GODAVARI INSTITUTE OF ENGINEERING & TECHNOLOGY

(AUTONOMOUS)

Approved by AICTE, Accredited by NBA & NAAC 'A' Grade, Recognized under 2(f) and 12(b) of UGC, Permanently Affiliated to JNTUK, Kakinada.

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
2 Years M.Tech. (Power Systems (High Voltage Engineering)) Course
Structure : (2020-21)
***

w.e.f. Academic Year : 2020-2021

M.Tech (PSHVE) I-SEMESTER											
S. No.	**Course Code**	**Course**	**Category**	**Periods per week**			**C**	Scheme of Examination Maximum Marks		
				L	**T**	**P**		Int	Ext	Total
1	20221101	Generation and Measurement of High Voltages	PC	3	0	0	3	30	70	100
2	20221102	Dielectrics and Insulation Engineering	PC	3	0	0	3	30	70	100
3	20221161A	**(PROGRAM ELECTIVE I)** Power Systems Reforms	PE	3	0	0	3	30	70	100
	20221161B	High Voltage Direct Current Transmission								
	20221161C	Break down Phenomenon in Electrical Insulation (Gases, Liquids, Solids and Vacuum								
4	20221162A	**(PROGRAM ELECTIVE II)** High Voltage Power Apparatus and Diagnostics	PE	3	0	0	3	30	70	100
	20221162B	Collision Phenomena in Plasma Science								
	20221162C	Advanced Electro Magnetic Fields								
5	20221103	Research Methodology	CC	2	0	0	2	30	70	100
6	20221111	Simulation Laboratory – I	LB	0	0	4	2	30	70	100
7	20221112	High Voltage Laboratory	LB	0	0	4	2	30	70	100
8	20221191	**Audit Course-I**	AC	2	0	0	0	30	70	100
		Total		**16**	**0**	**8**	**18**	**240**	**560**	**800**

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w.e.f. Academic Year : 2020-2021

M. Tech. (PSHVE) II-SEMESTER											
S. No.	**Course Code**	**Course**	**Category**	**Periods per week**			**C**	Scheme of Examination Maximum Marks		
				L	**T**	**P**		Int	Ext	Total
1	20221201	High Voltage Testing Techniques	PC	3	0	0	3	30	70	100
2	20221202	Surge Phenomenon and Insulation Co-ordination	PC	3	0	0	3	30	70	100
3		**(PROGRAM ELECTIVE III)**	PE	3	0	0	3	30	70	100
	20221261A	Partial Discharges in High Voltage Equipment								
	20221261B	Gas Insulated Systems and Substations								
	20221261C	Pulse Power Engineering								
4		**(PROGRAM ELECTIVE IV)**	PE	3	0	0	3	30	70	100
	20221262A	Flexible ac transmission Systems								
	20221262B	EHVAC Transmission								
	20221262C	Smart Grid Technologies								
5	20221211	Simulation Laboratory-II	LB	0	0	4	2	30	70	100
6	20221212	Power Systems Laboratory	LB	0	0	4	2	30	70	100
7	20221231	Mini Project	MP	0	0	4	2	100	0	100
8	20221291	**Audit Course – II**	AC	2	0	0	0	30	70	100
		Total		**14**	**0**	**12**	**18**	**310**	**490**	**800**

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Audit Course-1 * & 2*	
1. English for Research Paper Writing	4. Constitution Of India
2. Disaster Management	5. Pedagogy Studies
3. Value Education	6. Personality Development through Life Enlightenment Skills

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w.e.f. Academic Year : 2020-2021

M. Tech. (PSHVE) III Semester										
S. No.	**Course Code**	**Course**	**Category**	**Periods per week**			**C**	**Scheme of Examination Maximum Marks**		
				L	**T**	**P**		Int	Ext	Total
		(PROGRAM ELECTIVE V)	**PE**	3	0	0	**3**	30	70	100
	20221361A	Energy Audit Conservation & Management								
	20221361B	Power Quality								
	20221361C	Power System Transients								
2		**(OPEN ELECTIVE)**	**OE**	3	0	0	**3**	30	70	100
3	20221341	Dissertation – I / Industrial Project	**PJ**	-	-	20	**10**	-	-	-
		(to be continued and evaluated next semester)								
		TOTAL		**6**	**0**	**20**	**16**	**60**	**140**	**200**

