SHIVAJI UNIVERSITY, KOLHAPUR.

Accredited By NAAC with 'A++' Grade

NATIONAL EDUCATION POLICY (NEP-2020)

Syllabus For

B. Sc. Part-I
Physics

Syllabus to be implemented from AUGEST, 2022 onwards

Department of
Physics, Shivaji
University, Kolhapur
B. Sc. –Part-I (Physics) Course Structure

NOTE:
The following in a nutshell gives the scope and extent of each course offered. Each core theory course has two levels of teaching: Lectures and practical's.

B.Sc. (Physics) NEP-2020				
Part-I (Semester-I)				
	Sr. No	**Course code**	**Course Title**	**Credits**
CGPA	**1**	DSC A1	Mechanics - I	2
	2	DSC A2	Mechanics - II	2
	3	DSC B1	Electricity and Magnetism-I	2
	4	DSC B2	Electricity and Magnetism-II	2
	5	DSC A DSC B	i. Lab - Mechanics ii. Lab - **E**lectricity & Magnetism	2 2
Non-CGPA	**6**	AECC-1 AECC-2	English for communication English for communication	
Non-CGPA	**7**	SEC	Skill Enhancement Course	

Science Structure

Sem	**DSC**	**DSE/OEC/GEC/ IDS**	**AECClangages and Env Sci**	**SEC (Multidisciplinary)**	**Total Credits**
I	4x(4+2)= 24		1x 4= 4 ENG	SEC -I(1) VBC(1)	30
II	4x(4+2)= 24		1x 4= 4 ENG	SEC-II(2)	30
III	3x (4+4) = 24	--	-	SEC-III(2)	26
IV	3x (4+4) = 24	--	1x 4= 4 (EVS)	SEC- IV(2)	30
V		DSE 4x (2x2) = 16	1x 4= 4 ENG	SEC-V(2)	22
VI		DSE 4x (2x2) = 16	1x 4= 4 ENG	SEC -VI(2)	22
			Total		160

Shivaji University, Kolhapur
B. Sc. Part – I Semester-I(NEP-2020)
PHYSICS PART-I
DSC A1 MECHANICS-I
Theory: 30 Hours Marks-50 (Credits: 02)

Unit-I

1. **Vector Algebra and Elementary Calculus** : (9 Hours)

   Revision– (Vector Algebra: Components of Vectors and Unit Vector, Addition and Subtraction of Vectors), Scalar product, Vector product and their properties, Scalar triple product and its physical significance, Properties of scalar triple product, Vector triple product, properties of vector triple product. Derivatives of a vector with respect to a parameter (velocity and acceleration).

2. **Ordinary Differential Equations:** (6 Hours)

   Differential equation, degree, order, linearity and homogeneity of differential equation, Types of Differential Equations: Ordinary and Partial differential equations, First order homogeneous differential equations, Second order homogeneous differential equations with constant coefficients, Examples.

Unit -II

1. **Conservation Theorems :** (9 Hours)

   Single particle: Conservation theorem for linear momentum of a particle, Conservation theorem for angular momentum of a particle, work-energy theorem, Conservation theorem for energy of a particle.

   System of particles: Center of mass, Conservation theorem for linear momentum, Conservation theorem for angular momentum, Conservation theorem for energy.

2. **Rotational Motion:** (6 Hours)

   Angular velocity, Angular momentum, Torque, Kinetic energy of rotation, Moment of Inertia, Moment of inertia of a spherical shell about its diameter, Moment of inertia of solid cylinder about its axis of symmetry.

