The Kelkar Education Trust's

Vinayak Ganesh Vaze College of Arts, Science & Commerce

(Autonomous)

Mithaghar Road, Mulund East, Mumbai-400081, India

College with Potential for Excellence

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Syllabus for F.Y.B.Sc. Programme

Physics

Syllabus as per Choice Based Credit System (NEP-2020)

(June 2025 Onwards)

Submitted by

Department of Physics

Vinayak Ganesh Vaze College of Arts, Science and Commerce (Autonomous)

Mithagar Road, Mulund (East) Mumbai-400081. Maharashtra, India.

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Syllabus as per Choice Based Credit System (NEP 2020)

Syllabus for Approval

Subject: Physics

Sr. No.	Heading	Particulars
1	Title of Programme	**First Year B.Sc. Physics: Semester I and II**
2	Eligibility for Admission	H.S.C Passed
3	Passing marks	Minimum D Grade or equivalent minimum marks for passing at the Graduation level.
4	Ordinances/Regulations (if any)	---
5	No. of Years/Semesters	One year/ Two semester
6	Level	U.G. Part-I : Level- 4.5
7	Pattern	Semester
8	Status	Revised
9	To be implemented from Academic year	2025-2026

Date: …….. **Signature:**

BOS Chairperson: ……

The Framework of the Choice-Based Credit System [NEP-2020]

- **Major Subject**:
  A single subject course of study pursued by a student as a mandatory requirement of the programme of study. Indian Knowledge System (IKS) to be included in the core courses.
- **Elective Course**:
  An elective course could be a project designed to acquire skills to supplement the major study.
- **Minor Subject**:
  A second subject of study pursued by a student as an additional requirement of the programme of study.
- **OE: Open Elective**
  An elective course chosen generally from an unrelated discipline/subject, to seek multidisciplinary exposure.
- **AEC: Ability Enhancement Course**
  Mandatory Courses on content related to Language, and Literature
  (i) Compulsory – English communication
  (ii) Elective – any Indian language other than English.
- **IKS: Indian Knowledge System (Generic)**
  Mandatory course - an overview of the contribution of India towards multidisciplinary research and development.
- **VSC: Vocational Skill Course**
  Courses aimed at imparting practical skills, hands-on training, and soft skills to increase the employability of students. Specific or supporting the major subject is to be chosen from a basket/pool offered by the college.
- **SEC: Skill Enhancement Course**
  Courses aimed at imparting practical skills, hands-on training, and soft skills to increase students' employability. It could be chosen from a basket/pool offered by the college or a MOOC on Swayam or NPTEL platforms.
- **On-Job Training (OJT)/Internship/Field Project (FP)/Community Engagement Programme (CEP)/Research Project (RP)**
  Application of knowledge/concepts in solving or analysing a real-life problem. All these are related to the major subject.
- **CC: Co-curricular Course**
  For the holistic development of students through Cultural activities such as performing art, visual art, NCC, NSS, Yoga, etc.
- **VEC: Value Education Course**
  Compulsory courses on
  (i) The Constitution of India
  (ii) Environmental Education

B. Sc. Program in Physics: Cumulative Credit Structure

F.Y.B.Sc.																
Level	Sem	Mandatory				Minor		Any Faculty	VSC/SEC	Ability Enhancement Course / Indian Knowledge System/Value Education Course			OJT/FP/CEP/CC/RP	Credit	Cumulative Credit
		Major		Elective				OE							
		C-1	Practical	C-1	Practical	C-1	Practical	C-1		AEC	VEC	IKS			
4.5	I	2 [2L]	2 [2P]	-	-	2 [2L]	2 [2P]	4 [3L+1P]	VSC = 4 [2L + 2P]	2	2	2	-	22	44
	II	2 [2L]	2 [2P]	-	-	2 [2L]	2 [2P]	4 [3L+ 1P]	SEC = 4 [2L + 2P]	2	2	-	CC = 2	22	

