Course code: Course Title	Course Structure			Pre-Requisite
EE104: Circuit and	L	T	P	Nil

Field Theory	3	0	2	NIL

Course Objective: The objective of the course is to familiarize students with concepts of electrical circuits, magnetic circuits and basics of Electromagnetic field theory.

S. NO	Course Outcomes (CO)
CO1	Classify different types of sources, properties of electrical elements, solve DC networks using various techniques and theorems.
CO2	Analyze performance of single-phase AC circuits with help of phasor diagrams, apply the knowledge to explain phenomenon of resonance in series and parallel circuit.
CO3	Analyze and evaluate power in a balanced three phase AC circuit.
CO4	Analyze Magnetic circuits.
CO5	Describe the fundamental principles and mathematical models governing the behavior of electrostatic field and magnetostatic fields.
CO6	Describe the concept of time-varying fields and related Maxwell's equations, Poynting Vector.

S. NO	Contents	Contact Hours
UNIT 1	Introduction: Role and importance of circuits in Engineering, concept of fields, charge, current, voltage, energy and their interrelationships. V- I characteristics of ideal voltage and ideal current sources, various types of controlled sources, passive circuit components, V-I characteristics, and ratings of different types of R, L, C elements.	6
UNIT 2	Electrical Networks: DC Series and parallel circuits, power and energy, Kirchhoff's Laws, delta-star transformation, superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem. Single Phase AC Circuits: Average and effective values of sinusoids, concept of phasor, phasor diagram, complex impedance, series and parallel circuits, power factor, complex power, real power, reactive power and apparent power, resonance in series and parallel circuits, Q-factor, bandwidth and their relationship, half power points	10

UNIT 3	Three-Phase AC Circuits: Three phase emf generation, delta and star connection, line and phase quantities, solution of three phase circuits: balanced supply and balanced load, phasor diagram, three phase power measurement by two wattmeter method.Three-Phase AC Circuits: Three phase emf generation, delta and star connection, line and phase quantities, solution of three phase circuits: balanced supply and balanced load, phasor diagram, three phase power measurement by two wattmeter method.	6
UNIT 4	Magnetic Circuits: Ampere's circuital law, B-H curve, concept of reluctance, flux and mmf, analogies between electrical and magnetic quantities, solution of magnetic circuits, hysteresis and eddy current losses, mutual inductance, and dot convention.	4
UNIT 5	Electrostatic Fields: Coulomb's law and field intensity. Electric fields due to point, line, surface and volume charge distributions. Electric flux density, Gauss's Law. Application of Gauss's law - Point, Infinite line and sheet of charge and uniformly charged sphere. Electric potential, Relationship between E and V - Maxwell's equation. Scalar potential. Electric Dipole and its Electric field intensity. Electric flux lines and its properties- flux lines due to point charge and dipole. Energy density in Electrostatic filed. Convection, Conduction currents and current densities. Polarization in Dielectric and its effect on flux density(D). Continuity equation of current and Relaxation time. Electrostatic Boundary conditions - Dielectric- Dielectric, Conductor-Dielectric, Conductor-Free Space. Poisson's and Laplace's equations. The method of images used for finding V, E, D and r due to charges in the presence of conductors. Magnetostatic Fields: Biot-Savart's law, Amperes circuit law, and its Application on Infinite Line current, Infinite Sheet of current, Infinitely long co-axial Transmission line. Magnetic flux density. Maxwell equation for static EM fields. Magnetic scalar and vector potentials. Forces due to magnetic fields: Force on a charged particle, current element and between two current elements. Magnetic Torque and Moment, Magnetic Dipole. Magnetization in materials- M vector, Classification of magnetic materials. Magnetic boundary conditions. Inductance for simple geometry.	10
UNIT 6	Time Dependent Fields: General introduction, Faraday's Law. Transformer and motional emf - stationary loop in time varying B field (Transformer emf), Moving loop in static B field (Motional emf). Moving loop in time varying fields, Displacement current. Maxwell's equation in final forms, Time varying Potentials. Time harmonic fields. Introduction of Electromagnetic wave propagation, waves in general, wave propagation in lossy dielectric. Plane waves in loss less Dielectric, Plane waves in free space, Plane waves in good conductors. Power and Poynting vector. Reflection of Plane wave at normal incidence. Reflection of Plane wave at Oblique incidence - Parallel Polarization and Perpendicular Polarization.	6
	TOTAL	**42**

REFERENCES		
S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	Linear Circuit Analysis: Time, Domain, Phasor and Laplace Transform Approaches Raymond; A. D. Carlo, P. M. Lin, Oxford University Press, 2nd Edition.	2001
2	Basic Electrical Engineering,; A. E. Fitzgerald, D. Higginbotham, A. Grabel, Tata McGraw-Hill Publishing Company; 5th Edition.	2009
3	Introduction to Electrical Engineering; M. S. Sarma, Oxford University Press.	2001
4	Electrical and Electronic Technology; E. Hughes, Pearson Education, 10th Edition.	2010
5	Fundamentals of Electric Circuits; C. K. Alexander, M. N. O. Sadiku.	2022
6	Electrical Engineering Fundamentals; V. D. Toro, Pearson Education, 2nd Edition.	2015
7	Basic Electrical Engineering; C. L. Wadhwa, New Age International Pvt Ltd Publishers	2007
8	Elements of Electromagnetics; M. N. O. Sadiku, Oxford University Press.	2014
9	Engineering Electromagnetics; W. H. Hayt, Mc Graw-Hill Int. Edition, 8th Edition	2011

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