	To determine Constants of B.G.

❖ REFERENCE BOOKS:

1. Worsnop B. L. and H. T. Flint., *Advanced practical physics for students*, (London: Methuen & Co., Ltd, 9th Edition, 1951).
2. Gupta S.L. and V. Kumar., *Practical physics*. (Meerut: Pragati Prakashan,29thEdition.2017).
3. Chattopadhyay D. and P. C. Rakshit, *An advanced course in practical physics* (Calcutta: New Central Book,8th Edition,2013).
4. White, Marsh W. and Kenneth V. Manning, *Experimental college physics; a laboratory manual*, (New York: McGraw-Hill Publication,3rd Edition, 1954).
5. I. Prakash and Ramakrishna, *A Textbook of Practical Physics*, (Kitab Mahal,11th Edition ,2011).
6. Singh H. Harnam and Hemne P. S., B.Sc. Practical Physics, (New Delhi, S. Chand & Co. Ltd., 17th Edition, 2011.

❖ Course Outcomes: **After completion of the course, students should be able to:**

1. demonstrate basic experimental skills by setting up laboratory equipment/ experiment set up safely and efficiently, instruments calibration, carry out experimental procedure, data collection, analysis and report it in a written sheet manner.
2. Exhibit practical skills in using various measuring instruments (vernier caliper, micrometer screw gauge, travelling microscope, multimeter, stopwatch etc.) and learn to select and use the appropriate instrument for a given measuring task.
3. Display practical skills in measuring moment of inertia using various experimental setups such as flywheel, torsional oscillating annular disk.
4. exhibit practical skills in measuring time period of oscillation for Katers and bar pendulum.
5. Demonstrate electronics practical skills by measuring various electronic components and verification of network theorems (Kirchhoff's laws, Thevenin's theorem, Norton's theorem)
6. Demonstrate problem solving skills by encountering and resolving technical challenges that may arise during experiments.
7. Develop skills in taking precise and accurate measurement to minimize errors.
8. Analyzing experimental observations/readings using numerical calculations, graphical representation to interpret and draw conclusion.
9. Discuss and correlate their physics theory concepts and theoretical values with practical and experimental values.
10. Exhibit collaborative skills in working as part of a group to perform experiment.
11. Exhibit strong awareness of laboratory safety practices (proper handling of equipment, following dos and don'ts laboratory protocol

B.Sc. Part-I Semester-II
MN-BPT23-201: Mechanics-II (Credits: 2)

❖ **Learning Objectives: Students will be able to:**

1. learn about the motion of a particle under central force field, Newton's Law of Gravitation, Kepler's laws of planetary motion and their applications.
2. study flow of liquid using concept of viscosity and various physical parameters affecting it.
3. understand basic behavior of beam under different types loading, torsional pendulum and correlation between elastic constants.
4. know the concept of surface tension, angle of contact and wettability of the liquid, excess pressure under a bubble and its experimental determination and application.

Credit (2)	Semester II MN-BPT23-201: Mechanics-II	No. of hours per unit/credit
Unit I	**Gravitation-** Newton's Law of Gravitation, Motion of particle in central force field (motion in a plane, angular momentum isconserved, areal velocity is constant), Kepler's laws of planetary motion (statements only), Satellite in circular orbit and its applications, Geosynchronous orbits, Weightlessness, Basic idea of global positioning system (GPS), Problems.	08
Unit II	**Viscosity-** Introduction, rate of flow of liquid in a capillary tube, tubes offlow (streamline and turbulent), Poiseuille's formula (derivation) and determination of coefficient of viscosity of liquid by Poiseuille's method, Variation of viscosity of liquid with temperature and pressure, Problems.	07
Unit III	**Elasticity-** Bending of beam, Bending moment, Cantilever (without considering weight of cantilever), Beam supported at both ends (without considering weight of beam), Torsional pendulum, Work done in twisting a wire, Twisting couple on a cylinder, Determination of modulus of rigidity, Determination of Y, n and σ by Searle's method, Problems.	07
Unit IV	**Surface Tension-** Surface tension (definition), concept of surface, Angle ofcontact and wettability, Relation between surface tension, excess pressure and radius of curvature, Experimental determination of surface tension by Jaeger's method, Effect oftemperature, impurity on surface tension, Applications of surface tension, Problems	08