S.Y.B.Sc																
Level	Sem	Mandatory						Minor		Any Faculty	VSC/SEC	Ability Enhancement Course / Indian Knowledge System/Value Education Course			OJT/FP/CEP/CC/RP	Credit	Cumulative Credit
		Major				Elective				OE							
		C-1	C-2	C-3	Practical	C-1	Practical	C-1	Practical	C-1		AEC	VEC	IKS			
5.0	III	2 [2L]	2 [2L]	2 [2L]	2 [2P]	-	-	2 [2L]	2 [2P]	2 [2L]	VSC = 2 [2P]	2	-	-	FP = 2, CC = 2	22	44
	IV	2 [2L]	2 [2L]	2 [2L]	2 [2P]	-	-	2 [2L]	-	2 [2L]	SEC = 2 [2P]	2	-	-	CEP = 4, CC = 2	22	

T.Y.B.Sc.																	
Level	Sem	Mandatory							Minor		Any Faculty	VSC/SEC	Ability Enhancement Course / Indian Knowledge System/Value Education Course			OJT/FP/CEP/CC/RP	Credit	Cumulative Credit
		Major					Elective				OE							
		C-1	C-2	C-3	C-4	Practical	C-1	Practical	C-1	Practical	C-1		AEC	VEC	IKS			
5.5	V	2 [2L]	2 [2L]	2 [2L]	2 [2L]	2 [2P]	2 [2L]	2 [2P]	2 [2T]	2 [2P]	-	VSC = 2 [2P]	-	-	-	FP = 2	22	44
	VI	2 [2L]	2 [2L]	2 [2L]	2 [2L]	2 [2P]	2 [2L]	2 [2P]	2 [2T]	-	-	VSC = 2 [2P]	-	-	-	OJT = 4	22	

****L = Lecture , P = Practical**

F.Y.B.Sc. Physics Program Structure and Course Scheme

Semester	Major		Minor	OE	VSC / SEC	AEC/VEC/IKS	OJT/FP/CEP/CC/RP	Total Credit
	Mandatory	Elective						
I	4 Credit [2L + 2P] (One Paper)	NA	4 Credit [2L + 2P] (One Paper)	4 Credit [3L + 1P] (One Paper)	**VSC** 4 Credit [2L + 2P] (One Paper)	AEC – 2 Credit VEC – 2 Credit IKS – 2 Credit (One Paper Each)	NA	**22**
II	4 Credit [2L + 2P] (One Paper)	NA	4 Credit [2L + 2P] (One Paper)	4 Credit [3L + 1P] (One Paper)	**SEC** 4 Credit [2L + 2P] (One Paper)	AEC – 2 Credit VEC – 2 Credit (One Paper Each)	CC – 2 Credit	**22**
Total	**8**	**-**	**8**	**8**	**8**	**10**	**2**	**44**

Programme Educational Objectives

PEO1	Graduates will have a strong foundation in Physics, allowing them to pursue higher education or careers in academia, industry, and research.
PEO2	Graduates will demonstrate proficiency in problem-solving, analytical thinking, and application of Physics concepts in real-world settings.
PEO3	Graduates will be ethical, socially responsible, and contribute to societal well-being through their professional endeavours.
PEO4	Graduates will demonstrate leadership, communication, and teamwork skills, working effectively in multidisciplinary environments.
PEO5	Graduates will engage in lifelong learning to keep up with advancements in Physics and related fields.
PEO6	Graduates will apply their knowledge of Physics in industries, research institutions, and government agencies, contributing to technological innovation.

Programme Outcomes

Upon successful completion of the B.Sc. (Physics) course from Vaze College affiliated to Mumbai University, graduates can expect the following outcomes:

PO1	**Scientific Knowledge** Graduates will demonstrate a strong understanding of core principles of Physics and related disciplines, and will apply theoretical knowledge to solve complex problems in scientific contexts.
PO2	**Problem Analysis** Graduates will be able to identify and analyse complex scientific problems, collect relevant data, and apply appropriate methods to find meaningful solutions.
PO3	**Experimental and Practical Application Skills** Graduates will be able to apply theoretical knowledge to design and conduct practical experiments, analyse data, and derive conclusions. They will also connect experimental outcomes with theoretical concepts, even in papers that include practical components.
PO4	**Modern Tool Usage** Graduates will be proficient in using modern computational and experimental tools and software to model, analyse, and solve problems in Physics.
PO5	**Communication** Graduates will be able to communicate scientific concepts and experimental results effectively, both orally and in writing, to diverse audiences.
PO6	**Lifelong Learning and Societal Contribution** Graduates will recognize the importance of lifelong learning and contribute to societal and environmental challenges through responsible application of scientific knowledge.