Reference Books:

1. Mathematical Physics -B. S. Rajput, 25th edition 2013, PragatiPrakashan, Meerut.
2. Mechanics – D. S. Mathur, 2009, S. Chand & Company Ltd., New Delhi.
3. Mathematical Physics – B. D. Gupta, 3rd edition, 2009, Vikas Publishing House Pvt. Ltd., New Delhi.
4. Mathematical Physics – P. P. Gupta, R. P. S. Yadav, G. S. Malik, 4th edition 1983-84, KedarNath Ram Nath, Meerut, Delhi.
5. University Physics. FW Sears, MW Zemansky and HD Young, 13/e, 1986, Addison - Wesley.
6. Mechanics Berkeley Physics course, V.1: Charles Kittel, et. Al. 2007, Tata McGraw Hill.
7. Physics – Resnick, Halliday& Walker 9/e, 2010, Wiley Eastern Ltd, New Delhi.
8. Engineering Mechanics, Basudeb Bhattacharya, 2ndedn., 2015, Oxford University Press.

9. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
10. Physics – S.G. Starling and WoodalLongmams and Green Co. Ltd.
11. Elements of properties of matter – D.S. Mathur, 2016, ShyamLal Charitable Trust, New Delhi.
12. A text Book of properties of matter–N.S. Khare and S. Kumar, Atmaram and Sons New Delhi.
13. Concepts of Physics Vol. I - H.C. Verma, 2014, BharatiBhavan Publishers.

PHYSICS PART-II
DSC A2 MECHANICS-II

Theory: 30 Hours
Marks-50 (Credits: 02)

Unit-I

1. Gravitation (9 Hours)

Newton's Law of Gravitation, Motion of a particle in a central force field (motion in a plane, angular momentum is conserved), Kepler's Laws (statement only), Satellite in circular orbit and applications, Geosynchronous orbits, Weightlessness, Basic idea of global positioning system (GPS).

2. Oscillations (6 Hours)

Simple harmonic motion, Differential equation of SHM and its solutions, Kinetic and Potential Energy, Total energy and their time averages, Damped oscillations, Forced oscillations.

Unit-II

1. Elasticity (9 Hours)

(Revision Hooke's law, Stress-strain diagram, Definition of elastic constants (Y, η, K and σ)), Bending of beam, Bending moment, Cantilever (without considering weight of cantilever), Beam supported at both the ends (without considering weight of beam), Torsional oscillation and torsional couple per unit twist, Work done in twisting a wire, Torsional pendulum-Determination of rigidity modulus and moment of inertia, Determination of elastic constants (Y, η, and σ) by Searle's method.

2. Surface Tension (6 Hours)

Surface tension (definition), Molecular theory of surface tension, Angle of contact, Young equation and wettability, Relation between surface tension, excess of pressure and radius of curvature, Experimental determination of surface tension by Jaeger's method, Factors affecting surface tension, Applications of surface tension.

Reference Books:

1. University Physics. F W Sears, M W Zemansky and H D Young 13/e, 1986. Addison-Wesley
2. Mechanics Berkeley Physics course,v.1: Charles Kittel, et. Al. 2007, Tata McGraw - Hill.
3. Physics – Resnick, Halliday& Walker 9/e, 2010, Wiley eastern Ltd, New Delhi.
4. Engineering Mechanics, Basudeb Bhattacharya, 2nd edn., 2015, Oxford University Press
5. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
6. Physics – S.G. Starling and WoodalLongmams and Green Co. Ltd.
7. Elements of properties of matter – D.S. Mathur, Shamlal Charitable trust New Delhi.
8. A text Book of properties of matter–N.S. Khare and S. Kumar, Atmaram and sons, New Delhi.
9. Concepts of Physics –Vol.1 H.C. Verma -BharatiBhavan Publishers.

PHYSICS PART-III
DSC B1 ELECTRICITY AND MAGNETISM-I

Theory: 30 Hours
Marks-50 (Credits: 02)

Unit-I

Vector Calculus **(15 Hours)**

Introduction, Del operator, gradient of scalar field and its physical significance , divergence of vector field and its physical significance, curl of vector field, line integral, surface integral, volume integral (definitions only),Gauss divergence theorem(statements and proof), Statements of Stoke's theorem, Greens symmetrical theorem.

Unit-II

Electrostatics **(15 Hours)**

Electrostatic field, electric flux, Gauss's theorem of electrostatics, electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere, calculation of electric field from potential, capacitance of an isolated spherical conductor, parallel plate, spherical and cylindrical condenser, energy per unit volume in electrostatic field, dielectric medium, polarization vector, displacement vector, Gauss's theorem in dielectrics, Parallel plate capacitor completely filled with dielectric.

