JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. TECH (HIGH VOLTAGE ENGINEERING/
POWER SYSTEMS WITH EMPHASIS ON H.V. ENGINEERING)

EFFECTIVE FROM ACADEMIC YEAR 2017- 18 ADMITTED BATCH
COURSE STRUCTURE AND SYLLABUS

I Semester

Category	Course Title	Int. marks	Ext. marks	L	T	P	C
PC-1	Generation and Measurement of High Voltages	25	75	4	0	0	4
PC-2	Dielectric and Insulation Engineering	25	75	4	0	0	4
PC-3	Advanced HVDC Transmission	25	75	4	0	0	4
PE-1	1. Gas Insulated Systems (GIS) 2. Flexibility AC Transmission Systems (FACTS) 3. Voltage Stability	25	75	3	0	0	3
PE-2	1. Advanced Power System Protection 2. Reactive Power Compensation & Management 3. Breakdown Phenomenon in Insulation	25	75	3	0	0	3
OE-1	***Open Elective – I**	25	75	3	0	0	3
Laboratory I	High Voltage Laboratory	25	75	0	0	3	2
Seminar I	Seminar -I	100	0	0	0	3	2
Total		**275**	**525**	**21**	**0**	**6**	**25**

II Semester

Category	Course Title	Int. marks	Ext. marks	L	T	P	C
PC-4	High Voltage Testing Technology	25	75	4	0	0	4
PC-5	EHV AC Transmission	25	75	4	0	0	4
PC-6	Surge Phenomena and Insulation Coordination	25	75	4	0	0	4
PE-3	**1. Partial Discharges in High Voltage Equipment** 2. Power System Transients 3. Programmable Logic Controllers and Applications	25	75	3	0	0	3
PE4	1. HV Transformers 2. Pulse Power Engineering 3. Advanced Electromagnetic Fields	25	75	3	0	0	3
OE-2	***Open Elective – II**	25	75	3	0	0	3
Laboratory II	Simulation Lab	25	75	0	0	3	2
Seminar II	Seminar -II	100	0	0	0	3	2
Total		**275**	**525**	**21**	**0**	**6**	**25**

III Semester

Course Title	Int. marks	Ext. marks	L	T	P	C
Technical Paper Writing	100	0	0	3	0	2
Comprehensive Viva-Voce	0	100	0	0	0	4
Project work Review II	100	0	0	0	22	8
Total	**200**	**100**	0	**3**	22	**14**

IV Semester

Course Title	Int. marks	Ext. marks	L	T	P	C
Project work Review III	100	0	0	0	24	8
Project Evaluation (Viva-Voce)	0	100	0	0	0	16
Total	**100**	**100**	**0**	**0**	**24**	**24**

***Open Elective subjects must be chosen from the list of open electives offered by OTHER departments.**

 # For Project review I, please refer 7.10 in R17 Academic Regulations.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (PS H.V. Engg. / H.V. Engg.)

HIGH VOLTAGE TESTING TECHNOLOGY (Professional core - IV)

Prerequisite: Generation and Measurement of high voltages

Course Objectives:

- To know different testing methods for high voltage apparatus.
- To know various standards for various kind of high voltage tests.
- To know the procedures to measure the partial discharges in high voltage apparatus.
- To know the causes for failure of insulators.

Course Outcomes: After Completion of this course, student will be able to

- Have knowledge on various types of high voltage testing on high voltage apparatus.
- Follow the various standards for best practice high voltage tests.
- Have basic ideas to avoid the failures occur in insulators.

UNIT- I:
Non Destructive Testing Techniques : Measurement of DC Resistivity – Dielectric loss and dielectric constant of insulating materials – Schering bridge method – Transformer ration arm bridge for high voltage and high current applications – null detectors

UNIT- II:
High Voltage Testing of Power Apparatus: Need for testing standards – Standards for porcelain / Glass insulator – Classification of porcelain / glass insulator tests - Tests for cap and pin porcelain/ Glass insulators. High voltage AC testing methods, power frequency tests - Over voltage tests on insulators, Isolators, Circuit Breakers and power cables.

