

GUJARAT TECHNOLOGICAL UNIVERSITY

Power Electronics

M.E. Semester: II

Subject Name: **Magnetics for Power Electronics (Major Elective –II)**

Sr. No.	Course Content
1.	Fundamentals of Magnetic Theory: Basic laws of magnetic theory, magnetic materials, magnetic circuits, Fast design Approach Including Eddy Current Losses
2.	Magnetic Materials, Coil Windings & Electric Insulations: Magnetic core materials, Comparison and applications , Losses, ferrite core loss with non sinusoidal voltage waveforms; : Filling factor, wire length, physical aspects of break down, insulation requirements and standards, thermal requirements and standards, magnetic component manufacturing sheet
3.	Eddy Currents in Conductors: Introduction, basic approximations, losses in rectangular conductors, quadrature of the circle method for round conductors, Losses of a current carrying round conductor, losses of a round conductor in a uniform transverse AC field, Low frequency 2-D approximation method for round conductor, Wide frequency method for computing eddy current losses in windings, losses in foil windings, losses in planner windings
4.	Thermal aspects: Fast thermal design approach, single thermal resistance design approach, classic heat transfer mechanism, thermal design utilizing a resistive network, contribution to heat transfer theory of magnetic components, transient heat transfer
5.	Parasitic Capacitances in Magnetic Components: Capacitance between windings, self capacitance of a winding, capacitance between the windings and the magnetic material, practical approaches for decreasing the effects of parasitic capacitances
6.	Design Concept: Inductor - Air coils and related shapes, inductor shapes, typical ferrite inductor shapes, fringing in wire wound inductors with magnetic cores, eddy currents in inductor windings, foil wound inductors, inductor types depending on applications; Transformer design : Transformer design in power electronics, Magnetizing inductance, Leakage inductance, Using parallel wires and litz wires, Interleaved windings, superimposing frequency components, superimposing modes.
7.	Optimal Copper/Core Loss Ratio in Magnetic Components: Simplified approach, loss minimization in the general case, without eddy current loss, Loss minimization including low frequency eddy current losses

Reference Books:

- 1) Inductors and transformers for Power electronics by Alex van Den Bossche and Vencislav Cekov Valchev (Taylor and Francis)
- 2) Design of Magnetic Components by Umanand
- 3) Data books
- 4) Electronics engineers hand book by D. Fink (McGraw Hill)