Programme Specific Outcomes

PSO1	Understand and apply fundamental concepts of classical mechanics and optics to explain natural phenomena.
PSO2	Develop basic laboratory skills through experiments in mechanics, optics, and electricity.
PSO3	Gain introductory experience with numerical methods and their implementation using Excel for physical problems.
PSO4	Demonstrate understanding of basic electrical circuits and electronic components.
PSO5	Correlate physics principles with daily life experiences to appreciate their relevance and societal impact.

The Detailed Semester and Course Wise Syllabus as follows:

SEMESTER I						
	Code	**Course of Study**	**Cr.**	**L**	**T**	**P**
Major	VSPH100	Classical Mechanics and Optics	2	2	-	-
	VSPH101	Practical based on Classical Mechanics and Optics	2	-	-	4
VSC	VSPH102	Numerical Technique in Physics	2	2	-	-
	VSPH103	Microsoft Excel-Based Practical on Numerical Techniques in Physics	2	-	-	4
Minor	VSPH104	Classical Mechanics and Optics	2	2	-	-
	VSPH105	Practical based on Classical Mechanics and Optics	2	-	-	4
OE	VSPH106	Physics in Everyday Life	3	3	-	-
		Practical based on Physics in Everyday Life	1	-	-	1
AEC		From the Basket	2	2	-	-
VES		From the Basket	2	2	-	-
IKS		From the Basket	2	2	-	-
CC		NA	-	-	-	-
Total			**22**	**15**	**00**	**13**

SEMESTER II						
	Code	**Course of Study**	**Cr.**	**L**	**T**	**P**
Major	VSPH150	Electricity and Electronics	2	2	-	-
	VSPH151	Practical based on Electricity and Electronics	2	-	-	4
SEC	VSPH152	Modern Physics	2	2	-	-
	VSPH153	Practical based on Modern Physics	2	-	-	4
Minor	VSPH154	Electricity and Electronics	2	2	-	-
	VSPH155	Practical based on Electricity and Electronics	2	-	-	4
OE	VSPH156	Physics of Human Health	3	3	-	-
		Practical based on Physics of Human Health	1	-	-	1
AEC		From the Basket	2	2	-	-
VES		From the Basket	2	2	-	-
IKS		NA	-	-	-	-
CC		From the Basket	2	-	-	4
Total			**22**	**15**	**00**	**17**

L = Lecture hours per week
T = Tutorial hours per week
P = Practical hours per week

- **1 Credit = 15 Hours Lecture**
- **1 Credit = 30 Hours Practical**

Semester – I

Paper I – Major / Minor

Course Code: VSPH100 / VSPH104

Credits: 2

Classical Mechanics and Optics

Course Learning Objective

Upon Completion of the course the student will be able to

LO 1	Understand and explain Newton's Laws of Motion and apply them to solve real-world problems involving friction and pseudo forces.
LO 2	Recall the definitions and relations among elastic constants and illustrate their equivalence using real-life material behavior.
LO 3	Describe and analyze interference phenomena arising from both division of wavefront and amplitude, including applications such as thin films and Newton's rings.
LO 4	Distinguish between Fresnel and Fraunhofer diffraction, and evaluate diffraction patterns from slits and gratings using Huygens-Fresnel theory.

Course Code	**Major / Minor**	**Credits**	**Lectures**
VSPH100/VSPH104	**Classical Mechanics and Optics**	**2**	**30**
Course Outcomes : Upon Completion of the course the student will be able to			
CO 1	Apply Newton's laws of motion and analyze problems involving inertial and non-inertial frames, including pseudo forces and friction-based systems.		
CO 2	Calculate and relate different elastic constants and interpret their physical significance through experiments and graphical representations.		
CO 3	Demonstrate the concept of interference using experiments like Young's double slit and Newton's rings and deduce physical quantities from observed patterns.		
CO 4	Analyze and compare diffraction patterns from single slit, double slit, and diffraction grating setups, and predict intensity distributions.		
Unit	**Content**		**No. of Lectures**
Unit 1	**Chapter 1: Newton's Laws of Motion** 1.1 Newton's first, second and third laws of motion, 1.2 Interpretation and applications 1.3 Pseudo forces, Inertial and non-inertial frames of reference. 1.4 Worked out examples (with friction present) **Chapter 2: Elasticity** 2.1 Review of Elastic Constants Y, K, η and σ;		**10**