II YEAR II SEMESTER

M. Tech. (PSHVE) IV SEMESTER										
S. No.	**Course Code**	**Course**	**Category**	**Periods per week**			**C**	**Scheme of Examination Maximum Marks**		
				L	**T**	**P**		Int	Ext	Total
1	20221441	Dissertation Phase-II	PJ	-	-	32	**16**	**-**	**-**	**-**
		Total		**-**	**-**	32	**16**	**-**	**-**	**-**

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Open elective courses offered by other departments in the college

S. No.	Course Code	Courses
1	20221362a	Operations Research
2	20221362b	Micro Electro Mechanical Systems
3	20221362c	Composite Materials, Cost Management of Engineering Projects
4	20221362d	Machine Learning
5	20221362e	Cyber Security
6	20221362f	Internet of Things and Applications
7	20221362g	Real time operating systems

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
2 Years M.Tech. (Power Systems (High Voltage Engineering)) Course Structure : (2020-21)
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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	GENERATION AND MEASUREMENTS OF HIGH VOLTAGES	3	0	0	3
Teaching	Total contact hours - 60				

Unit-I

Electrostatic fields and field stress control: Electric fields in homogeneous Isotropic materials and in multi dielectric media-Simple configurations-field stress control. Methods of computing electrostatic fields-conductive analogues-Impedance networks Numerical techniques-finite difference method-finite element method and charge simulation method

Unit-II

Generation of High AC & DC Voltages: Direct Voltages: AC to DC conversion methods electrostatic generators-Cascaded Voltage Multipliers. Alternating Voltages: Testing transformers-Resonant circuits and their applications, Tesla coil.

Unit-III

Generation of Impulse Voltages: Impulse voltage specifications-Impulse generations circuits- Operation, construction and design of Impulse generators-Generation of switching and long duration impulses. Impulse Currents : Generation of High impulse currents and high current pulses.

Unit-IV

Measurement of High AC & DC Voltages: Measurement of High D.C. Voltages: Series resistance meters, voltage dividers and generating voltmeters. Measurement of High A.C. Voltages: Series impedance meters electrostatic voltmeters potential transformers and CVTS-voltage dividers and their applications.

Unit –V

Measurement of Peak Voltages: Sphere gaps, uniform field gaps, rod gaps. Chubb-Fortesque methods. Passive and active rectifier circuits for voltage dividers. Measurement of Impulse Voltages: Voltage dividers and impulse measuring systems-generalized voltage measuring circuits-transfer characteristics of measuring circuits-L.V. Arms for voltage dividers-compensated dividers. Measurement of Impulse Currents: Resistive shunts-current transformers-Hall Generators and Faraday generators and their applications-Impulse Oscilloscopes.

Text Books

1. High Voltage Engineering , E.Kuffel and W.S.Zaengl. Pergaman press Oxford, 1984.
2. High Voltage Engineering, .S.Naidu and V.Kamaraju, Mc Graw-Hill Books Co., New Delhi, 2nd edition, 1995

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Reference Books

1. High Voltage Technology,LL Alston, Oxford University Press 1968.
2. High Voltage Measuring Techniques – A. Schwab MIT Press, Cambridge,USA, 1972.
   Relevant
   I.S. and IEC Specifications

Course Outcomes

After completion of this course, a successful student will be able to:

1. Understand numerical computation of electrostatic problems.
2. Understand the techniques of generation of high AC, DC and transient voltages.
3. Measure high AC, DC and transient voltages.
4. Measure high AC, DC and transient currents.

Course Code :	**GENERATION AND MEASUREMENTS OF HIGH VOLTAGES**											
Course Designed by		Department of Electrical and Electronics Engineering										
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO 10	PO 11	PO 12
Course outcomes	CO 1	✓		✓	✓								
	CO 2						✓						
	CO 3			✓								✓	
	CO 4						✓						

Category	**General Humanities**	**Basic Sciences**	**Engineering Sciences And Technical**	**Professional Subjects**
			✓	

Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
2 Years M.Tech. (Power Systems (High Voltage Engineering)) Course
Structure : (2020-21)
***

Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	DIELECTRICS AND INSULATION ENGINEERING	3	0	0	3
Teaching	Total contact hours - 60				

Unit-I

Dielectrics and Insulating Materials: Review of Dielectric Phenomenon : Complex permittivity – Polarization - Relaxation and resonant models. Solid, Liquid and Gaseous insulating materials-Physical, Thermal & Electrical properties-Classification of Insulating Materials

Unit-II

Solid Insulating Materials: Organic Fiber materials Ceramics & Synthetic polymers and their applications. Liquid Insulating Materials : Insulating oils, their properties and applications. Gaseous Insulating Materials : Air and SF6- applications in electrical apparatus.