Reference Books:

1. Electricity and Magnetism, Edward M. Purcell, McGraw-Hill Education, Cambridge University Press, (1985).
2. Electricity and Magnetism, J.H. Fewkes& J. Yarwood., Oxford Univ. Press.Vol. - I, (1991).
3. Electricity and Magnetism, D C Tayal, Himalaya Publishing House, 2nd Edition (1988).
4. University Physics, Ronald Lane Reese, Thomson Brooks/Cole Publishing Company, (2003).
5. D.J. Griffiths, Introduction to Electrodynamics, Cambridge University Press, Pearson,(1999).
6. Electricity and Magnetism – N. S. Khare and S. S. Shrivastav,Atma Ram & Sons, Delhi. 9th edition (1976).
7. Foundations of Electromagnetic Theory, John R Reitz, Frederick J. Milford, Addison-Wesley Publishing Company 4th edition (2008)
8. University Physics– Hugh D. Young and Roger A. Freedman, Addison- Wesley Publishing Company, Inc., 9th edition,(1996)
9. Concepts of Physics, H. C. Verma, BhartiBhawan publisher, Vol-2, (2016)
10. Mathematical Physics, B. D. Gupta, Vikas Publication House Pvt Ltd, 4th edition, (2009).
11. Electricity and Magnetism by R. Murugeshan, S. Chand & Co., New Delhi, (2008).

PHYSICS PART-IV
DSC B2 ELECTRICITY AND MAGNETISM – II

Theory: 30 Hours
Marks-50 (Credits: 02)

UNIT I

1. **A.C. Circuits** **(07 Hours)**
   Complex numbers and their application in solving a. c. series LCR circuit using j operator and phasor diagram, Resonance in LCR series circuit, Sharpness of resonance (qualitative treatment only), Resonance in LCR Parallel circuit, complex Impedance, Reactance, Admittance, and Susceptance, Examples of series and parallel resonance, A.C.Bridge - Owen's Bridge Q-factor (definition only).
2. **Network theorems** **(04 Hours)**
   Review of network terminology(Circuit element, Active element, Passive element, Branch, Node or junction, Loop, Mesh, Voltage source, Current source, Ohms law, Resistances in series, Resistances in parallel), Thevenin theorem, Nortan theorem, Equivalnce between Thevenin theorem and Nortan theorem, solved problems.
3. **Ballistic Galvanometer:** **(04 Hours)**
   Construction and working of B. G., expression for charge flowing through ballistic galvanometer, Correction for damping in galvanometer, Constants of ballistic galvanometer.

UNIT II

1. **Magnetism** **(08 Hours)**
   Introduction to magnetization and intensity of Magnetization, Biot-Savart's law & its applications- straight conductor, circular coil, solenoid carrying current, Divergence and curl of magnetic field, Magnetic vector potential, Ampere's circuital law.
2. **Magnetic materials and their Properties** **(07 Hours)**
   Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Hysteresis and hysteresis curve, diamagnetic, paramagnetic, ferromagnetic, ferrimagnetic and anti-ferromagnetic materials.

Reference Books

1. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.
2. Electricity and Magnetism, J.H. Fewkes& J. Yarwood. Vol.I, 1991, Oxford UniversityPress.
3. Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
4. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
5. Electricity and Magnetism ,Khare and Shrivastav.Atma Ram & Sons, Delhi, 1976
6. University Physics 9th Edition ,Young and Freedman.
7. Foundations of Electromagnetic Theory ,Rritz and Milford. Pearson Publication
8. Electricity and Magnestism, Gupta,Kumar and Singal
9. Basic Electronics and Liner Circuits, N.N.Bhargava, D.C.Kulshrestha and S.S.Gupta, Tata McGraw-Hill
10. Electronic Fundamentals and Applications, J.D.Ryder, Prentice-Hall of India Pvt.Ltd
11. Network theory and Filter Design, V.K.Aatre, New Age International Publisher
12. Principals of Electronics, V.K.Mehata, S. Chand Publication, New Delhi