	2.2 Equivalence of shear strain to compression and extension strains. 2.3 Relations between elastic constants	
Unit 2	**Chapter 3: Interference –I (Division of wave front)** 3.1 Introduction 3.2 Young's Double Slit Experiment **Chapter 4: Interference –II (Division of Amplitude)** 4.1 Interference in thin films 4.2 Interference in wedge shaped film 4.3 Fringes in Wedge shaped films 4.4 Applications of wedge shaped film 4.5 Newton's Rings 4.6 Applications of Newton's ring experiment	**10**
Unit 3	**Chapter 5: Introduction to Diffraction** 5.1 Introduction, Huygens's - Fresnel theory 5.2 Distinction between interference and diffraction 5.3 Fresnel and Fraunhoffer types of diffraction **Chapter 6: Fraunhoffer Diffraction** 6.1 Introduction, Fraunhoffer diffraction at a single slit Intensity distribution in diffraction pattern due to a single slit 6.2 Fraunhoffer diffraction at a double slit, 6.3 Distinction between single slit and double slit diffraction pattern and missing orders 6.4 Plane diffraction Grating, Theory of plane transmission grating, Width of principal maxima	**10**

Reference Books :

1. Halliday, Resnick and Walker, Fundamental of Physics (extended) – (6th Ed.), John Wiley and Sons.
2. H. C. Verma, Concepts of Physics – (Part–I), 2002 Ed. Bharati Bhavan Publishers.
3. Brijlal, Subramanyam and Avadhanulu - A Textbook of Optics, 25th revised ed.(2012) S. Chand
4. Jenkins and White, Fundamentals of Optics by (4th Ed.), McGraw Hill International.

Additional References:

1. Thornton and Marion, Classical Dynamics – (5th Ed)
2. D S Mathur, Element of Properties of Matter, S Chand & Co.
3. R Murugeshan and K Shivprasath, Properties of Matter and Acoustics S Chand.
4. C L Arora, Optics, S Chand.
5. Hans and Puri, Mechanics –, 2nd Ed. Tata McGraw Hill

Practical
Course Code: VSPH101 / VSPH105
Credits: 2
Major/Minor Physics Practical

Course Code VSPH101/VSPH105	Practical based on Classical Mechanics and Optics	Credits 2	Lectures 60
Lists of Experiment of GROUP A			
1.	Vernier Callipers: Length, Breadth, Thickness, Inner and Outer Diameters		
2.	Micrometer Screw Gauge: Diameter of Wire and Thickness of Sheet/Slab		
3.	Measurement of Small Dimensions using Travelling Microscope		
4.	Study of Flywheel		
5.	Surface Tension of liquid by Capillary Rise Method		
6.	Determination of Modulus of Rigidity (η) using Flat Spiral Spring (Method of Vibrations)		
7.	Determination of Young's Modulus by Vibrational Method		
8.	Study of Bar Pendulum		
Lists of Experiment of GROUP B			
1.	Combination of Lenses: Equivalent Focal Length of Lens by Magnification Method (Arrow Method)		
2.	Spectrometer: Determination of Angle of Prism		
3.	Spectrometer: Determination of Refractive Index (μ) of Prism Material		
4.	Study of Thermistor: Resistance vs Temperature Characteristics		
5.	Newton's Rings: Determination of Radius of Curvature of Convex Lens		
6.	Wedge-Shaped Film: Determination of Diameter of Thin Wire or Film		
7.	Determination of Focal Length of Lens by u-v Method		
8.	Study of Single-Slit Diffraction Pattern		

Note: Minimum **6 from each group** and **total 12 experiments** along with skills experiment should be completed in the semester I. All experiments are to be reported in a journal. Certified journal is must to be eligible to appear for the semester end practical.

Vocational Skill Course
Course Code: VSPH102
Credits: 2

Numerical Techniques in Physics

Course Learning Objective

Upon Completion of the course the student will be able to

LO 1	Understand the principles of various root-finding iterative methods and their convergence behavior.
LO 2	Apply interpolation techniques such as Lagrange's method and difference tables to estimate unknown values from discrete data.
LO 3	Analyze and implement curve fitting techniques (linear, polynomial, exponential, trigonometric) for modeling real-world data.
LO 4	Understand and apply numerical integration methods like Simpson's rule and trapezoidal rule, and evaluate the associated errors.