Unit-III

Breakdown phenomenon in gaseous and vacuum insulation: Insulation and decay processes- transition from self sustained discharges to breakdown-Townsend and streamer discharge paschen's law penning effect-Time lags-Surge breakdown voltage-Breakdown an non uniform fields-Vacuum insulation and vacuum breakdown.

Unit-IV

Breakdown Phenomenon in Liquid and Solid Insulation : pure and commercial liquids-suspended particle and bubble theories-stressed oil volume theory-Breakdown in solid insulation Intrinsic breakdown-Treeing and tracking phenomenon-Thermal breakdown—Breakdown in composite dielectrics.

Unit-V

Insulation Engineering : Insulation design for power cables, capacitors, bushings, switchgear, Transformers and rotating machines-resents trends.

Reference 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 Mc Graw-Hill Books Co., New Delhi, 2nd edition, 1995.
3. Electrical Engineering Materials – B. Tareev, M.I.R. Publications, MOSCOW.
4. Physics of Dielectrics - B. Tareev, M.I.R. Publications, MOSCOW
5. High Voltage Technology - LL Alston, Oxford University Press 1968.
6. Insulation Engineering- by Arora ,John Wiley & Sons
7. Insulating Materials-by Dekker,S.Chanda & Co
8. Dieletrics and waves-by vonhipple,John Wiley & Sons

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Course Outcomes

After completion of this course, a successful student will be able to:

1. Learn Properties of insulating materials.
2. Know Electrical breakdown in gas and vacuum insulation.
3. Know Electrical breakdown in liquid and solid insulation.
4. Know Insulation design in electrical power apparatus

Course Code :		**DIELECTRICS AND INSULATION ENGINEERING**											
Course Designed by		Department of Electrical and Electronics Engineering											
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course outcomes	CO 1					✓	✓						
	CO 2							✓					
	CO 3							✓					
	CO 4							✓	✓				
Category		**General Humanities**		**Basic Sciences**		**Engineering Sciences And Technical**			**Professional Subjects**				
						✓							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
2 Years M.Tech. (Power Systems (High Voltage Engineering)) Course Structure : (2020-21)
***

Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	ARTIFICIAL INTELLIGENCE TECHNIQUES	3	0	0	3
Teaching	Total contact hours - 60				

Unit-I

Introduction to Neural Networks: Introduction, Humans and Computers, Biological Neural Networks, Historical development of neural network, Terminology and Topology, Biological and artificial neuron models, Basic learning laws.

Unit-II

Feed Forward Neural Networks: Introduction, Perceptron models: Discrete, continuous and multi- category, Training algorithms: Discrete and Continuous Perceptron Networks, Perceptron convergence theorem, Limitations and applications of the Perceptron model, Generalized delta learning rule, Feedforward recall and error back propagation training-Radial basis function algorithms-Hope field networks

Unit-III

Genetic algorithms & Modelling: Introduction-encoding-fitness function-reproduction operators- genetic operators-cross over and mutation-generational cycle-convergence of genetic algorithm.

Unit -IV

Classical and Fuzzy Sets Introduction to classical sets :properties, operations and relations; Fuzzy sets, membership, Uncertainty, operations, properties, fuzzy relations, cardinalities, membership functions. Fuzzy Logic System Components-Fuzzification, Membership value assignment, development of rule base and decision making system, defuzzification to crisp sets, defuzzification methods.

Unit-V

Application of AI Techniques: Load forecasting-load flow studies-economic load dispatch-load frequency control-reactive power control-speed control of dc and ac motors.

Text Books

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan and Rai PHI Publication.
2. Introduction to Artificial Neural Systems - Jacek M. Zuarda, Jaico Publishing House, 1997.

Course Outcomes

After completion of this course, a successful student will be able to:

1. Understand neural networks and analyze different types of neural networks.
2. Design training algorithms for neural networks.
3. Develop algorithms using genetic algorithm for optimization.

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4. Analyze and design fuzzy logic systems and apply AI Techniques in electrical engineering .

