Date: 18-02-2026

CO-PO Mapping and CIE Portions Coverage Details.

Batch: 2024-28	**Academic Year & Semester:** 2025-26 & IV
Course Name: Electromagnetic Theory	
Course Title & Code: BEC401	
Course Coordinators: Mr. Girish M & Mrs. Swetha K T	

1. Course Outcomes (COs)
(a) VTU Defined & Redefined COs

CO	VTU Defined CO Statement	Redefined CO (if applicable)
CO1	Evaluate problems on electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume.	
CO2	Apply Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge distributions by using Divergence Theorem.	
CO3	Determine potential and energy with respect to point charge and capacitance using Laplace equation and Apply Biot-Savart's and Ampere's laws for evaluating Magnetic field for different current configurations	
CO4	Calculate magnetic force, potential energy and Magnetization with respect to magnetic materials and voltage induced in electric circuits.	
CO5	Apply Maxwell's equations for time varying fields, EM waves in free space and conductors and Evaluate power associated with EM waves using Poynting theorem	

2. CO–PO–PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	2	2	1
CO2	3	3	2	-	-	-	-	-	-	-	2	2	1
CO3	3	3	2	-	-	-	-	-	-	-	2	2	1
CO4	3	3	2	-	-	-	-	-	-	-	2	2	1
CO5	3	3	2	-	2	-	-	-	-	-	2	3	1

Note: *1: Low, 2: Medium, 3: High contribution*

Note: The Course Outcomes (COs) and the CO–PO Mapping presented in this document have been retained as per the **revisions made at the institutional level**.

3. CIE Portion & Coverage (IA-1, IA-2, IA-3)

IA No.	Module(s)/ Topic Covered	COs Mapped	RBT Levels (L1–L6)	Remarks
IA-1	**Module 1:** Coulomb's Law, Electric Field Intensity and Flux density, Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge, Field due to Sheet of charge, Electric flux density, Numerical Problems.	CO1	L3	
	Module 2: Gauss's law and Divergence: Gauss law, Application of Gauss law to point charge, line charge, Surface charge and volume charge, Point (differential) form of Gauss law, Divergence. Maxwell's First equation (Electrostatics), Vector Operator V and divergence theorem, Numerical Problems	CO2	L3	
IA-2	**Module 2: Energy, Potential and Conductors:** Energy expended, or work done in moving a point charge in an electric field, The line integral, Definition of potential difference and potential, The potential field of point charge, Potential gradient, Numerical Problems. Current and Current density, Continuity of current.	CO3	L3	
	Module 3: Poisson's and Laplace's Equations: Derivation of Poisson's and Laplace's Equations, Uniqueness theorem, Examples of the solution of Laplace's equation, Numerical problems on Laplace equation. **Steady Magnetic Field**: Biot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem, Magnetic flux and magnetic flux density, Basic concepts Scalar and Vector Magnetic Potentials, Numerical problems.	CO3	L3	
IA-3	**Module 4: Magnetic Forces:** Force on a moving charge, differential current elements, Force between differential current elements, Numerical problems. Magnetic Materials: Magnetization and permeability, Magnetic boundary conditions,	CO4	L3	

	The magnetic circuit, Potential energy and forces on magnetic materials, Inductance and mutual reactance, Numerical problems. Faraday's law of Electromagnetic Induction -Integral form and Point form, Numerical problems.			
	Module 5: Maxwell's equations Continuity equation, Inconsistency of Ampere's law with continuity equation, displacement current, Conduction current, Derivation of Maxwell's equations in point form, and integral form, Maxwell's equations for different media, Numerical problems. **Uniform Plane Wave:** Plane wave, Uniform plane wave, Derivation of plane wave equations from Maxwell's equations, Solution of wave equation for perfect dielectric, Relation between E and H, Wave propagation in frees pace, Solution of wave equation for sinusoidal excitation, wave propagation in any conducting media and good conductors, Skin effect or Depth of penetration, Poynting's theorem and wave power, Numerical problems..	CO5	L3	

Course Coordinators Sign **Vertical Head Sign** **HoD**

Justification of CO-PO Mapping	
Course Name: **Electromagnetic Theory (BEC401)**	Year of Study: **2025-26**
Coordinators: **Girish M and Swetha K T**	Semester: **4th**

Course Outcomes

CO1:	Evaluate problems on electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume.
CO2:	Apply Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge distributions by using Divergence Theorem.
CO3:	Determine potential and energy with respect to point charge and capacitance using Laplace equation and Apply Biot-Savart's and Ampere's laws for evaluating Magnetic field for different current configurations
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CO5:	Apply Maxwell's equations for time varying fields, EM waves in free space and conductors and Evaluate power associated with EM waves using Poynting theorem

CO	Mapped POs	Justification
CO1	PO1	Here students apply the knowledge of mathematics like vector algebra, coordinate systems, and engineering principles to solve electrostatic problems, using traditional methods. This is supported through numerical problem-solving and derivation-based learning.
	PO2	Evaluating electric field interactions using different charge configurations will contribute towards the analytical skills, Practice problems and tutorial sessions reinforce this.
	PO3	Students are exposed to solve the numerical problems with scenarios which resembles the real time cases, moderately contribute towards the analysis of complex investigations
	PO12	Awareness of modern techniques and simulation tools (e.g., MATLAB, CSTudio or ANSYS Maxwell) helps students evaluate complex charge systems, supporting life-long learning.
CO2	PO1	Application of Gauss's Law and divergence theorem requires strong mathematical grounding, helping students relate theoretical EM laws to practical situations.
	PO2	Interpretation and calculation of electric flux through different surfaces involve critical analysis and structured logical steps.
	PO3	Different charge distribution cases were discussed to analyse the real time problems

	PO12	Exposure to computational methods for field evaluation strengthens their ability to adapt to evolving tools and technologies.
CO3	**PO1**	Applying Biot–Savart and Ampère's laws involves conceptual understanding of vector calculus and physical laws, enhancing theoretical clarity.
	PO2	Learners are trained to solve magnetic field problems by evaluating multiple current geometries, improving interpretation skills.
	PO3	Simulations and assignments guide students in visualizing and analyzing magnetic fields in engineering applications.
	PO12	Case studies and tools like FEMM are introduced to simulate magnetic field problems, promoting lifelong learning abilities.
CO4	**PO1**	Understanding magnetic energy and force aligns with fundamental principles of physics and electrical engineering.
	PO2	Application-based numerical problems in class and practical exercises develop analytical and problem-solving skills.
	PO3	Evaluate voltage induction and magnetization in practical electric circuits helps to analyse the real time scenario
	PO12	Students were encouraged to use software-based analysis (e.g., Matlab, EMWorks) for induced voltage and magnetization which helps to increase self-learning ability
CO5	**PO1**	Maxwell's equations and Poynting vector form the core theoretical basis of EM wave propagation, enhancing engineering knowledge through the application of vector identities, simplification and application of fundamental mathematical laws
	PO2	Time-varying field problems using Maxwell's equations improving interpretation skills.
	PO3	Analysing the concepts in real-world wireless and waveguide, skin effect at various media scenarios builds engineering design competency.
	PO12	Students are encouraged to learn more about advanced topics like antenna theory as the application of Maxwell's equations, EM wave propagation and power vectors helping them stay curious and keep learning throughout their future endeavours

Signature of Faculty