Paper V: Electricity, Magnetism&
Electronics(For Maths Combinations)

V Semester

Work load: 60 hrs per semester **4 hrs/week**

UNIT-I (12 hrs)

1. **Electric field intensity and potential:**
   Gauss's law statement and its proof- Electric field intensity due to Uniformly chargedsphere.Electrical potential – equipotential surfaces- potential due to i) a point charge,
   ii) uniformly charged sphere.
2. **Dielectrics:**
   Electric dipolemoment and molecular polarizability- Electric displacement D, electric polarization P – relation between D, E and P- Dielectric constant and susceptibility.

UNIT-II (12 hrs)

3. **Electric and magnetic fields**
   Biot-Savart's law, explanation and calculation of B due to long straight wire, a circularcurrent loop and solenoid
4. **Electromagnetic induction**
   Faraday's law-Lenz's law- Self and mutual inductance, coefficient of coupling, calculationof self inductance of a long solenoid, energy stored in magnetic field.

UNIT-III (12 hrs)

5. **Alternating currents and electromagnetic waves**
   Alternating current - Relation between current and voltage in LR and CR circuits, vectordiagrams, LCR series and parallel resonant circuit, Q –factor, power in ac circuits.
6. **Maxwell's equations**
   Idea of displacement current - Maxwell's equations (integral and differential forms) (noderivation), Maxwell's wave equation (with derivation).

UNIT-IV (12 hrs)

7. **Basic electronics:**
   PN juction diode, Zener diode, I-V characteristics, PNP and NPN transistors, CB, CE andCC configurations – Relation betweena, b and g - transistor (CE) characteristics - Determination of hybrid parameters.

UNIT-V: (12 hrs)

8. **Digital electronics**
   Number systems - Conversion of binary to decimal system and vice versa. Binary additionand subtraction (1's and 2's complement methods).Laws of Boolean algebra - De Morgan's laws-statement and proof, Basic logic gates, NAND and NOR as universal gates, exclusive- OR gate, Half adder and Full adder.

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. Principles of Electronics, V.K. Mehta, S.Chand& Co.,
5. Digital Principles and Applications, A.P. Malvino and D.P.Leach, Mc GrawHillEdition.

Practical Paper V: Electricity, Magnetism & Electronics

Work load: 30 hrs **2 hrs/week**

Minimum of 6 experiments to be done and recorded

1. Figure of merit of a moving coil galvonometer.
2. LCR circuit series/parallel resonance, Q factor.
3. Determination of ac-frequency –sonometer.
4. Verification of Kirchoff's laws and maximum power transfer theorem.
5. Field along the axis of a circular coil carrying current.
6. PN Junction Diode Characteristics
7. Zener Diode Characteristics
8. Transistor CE Characteristics- Determination of hybrid parameters
9. Logic Gates- OR,AND,NOT and NAND gates. Verification of Truth Tables.
10. Verification of De Morgan's Theorems.

Scheme of Valuation

Practicals	**50 marks**
Formula & Explanation	6
Tabular form +graph +circuit diagram	6
Observations	12
Calculation, graph, precautions & Result	6
Viva-Voce	10
Record	10

Suggested student activities

Student seminars, group discussions, assignments, field trips, study project and experimentationusing virtual lab

Examples

Seminars - A topic from any of the Units is given to the student and asked to give abrief seminar presentation.

Group discussion - A topic from one of the units is given to a group of students and asked todiscuss and debate on it.

Assignment - Few problems may be given to the students from the different units andasked them to solve.
Field trip - Visit to Satish Dhawan Space Centre, Sriharikota / Thermal andhydroelectric power stations / Science Centres, any other such visit etc.
Study project - Web based study of different satellites and applications.

QUESTION BANK

UNIT – I (Electric field intensity and potential)

Essay Questions(10M)

1. State and prove Gauss theorem in electrostatics. Derive an expression for the electric field

due to uniformly charged sphere.