Course Code VSPH102	**VSC – Numerical Techniques in Physics**	**Credits** 2	**Lectures** 30
Course Outcomes : Upon Completion of the course the student will be able to			
CO 1	Apply and compare different iterative techniques such as Bisection, Newton-Raphson, Secant, and Gauss elimination to solve equations.		
CO 2	Use interpolation methods and difference tables to estimate intermediate values from tabulated data and assess the truncation error.		
CO 3	Perform curve fitting and regression analysis using computational tools to fit polynomial, exponential, and trigonometric models.		
CO 4	Implement numerical integration methods and evaluate their accuracy using error analysis and algorithms.		
Unit	**Content**		**No. of Lectures**
Unit 1	**Chapter 1: Iterative methods** 1.1 Beginning an iterative method 1.2 The method of successive bisection, 1.3 The method of false position, Newton-Raphson iterative method 1.4 The secant method, 1.5 The method of successive approximations, 1.6 The Gauss elimination method 1.7 Applications		**10**

Unit 2	**Chapter 2: Interpolation** 2.1 Lagrange interpolation 2.2 Difference tables, 2.3 Truncation error in interpolation, 2.4 Linear regression, 2.5 Polynomial regression, 2.6 Fitting exponential and trigonometric functions 2.7 Applications	**10**
Unit 3	**Chapter 3: Integration** 3.1 Numerical integration, 3.2 Simpson's rule, 3.3 Trapezoidal Rule, 3.4 Errors in integration formulae, 3.5 Algorithms for integration of tabulated function, 3.6 Applications	**10**

Reference Books :

1. Computer Oriented Numerical Methods, by V. Rajaraman (PHI Learning Publications)
2. Numerical methods for scientists and engineers, by H. M. Antia (Hindustan Book Agency)
3. Computational Physics, by N. J. Giordano and Hisao Nakanishi (Pearson Education India)
4. Introductory Methods of Numerical Analysis by S. S. Sastry, 5th ed. (PHI Learning Publications

Vocational Skill Course
Course Code: VSPH103
Credits: 2

Microsoft Excel-Based Practical on Numerical Techniques in Physics

Course Code VSPH103	Microsoft Excel-Based Practical on Numerical Techniques in Physics	Credits 2	Lectures 60

1.	**Bisection Method -** Solve the given function using successive bisections. Plot convergence steps and compare with the theoretical root.
2.	**False Position Method (Regula Falsi) -** Implement in Excel using an initial interval and stopping criteria. Display iterations step-by-step in a table.
3.	**Newton-Raphson Method** - Automate root-finding using derivative values calculated in Excel. Include a convergence plot.
4.	**Secant Method** - Find the root using Excel formula. Display the sequence of approximations.
5.	**Successive Approximation Method** - Use the iterative form $x = g(x)$. Show each step until convergence.
6.	**Gauss Elimination Method** - Solve a system of 2 or 3 linear equations using row operations. Present the augmented matrix and each elimination step.
7.	**Lagrange Interpolation** - Input data points and interpolate values between them. Plot the original data points and the interpolated curve.
8.	**Linear Regression** - Fit a straight-line $y = mx + c$ using built-in Excel functions or formulae. Show slope, intercept, and graph.
9.	**Polynomial Regression** - Fit a 2nd or 3rd degree polynomial using Excel's LINEST function or chart options. Display the regression equation and curve.
10.	**Fitting Exponential Functions** - Fit data of the form $y = a.e^{bx}$ using logarithmic transformations and regression techniques.
11.	**Trigonometric Function Fitting** - Fit data to a trigonometric model such as $y = a.\sin(bx + c)$ using Excel tools or transformations.
12.	**Trapezoidal Rule** - Integrate a tabulated or defined function over a given interval. Show area approximations visually using Excel charts.
13.	**Simpson's 1/3 Rule** - Calculate the integral using evenly spaced data points. Highlight differences from the Trapezoidal Rule results.
14.	**Error Analysis in Integration** - Estimate and interpret numerical error between exact and approximate results. Discuss accuracy and limitations.
15.	**Algorithm for Tabulated Function Integration** - Given a table of x and f(x), compute the area under the curve using any suitable method. Use conditional formatting in Excel to highlight function values and integration weights.