UNIT- III:
Artificial Contamination Tests: Contamination flashover phenomena – Contamination Severity - Artificial contamination tests - Laboratory Testing versus in-Service Performance – Case study.
Impulse Testing: Impulse testing of transformers – Surge diverters – and other apparatus.

UNIT- IV:
Partial Discharge Measurement : PD equivalent model - PD currents-PD currents PD measuring circuits – Straight and balanced detectors - Location and estimation of PD in power apparatus - PD measurement by non electrical methods - Calibration of PD detectors.
RIV Measurements: Radio Interference – RIV - Measurement of RI and RIV in laboratories and in field Different test arrangements and their limitations.

UNIT- V:
Insulators Fail: Handling – Vandalism – Quality control – Application problems Detecting defective Non Ceramic insulators. Making Insulators work in contaminated environments: Cleaning Modification of Insulator design – Mobile protective coatings-Solid water Repellent coating – line voltage reduction.

TEXT BOOKS:

1. High Voltage Engineering – by E. KUFFEL and W.S. ZAEGNL Pergamon press oxford 1984.
2. High Voltage Engineering- by M.S. Naidu and V. Kamaraju Tata McGraw Hill Publishing Company Limited New Delhi 2001

REFERENCES:

1. Discharge Detection in H.V. Equipment – by KREUGER F.H. Haywood Londor- 1964.
2. Outdoor Insulators- by Gorur & Cherney.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (PS H.V. Engg. / H.V. Engg.)

EHV AC TRANSMISSION (Professional core - V)

Prerequisite: Power Systems

Course objectives:

- To identify the different aspects of Extra High Voltage A.C and DC Transmission design and analysis.
- To understand the importance of modern developments of EHV and UHV transmission systems.
- To demonstrate EHV AC transmission system components, protection and insulation level for over voltages.

Course Outcomes: Upon the completion of this course, the student will be able to

- Understand the importance of EHV AC transmission
- Estimate choice of voltage for transmission, line losses and power handling capability of EHV Transmission.
- Analyse by applying the statistical procedures for line designs, scientific and engineering principles in power systems.

UNIT- I:
E.H.V.A.C. Transmission line trends and preliminary aspect standard transmission voltages – Estimation at line and ground parameters-Bundle conductor systems-Inductance and Capacitance of E.H.V. lines – positive, negative and zero sequence impedance – Line Parameters for Modes of Propagation.

UNIT- II:
Electrostatic field and voltage gradients – calculations of electrostatic field of AC lines – effect of high electrostatic field on biological organisms and human beings - surface voltage gradients and maximum gradients of actual transmission lines – voltage gradients on sub conductor.

UNIT- III:
Electrostatic induction in unenergized lines – measurement of field and voltage gradients for three phase single and double circuit lines – unenergized lines. Power Frequency Voltage control and over-voltages in EHV lines: No load voltage – charging currents at power frequency-voltage control – shunt and series compensation – static VAR compensation.

UNIT - IV:
Corona in E.H.V. lines – Corona loss formulae- attention of traveling waves due to Corona – Audio noise due to Corona, its generation, characteristic and limits. Measurements of audio noise radio interference due to Corona - properties of radio noise – frequency spectrum of RI fields – Measurements of RI and RIV.

UNIT- V:
Design of EHV lines based on steady state and transient limits - EHV cables and their characteristics.

TEXT BOOKS:

1. R. D. Begamudre, “EHVAC Transmission Engineering”, New Age International (p) Ltd. 3rd Edition.
2. K.R. Padiyar, “HVDC Power Transmission Systems” New Age International (p) Ltd. 2nd revised Edition, 2012.