❖ REFERENCE BOOKS:

1. S. G. Sterling and A. J. Woodal, *Physics* (London: Longman's & Green Co. Ltd.,2nd Edition,1963).
2. Walker, Halliday and Resnick, *Fundamentals of Physics* (Hoboken, New Jersey: John Wiley & Sons, 11th Edition, 2018).
3. D.S.Mathur, *Elements of Properties of Matter*, (New York: S. Chand & Company, 2010).
4. Brij Lal and N. Subrahmanyam, *Properties of Matter*, (New Delhi: Eurasia Publishing House Limited, 1993).
5. R. Murugeshan, Properties *of Matter*, (New Delhi: S Chand & Company, 2017).
6. J.C. Upadhyaya, *General Properties of Matter*, (Agra: Ram Prasad Publication,3rd Edition,2017).

❖ Learning Outcomes: After completion of the course, student should be able to

1. state and explain Newton's law of gravitation and Kepler's laws of planetary motion, geosynchronous orbits and global positioning system (GPS).
2. enlist and prove the properties of the particle moving in central force field.
3. interpret the motion of satellite in circular orbit, its applications and geosynchronous orbits, basic idea of global positioning system (GPS)
4. distinguished between streamline and turbulent flow and explain the effect of temperature and pressure on viscosity of liquid.
5. derive Poiseuillie's formula for flow of liquid through a capillary tube and apply it to calculate coefficient of viscosity.
6. define beam, cantilever and formulate the expression of depression under various types of loading.
7. describe torsional pendulum, twisting behavior of wire and corelate Y, η and σ.
8. define and corelate surface tension, angle of contact and wettability of the liquid.
9. formulate the relation between surface tension, excess pressure and radius of curvature of liquid bubble
10. describe experimental determination of surface tension by Jaeger's method and effect of temperature, impurity on it.

B.Sc. Part-I Semester-II

MN-BPT23-202: Electricity & Magnetism (Credits:2)

❖ Learning Objectives: Students will be able to:

1. use complex number to study the concept of resonance phenomenon, sharpness and quality factor for a series LCR circuit.
2. study the concepts of magnetostatics using Biot - Savart's law and apply it to calculate magnetic field for various current carrying elements.
3. know various magnetization entities with their interrelations and different types of magnetic materials.
4. impart knowledge on concepts of Faraday's law, Lenz law, electromagnetic induction and Ballistic galvanometer.
5. interpret importance of Maxwell's equations and electromagnetic Wave propagation.

Credit (2)	B.Sc. Part-I Semester-II MN-BPT23-202: Electricity & Magnetism	No. of hours per unit/credit
Unit I	**AC Circuits-** Complex numbers and their application in solving AC series LCR circuit, Complex impedance, Reactance, Admittance andSusceptance, Resonance in LCR series circuit, Sharpness of resonance, (qualitative treatment only), Q-factor (definition only), AC Bridge- Owen's Bridge, Problems.	**08**
Unit II	**Magnetostatics and Magnetism-** **Magnetostatics:** Biot - Savart's law & its applications – straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field, Ampere's circuitallaw, **Magnetism:** Properties of magnetic materials –Magnetic intensity (H), magnetic induction (B), permeability, susceptibility, brief introduction of dia, para, and ferro magnetic materials, Problems.	**07**
Unit III	**Electromagnetic Induction-** Faraday's laws of electromagnetic induction, Lenz's law, self and mutual induction, Ballistic Galvanometer, construction and working (Revision), expression for charge flowing through ballistic galvanometer, correction for damping in galvanometer, Constants of ballistic galvanometer.	**07**
Unit IV	**Maxwell's equations and Electromagnetic Wave propagation-** Equation of continuity of current, Maxwell's correction to Ampere's law (displacement current), Maxwell's equations and its physical interpretation, Poynting vector, electromagnetic wave propagation through vacuum and isotropic dielectric medium.	**08**