Course Code :		**ARTIFICIAL INTELLIGENCE TECHNIQUES**											
Course Designed by		Department of Electrical and Electronics Engineering											
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course outcomes	CO 1				✓			✓					
	CO 2			✓									
	CO 3							✓					
	CO 4							✓					
Category		**General Humanities**		**Basic Sciences**		**Engineering Sciences And Technical**			**Professional Subjects**				
						✓							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	HIGH VOLTAGE DIRECT CURRENT TRANSMISSION	3	0	0	3
Teaching	Total contact hours - 60				

Unit-I

Limitation of EHV AC Transmission :Advantages of HVDC Technical economical reliability aspects.

H.V.D.C. Transmission: General considerations, Power Handling Capabilities of HVDC Lines, Basic Conversion principles, static converter configuration. Types of HVDC links-Apparatus and its purpose.

Unit-II

Static Power Converters : 6-pulse bridge circuit and 12-pulse converters, converter station and Terminal equipment, commutation process, Rectifier and inverter operation, equivalent circuit for converter – special features of converter transformers. Comparison of the perform of diametrical connection with 6-pulse bridge circuit

Unit-III

Control of HVDC Converters and systems : constant current, constant extinction angle and constant Ignition angle control. Individual phase control and equidistant firing angle control, DC power flow control. Factors responsible for generation of Harmonics voltage and current harmonics effect of variation of α and μ. Filters Harmonic elimination

Unit-IV

Interaction between HV AC and DC systems:Voltage interaction, Harmonic instability problems and DC power modulation. Development of DC circuit Breakers, Multi-terminal DC links and systems; series, parallel and series parallel systems, their operation and control.

Unit –V

Transient over voltages in HV DC systems : Over voltages due to disturbances on DC side, over voltages due to DC and AC side line faults. Converter faults and protection in HVDC Systems: Converter faults, over current protection - valve group, and DC line protection, circuit breakers. Over voltage protection of converters, surge arresters.

Reference Books

1. High Voltage Direct current Transmission, K.R.Padiyar Wiley Eastern Ltd., New Delhi – 1992.
2. Direct current Transmission, E.W. Kimbark, Wiley Inter Science – New York.
3. H.V.D.C.Transmission, J.Arillaga Peter Peregrinus ltd., London UK 1983
4. Power Transmission by Direct Current, E.Uhlman ,Springer Verlag, Berlin Helberg – 1985.
5. HVDC Transmission-S Kamakshaih and V Kamaraju MG hill.

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Course Outcomes

After completion of this course, a successful student will be able to:

1. Understand the various schemes of HVDC transmission.
2. Understand the basic HVDC transmission equipment.
3. Understand the control of HVDC systems.
4. Understand the interaction between HVAC and HVDC system and the various protection schemes of HVDC engineering.

Course Code :		**HIGH VOLTAGE DIRECT CURRENT TRANSMISSION**											
Course Designed by		Department of Electrical and Electronics Engineering											
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course outcome	CO 1	✓											
	CO 2		✓										
	CO 3			✓									
	CO 4						✓	✓					
Category		**General Humanities**		**Basic Sciences**		**Engineering Sciences And Technical**			**Professional Subjects**				
						✓							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	BREAK DOWN PHENOMENON IN ELECTRICAL INSULATION (GASES, LIQUIDS, SOLIDS AND VACUUM)	3	0	0	3
Teaching	Total contact hours - 60				

Unit-I

Fundamentals of Electrical Breakdown Phenomena in Gases: Review of gas laws-mean free path of a particle-velocity distribution of swarm of molecules-Expression for mean free path (λ)-Distribution of free paths-Bohr's model of an atom. Calculation of radius of Bohr's orbit Energy of an electron- Ionization energy of an atom calculation of frequency of emitted radiation.

Unit-II

Ionization Its Gases: Methods of ionization in gases-Ionization by collision-types of inelastic collisions, collision cross sections. Behavior of charged particles in a gas in electric fields of low (E/P)- drift velocity –mobility conditions for low (E/P). Electrical Breakdown in Uniform Fields: Voltage- current relationship is gaseous gap (small gaps)-condition for high (E/P)-Townsend's first Ionization coefficient (α) - (α/p) is a function of (E/P)-Experimental determination of (α) –Penning effect.

Unit-III

Self-sustained discharge: β-process and its limitations cathode process –methods of liberating secondary electrons –Townsend's second ionization coefficient -γ -process . Condition for electric spark breakdown. Secondary emission by gas produced photons – Meta stables-Role of solid contaminants. Electron Attachment, electronegative gases (SF6 etc).