Note: A **minimum of 12 experiments** must be completed from the VSC paper in Semester I. All experiments should be recorded **neatly in a certified journal**. Submission of the certified journal is **compulsory to be eligible** for the semester-end practical examination.

Semester – II

Paper I – Major / Minor

Course Code: VSPH150 / VSPH154

Credits: 2

Electricity and Electronics

Course Learning Objective

Upon Completion of the course the student will be able to

LO 1	Understand the behavior of R, L, C elements in AC circuits and apply phasor methods to analyze resonance, power, and Q-factor.
LO 2	Analyze and interpret the working of standard AC bridges and their applications in impedance measurements.
LO 3	Apply circuit theorems (Thevenin, Norton, Superposition, etc.) to solve complex DC and AC network problems.
LO 4	Understand the operation of BJTs and logic gates, and develop basic circuit applications including rectifiers, filters, and adders.

Course Code	Major / Minor	Credits	Lectures
VSPH150/VSPH154	Electricity and Electronics	2	30

Course Outcomes : Upon Completion of the course the student will be able to

CO 1	Analyze AC circuits with resistive, inductive, and capacitive components using phasor representation, and determine conditions for resonance and Q-factor.
CO 2	Compare and apply different AC bridges like Maxwell, Wien, and Hay for measuring impedance and frequency.
CO 3	Solve electrical circuits using various network theorems and design simple regulated power supply circuits using rectifiers and filters.
CO 4	Explain the working of BJTs in different configurations and design logic circuits using gates, Boolean expressions, and adder circuits.

Unit	Content	No. of Lectures
Unit 1	**Chapter 1: Alternating current theory** 1.1 AC circuit containing pure R, pure L and pure C, 1.2 Representation of sinusoids by complex numbers, 1.3 Series L-R, C-R and LCR circuits. 1.4 Resonance in LCR circuit (both series and parallel) 1.5 Power in ac circuit 1.6 Q-factor **Chapter 2: A. C Bridges** 2.1 AC-bridges: General AC bridge 2.2 Maxwell, De-Sauty 2.3 Wien Bridge	**10**

	2.4 Hay Bridge	
Unit 2	**Chapter 3: Circuit Theorem** 3.1 Voltage Divider, Current divider 3.2 Ideal voltage source and ideal current source 3.3 Superposition Theorem 3.4 Thevenin's Theorem 3.5 Norton's Theorem 3.6 Reciprocity Theorem 3.7 Maximum Power Transfer Theorem 3.8 Numerical related to circuit analysis using the above theorems **Chapter 4: DC power supply** 4.1 Half wave rectifier & Full wave rectifier 4.2 Bridge rectifier 4.3 Peak inverse voltage and Ripple factor of full wave rectifier 4.4 Clipper and Clampers (Basic circuits only) 4.5 Capacitor Filter 4.6 Zener diode as voltage stabilizer	**10**
Unit 3	**Chapter 5: Bipolar Junction Transistors** 5.1 Introduction to BJT: symbols and operation 5.2 BJT Circuit configurations 5.3 Current gain of BJT in CB, CE and CC configuration 5.4 Input and output characteristics in CB, CE configuration **Chapter 6: Digital Electronics** 6.1 Logic gates (Review), NAND and NOR as universal building block 6.2 EXOR gate: logic expression, logic symbol, truth table 6.3 Implementation using basic gates and its applications 6.4 Boolean algebra, Boolean theorems 6.5 De-Morgan theorems, Half adder and Full adder	**10**

Reference Books :

1. VM: V K Mehta and R Mehta Electronics Principals, Multicoloured Revised 11th Ed. reprint in 2012 ,S Chand.
2. CR: D. Chattopadhyay, P C Rakshit , Electricity and Magnetism 7th Ed. New Central Book agency.
3. TT :B.L. Theraja and A.K. Theraja , A Textbook of Electrical Technology Vol. I , S. Chand Publication
4. BN : Boylestad and Nashelsky, Electronic devices and Circuit Theory: 7th edition, Prentice Hall of India.

