



S.V. University 4-Year Honours Degree Programme
BSc (Physics) Honours Degree Syllabus (W.E.F. AY-2026-27)

**Model Syllabus for 4-Year UG Honours in B.Sc. (Physics) as Major in
consonance with Curriculum framework w.e.f. AY 2026-27**

COURSE STRUCTURE

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
II	IV	8	Electricity, Magnetism and Electromagnetic Theory	3	3
			Electricity, Magnetism and Electromagnetic Theory-Practical	2	1
		9	Analog Electronics	3	3
			Analog Electronics-Practical	2	1
		10	Advances in Physics	3	3
			Advances in Physics-Practical	2	1

SEMESTER-IV

COURSE 8: ELECTRICITY, MAGNETISM AND ELECTROMAGNETIC THEORY

Theory

Credits: 3

3 hrs/week

COURSE OBJECTIVE:

The course on Electricity, Magnetism and Electromagnetic theory aims to provide students with a fundamental understanding of the principles of electricity, magnetism, and electromagnetic theory.

LEARNING OUTCOMES:

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

1. Understand the Gauss law and its application to obtain electric field in different cases and formulate the relationship between electric displacement vector, electric polarization, Susceptibility, Permittivity and Dielectric constant.
2. To learn the methods used to solve problems using loop analysis, Nodal analysis, Thvenin's theorem, Norton's theorem, and the Superposition theorem
3. Distinguish between the magnetic effect of electric current and electromagnetic induction and apply the related laws in appropriate circumstances.
4. Understand Biot and Savart's law and Ampere's circuital law to describe and explain the generation of magnetic fields by electrical currents.
5. Develop an understanding on the unification of electric, and magnetic fields and Maxwell's equations governing electromagnetic waves.
6. Phenomenon of resonance in LCR AC-circuits, sharpness of resonance, Q- factor, Power factor and the comparative study of series and parallel resonant circuits

UNIT-I: ELECTROSTATICS AND DIELECTRICS

(9 hrs)

Gauss's law - Statement and its proof, Electric field intensity due to uniformly charged solid sphere, Electrical potential-Equipotential surfaces, Potential due to a uniformly charged sphere. Dielectrics-Polar and Non-polar dielectrics - Effect of electric field on dielectrics, Dielectric strength, Electric displacement D, electric polarization Relation between D, E and P, Dielectric constant and electric susceptibility.

UNIT-II: CURRENT ELECTRICITY

(9 hrs)

Electrical conduction - drift velocity-current density, equation of continuity, ohms law and limitations, Kirchhoff's Law's, Branch current method, Nodal Analysis, Star to Delta & Delta to Star conversions. Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum power transfer theorem.

UNIT-III: MAGNETOSTATICS AND ELECTROMAGNETIC INDUCTION (9 hrs)

Magneto statics: Biot-Savart's law and its applications: (i) long straight wire and (ii) circular loop, Hall Effect, determination of Hall coefficient and applications, magnetic charge, concept of vector potential.

Electromagnetic Induction: Faraday's laws of electromagnetic induction, Lenz's law, Self-induction and Mutual induction, Self- inductance of a long solenoid, Magnetic Energy density, mutual inductance of a pair of coils, coefficient of Coupling.

UNIT-IV ELECTROMAGNETIC WAVES-MAXWELL'S EQUATIONS (9 hrs)

Maxwell's equations: integral and differential forms (No derivation), Continuity equation, Concept of displacement current. Plane electromagnetic wave equation, Hertz experiment - Transverse nature of electromagnetic waves, Electromagnetic wave equation in conducting media, Skin depth, Poynting theorem-Pointing vector, Wave equations for E & B, Maxwell's equations in matter.

UNIT-V VARYING AND ALTERNATING CURRENTS (9 hrs)

Growth and decay of currents in LR, CR, LCR circuits-Critical damping, alternating current - A.C. fundamentals, and A.C through pure R, L and C, Relation between current and voltage in LR and CR circuits, Phasor and Vector diagrams, LCR series and parallel resonant circuit, Q - factor, Power in ac circuits, Power factor.