❖ REFERENCE BOOKS:

1. D.C.Tayal, *Electricity and Magnetism* (Mumbai: Himalaya Publishing House, 4th Edition, 2016).
2. B. B. Laud, *Electromagnetics,* (New Delhi: New age international (P) Ltd.,2nd Edition, 1987).
3. David J. Griffith, *Introduction to Electrodynamics* (New Jersey: Prentice Hall Publisher,3rd Edition, 1999).
4. J. Yarwood& J. H. Fewkes, *Electricity & Magnetism* (London: University Tutorial Press, 2nd Edition,1965).
5. N. Subramanyam, BrijLal, *Textbook of Electricity and Magnetism,* (Agra: Ratan Prakashan,1966).
6. Matthew N. O. Sadiku, *Elements of Electromagnetism* (New York: Oxford University Press 7th Edition, 2018).
7. S. Mahajan and Chaudhary, Electricity, Magnetism and Electromagnetic Theory (Tata McGraw Hill,2012)

❖ Learning Outcomes:

After completion of the course, student should be able to

1. state and explain Newton's law of gravitation and Kepler's laws of planetary motion, geosynchronous orbits and global positioning system (GPS).
2. enlist and prove the properties of the particle moving in central force field.
3. interpret the motion of satellite in circular orbit, its applications andgeosynchronous orbits, basic idea of global positioning system (GPS).
4. distinguished between streamline and turbulent flow and explain the effect of temperature and pressure on viscosity of liquid.
5. derive Poiseuillie's formula for flow of liquid through a capillary tube and apply it to calculate coefficient of viscosity.
6. define beam, cantilever and formulate the expression of depression under various types of loading.
7. describe torsional pendulum, twisting behavior of wire and corelate Y, n and σ.
8. define and corelate surface tension, angle of contact and wettability of the liquid.
9. formulate the relation between surface tension, excess pressure and radius of curvature of liquid bubble
10. describe experimental determination of surface tension by Jaeger's methodand effect of temperature, impurity on it.

B.Sc. Part-I Semester-II

Practical: MN-BPP23-203: Mechanics-II, Electricity and Magnetism (Credits:2)

❖ Course Objectives: students will able to-

1. develop fundamental experimental skills to perform an experiment.
2. learn the experimental setup and procedure to perform given experiment.
3. develop skills in taking readings/observations obtained from these instruments.
4. learn how to analyze and interpret experimental data, including error analysis, graphical representation.
5. perform calculations to obtain the experimental results.
6. test whether the experimental results hold good with theoretical results.
7. acquire knowledge and practice safe laboratory procedures, including proper handling of equipment, electrical, and potential hazards.

Experiments:

Sr. No.	Titles of experiment
1.	Young's modulus of material of bar by vibration.
2.	Modulus of rigidity of material of wire by torsional oscillations
3.	Y and n of wire by Searle's method.
4.	Poisson's ratio for rubber using rubber tube
5.	Surface Tension by Jaegar's method.
6.	To study a series LCR circuit and determine its (a) resonant frequency (b) quality factor Q.
7.	To study a parallel LCR circuit and determine its (a) anti-resonant frequency (b) quality factor Q.
8.	Frequency of AC mains by sonometer
9	Coefficient of viscosity Poiseiulle's Method
10	Measurement of field strength B and its variation in a solenoid ( )
11	To verify maximum power theorem
12	To study Half wave & Full wave rectifier

❖ REFERENCE BOOKS:

1. Worsnop B. L. and H. T. Flint., *Advanced practical physics for students*, (London: Methuen & Co., Ltd, 9th Edition, 1951).
2. Gupta S.L. and V. Kumar., *Practical physics*. (Meerut: Pragati Prakashan,29thEdition.2017).
3. Chattopadhyay D. and P. C. Rakshit, *An advanced course in practical physics* (Calcutta: New Central Book,8th Edition,2013).
4. White, Marsh W. and Kenneth V. Manning, *Experimental college physics; a laboratory manual*, (New York: McGraw-Hill Publication,3rd Edition, 1954).
5. I. Prakash and Ramakrishna, *A Textbook of Practical Physics*, (Kitab Mahal,11th Edition ,2011).