Practical
Course Code: VSPH151 / VSPH155
Credits: 2
Major / Minor Physics Practical

Course Code VSPH151/VSPH155	Practical based on Electricity and Electronics	Credits 2	Lectures 60
Lists of Experiment of GROUP A			
1.	**LR Circuit**: To determine the given inductance and phase angle		
2.	**CR Circuit**: To determine the given capacitance and phase angle		
3.	**AC Mains Frequency**: To determine the frequency of AC mains		
4.	**LCR Series Resonance**: To determine the resonance frequency of an LCR series circuit		
5.	**LCR Parallel Resonance**: To determine the resonance frequency of an LCR parallel circuit		
6.	**Thevenin's Theorem**: To verify Thevenin's theorem for DC circuit		
7.	**Norton's Theorem**: To verify Norton's theorem for DC circuits		
8.	**Reciprocity Theorem**: To verify the Reciprocity Theorem in electrical networks		
9.	**NPN Transistor (CE Configuration)**: To study the input characteristics		
10.	**NPN Transistor (CE Configuration)**: To study the output characteristics		
11.	**De Sauty's Bridge**: To determine unknown capacitance using De Sauty's capacitance bridge		
Lists of Experiment of GROUP B			
1.	**Zener Diode Characteristics**: Study of V-I Characteristics		
2.	**Zener Diode as Voltage Regulator**: Study of Regulation Properties		
3.	**Bridge Rectifier**: Study of Load Regulation with and without Filter Capacitor		
4.	**Universal Gates**: Verification of NAND and NOR Gates as Universal Building Blocks		
5.	**EX-OR Gate using NAND Gates**: Design and Verification		
6.	**EX-OR Gate using NOR Gates**: Design and Verification		
7.	**De Morgan's Theorems**: Verification using Basic Gates		
8.	**De Morgan's Theorems**: Verification using Universal Gates		
9.	**Half Adder and Full Adder**: Design and Verification		
10.	**Half Subtractor and Full Subtractor**: Design and Verification		
11.	**Boolean Algebra**: Verification of Laws and Theorems using NAND/NOR Gates		

Note: Minimum **6 from each group** and **total 12 experiments** should be completed in the semester II. All experiments are to be reported in a journal. Certified journal is must to be eligible to appear for the semester end practical.

Skill Enhancement Course
Course Code: VSPH152
Credits: 2

Modern Physics

Course Learning Objective

Upon Completion of the course the student will be able to

LO 1	Understand the limitations of classical physics and the origins of modern physics through experiments such as blackbody radiation, photoelectric effect, and Compton scattering.
LO 2	Explore foundational quantum concepts including the de Broglie hypothesis, Davisson–Germer experiment, and the Heisenberg Uncertainty Principle with its implications.
LO 3	Learn and apply fundamental concepts of crystal structures, symmetry, Miller indices, and interplanar spacing in solid-state physics.
LO 4	Understand the principles of X-ray generation, diffraction, and applications, and gain basic conceptual knowledge of radioactivity and its uses in real life.

Course Code VSPH152	**SEC –** Modern Physics	**Credits** 2	**Lectures** 30
Course Outcomes : Upon Completion of the course the student will be able to			
CO 1	Explain key experimental phenomena such as blackbody radiation, photoelectric effect, and Compton effect, and their role in the development of quantum theory.		
CO 2	Apply quantum concepts like wave-particle duality and uncertainty principle to explain microscopic phenomena and their applications.		
CO 3	Describe and interpret various crystal structures and calculate Miller indices and interplanar distances for given crystal systems.		
CO 4	Analyze the production and applications of X-rays, and demonstrate conceptual understanding of radioactivity, nuclear decay, and its practical applications in medicine and archaeology.		
Unit	**Content**		**No. of Lectures**
Unit 1	**Chapter 1: Origins of Modern Physics** 1.1 Breakdown of Classical Physics 1.2 Blackbody Radiation and Planck's Hypothesis 1.3 Photoelectric Effect and Einstein's Equation 1.4 Compton Effect (qualitative) **Chapter 2: Foundations of Quantum Theory** 2.1 de-Broglie hypothesis		**10**