Measurement of ‗γ'- Paschen's law –expression for Minimum Breakdown voltage and minimum (Pdmin) - limitations of Paschen's law. Breakdown of long gaps: Streamer Mechanism- Explanation for positive streamer. Estimation of space charge fields (Es) - Anode directed streamer - comparison between Townsend and streamer mechanism. Breakdown in non-uniform fields –corona discharges - difference between DC and AC corona. Effect of polarity on break down of point-plane gaps.

Unit-IV

Breakdown in Solids and Liquid Insulations: Types of Breakdown: Intrinsic Breakdown – Electronic Breakdown – Streamer Breakdown – Electromechanical Breakdown –Thermal Breakdown -treeing and tracking. Electro – Chemical Breakdown – BD due to thermal

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discharges. Breakdown in liquids dielectrics: Pure and commercial liquids – Breakdown tests – Pre-breakdown currents and breakdown in pure liquids – breakdown in commercial liquids –Suspended particle theory, cavitations and bubble mechanism. Thermal breakdown – Stressed oil – Volume Theory.

Unit-V

Breakdown in Vacuum Insulation: Pre-Breakdown currents – Steady currents –Micro discharges- Factors affecting the Breakdown . like electrode separation - electrode conditioning - electrode material
–Surface condition surface contamination - electrode area and configurations –effect of electrode temperature –frequency of applied voltage – pressure - recovery strength of vacuum gap. Practical Exchange theory –electron beam Hypothesis – Clump mechanism- transition in breakdown mechanisms
– criteria for B.D - effect of solids dielectrics in vacuum and liquids.

Reference Books

1. Fundamentals of gaseous ionization and plasma electronics by Izam Nassar
2. High voltage & electrical insulation by Ravindra Arora , john willy and sons.
3. High voltage technology –Alston Ll -Oxford Press.

Course Outcomes

After completion of this course, a successful student will be able to:

1. Understand the fundamental process of conduction in gases.
2. Understand ionization and breakdown phenomena in gases.
3. Understand breakdown phenomena in liquid and solid dielectrics.
4. Understand breakdown phenomena in vacuum.

Course Code : BREAK DOWN PHENOMENON IN ELECTRICAL INSULATION (GASES, LIQUIDS, SOLIDS AND VACUUM)													
Course Designed by		Department of Electrical and Electronics Engineering											
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course outcomes	CO 1	✓											
	CO 2	✓	✓			✓							
	CO 3	✓											
	CO 4	✓				✓							
Category		**General Humanities**		**Basic Sciences**		**Engineering Sciences And Technical**			**Professional Subjects**				
						✓							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
2 Years M.Tech. (Power Systems (High Voltage Engineering)) Course
Structure : (2020-21)
***

Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	HIGH VOLTAGE POWER APPARATUS AND DIAGNOSTICS	3	1	0	3
Teaching	Total contact hours - 60				

Unit-I

Introduction to power transformer, important components of power transformer, winding configuration, various types of insulation material, LV and HV bushings, cooling of winding. Reasons of failure of transformer, short circuit, overvoltage due to switching operation, inadequate clearances between various windings, over-voltage due to lightning impulse, over voltage due to fault, high level of partial discharges, inappropriate design, over fluxing.

Unit-II

Tan delta, capacitance in transformer winding, method of measurement of tan delta and capacitance in transformer ,Tan delta ,resistivity and capacitance of transformer oil, bushing capacitance ,tan delta and resistivity, on-site measurement, analysis to detect ageing and likely failure

Unit-III

Moisture in transformer oil and paper, ageing effect of paper, insulation resistance, Method of measurement of polarization, polarization value, method of moisture reduction, winding resistance, Influence with regard to life of transformer. Partial Discharges in transformer, causes of partial discharges, concept of partial discharges, acoustic method of measurement of partial discharges, discharges in oil, discharges in paper, method of reduction of partial discharges, analysis and detection of partial discharge sites within transformer volume.

Unit-IV

Degree of polymerization (DP) of transformer paper, effect of DP on life of transformer, effect of transformer temperature on degree of polymerization, furfural content in oil insulation, inter – relationship between degree of polymerization and furfural content , method of measurement of tan delta and capacitance in transformer, method of measurement of tan delta and capacitance in transformer bushing , reduction of degree of polymerization in transformer paper. Dissolved gas analysis in
transformer oil, various gas product in transformer oil, tolerable level of gases in transformer on load , detection of important gases in transformer, causes of various gases, likely reason of gases with reference to high temperature and partial discharges.