❖ Course Outcomes: After completion of the course, students should be able to:

1. Demonstrate basic experimental skills by setting up laboratory equipment/ experiment set up safely and efficiently, instruments calibration, carry out experimental procedure, data collection, analysis and report it in a written sheet manner.
2. Exhibit practical skills in using various measuring instruments (vernier caliper, micrometer screw gauge, travelling microscope, multimeter, stopwatch etc.) and learn to select and use the appropriate instrument for a given measuring task.
3. Display practical skills in measuring moment of inertia using various experimental setups such as flywheel, torsional oscillating annular disk.
4. exhibit practical skills in measuring time period of oscillation for Katers and bar pendulum.
5. Demonstrate electronics practical skills by measuring various electronic components and verification of network theorems (Kirchhoff's laws, Thevenin's theorem, Norton's theorem)
6. Demonstrate problem solving skills by encountering and resolving technical challenges that may arise during experiments.
7. Develop skills in taking precise and accurate measurement to minimize errors.
8. Analyzing experimental observations/readings using numerical calculations, graphical representation to interpret and draw conclusion.
9. Discuss and correlate their physics theory concepts and theoretical values with practical and experimental values.
10. Exhibit collaborative skills in working as part of a group to perform experiment.

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Titles of Courses of B.Sc. I (INDIAN KNOWLEDGE SYSTEM)

B. Sc. I (Semester-I)

Theory Course: 30 lectures, 30 hours (for each Course)

Course – I: IKSP23-101: Physics in Astrology (Credits: 02)

SYLLABUS

B.Sc. I: Semester-I

Course – I: IKSP23-101:Physics in Astrology (Credits: 02)

Learning Objectives:

Students will be able

1. To understand contribution of ancient scientists in development of physics, astronomy and astrology
2. To understand zero and the number system.
3. To understand fundamental basic theories of Astronomy and Astrology
4. To understand positions of the planets and of the zodiacal signs at particular time

Credits (2)	Semester I : IKSP23-101: Physics in Astrology	No. of hours per unit
Unit-I	**Contribution of ancient Indian scientists** Bhaskaracharya, Aryabhatta, Virasena, Kanada, Nagarjuna, Bodhayan, Varah Mihir.	**07**
Unit-II	**Galaxies** Components of the Universe: Introduction of Stars, Planets, Asteroids, Meteors, Comets, Galaxies, Formation of galaxies, visual morphology of galaxy, Identification of stars, Constellations – Aries, Pisces, Orion etc., Asterisms – summer triangle and Big Dipper (Saptarishi).	**08**
Unit-III	**Horoscope: The map of the sky** Significance of horoscopic houses, Rashichakra, Constellations and Rashi connection. Case study of Indian observatories.	**08**
Unit -IV	**The Sky, Calendar and Celestial coordinates** The moon, Sun and stars as calendars, sidereal day, sidereal time.	**07**

REFERENCE BOOKS:

1. Astronomy: Fundamentals and Frontiers – Jastrow & Thomson
2. Our Solar System – A. W. Joshi and N. Rana
3. The Structure of Universe – Jayant Naralikar
4. Astrophysics (Stars & Galaxies) – K. D. Abhyankar
5. Astrology: Using the Wisdom of the Stars in Your Everyday Life – Carole Taylor
6. Kimayagar – Achyut Godbole

Learning Outcome:

1. Student will understand the basics of galaxies, Cosmology and solar system.
2. The movements and positions of the planets and stars can help us understand ourselves and our place in the universe.
3. Astrology studies correlate astronomical positions and terrestrial going-on.
4. This course will help students to eliminate superstitions.

