Course Syllabi: UEE502: High Voltage Engineering (L : T : P :: 3 : 0 : 2)

1. **Course number and name**: UEE502: High Voltage Engineering

2. **Credits and contact hours**: 4.0 and 5

3. **Text book, title, author, and year**

Text Books / Reference Books

- *Chakrabarti, A., Soni, M.L., Gupta, P.V. and Bhatnagar, U.S., a Text Book on Power System Engineering, DhanpatRai (2008).*
- *Wadhwa, C.L., Electrical Power Systems, New Age International (P) Limited, Publishers (2008).*
- *Gupta, B.R., Power System Analysis and Design, S. Chand (2009).*
- *Nagrath, I.J. and Kothari, D.P., Power System Engineering, Tata McGraw–Hill (2007).*
- *Pabla, A.S., Electric Power Distribution, McGraw Hill (2008).*
- *Stevenson, W.D., Power System Analysis, McGraw–Hill (2007).*

a. Other supplemental materials
   - Nil

4. **Specific course information**

a. Brief description of the content of the course (catalog description)

Introduction: Introduction to AC and DC impulse voltages and their use, Problems in dealing with high voltages.

Breakdown in Gases: Elementary ideas on ionization by electron collision, Townsend mechanism, Townsend first and second ionization coefficients, Paschen law, breakdown in non-uniform fields and corona discharges, vacuum breakdown mechanisms, breakdown in liquids, fundamentals of insulating oils, conduction and breakdown in pure and commercial liquids.

Breakdown in Solids: Fundamentals of solid insulating materials intrinsic, electromechanical and thermal breakdown, breakdown in simple and composite dielectrics, types of insulating materials, temperature classification, factor affecting dielectric strength, insulation design of rotating machines, transformers, transmission lines, Switch gear, etc.

Generation of High Voltages: Generation of high voltages, testing transformers in cascade, series resonant circuits and their advantages, half and full wave rectifier circuits, voltage doubler and cascade circuits, electrostatic generator, characteristics parameters of impulse voltages, single stage impulse generator circuits, multistage impulse generation circuits.

Measurement of High Voltages: Measurement of direct, alternating and impulse voltages by electrostatic voltmeters, sphere gap, uniform field gap, ammeter in series with high voltage resistors and voltage divider

Non-Destructive High Voltage Tests: Loss in a dielectric and its measurement, dielectric loss measurement by Schering bridge, partial discharges at alternating voltages, external and internal partial discharges and discharge measurements.

Laboratory work: Voltage measurement by sphere gap and Chubb and Fortesque methods, Insulation resistance measurement using Meggar, Experimental setup for standard lightning wave, Efficiency and peak voltage measurement by sphere gap impulse voltage time curves, Breakdown voltage, Conductivity and dissipation factor measurement with Schering bridge, partial discharge measurements.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:

   - Conceptualize the idea of high voltage and safety measures involved.
   - Analyse the breakdown mechanism of solids, liquids and gases.
   - Analyse and calculate the circuit parameters involved in generation of high voltages.
   - Measure direct, alternating and impulse high voltage signals.
   - Measure the dielectric loss and partial discharge involved in non-destructive high voltage tests.

6. **Brief list of topics to be covered**

   - Breakdown in Gases
   - Breakdown in Solids
   - Generation of High Voltages
   - Measurement of High Voltages
   - Non-Destructive High Voltage Tests