Unit-V

Fourier Transform and frequency response analysis of transformer winding, concept of Fourier Transformer with regard to configuration of winding, low, medium and high frequency comparison of frequency response of LV , HV and tapping winding, concept of winding movement on the basis of frequency comparison, turn failure.

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Text Books

1. Transformer, Bharat Heavy Electricals Limited (Bhopal), Second edition 2003, First Edition 1987 Tata Mc.Graw-hill Publishing Company Ltd. Mc.Graw –Hill office Page 1- 602.

Reference books

1. Seminar on fault finding and life assessment of power transformers Proceedings 25-26 April2008 New Delhi, Organized by Central Board of Irrigation and Power, New Delhi in association with Omicron India.

Course Outcomes

After completion of this course, a successful student will be able to:

1. Learn power transformer, types of insulation material.
2. Measure tan delta and capacitance of transformer oil.
3. Know the concept of moisture in transformer oil and paper and partial discharges and degree of polymerization..
4. Know concept of fourier transformer and frequency response analysis of transformer winding.

Course Code : HIGH VOLTAGE POWER APPARATUS AND DIAGNOSTICS													
Course Designed by		Department of Electrical and Electronics Engineering											
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course outcomes	CO 1	✓											
	CO 2	✓											
	CO 3		✓										
	CO 4	✓											
Category		**General Humanities**		**Basic Sciences**		**Engineering Sciences And Technical**			**Professional Subjects**				
						✓							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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2 Years M.Tech. (Power Systems (High Voltage Engineering)) Course Structure : (2020-21)
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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	COLLISION PHENOMENA IN PLASMA SCIENCE	3	1	0	3
Teaching	Total contact hours - 60				

Unit-I

Ionization, Deionization and Electron Emission :Ionization and plasma conductivity, Production of charged particles, Ionization by cosmic rays, Thermal ionization. The free path, excited states, metastable states. Diffusion, Recombination, Negative ions. Photoelectric emission, Thermionic emission, Field emission.

Unit-II

Behavior of charged particles in a gas in electric fields of low E/P and high E/P, Definition and significance of mobility, Forces between ions and molecules, Diffusion under low fields, Electron drift velocity.

Unit-III

What is high E/P?, Coefficient of ionization by electron collision, evaluation of , electron avalanche, effect of the cathode, Ionization coefficient in alternating fields. The Self-Sustaining Discharge Breakdown Mechanisms: Ionization by positive-ion collision, Cathode processes, space-charge field of an avalanche. Critical avalanche size.

Unit-IV

Townsend mechanism and its limitations, Streamer formation. The transition between the breakdown mechanisms, The effect of electron attachment. Partial Breakdown and Breakdown Under Alternating Fields: Electron current, positive-ion current, total current, characteristic time, effect of space charge, Anode coronas, Cathode coronas.

Unit-V

The Glow and Plasma: General description, The cathode zone, Negative glow and Faraday dark space, positive column, Anode region, other effects. Definition of plasma, Debye length, scope of known plasmas, Plasma oscillations, high-temperature plasmas, Plasma diagnostics.

Reference Books

1. Fundamentals of Gaseous Ionization And Plasma Electronics by Essam Nasser, John Willey & Sons, Printed in America, 1971

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Course Outcomes

After completion of this course, a successful student will be able to:

1. Understand the collision phenomena in different materials.
2. Know Transition from Streamer to Townsend mechanisms of breakdown.
3. Understand Electric glow discharge and plasma glow discharge.

Course Code : COLLISION PHENOMENA IN PLASMA SCIENCE													
Course Designed by		Department of Electrical and Electronics Engineering											
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course outcomes	CO 1	✓											
	CO 2	✓											
	CO 3	✓											
Category		**General Humanities**		**Basic Sciences**		**Engineering Sciences And Technical**			**Professional Subjects**				
						✓							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	ADVANCED ELECTRO MAGNETIC FIELDS	3	1	0	3
Teaching	Total contact hours - 60				

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)=v – Laplace's and Poisson's equations – Solution of Laplace's equation in one variable

Unit-II

Electric fields-1: Introduction, Analytical calculation of space-charge-free fields, simple geometries, transmission conductors to ground, fields in multidielectric media, experimental analogs for space- space-charge-free fields, electrolytic tank, semi conducting paper analog, resistive-mesh analog.

Unit-III

Electric fields-2: 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 : 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 continuity

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Unit-V

Force in Magnetic fields & Time Varying Fields: 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.