REFERENCES:

1. S. Rao “EHVAC and HVDC Transmission Engineering. Practice” Khanna publishers.
2. Arrillaga. J “High Voltage Direct Current Transmission” 2nd Edition (London) Peter Peregrines, IEE, 1998.
3. Padiyar. K.R, “FACTS Controllers in Power Transmission and Distribution” New Age International Publishers, 2007.
4. Hingorani H G and Gyugyi. L “Understanding FACTS-Concepts and Technology of Flexible AC Transmission Systems” New York, IEEE Press, 2000.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech – I Year – II Sem. (PS H.V. Engg. / H.V. Engg.)

SURGE PHENOMENA AND INSULATION COORDINATION (Professional core - VI)

Prerequisite: Dielectric and Insulation Engineering

Course objectives:
- To know the transmission line properties and its successive reflections coefficients.
- To understand the lighting mechanism and its mathematical modeling.
- To understand the high voltage ac circuit breakers and it protection schemes.
- To know the different types of insulation characteristics and it co-ordination methods

Course Outcomes: After Completion of this course, student will be able to:
- To understand the basic modeling on transmission lines in various cases.
- Follow the various standards for best practice in switching over voltage techniques.
- To understand the high voltage circuit breakers and its requirement in transmission lines.
- To know the general protection schemes against over voltages.
- Basic ideas to avoid the failures occur in insulators and co-ordination methods in EHV substation.

UNIT-I:
Traveling Waves: Transmission line equation, attenuation, distortion, types of traveling waves, Reflection of traveling waves at a transition point, typical cases.
Successive Reflections: Reflection lattice, line with different terminations, line-cable connection, line-cable-transformer connection.

UNIT-II:
Lightning: Mechanism of the lightning stroke, Mathematical model of lightning stroke. Over voltage due to lightning. Power frequency over voltages, over voltages due to faults. Switching over voltages, switching over voltage reduction techniques.

UNIT-III:
High voltage AC circuit breakers: Opposing forces during closing and opening operation, inter locks, indication and auxiliary switches, CB time, auto re-closure, transient recovery voltage, single frequency transient, double frequency transient, rate of rise of TRV, resistance switching, damping of TRV, opening resistors.

UNIT-IV:
Protection of power system against over voltages: General principles of lighting protection, ground wires, surge arresters, counter poises, tower footing resistances, protection of rotating machines against surges.

UNIT-V:
Insulation characteristics of long air gaps: Types of electrode geometries, breakdown characteristics of long air gaps, breakdown models of long gaps with non uniform fields, CFO and withstand voltages of long air gaps.
Insulation Coordination: Protective characteristics of rod gaps, surge arrestors, insulation withstand voltage characteristics, correlation between insulation and protective levels, and illustration of insulation coordination in an EHV substation.

TEXT BOOKS:
1. "Traveling waves of Transmission systems", by LV Bewley.
2. "Insulation Co-ordination ELBS in H.V. Electrical Power Systems", by W.Diesendorf, Butter worth publications, London, 1974.

REFERENCE:
1. "E.H.V. Transmission Engineering", by Rakosh Das Begamudre, Wiley Eastern Ltd., New Delhi, 1986.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (PS H.V. Engg. / H.V. Engg.)

PARTIAL DISCHARGES IN HIGH VOLTAGE EQUIPMENT (Professional Elective - III)

Prerequisite: Generation &measurement of high voltages and Dielectric & insulation engineering.

Course Objectives:

- To know the types of partial discharges
- To know the PD testing and monitoring
- To understand the Electrical discharge detection circuits
- To locate the partial discharges

Course Outcomes:

- A solid background in the basics of PD test and monitoring techniques and methodology
- To analyze partial discharge occurrence in electrical equipments
- To analyze the gas insulated switchgear devices

UNIT-I:
Types of partial discharges and its occurrence and recurrence and magnitudes**:** Definition of partial discharges, inception of internal discharges, inception of corona discharges.

UNIT-II:
Discharges by electrical treeing. Discharges at AC Voltages corona discharges at D.C. Voltages discharges at impulse voltages. Object of discharge detection, Quantities related to the magnitude of discharges, choice of PD as a measure for discharges.