Titles of Courses of B.Sc. I (GENERIC ELECTIVE)

B. Sc. I (Semester-I)

Theory Course: 30 lectures, 30 hours (for each Course)

Paper –I: GE-BPT23-101: Fundamentals of Astronomy (Credits: 02)

Paper– II: GE-BPT23-102: Fundamentals of Astrophysics (Credits: 02)

Physics Practical –I

Practical: 60 lectures: 60 hours (Total)

Practical: GE-BPP23-103: Astrophysics & Astronomy (Credits: 02)

B. Sc. I (Semester-II)

Theory Course: 30 lectures, 30 hours (for each Course)

Paper–III: GE-BPT23-201: Galaxies, Cosmology and Solar System (Credits: 02)

Paper –IV: GE-BPT23-202: Hydrodynamics and Stellar Evaluation(Credits: 02)

Physics Practical - II

Practical: 60 lectures: 60 hours (Total)

Practical: GE-BPP23-203: Cosmology, Solar System, Hydrodynamics and Stellar Evaluation (Credits: 02)

Program Outcomes-

1. To develop fundamental scientific knowledge .
2. To develop basic scientific and mathematical skills .
3. Students should progress their vertical mobility.
4. To develop required technical skills.
5. Develop moral, social and ethical values.
6. Able to survive in society.

Program Specific Outcomes-

1. Students should understand mathematical concepts needed for understanding Astrophysics.
2. Students should understand fundamental basic theories of Space Science, Astronomy, Cosmology, Solar system etc.
3. Students should learn laboratory skills; students should take measurements in Astro Physics laboratory and analyse the measurements to draw valid conclusions.
4. Students will be capable of oral and written scientific communication and will prove that they can think critically and work independently.

SYLLABUS

B.Sc. I: Semester-I

Paper I: GE-BPT23-101: Fundamentals of Astronomy (Credits: 02)

Learning Objectives: Students will be able to-

1. understand the basic primary concept of ancient astronomical theories.
2. demonstrate a proficiency in solving problems in explain Newton's laws of motion, conservation laws for single and system of particles and their applications.
3. understand the basic concepts of (I) Celestial objects, Celestial Sphere, Celestial Coordinates. (II) Terrestrial distances , concept of light years, distance of sun, moon and stars. (III) Identification of stars, various constellations and Comets ,Asteroids and Meteors. learn the concept of rotational motion and moment of inertia of various bodies.
4. develop the critical skill in students to understand Astronomy.

Credits (2)	Semester I: GE-BPT23-101: Fundamentals of Astronomy	No. of hours per unit/credit
Unit I	**Introduction to Astronomy –** Babylonian astronomy, Greek astronomy, Aristotle work, Ptolemy's astronomical work, Copernican heliocentric theory, Tychonian system.	07
Unit II	**The Sky, Calendar and Celestial coordinates-** The moon, Sun and stars as calendars, sidereal day, sidereal time.	08
Unit III	**The Stellar distances–** Measurement of terrestrial distances, distance of moon, distance of planets, Astronomical unit aberration of star light.	08
Unit IV	**Constellations, Comets, Asteroids, Meteors –** Identification of stars, Constellations – Aries, Pisces, Orion, Asterisms – summer triangle and Big Dipper (Saptarishi). Comets, Asteroids, Meteors- Structure, chemical composition, and orbits.	07

❖ REFERENCE BOOKS:

1. Astronomy: Fundamentals and Frontiers – Jastrow & Thomson.
2. Our Solar System – A. W. Joshi and N. Rana.
3. The Structure of Universe – Jayant Naralikar.
4. Astrophysics (Stars & Galaxies) – K. D. Abhyankar
5. Fluid Mechanics - L. D. Landau and E. M. Lifshitz.
6. Classical Electrodynamics – J. D. Jackson.
7. Cosmic Electrodynamics – J. H. Pidington.
8. An Introduction to Stellar Structure – S. Chandrashekher.
9. Electrodynamics–David Griffiths. 10) An introduction to Cosmology-Jayant Vishnu Narlikar.