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Text Books

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

Reference Books

1 Field Theory , Gangadhar, Khanna Publishers.
2 Elements of Electromagnetic field theory , 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 magnetic" by Nathan Ida, Springer(India) Pvt. Ltd. 2nd Edition.

Course Outcomes

After completion of this course, a successful student will be able to:

1. Know about analysis of electrostatic fields and properties of potential gradients.
2. Know about the dielectric boundary conditions and electric stress control and optimization and time varying fields.

Course Code : ADVANCED ELECTRO MAGNETIC FIELDS													
Course Designed by		Department of Electrical and Electronics Engineering											
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course outcomes	CO 1	✓											
	CO 2	✓											
Category		**General Humanities**		**Basic Sciences**		**Engineering Sciences And Technical**			**Professional Subjects**				
						✓							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	RESEARCH METHODOLOGY	3	1	0	3
Teaching	Total contact hours - 60				

UNIT-I
Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT-II
Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT-III
Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT-IV
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT-V
New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

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REFERENCES:

1. Stuart Melville and Wayne Goddard, —Research methodology: an introduction for science& engineering students'
2. Wayne Goddard and Stuart Melville, —Research Methodology: An Introduction
3. Ranjit Kumar, 2nd Edition, —Research Methodology: A Step by Step Guide for beginners
4. Halbert, —Resisting Intellectual Property‖, Taylor & Francis Ltd,2007.

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5. Mayall, ―Industrial Design‖, McGraw Hill, 1992.

COURSE OUTCOMES

1. Understand some basic concepts of research and its methodologies
2. Identify appropriate research topics
3. Select and define appropriate research problem and parameters
4. Write a research report, thesis and research proposal (grants)

Course Code : RESEARCH METHODOLOGY												
Course Designed by		Department of Electrical and Electronics Engineering										
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course outcomes	CO 1	✓											
	CO 2				✓								
	CO 3										✓		
	CO 4							✓					
Category		**General Humanities**		**Basic Sciences**		**Engineering Sciences And Technical**			**Professional Subjects**				
						✓							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	SIMULATION LABORATORY I	0	0	3	2
Teaching	Total contact hours - 45				

List of experiments

1. Formation of Y- Bus by Direct-Inspection Method.
2. Load Flow Solution Using Gauss Siedel Method
3. Load Flow Solution Using Newton Raphson Method
4. Load Flow Solution Using Fast Decoupled Method
5. Formation of Z-Bus by Z-bus building algorithm
6. Symmetrical Fault analysis using Z-bus
7. Unsymmetrical Fault analysis using Z-bus
8. Economic Load Dispatch with & without transmission losses
9. Transient Stability Analysis Using Point By Point Method
10. Load Frequency Control of Single Area Control & Two Area Control system withand without controllers.

Course Outcomes:

At the end of the lab, student will be able to

1. Distinguish between different load flow methods.
2. Analyze Y-bus & Z-bus algorithm.
3. Analyze symmetrical & unsymmetrical faults.
4. Understand importance of load flow control, Economic load dispatch and transient stability analysis.

Course Code : SIMULATION LABORATORY I												
Course Designed by		Department of Electrical and Electronics Engineering										
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course outcomes	CO 1	✓											
	CO 2	✓											
	CO 3	✓											
	CO 4						✓	✓					

Category	General Humanities	Basic Sciences	Engineering Sciences And Technical	Professional Subjects
			✓	

Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination

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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	HIGH VOLTAGE LABORATORY	0	0	3	2
Teaching	Total contact hours - 45				

Any 10 of the following experiments are to be conducted List of Experiments:

1 Milli volt drop test and Tong tester calibration
2 Breakdown characteristics of sphere-sphere gap
3 Measurement of Leakage current and breakdown voltage of pin insulator
4 Breakdown test of transformer oil
5 Breakdown characteristics of rod-rod gap
6 Measurement of Leakage current and insulation resistance of polypropylene scale
7 Measurement of Leakage current and insulation resistance of polypropylene rope
8 Breakdown characteristics of plane-rod-gap
9 Measurement of leakage current and breakdown voltage of suspension insulator
10 Breakdown characteristics of point-sphere gap
11 Measurement of tan delta and dielectric constant
12 Power frequency testing of HV transformer
13 Power frequency testing of HV Bushing
14 Power frequency testing of HV Cable

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Course Outcomes:

At the end of the lab, student will be able to

1. Design the various testing procedures of various insulators.
2. Design the procedure for calibration of tong tester.
3. Compute the breakdown strength of dielectric coil.
4. Determine the leakage current of various insulators.