UNIT-III:
Electrical discharge detection & Detection circuits: Basic diagram, amplification of impulse, sensitivity, resolution, observation, Straight detection. Balanced detection, calibrators, Interferences, choice between straight detection & balance detection, common mode rejection.

UNIT-IV:
Location of Partial discharges; Non – electric location, location by separation of electrodes, location with electrical probes. Location by traveling waves, PD location in cables & switchgear by traveling waves. Evaluation of discharges; Recognition, mechanisms of deterioration, evaluation, specification.

UNIT-V:
Detection in actual specimen: Detection in capacitors, cables, bushings. Transformers, machine insulation, Gas – insulated switchgear.

TEXT BOOK:

1. Partial Discharge in HV Equipment by F. Kruguer, Butterworths & Co., Publications Ltd., 1989.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (PS H.V. Engg. / H.V. Engg.)

POWER SYSTEM TRANSIENTS (Professional Elective - III)

Prerequisite: Power Systems

Course objectives:

- To analyze the electrical transients in power systems.
- To impart the concepts of traveling waves and propagation.
- To discuss issues related to insulation coordination, grounding and limiting of surge effects.
- To develop the techniques related to transition points in transmission lines and cables.

Course Outcomes: After Completion of this course, student will be able to

- Analyze the electrical transients in power systems.
- Describe the issues related to insulation coordination, grounding and limiting of surge effects.
- Develop the techniques related to transition points in transmission lines and cables.

UNIT- I:
Basic Concepts and Simple Switching Transients: Switching an LR, LC, RLC circuits
Transients Analysis of Three-Phase power Systems: Symmetrical components in Three-phase Systems, Sequence Components for Unbalanced Network Impedances, the Sequence Networks, analysis of Unsymmetrical Three-Phase Faults-single line-to-Ground Fault, Three phase-to-ground faults.

UNIT- II:
Travelling Waves: Velocity of Travelling waves and Characteristic Impedance, Energy Contents of Travelling Waves, Attenuation and Distortion of Electromagnetic Waves, telegraph equations-lossless line, distortion less line, Reflection and Refraction of Travelling Waves, Reflection of Travelling Waves against Transformer-and-Generator-windings, the Origin Transient Recovery voltages, the lattice diagram.

UNIT- III:
Circuit Breakers: Switching arc, Oil Circuit Breakers, Air-Blast, SF6 Circuit Breakers, Vacuum Circuit Breakers, Modelling of the Switching Arc, Arc-Circuit Interaction.
Switching Transients: Interrupting Capacitive currents, Capacitive Inrush currents, Interrupting Small Inductive Currents, Transformer Inrush currents, Short Line Fault.

UNIT- IV:
Power System Transient Recovery Voltages: Characteristics of the Transient Voltage- Short-circuit test duties based on IEC 60056 (1987),ANSI/IEEE Standards, the Harmonization between IEC and ANSI/IEEE Standards with respect to Short-circuit Test duties, Transient recovery voltage for Different types of faults.

UNIT- V:
Lightning – Induced Transients: Mechanism of Lightning, Wave shape of the lightning current, direct lighting Stroke to transmission line towers, direct lightening stroke to a line.
Numerical simulation of electrical transients: The Electromagnetic Transient Program, The MNA Program, The X- Trans Program.

TEXT BOOKS:

1. "Transients in Power Systems", by Lou van der Sluis, John Wiley & Sons, Ltd, Chic ester, UK 2002.
2. "Power System Transients: Theory and Applications", by Akihiro Ametani, Naoto Nagaoka, Yoshihiro Baba, Teruo Ohno, CRC Press 2013.
3. "Electrical Transients in Power Systems", by Allan Greenwood, Wiley-Interscience; 2 edition, April 1991.