	2.2 Davisson–Germer Experiment 2.3 Heisenberg's Uncertainty Principle (simple statement and examples) 2.4 Applications of HUP (Non-Existence of electron in Nucleus)	
Unit 2	**Chapter 3: Structure of solid** 3.1 Crystalline vs. Amorphous Solids 3.2 Unit Cell, Lattice Types, Unit Cells and lattice parameters, Primitive Cells, Crystal Systems, Crystal Symmetry, Bravais space lattices 3.3 Study of S.C, B.C.C & F.C.C Crystal Structure, Diamond Crystal Structure, NaCl Crystal Structure, HCP (Hexagonal Closed Packed) Crystal Structure, Determination of c/a ratio of HCP unit cell 3.4 Miller Indices (Plane & Directions) 3.5 Interplanar Distance	**10**
Unit 3	**Chapter 4: X-Rays** 4.1 X-Rays production and properties. 4.2 Continuous and characteristic X-Ray spectra, 4.3 X-Ray Diffraction, 4.4 Bragg's Law 4.5 Applications of X-Rays – Industrial & Medical 4.6 Bragg's Law and Bragg Spectrometer **Chapter 5: Radioactivity** 5.1 Basics of Radioactivity 5.2 Types of Radioactive Decay (α, β, γ) 5.3 Half-life and Decay Law (concept only) 5.4 Mass Defect and Binding Energy (qualitative) 5.5 Applications: Carbon Dating, Radiation in Medicine	**10**

Reference Books :

1. BSS: N Subrahmanyam, Brijlal and Seshan, Atomic and Nuclear Physics Revised Ed. Reprint 2012, S.Chand
2. Arthur Beiser: Perspectives of Modern Physics : Tata McGrawHill
3. Introduction to Solid State Physics: S. O. Pillai (New Age International)
4. Introduction to Solid State Physics: Babar &Puri (S.Chand Publication)

Skill Enchanment Course
Course Code: VSPH153
Credits: 2

Practical Based on Modern Physics

Course Code VSPH153	Practical based on Modern Physics	Credits 2	Lectures 60
1.	To use a breadboard for assembling basic electronic circuits (Transistor as switch, Bridge Rectifier)		
2.	To use a breadboard to implement logical circuits (EX-NOR gate)		
3.	To use an oscilloscope for measurement of frequency, voltage, and phase angle		
4.	To determine an unknown frequency or compare two frequencies using Lissajous figures on a CRO		
5.	To study charging and discharging characteristics of a capacitor		
6.	To use a Digital Multimeter (DMM) for basic measurements		
7.	To use a PC for graph plotting and data visualization		
8.	To study clipper and clamper circuits		
9.	To study a thermocouple as a temperature sensor		
10.	To verify Planck's constant using Light Emitting Diodes (LEDs)		
11.	To demonstrate the concept of radioactive half-life using a dice model		
12.	To study the photoelectric effect using a photocell setup		
13.	To determine the wavelength of light using a diffraction grating		
14.	To determine the wavelength of light using a steel ruler (diffraction method)		
15.	To determine the groove spacing of a CD/DVD using a LASER		
16.	To perform X-ray Diffraction (XRD) analysis for identifying crystal structures (SC, BCC, FCC) and determining Miller indices form given data.		

Note: A **minimum of 12 experiments** must be completed from the SEC paper in Semester II. All experiments should be recorded **neatly in a certified journal**. Submission of the certified journal is **compulsory to be eligible** for the semester-end practical examination.

Theory / Practical Examination Pattern for
(Major / Minor and VSC / SEC)

- **Internal Assessment – Theory Paper (Total: 40 Marks)**

Sr. No.	Component	Nature of Assessment	Marks
1.	**CIA-1** **Class Test** (Short Answers / MCQs / Objective Questions)	Written test conducted in class	**15**
2.	**CIA-2** **Assignment / Project / Presentation / Book Review / Research Review**	Individual or group work submitted as report or presented orally	**15**
3.	**CIA-3** **Participation, Performance & Attendance**	Based on engagement, attentiveness, regularity	**10**
Total			**40**

- **External Assessment – Semester End Theory Paper (Total: 60 Marks)**

Paper Name		
Duration : 2 Hours		**Marks : 60**
Q. 1	Questions Based on Unit 1	15
Q. 2	Questions Based on Unit 2	15
Q. 3	Questions Based on Unit 3	15
Q. 4	Questions Based on Unit 1, 2, 3	15

- **External Assessment – Semester End Practical Examination (Total: 100 Marks)**
  - Every student must maintain and complete a practical journal as per the prescribed syllabus.
  - The journal must be duly checked and certified by the subject teacher and HOD.
  - Students without a completed and certified journal will not be permitted to appear for the practical examination.

Component	Marks
Experiment - I	40
Experiment - II	40
Viva Voce	10
Journal Evaluation	10
Total Marks	**100**