B. Sc. Part – I
PHYSICS PRACTICAL

Marks 50 (Credits: 02)

DSC A- LAB: MECHANICS

1. Measurements of length (or diameter) using Vernier caliper, screw gauge and travelling microscope.
2. To determine the Moment of Inertia of a Flywheel.
3. To determine the Moment of inertia of a disc using auxiliary annular ring.
4. To determine modulus of rigidity of material of wire by torsional oscillations.
5. To determine Young's modulus of material of Bar by vibration.
6. To determine Y/η of Wire by Searle's method.
7. To determine 'g' by Bar Pendulum.
8. To determine Poisson ratio of rubber (rubber tube).
9. To study exponential decay of amplitude of simple pendulum.
10. To determine surface tension of water by Jaeger's method

DSC B- LAB ELECTRICITY AND MAGNETISM

1. To use digital multimeter for measurement of (a) Resistances, (b) AC and DC Voltages, (c)DC Current and (d) checking electrical fuses.
2. To level the prism table using spirit level and optical method and hence determine angle of prism using spectrometer.
3. To determine constants of B. G.(Figure of merit, Current sensitivity, Voltage sensitivity and charge sensitivity)
4. To compare capacitances using De'Sauty's bridge (B.G/Spot Galvanometer).
5. To determine low resistance by Carey Foster's Bridge.
6. To determine impedance of series LCR circuit.
7. To study the series LCR circuit and determine its resonant frequency and quality factor.
8. To study a parallel LCR circuit and determine its anti-resonant frequency and quality factor.
9. To determine frequency of A. C. mains by sonometer for magnetic or non-magnetic material of wire.
10. To verify Thevenin / Norton theorem.

Reference Books:

1. Advanced Practical Physics for students, B.L.Flint&H.T.Worsnop, 1971, Asia Publishing House.
2. A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
4. College Practical Physics – Khanna and Gulati (S. Chand and Co. Ltd, Delhi).
5. Practical Physics – Gupta and Kumar (PragatiPrakationMeerat)
6. Advanced Level Practical Physics – J.M. Nelcon, J.M. Ogloom (EIBS).
7. Engineering Practical Physics- S. Panigrahi& B.Mallick,2015, Cengage Learning India Pvt. Ltd.

TITLES FOR REVISED THEORY COURSES

Semester	Physics Part	Course Code	Course title old and New
I	I	DSC A1	MECHANICS-I
	II	DSC A2	MECHANICS-II
II	III	DSC B1	ELECTRICITY AND MAGNETISM – I
	IV	DSC B2	ELECTRICITY AND MAGNETISM – II

- **Scheme of Practical Examination for B. Sc. Part –I**

1. Practical examination will be conducted annually.
2. Practical examination will be conducted for one day per batch.
3. The examination will be conducted in two sessions per day and each session will be of three hours duration.
4. Every candidate should perform one experiment each from Lab A and Lab B .
5. At least eighty percent practical should be completed by the student.
6. The marks distribution for practical is as below.

Practical groups	**Marks**
Group I	20
Group II	20
I)Certified laboratory journal	10
Total Marks	**50**

Nature of Question Paper

Theory: Time -2 hours, Marks-50 Credits-2

Question 1: Select the correct alternative (Compulsory 10 questions) 10 marks
(Four alternatives for each question)

Question 2: (Attempt any Two out of three) 20 marks
(Long answer type)

Question 3: (Attempt any four out of six) 20 marks
(Short answer type)

Note: Equal weightage should be given to each unit.