REFERENCES:

1. "Power System Transients: A Statistical Approach", by C.S Indulkar, D.P. Kothari, K. Ramalingam, PHI, 2 edition, 2010.
2. "Electrical Transients in Power Systems", by Allan Greenwood Wiley India Private Limited; Second edition, July 2010.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (PS H.V. Engg. / H.V. Engg.)

PROGRAMMABLE LOGIC CONTROLLERS AND APPLICATIONS
(Professional Elective - III)

Course Objectives:

- To provide and ensure a comprehensive understanding of using advanced controllers in measurement and control instrumentation.
- To illustrate about data acquisition - process of collecting information from field instruments.
- To analyze Programmable Logic Controller (PLC), IO Modules and internal features.
- To Comprehend Programming in Ladder Logic, addressing of I/O.
- To apply PID and its Tuning.

Course Outcomes: Upon the completion of this course, the student will be able to

- Describe the main functional units in a PLC and be able to explain how they interact.
- They should know different bus types used in automation industries.
- Development of ladder logic programming for simple process.

UNIT- I:
PLC Basics PLC system, I/O modules and interfacing CPU processor programming equipment programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

UNIT- II:
PLC Programming input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill-press operation.
Digital logic gates programming in the Boolean algebra system, conversion examples Ladder diagrams for process control Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

UNIT- III:
PLC Registers: Characteristics of Registers module addressing holding registers input registers, output registers. PLC Functions Timer functions and industrial applications counters counter function industrial applications, Architecture functions, Number comparison functions, number conversion functions.

UNIT- IV:
Data handling functions: SKIP, Master control Relay Jump Move FIFO, FAL, ONS, CLR and Sweep functions and their applications. Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two axes and three axis Robots with PLC, Matrix functions.

UNIT- V:
Analog PLC operation: Analog modules and systems Analog signal processing multi bit data processing , analog output application examples, PID principles position indicator with PID control, PID modules, PID tuning, PID functions

TEXT BOOKS:

1. Programmable Logic Controllers – Principle and Applications by John W. Webb & Ronald A. Reiss, Fifth Edition, PHI
2. Digital Design by Morris Mano, PHI, 3rd Edition 2006.

REFERENCES:

1. Programmable logic Controllers, Frank D. Petruzella, 4th Edition, McGraw Hill Publishers.
2. 2. Programmable Logic Controllers – Programming Method and Applications by JR. Hackworth & F.D Hackworth Jr. – Pearson, 2004.
3. Programmable logic controllers and their Engineering Applications, 2nd Edition, Alan J. Crispin.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (PS H.V. Engg. / H.V. Engg.)

HV TRANSFORMERS (Professional Elective - IV)

Prerequisite: Generation & measurement of high voltages and Electrical Machines

Course objectives:

- To analyze the basic principle of transformer and its specifications.
- To analyze the materials concept in transformers.
- Analyze the design approach with respect to core and windings in dry type distribution transformers.

Course Outcomes: After completion of this course, student will be able to

- Well known about transformer working and its selection process in real time.
- To design a transformer as per user specifications with respect of various windings.
- Clear information about dry type distribution transformer and it application in real time.

UNIT–I:
Working Principle of a Transformer
Brief idea about a transformer and how it operates in the distribution system. The working principle in respect of induced EMF, Transformer core and winding. End turns, Losses. Future requirement of transformers with the growth of the power scenario in India.

UNIT-II:
Requirements of Transformer Specifications Form End – Users
The basic information that buyers should pass on to the manufacturer while placing an order. Preparing specifications in respect of mandatory, Supplementary and additional requirements.

UNIT-III:
Basic Materials of Transforms
The processing of three basic new materials, viz., CRGO steel, winding wires and strips and transformer oil, raw material processors.

UNIT–IV:
The Basic Concept of Design
Design concepts, a commercial design, the design approach in respect of core and winding. The procedure of handling computer aided design, the design inputs and outputs, and operation. Two standard designs of 250 kVA and 400 kVA. 11/0.433 kV.