❖ Learning Outcomes:

After completion of the course, student should be able to:

1. the basic primary concept of ancient astronomical theories.
2. explain Babylonian astronomy, Greek astronomy.
3. explain Aristotle work, Ptolemy's astronomical work, Copernican heliocentric theory, Tychonian system.
4. explain the moon, Sun and stars as calendars, sidereal day, sidereal time.
5. compute the of terrestrial distances, distance of moon, distance of planets, Astronomical unit aberration of star light.
6. Identify and knows stars, Constellations – Aries, Pisces, Orion, Asterisms – summer triangle and Big Dipper (Saptarishi). Comets, Asteroids.
7. explain Meteors- Structure, chemical composition, and orbits.

B.Sc. Part-I Semester-I

Paper–II: GE-BPT23-102: Fundamentals of Astrophysics (Credits: 02)

❖ Learning Objectives: Students will be able to:

1. To understand the basic primary concept of ancient astronomical theories.
2. Students will demonstrate a proficiency in solving problems in Astronomy
3. To understand the basic concepts of (I) Celestial objects, Celestial Sphere, Celestial Coordinates. (II) Terrestrial distances, concept of light years, distance of sun, moon and stars. (III) Identification of stars, various constellations and Comets, Asteroids and Meteors.
4. To develop the critical skill in students to understand Astronomy.

Credits (2)	Semester I: GE-BPT23-102: Fundamentals of Astrophysics	No. of hours per unit/credit
Unit I	**Basic Tools of Astronomers-** Optical telescopes-Galilean, Newtonian, Cassegranian, Hubble space telescope, Magnifying power of telescope, Resolving power of telescope, Spectroscope (prism, grating), UV, IR, Radio, X-Ray.	07
Unit II	**The Nature of Light and Message of The Star Light -** Light as an electromagnetic wave, Electromagnetic spectrum. Electromagnetic radiation from heated object, Doppler shift, and its applications.	08
Unit III	**Theories on origin of stars -** Nebular hypothesis, Spectral classification of stars, O,B,A,F,G,K,M., Nuclear Reactions in stars, Luminosity of star, Photon diffusion time, luminosity of star, gravitational potential energy of a star, internal temperature and pressure of a star	08
Unit IV	**Study of spectra-** Atomic spectra-emission and absorption spectra (Fraunhofer lines), Stellar spectra, Classification of stellar spectra.	07

❖ REFERENCE BOOKS:

1. Astronomy: Fundamentals and Frontiers – Jastrow & Thomson.
2. Our Solar System – A. W. Joshi and N. Rana.
3. The Structure of Universe – Jayant Naralikar.
4. Astrophysics (Stars & Galaxies) – K. D. Abhyankar
5. Fluid Mechanics - L. D. Landau and E. M. Lifshitz.
6. Classical Electrodynamics – J. D. Jackson.
7. Cosmic Electrodynamics – J. H. Pidington.
8. An Introduction to Stellar Structure – S. Chandrashekher.
9. Electrodynamics–David Griffiths. 10) An introduction to Cosmology-Jayant Vishnu Narlikar

❖ Learning Outcomes:

After completion of the course, student should able to:

1. understands and explains optical telescopes-Galilean, Newtonian, Cassegranian, Hubble space telescope, Magnifying power of telescope, Resolving power of telescope,
2. explains Magnifying power of telescope, Resolving power of telescope, Spectroscope.
3. explains UV, IR, Radio, X-Ray.
4. explains nature of light and messages.
5. explains electromagnetic wave, Electromagnetic spectrum.
6. explains. electromagnetic radiation from heated object, Doppler shift, and its applications.
7. State the Nebular hypothesis and explains Spectral classification of stars.
8. explains Nuclear Reactions in stars, Luminosity of star, Photon diffusion time, luminosity of star, gravitational potential energy of a star, internal temperature and pressure of a star
9. explains atomic spectra-emission and absorption spectra (Fraunhofer lines), Stellar spectra, Classification of stellar spectra.

