Kadi Sarva Vishvavidyalaya, Gandhinagar
Bachelor of Engineering (Electrical Engineering Syllabus)

B.E Semester: Vth (EE)
Subject Name & Subject Code: Engineering Electromagnetics (EE-502)

Course Objective:

- To identify and solve the problems regarding mathematical operations related to the field distributed in the three dimensional space.
- To understand concepts of vectors for engineering electromagnetic.

A. Teaching / Examination Scheme

SUBJECT		Teaching Scheme				Total Credit	Examination Scheme					Total Marks
		L	T	P	Total		THEORY		IE	CIA	PR. / VIVO	
CODE	NAME	Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
EE-502	Engineering Electromagnetics	4	2	0	6	6	3	70	30	20	00	120

1.Vector Analysis:

Scalars and vectors- Vector algebra, The coordinate systems (Cartesian, cylindrical and spherical), Position and distance vectors, Differential length, area and volume, Dot product and cross product, Transformation of vectors, Line, surface and volume integrals, examples.

2.Electrostatic Fields In Free Space:

Coulomb's law, Electric field intensity, Types of charge distribution, Electric field intensity due to various charge distribution, Electrical Field due to infinite line charge, Electrical Field due to charged circular ring, Electrical Field due to infinite sheet of a charge, Electric flux, Electric flux density, Relationship between Electric flux density and Electric field intensity, Electric flux density for various charge distribution, Gauss's law, Application of Gauss's law, Gauss's law applied to differential volume element, Divergence Theorem, Maxwell's first equation, examples.

3.Energy and Potential:

Work done, Electric potential and potential difference, Potential due to point charge, line charge, surface charge, volume charge, Potential Gradient, relation between field intensity and electric potential, conservative field, An electric dipole and flux lines.

4.Conductors and Dielectrics:

Convection and conduction current densities, Continuity Equation, Conductor properties, Relaxation Time, Dielectric materials, Boundary conditions, Polarization and dielectric constant-Boundary conditions between conductor and free space, Poisson's and Laplace's equations, Uniqueness theorem, examples.

5.Steady Magnetic Field:

Magnetic field and its properties, Biot-Savart's law, Magnetic field intensity due to infinite long straight conductor, Ampere's circuital law, application of ampere's circuital law, Curl, Stokes' theorem, Magnetic flux and magnetic flux density, Magnetic field intensity due to various current configurations, Maxwell's equations for static EM fields, Magnetic resonance Imaging, Magnetic prospecting.

6.Magnetic Forces and Materials:

Force on a moving point charge, Lorentz force equation, Magnetic forces and torques, A magnetic dipole, magnetization and permeability, Classification of magnetic materials, Magnetic boundary conditions, Neuman's formula, Inductance and mutual inductance, Magnetic energy, magnetic circuits, Magnetic recording, Shielding.

7.Time Varying Fields and Maxwell's Equations:

Faraday's law, Displacement current and current density, Maxwell's equation in point form and integral form, Boundary condition for time varying field, Magnetic Brake, Magnetic Levitation, electromagnetic launcher, Magneto-hydrodynamic generator,EM waves.

8.Analytical and Numerical techniques:

Advantages of numerical techniques Separation of variable method, Method of images, Finite difference method (FDM), Finite Element method (FEM), Application of numerical techniques.

INSTRUCTIONAL METHOD AND PEDAGOGY (Continuous Internal Assessment (CIA) Scheme)

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures, practical's and Tutorial which carries 05 Marks.
- At regular intervals assignments is given. In all, a student should submit all assignments of 05 marks each.
- Classroom participation and involvement in solving the problems in Tutorial rooms carries 05 Marks.
- Viva Voce will be conducted at the end of the semester of 05 Marks.
- One internal exam of 30 marks is conducted as a part of mid semester evaluation.
- Experiments shall be performed in the laboratory related to course contents.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concept being taught in lectures.

STUDENTS LEARNING OUTCOME:

On successful completion of the course

- The student can learn about various co-ordinate system and vectors.
- The student can learn about different type of magnetic material and its properties.
- The student can learn about various electrical quantities in vectorial form.

B. **Lesson Planning**

SR No.	Lectures (Hours)	Weightage in % in Exam	Topic
1	8	15	Vector algebra, Cartesian, cylindrical and spherical co-ordinate system, Differential length, area and volume, Dot product and cross product, Transformation of vectors, Line, surface and volume integrals, examples.
2	12	25	Coulomb's law, Electric field intensity, Electric field intensity due to various charge distribution, Electrical Field due to infinite line charge, Electrical Field due to charged circular ring, Electrical Field due to infinite sheet of a charge, Electric flux, Electric flux density, Relationship between Electric flux density and Electric field intensity, Electric flux density for

			various charge distribution, Gauss's law, Gauss's law applied to differential volume element, Divergence Theorem, Maxwell's first equation, examples.
3	8	10	Work done, Electric potential and potential difference, Potential due to point charge, line charge, surface charge, volume charge, Potential Gradient, relation between field intensity and electric potential, conservative field, An electric dipole and flux lines.
4	8	15	Convection and conduction current densities, Continuity Equation, Conductor properties, Relaxation Time, Dielectric materials, Boundary conditions, Polarization and dielectric constant-Boundary conditions between conductor and free space, Poisson's and Laplace's equations, Uniqueness theorem, examples.
5	8	10	Biot-Savart's law, Magnetic field intensity due to infinite long straight conductor, Ampere's circuital law, Stokes' theorem, Magnetic flux and magnetic flux density, Magnetic field intensity due to various current configurations, Magnetic resonance Imaging, Magnetic prospecting.
6	6	10	Force on a moving point charge, Lorentz force equation, Magnetic forces and torques, A magnetic dipole, Classification of magnetic materials, Magnetic boundary conditions, Neuman's formula, Inductance and mutual inductance, Magnetic energy, Magnetic recording, Shielding.
7	6	10	Faraday's law, Displacement current and current density, Maxwell's equation in point form and integral form, Boundary condition for time varying field, Magnetic Brake, Magnetic Levitation, electromagnetic launcher, Magneto-hydrodynamic generator,EM waves.
8	4	5	Method of images, Finite difference method (FDM), Finite Element method (FEM), Application of numerical techniques.
	60	100	

C. **Instructional Method & Pedagogy**

- At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal weightage should be given to all topics while teaching and conduction of all examinations.
- Attendance is compulsory in lectures, which may carries five marks in overall evaluation.
- One/Two internal exams may be conducted and total/average/best of the same may be converted to equivalent of 30 marks as a part of internal theory evaluation.

- Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.

- Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.

Suggested Books:

1. William Hart Hayt and John A. Buck. Engineering Electromagnetics , McGraw-Hill.

2. Engineering Electromagnetics Umran S. Inan, Pearson Education.

3. Engineering Electromagnetics Robert Stratman Elliott Tata Mcgraw Hill.

4. Elements of engineering electromagneticsNannapaneni Narayana Rao Prentice Hall-India.