REFERENCE BOOKS:

1. BSc Physics, Vol.3, Telugu Akademy, Hyderabad.
2. Electricity and Magnetism, D.N. Vasudeva. S. Chand & Co.
3. Electricity, Magnetism with Electronics, K.K. Tewari, R. Chand & Co.,
4. "Electricity and Magnetism" by Brijlal and Subramanyam Ratan Prakashan Mandir, 1966
5. "Electricity and Magnetism: Fundamentals, Theory, and Applications" by Murugesan, Kiruthiga Siva prasath, and M. Saravanapandian
6. "Electricity and Magnetism: Theory and Applications" by Ajoy Ghatak and Lokanathan
7. Electricity and Magnetism: Problems and Solutions" by Ashok Kumar and Rajesh Kumar
8. Electricity and Magnetism, R.Murugesan, S. Chand & Co.

SEMESTER-IV

COURSE 8: ELECTRICITY, MAGNETISM AND ELECTROMAGNETIC THEORY

Practical

Credits: 1

2 hrs/week

COURSE OBJECTIVE:

The Course Objective for a practical course in electricity and magnetism may include to develop practical skills in handling electrical and electronic components, such as resistors, capacitors, inductors, transformers, and oscillators.

LEARNING OUTCOMES:

1. Demonstrate a thorough understanding of the fundamental concepts and principles of electricity and magnetism.
2. Apply the laws and principles of electricity and magnetism to analyze and solve electrical and magnetic problems.
3. Design, construct, and test electrical circuits using various components and measuring instruments.
4. Measure and analyze electrical quantities such as voltage, current, resistance, capacitance, and inductance using appropriate instruments.
5. Apply the principles of electromagnetism to understand and analyze the behavior of magnetic fields and their interactions with electric currents

Minimum of 6 experiments to be done and recorded

1. LCR circuit series resonance, Q factor.
2. LCR circuit parallel resonance, Q factor.
3. Determination of AC-frequency –Sonometer.
4. Verification of Kirchhoff's laws and Maximum Power Transfer theorem.
5. Field along the axis of a circular coil carrying current-Stewart & Gee's apparatus.
6. Charging and discharging of CR circuit-Determination of time constant
7. A.C Impedance and Power factor
8. Determination of specific resistance of wire by using Carey Foster's bridge.
9. Study of electric field and equipotential lines using conducting paper/Solution
10. Measurement of inductance using bridge method (Maxwell's or Anderson's bridge)
11. Demonstration of electromagnetic shielding (Faraday cage effect)
12. Study of skin effect using high-frequency AC and measuring resistance variation
13. Simulation of electromagnetic wave propagation using MATLAB/Python
14. Poynting vector direction demonstration using polarizers and wave sources (conceptual demo)
15. Q factor and resonance frequency using CRO in LCR circuits (with variable frequency AC generator)

STUDENT ACTIVITIES

UNIT-I Electrostatics and Dielectrics

Conduct a simulation to visualize equipotential surfaces for a given charge distribution.

Conduct a group discussion on the significance of electric field lines and how they can be used to predict the motion of charged particles in electric fields.

UNIT-II Current electricity

Conduct a Wheatstone bridge experiment in class and discuss the balancing condition and sensitivity. Conduct a group activity where students are divided into groups and assigned a different circuit analysis method (nodal analysis, mesh analysis, superposition theorem, etc.) and asked to present their findings to the class.

UNIT-III Magneto statics and Electromagnetic Induction

Conduct a demonstration to show the Hall Effect and measure the Hall coefficient of a given material. Conduct a group activity where students are divided into groups, and assigned a different application of Faraday's law (electromagnetic induction, transformers, etc.) and asked to present their findings to the class.

UNIT-IV Electromagnetic waves

Conduct a group activity where students are asked to research the history of the development of Maxwell's equations and present their findings to the class.

Conduct a simulation to visualize the propagation of electromagnetic waves in different media (vacuum, air, water, etc.) and discuss the differences in the behaviour of waves in different media.

UNIT-V Varying and alternating currents

Conduct a demonstration to show the resonance in an LCR circuit and measure the Q-factor.

Conduct a group activity where students are divided into groups and assigned a different power factor correction method (capacitor banks, synchronous condensers, etc.) and asked to present their findings to the class.

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4- Year UG Honours, Major
Syllabus
(2026-27)
Semester-IV

Model Question Paper

Time : 3hrs

Marks:75

Part-A

Answer any Five Questions. Each Question carries 3 Marks.

5x3=15

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

Answer the following questions. Each question carries 12 Marks

5x12=60

11. a) Unit-I
(Or)
b) Unit-I

12. a) Unit-II
(Or)
b) Unit-II

13. a) Unit-III
(Or)
b) Unit-III

14. a) Unit-IV
(Or)
b) Unit-IV

15. a) Unit-V
(Or)
b) Unit-V