B.Sc. Part-I Semester-I
Practical: GE-BPP23-103: Astronomy & Astrophysics (Credits: 2)
30 Hours - Credits – 02

1. Numerical Integration.
2. Numerical Differentiation.
3. Numerical interpolation.
4. Solution of ordinary differential equations.
5. Measurement of terrestrial distance using Sextant.
6. Total internal reflection in prism.
7. To use idea of parallax to determine large distance
8. Adjustment of spectrometer for parallel light using Schuster's method
9. Measurement of refractive index of water using convex lens
10. Spherical aberration (caustic curve

❖ Learning outcomes:

❖ **Students will be able to:**

1. To understand the basic knowledge about galaxies Cosmology, solar system
2. Students from other than science stream will also demonstrate a proficiency in solving problems in galaxies Cosmology, solar system.
3. To understand the basic concepts of (I) Cosmological theories, cosmological tests. (II) Milky way galaxy, position of our solar system in milky way galaxy (III) Details of our solar system, theories of moon
4. To develop the critical skill in students to understand applied knowledge of Galaxies, Cosmology, solar system.

B.Sc. Part-I Semester-II

Credit (2)	GE-BPT23-201: Galaxies, Cosmology and Solar System	No. of hours per unit/credit
Unit I	**Galaxies-** Components of the Universe: Introduction of Stars, Planets, Asteroids, Meteors, Comets, Galaxies, Formation of galaxies, visual morphology of galaxy, Types of galaxies-Elliptical, Spiral, Barred spiral, irregular, Hubble tuning fork diagram, Peculiar galaxies, Radio galaxies, Seyfert galaxy, Quasars. [Galaxy: Nomenclature, observation theory, Types and morphology, properties, formation and evolution, large scale structure]	**08**
Unit II	**Milky Way galaxy -** Shape of the galaxy, interstellar medium and molecules, Radio emission from interstellar carbon monoxide, clusters of stars, Galactic clusters. [Appearance, size and mass, contents, structure, formation, environment, astronomical history]	**07**
Unit III	**Cosmology -** Introduction to theory of relativity, The expanding universe, Big Bang universe, the steady state cosmology and oscillating universe, Hubble law. Hubble constant, cosmological tests.	**07**
Unit IV	**The Solar system -** Origin of the solar system and planets, Basic structure of Sun - Sun's interior, the photosphere, the solar atmosphere (chromospheres and corona). Sunspots, Sun's rotation and Solar magnetic field, Explanation for observed features of sunspots, Planetary properties and quick facts of Mercury, Venus, and Mars. Moon, Structure of the moon and its quick facts.	**08**

❖ REFERENCE BOOKS:

1. Astronomy: Fundamentals and Frontiers – Jastrow & Thomson.
2. Our Solar System – A. W. Joshi and N. Rana.
3. The Structure of Universe – Jayant Naralikar.
4. Astrophysics (Stars & Galaxies) – K. D. Abhyankar
5. Fluid Mechanics - L. D. Landau and E. M. Lifshitz.
6. Classical Electrodynamics – J. D. Jackson.
7. Cosmic Electrodynamics – J. H. Pidington.
8. An Introduction to Stellar Structure – S. Chandrashekher.
9. Electrodynamics–David Griffiths. 10) An introduction to Cosmology-Jayant Vishnu Narlikar

❖ **Learning Outcomes: After completion of the course, student should be able to-**

1. explain Stars, Planets, Asteroids, Meteors, Comets, Galaxies, Formation of galaxies, visual morphology of galaxy.
2. explain various types of galaxies-Elliptical, Spiral, Barred spiral, irregular, Peculiar galaxies, Radio galaxies, Seyfert galaxy, Quasars.
3. Draw the Hubble tuning fork diagram.
4. explain Shape of the galaxy, interstellar medium and molecules, Radio emission from interstellar carbon monoxide.
5. explain clusters of stars and Galactic clusters.
6. explain theory of relativity.
7. knows expanding universe, Big Bang universe, the steady state cosmology and oscillating universe.
8. state and explain Hubble law. Hubble constant, cosmological tests.
9. explain Origin of the solar system and planets, Basic structure of Sun -Sun's interior, the photosphere, the solar atmosphere.
10. explain Sunspots, Sun's rotation and Solar magnetic field, Explanation for observed features of sunspots, Planetary properties and quick facts of Mercury, Venus, and Mars. Moon, Structure of the moon and its quick facts.