UNIT–V:
Dry – Type Distribution Transformers
Basic constructional details and superiority of resign impregnated dry type transformers have been compared with oil filled and resin cast transformers. VPI plant requirements, application of dry type transformers.

TEXT BOOK:

1. Design of Transformers, Indirajit Dasgupta, Tata McGraw Hill.

REFERENCE:

1. Transformers, BHEL, Tata McGraw Hill Publishers.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (PS H.V. Engg. / H.V. Engg.)

PULSE POWER ENGINEERING (Professional Elective - IV)

Prerequisite: Power Systems

Course Objectives:
- To know the static and dynamic breakdown strength of dielectric materials
- To comprehend the importance of energy storage in generators
- To understand the transmission line performance
- To understand the performance of pulse transformers

Course Outcomes: After completion of this course, the student will be able
- To analyze the breakdown strength of dielectric materials
- To have understanding of the applications of energy storage in generators
- To analyze the performance of pulse transformers

UNIT-I:
Static and Dynamic Breakdown Strength of Dielectric Materials
Introduction – Gases - static breakdown - pulsed breakdown - spark formation – liquids - basic electrical Process - steamer breakdown - practical considerations – solids - General observations - charge Transport, injection and Breakdown - statistical Interpretation of breakdown Strength Measurements.

UNIT-II:
Energy Storage
Pulse Discharge Capacitors - Marx Generators - classical Marx generators - LC Marx Generator - Basic Pulsed - Power Energy Transfer Stage - inductive energy storage - power and voltage multiplication - rotors and homo polar Generators.
Switches:
Closing switches - gas switches - semi conductor closing switches - magnetic switches – summary - opening switches – fuses - mechanical interrupters - superconducting opening switches - plasma opening switches - plasma flow switches - semiconductor opening switches.

UNIT-III:
Pulse Forming Networks
Transmission lines - terminations and junctions - transmission lines with losses - the finite transmission line as a circuit element - production of pulses with lossless transmission lines - RLC networks - circuit simulation with LEITER.

UNIT-IV:
Pulse Transmission and Transformation
Self magnetic insulation in vacuum lines - vacuum break down in metallic surfaces - qualitative description of self magnetic insulation - quantitative description of self magnitude insulation - pulse Transformers-High Voltage Power supplies - Capacitor-Charging Techniques - Cascade Circuits - Transformation Lines.

UNIT-V:
Power and Voltage Adding
Adding of Power-Voltage Adding - voltage adding by transit-time Isolation - voltage adding by Inductive Isolation - Blumlein Generators - Cumulative Pulse Lines.
Examples of Pulsed-power Generators: Single-pulse generators - KALIF-PBFA 2 and the Z-Machine - HERMES III.
Repetitive Generators: RHEPP and Generators with opening switches.

TEXT BOOK:

1. “Pulsed Power Engineering”, by Dr. Hasjoachim Bluhm.
2. “Pulsed power” by Gennady A. Mesyats, Springer publications

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (PS H.V. Engg. / H.V. Engg.)

ADVANCED ELECTROMAGNETIC FIELDS
(Professional Elective - IV)

Prerequisite: Electromagnetic Fields

Course Objectives:

- To understand the basic skills required to understand, develop, and design various engineering applications involving electromagnetic fields.
- To understand the foundations of electromagnetism and its Practice in modern communications.
- To understand Behavior of Conductors and Insulators in electric field

Course Outcomes: After the completion of this course, student will be able to:

- Apply vector calculus to static electric-magnetic fields in different engineering situations.
- Analyze Maxwell's equation in different forms (differential and integral) and apply them to diverse engineering problems.
- Examine the phenomena of wave propagation in different media and its interfaces and in applications of microwave engineering.
- Analyze the nature of electromagnetic wave propagation in guided medium which are used in microwave applications.