Shivaji University, Kolhapur
B.Sc. Part-I Physics Syllabus (NEP-2020) with effect from August, 2022

COURSE OUTCOME

Semester-I		
Course Code	Part	Course Outcome
DSC A1	Mechanics-I	▪ Students are able to ***understand and identify*** scalar and vector physical quantities in mechanics ▪ Students are able to ***understand and apply*** vector algebraic methods to elementary exercises in mechanics ▪ Students are able to ***understand and identify*** degree and order of given differential equations ▪ Students are ***able to solve*** second order, homogenous ordinary differential equations in mechanics ▪ Students are able to ***understand the conceptual evolution***of conservation laws of momentum and energy for both single and system of particles ▪ Students are able to ***understand and apply***basicconcepts of rotational motion ▪ In general, students are capable of ***correlating*** above concepts and methods in mechanics to *both* ***theoretical and experimental domains revealing analytical as well as numerical skills***
DSC A2	Mechanics-II	▪ Students are able to ***understand and apply*** Newtons Law of Gravitation to celestial objects ▪ Students are able to ***understand geometry of planetary orbits under the action of central force*** ▪ Students are able to ***solve*** numerical problems based on Kepler`s Laws of planetary motion ▪ Students are able to ***understand*** **simple concepts like weightlessness, Geosynchronous satellite and GPS** ▪ Students are ***able to setup*** differential equation for simple harmonic motion and its allied cases ▪ Students are ***able to*** calculate time averages of KE, PE and TE ▪ Students ***are able to revise*** basic concepts such as stress, strain and elastic constants of elasticity ▪ Students are ***able to derive*** elastic constants for beam supported at both ends and at one end ▪ Students are ***able to derive*** elastic constant (eta) of a wire under torsional oscillations (Searle's Method) ▪ Students are ***able to explain*** the phenomenon of surface tension on the basis of molecular forces ▪ Students are ***able to derive*** the relation between surface tension and excess pressure ▪ Students are ***able to perform*** an experiment to

		determine ST by Jaeger`s method ▪ Students are ***able to discuss and state*** the factors affecting the ST ▪ In general, students are capable of ***correlating*** above concepts and methods to ***both theoretical and experimental domains revealing analytical as well as numerical skills***
Semester-II		
Course Code	Part	Course Outcome
DSC B1	Electricity and Magnetism-I	▪ Students are able to ***understand the physical significance of*** gradient, divergence and curl ▪ Students are able to ***apply*** concepts in vector calculus such as gradient, divergence and curl related to vector and scalar fields using Gauss, Stokes and green`s theorem ▪ Students are able to ***understand*** and ***apply*** concepts of electrostatic field, potential to point charges, electric dipole and geometrically regular charged bodies ▪ Students are able to ***understand*** and ***apply*** concept of capacitor to isolated conductor, parallel plates, cylindrical and spherical capacitors and allied modifications in it ▪ Students are able to ***understand and apply*** concept of energy density in electric field ▪ Students are capable of ***applying*** above concepts to ***solve numerical exercise*** in electrostatics
DSC B2	Electricity and Magnetism-II	▪ Students are able ***to understand*** importance of complex numbers in analysis of AC Circuits contacting Inductance(L) Capacitor(C) and Resistance (R) and their various configurations ▪ Students are able to ***define and apply*** the concepts in AC circuits such as Impedance (Z), reactance (X_C and X_L), Admittance, Susceptance and Quality Factor (Q) ▪ Students are able to ***understand and design*** AC bridge: Owen`s Bridge ▪ Students ***reveal*** mastery in basic terminology in network analysis for further studies ▪ Students are able to ***state and apply*** Network theorems to simple circuits ▪ Students are able to ***understand*** basic working principle of Ballistic galvanometer ▪ Students are able to ***define*** constants of ballistic galvanometer ▪ In general, students are capable of ***applying*** above concepts in network analysis to ***both theoretical and experimental domains*** ▪ Students are able to understand simple elementary

		concepts such as magnetization and intensity of magnetization ▪ Students are ***able*** to state Biot-Savart`s law and are ***capable*** to apply it to straight, circular wires and solenoid ▪ Students are able to ***understand*** concept of magnetic vector potential along with Ampere`s circuital law ▪ Students are able to understand the explain the phenomenon of hysteresis in magnetism ▪ Students are able to ***discriminate*** different magnetic materials based on their characteristic properties