2. State and prove Gauss theorem in electrostatics. Derive an expression for the electric field

due to uniformly charged sphere(non-conducting)at points (i)Outside the sphere (ii)at the surface of the sphere and (iii)inside the sphere

3. Use Gauss's law to find electric intensity at a point near the infinite plane sheet of charge.

4. Derive an expression for the force on the surface of charged conductor.

5. Define electric potential. Derive an expression for potential due to a charged spherical conductor.

Short Answer (5M)

1. State and prove Gauss theorem in electrostatics.

2. State and prove Gauss law in differential form.

3. Derive and explain Gauss law in electrostatics and write any two applications.

4. What do you mean by electric potential difference and electric potential?

5. Explain equipotential surfaces.

6. Obtain an expression for potential due to a point charge.

Dielectrics

Essay Questions(10M)

1.Define D,P, and E and deduce relation between them. Hence derive the relationship between

dielectric constant and susceptibility .

Short Answer (5M)

1. Explain polarization and polarizability.

2. Define polarization and show that it is equal to the surface density.

3. What is electric displacement? How it is related to electric intensity?

4. Define D,P and E and deduce relation between them.

5. Define electric constant and susceptibility. Derive a relationship between dielectric constant

and susceptibility.

6. State and prove the boundary conditions at the dielectric surface.

UNIT-II(Electric and magnetic fields)

Essay Questions(10M)

1.state and explain biot and savarts law. derive an expression for magnetic induction at a point due to

an infinite straight conductor carrying current.

2.state and explain biot and savarts law. derive an expression for magnetic induction at a point due to

a circular wire carrying current.

3. state and explain biot and savarts law. Derive an expression for magnetic induction at a point due

to a long solenoid.

Short Answer (5M)

1. What is hall effect and mention its application.

2. write a short note on hall effect

3. state and explain biot and savarts law.

UNIT-III (Electromagnetic induction)

Essay Questions(10M)

1.What is self induction and define coefficient of self induction and obtain an expression for the selfinductance of solenoid.

2.define self inductance. Calculate the self inductance due to a long solenoid.

3.Define mutual inductance, coefficient of coupling and arrive at an expression for coefficient of

coupling between two coils separated by a distance d.

Short Answer (5M)

1.State faraday's law of electric magnetic induction .derive the differential and integral forms of

Faraday's law

2.State and explain lenz's law. Does it contradict the lae of conservation of energy?

3.What is self inductance? In what units is it expressed?

4.What is mutual inductance? what are the units in which the coefficient of mutual inductance is

expressed?

5. (a) state and explain faraday's law and lenz's law of induction

(b) derive an expression for mutual inductance between two coils.

6.explain the principle of transformer

UNIT-IV(Varying and Alternating currents)

Essay Questions(10M)

1.Derive an expression for the growth and decay of current in an inductance- resistance circuit.

2.discuss the nature of growth and decay of current in a capacitance –resistance circuit.

3.Discuss the growth and decay in a circuit containing resistance ,inductance and capacitance when

direct e.m.f is applied.

Short Answer (5M)

1.Write a short note on power factor?

2.Write a short note on Q-factor?

3.Discuss the growth of charge in C-R Circuit.

4.Write about the growth and decay of current in L-R Circuit.

5.Derive the decay of charge in L-C-R Circuit.

6.Calculate the impedance of L,C, and R in series of an A.C.circuit

7.What is electric resonance? Distinguish between series and parallel resonance.

UNIT-V(Maxwell's equations)

Essay Questions(10M)

1.write Maxwell's equations in differential and integral forms. Derive an expression for energy flow

by electromagnetic waves

2.Describe Hertz experiment for the production and detection of electromagnetic waves

3.what is pointing vector ? what is its significance?

4.write down maxwell's equation for electromagnetic fields and explain what each equation represents. Show that electromagnetic waves are transverse in nature.

Short Answer (5M)

1.write down the Maxwell's equation in differential form.

2.what is meant by Poynting vector? Discuss the use in electromagnetic principles.

3.Show that electromagnetic waves are transverse in nature.