UNIT– I:
Electrostatics
Electrostatic Fields – Coulomb's Law – Electric Field Intensity (EFI) – EFI due to a line and a surface charge – Work done in moving a point charge in an electrostatic field – Electric Potential – Properties of potential function – Potential gradient – Gauss's law – Application of Gauss's Law – Maxwell's first law, div(D)=ρv – Laplace's and Poisson's equations – Solution of Laplace's equation in one variable.

UNIT– II:
Electric Fields - I
Introduction, Analytical calculation of space-charge-free fields, simple geometries, transmission conductors to ground, fields in multi-dielectric media, experimental analogs for space - space-charge-free fields, electrolytic tank, semi conducting paper analog, resistive-mesh analog. Numerical computation of space-charge – free fields, successive imaging technique, the dipole method, charge-simulation technique, finite-difference technique, combined charge-simulation and finite-difference technique, finite-element technique, combined charge-simulation and finite-element technique, boundary-element method, integral-equations technique, monte-cario technique.

UNIT– III:
Electric Fields - II
Analytical Calculations Of Fields With Space Charges, Numerical Computation Of Fields With Space Charges, Finite Element Technique, Finite Element Technique Combined With The Method Of Characteristics, Charge-Simulation Technique Combined With The Method Of Residues, Electric Stress Control And Optimization, Electric Stress Control, Electric Stress Optimization.

UNIT– IV:
Conductors, Dielectrics, Dipole and Capacitance
Behavior of conductors in an electric field – Conductors and Insulators – Electric field inside a dielectric material – polarization – Dielectric – Conductor and Dielectric – Dielectric boundary conditions – Energy stored and energy density in a static electric field – Current density – conduction and Convection current densities – Ohm's law in point form – Equation of Electric dipole – Dipole moment – potential and EFI due to an electric dipole – Torque on an Electric dipole in an electric field – Capacitance – Capacitance of parallel plate and spherical capacitors.

UNIT–V:

Magneto Statics Time Varying Fields

Biot-Savart's law – Magnetic field intensity (MFI), magnetic flux density and MFI, Ampere's circuital law and its applications Point form of Ampere's circuital law. Scalar Magnetic potential and its limitations – vector magnetic potential and its properties, vector Poisson's equations. Energy stored and density in a magnetic field. Magnetic force - Moving charges in a Magnetic field – Lorentz force equation — a differential current loop as a magnetic dipole, Time varying fields – Faraday's laws of electromagnetic induction – Its integral and point forms, Statically and Dynamically induced EMFs - Modification of Maxwell's equations for time varying fields – Displacement current.

TEXT BOOKS:

1. "Engineering Electromagnetics" by William H. Hayt & John. A. Buck McGraw Hill Companies, 7th Editon.2005.
2. "Electromagnetics" by J. D Kraus McGraw Hill Inc. 4th edition 1992.

REFERENCES:

1. "Field Theory", by Gangadhar, Khanna Publishers.
2. "Elements of Electromagnetic field theory ", by Sadiku, Oxford Publ.
3. "Electromagnetics" by J P Tewari.
4. "Introduction to E-Magnetics" by CR Paul and S.A. Nasar, McGraw Hill Publications
5. "Introduction to Electro Dynamics" by D J Griffiths, Prentice Hall of India Pvt. Ltd, 2nd editon
6. "Electromagnetics" by Plonsy and Collin
7. "Engineering Electro magnetics" by Nathan Ida, Springer(India) Pvt. Ltd. 2nd Edition.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (PS H.V. Engg. / H.V. Engg.)

SIMULATION LAB

1. Analysis and Design of high DC generators
2. Analysis and Design of high AC generators
3. Analysis and Design of high Impulse voltage generators
4. Generation and measurement of HVDC
5. Generation and measurement of HVAC
6. Generation and measurement of standard impulse voltages
7. Generation and measurement of non-standard impulse voltages
8. AC breakdown studies on solid insulation
9. AC breakdown studies on liquid insulation
10. Simulation of field for different electrode arrangements

The above experiments may be performed using suitable simulation software.