Course Code	TKIE162201
Course Name	Electromagnetic Field (Course+Tutorial)
Course Instructors	Eny Sukani Rahayu; Iswandi.
Course Type	Required
Course Classification	Engineering Topics
Credit / Contact Hour per Week	3 / 150 minutes per Week
Course Description	Understand the basic concepts of Electromagnetic Fields include: Concept of Field and Vector Calculus, Coordinate System, Electrical Field Theory, Electric Current, Magnetic Field Theory, Electrical and Magnetic Material, Hysteresis, Electromagnetic Boundary Condition, Electromagnetic Induction, Inductance, Capacitance, Resistance, Ampere's Law, Faraday's Law, Gauss' Law, Ohm, Joule's Law, Magnetic Circuit, Transmission Line, Maxwell's Equation, Electromagnetic Waves
Prerequisites Courses	-
Covered Student Outcome	**Fundamental Engineering Knowledge (a)** **Development of Engineering Solution (b)**

Learning Outcome	1. Students are able to calculate and find appropriate solutions of fundamental electromagnetic field 2. Students are able to formulate and use the Maxwell Equations to model the behavior of the electromagnetic field in a line, field, or volume and can analyze the behavior of the field 3. Students are able to solve magnetic strand-related cases, electronic induction and its application. 4. Students are able to model and calculate electromagnetic wave parameters of uniform plane wave types 5. Students are able to understand the concept of left-handed EMW metamaterial and propagation.
Topic	1. Concept of Field 2. Calculus vector: multiplication and addition of vector, del / nabla, curl, grad, div, laplacian, line integral, surface integral, and integral volume 3. Coordinate system (s.k) and its transformation: square c.s., cylinder c.s., and ball c.s. 4. Electric field theory: electric field source (charge and charge distributed), electric field strength, electric flux, electric flux density, electric force / Coulomb force, electric potential, energy stored in an electric field 5. Magnetic field theory: magnetic field source, magnetic field strength, magnetic flux, magnetic flux density, Biot-Savart's law, Lorentz force, Ampere force, energy stored in magnetic field 6. Electrical materials and magnetic materials, polarization, and magnetization 7. Hysteresis and Magnetic Circuit. 8. Electromagnetic Boundary Condition 9. Electromagnetic Induction 10. Inductance and Capacitance 11. Ohm's Law, Joule's Law, Resistance, Conductance 12. Transmission Line 13. Maxwell's Equations: Ampere's Law, Faraday's Law, and Gauss' Law for electric and magnetic fields, for dynamic, static, source free, and harmonic conditions in both integral and differential form 14. The equation of electromagnetic waves (EMW) and uniform field wave model, EMW polarization. 15. Introduction to the concept of metamaterial.
Direct Asessment	

Direct Asessment Plan	**Measured Learning Outcome**
Mid Exam	LO1, LO2
Final Exam	LO3, LO4, LO5

Indirect Assesment	Questionnaire and direct communication
References	a. W.H.Hayt dan J.A. Buck, Engineering Electromagnetic 8ed , Mc Graw Hill, 2010 b. Maxwell Equations, J. A. Kong, EMW Publishing, 398 pg, 2002 c. Veselago, V., 1968, The electrodynamics of substance with simultaneously negative values of □ and □, Soviet Phys. Uspekhi, 10:509-514 d. Li, Ji Chun, dan Huang, Yun Qing, 2013, Tine Domain Finite Element Method for Maxwell's Equations in Metamaterials, Springer Series in Computational Mathematics a. e. Katsarakis, N., dkk, 2004, Electric coupling to the magnetic resonance of split ring resonators, Applied Physics Letters, Vol. 84., No.15