B.Sc. Part-I Semester-II

GE-BPT23-202: Hydrodynamics and Stellar Evaluation (Credits:2)

❖ **Learning Objectives: Students will be able to-**

1. To understand the basic knowledge about Hydrodynamics and Stellar evolution from the students from any stream like arts, commerce etc.
2. Students will demonstrate a proficiency in understanding Hydrodynamics and Stellar evolution.
3. To understand the basic concepts of (I) Concepts of fluid, continuity equation, basic equation of fluid dynamics. (II) Stellar evolution.
4. To develop the critical skill in students to understand applied knowledge of cosmic electrodynamics.

Credit (2)	GE-BPT23-202: Hydrodynamics and Stellar evolution	No. of hours per unit/credit
Unit I	**Fluids -** Perfect Fluid: Assumptions, Equation of state, equation of motion, stars of uniform density, limit of mass to radius ratio. Basic equations of fluid mechanics, Energy equation, continuity equation viscosity, gas dynamics, waves and instabilities, turbulence, orbit theory, properties.	08
Unit II	**Hydrodynamics -** Equation of continuity - conservation of mass, Ideal fluid and Euler's equation of motion, Navier- Stokes equation for viscous fluid.	07
Unit III	**Stellar evolution I -** Birth of a star, maturity of a star, ageing of stars, death of a star, supernova explosion, pulsars andblack holes.	07
Unit IV	**Stellar evolution II -** Hertzsprung-Russell (H-R) diagram- white and red dwarfs, electron in a white dwarf, Chandrasekhar limit, Neutron stars	08

❖ REFERENCE BOOKS:

1. Astronomy: Fundamentals and Frontiers – Jastrow & Thomson.
2. Our Solar System – A. W. Joshi and N. Rana.
3. The Structure of Universe – Jayant Naralikar.
4. Astrophysics (Stars & Galaxies) – K. D. Abhyankar
5. Fluid Mechanics - L. D. Landau and E. M. Lifshitz.
6. Classical Electrodynamics – J. D. Jackson.
7. Cosmic Electrodynamics – J. H. Pidington.
8. An Introduction to Stellar Structure – S. Chandrashekher.
9. Electrodynamics–David Griffiths. 10) An introduction to Cosmology-Jayant Vishnu Narlikar

❖ Learning Outcomes:

After completion of the course, student should be able to

1. explain Equation of state, equation of motion, stars of uniform density, limit of mass to radius ratio.
2. state and explain Basic equations of fluid mechanics, Energy equation, continuity equation viscosity, gas dynamics, waves and instabilities, turbulence, orbit theory, properties.
3. state and explain Equation of continuity - conservation of mass, Ideal fluid and Euler's equation of motion, Navier- Stokes equation for viscous fluid.
4. explain birth of a star, maturity of a star, ageing of stars, death of a star, supernova explosion, pulsars and black holes.
5. explain Hertzsprung-Russell (H-R) diagram- white and red dwarfs, electron in a white dwarf, Chandrasekhar limit, Neutron stars.

B.Sc. Part-I Semester-II

GE-BPP23-203: Galaxies, Cosmology and Solar System (Credits: 2)

30 Hours - Credits – 02

1. I-V Characteristics of solar cell.
2. Goniometer: Equivalent focal length
3. Study of Lissajous figures using CRO.
4. Determination of wavelength of light by spectrometer.
5. Determination of Planck's constant using LED
6. Divergence of LASER beam
7. Measurement of wavelength of given LASER source using diffraction grating.
8. Calibration of spectrometer.
9. Study of Balmer lines.
10. Study of solar spectrum.