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Course Code : HIGH VOLTAGE LABORATORY													
Course Designed by		Department of Electrical and Electronics Engineering											
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course outcomes	CO 1			✓									
	CO 2			✓									
	CO 3	✓				✓							
	CO 4	✓						✓					
Category		**General Humanities**		**Basic Sciences**		**Engineering Sciences And Technical**			**Professional Subjects**				
						✓							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	ENGLISH FOR RESEARCH PAPER WRITING	0	0	3	2
Teaching	Total contact hours - 45				

UNIT I

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT III

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT IV

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature

UNIT V

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions - useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

References

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook .
4. Adrian Wallwork , English for Writing Research Papers, Springer New YorkDordrecht Heidelberg London, 2011

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COURSE OUTCOMES:

Students will be able to:

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a title and ensure the good quality of paper at very first time submission

Course Code : ENGLISH FOR RESEARCH PAPER WRITING												
Course Designed by		Department of Electrical and Electronics Engineering										
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course outcomes	CO 1										✓		
	CO 2										✓		
	CO 3										✓		
Category		**General Humanities**		**Basic Sciences**		**Engineering Sciences And Technical**			**Professional Subjects**				
						✓							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	DISASTER MANAGEMENT	0	0	3	2
Teaching	Total contact hours - 45				

UNIT I Introduction
Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

UNIT II Repercussions Of Disasters And Hazards:
Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man- made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT III Disaster Prone Areas In India
Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics

UNIT IV Disaster Preparedness And Management
Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

UNIT V Risk Assessment & Disaster Mitigation
Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival. - Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

References

1. R. Nishith, Singh AK, —Disaster Management in India: Perspectives, issues and strategies —'New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.),| Disaster Mitigation Experiences And Reflections|, Prentice Hall Of India, New Delhi.
3. Goel S. L. , Disaster Administration And Management Text And Case Studies| ,Deep &Deep Publication Pvt. Ltd., New Delhi.

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COURSE OUTCOMES:

Students will be able to:

1. Learn to demonstrate a critical understanding of keyconcepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practicefrom multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance inspecific types of disasters and conflict situations.
4. Critically understand the strengths and weaknesses of disaster management approaches, planning and Programming in different countries, particularly their home country or the countries they work in

Course Code : DISASTER MANAGEMENT													
Course Designed by		Department of Electrical and Electronics Engineering											
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course outcome s	CO 1									□			
	CO 2								□	□			
	CO 3									□			
	CO 4							□		□			
Category		**General Humaniti**		**Basic Sciences**		**Engineering Sciences And Technical**			**Professional Subjects**				
						□							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	VALUE EDUCATION	3	1	0	3
Teaching	Total contact hours - 60				

Unit I: **Social Justice**

Definition – need – parameters of social justice – factors responsible for social injustice – caste and gender – contributions of social reformers.

Unit II: Human Rights and Marginalized People

Concept of Human Rights – Principles of human rights – human rights and Indian constitution – Rights of Women and children – violence against women – Rights of marginalized People – like women, children, dalits, minorities, physically challenged etc

Unit III: Social Issues and Communal Harmony

Social issues – causes and magnitude - alcoholism, drug addiction, poverty, unemployment etc – communal harmany –concept –religion and its place in public in public domain – separation of religion from politics –secularism role of civil society

Unit IV: Media Education and Globalized World Scenario

Mass media –functions –characteristics –need and purpose of media literacy – effects and influence - - youth and children – media power – socio cultural and political consequences mass mediated culture - - consumeristic culture – Globalization – new media- prospects and challenges

Unit V: Values and Ethics

Personal values – family values – social values – cultural values – Professional values – and overall ethics – duties and responsibilities

References

1 Chakroborty, S.K. ―Values and Ethics for organizations Theory and practice‖, Oxford University Press, New Delhi

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Course outcomes

Students will be able to
1.Knowledge of self-development 2.Learn the importance of Human values
3.Developing the overall personality

Course Code : VALUE EDUCATION													
Course Designed by		Department of Electrical and Electronics Engineering											
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course outcomes	CO 1								✓	✓	✓		✓
	CO 2								✓	✓	✓		✓
	CO 3								✓	✓	✓		✓
Category		**General Humaniti**		**Basic Sciences**		**Engineering Sciences And Technical**			**Professional Subjects**				
						✓							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	HIGH VOLTAGE TESTING TECHNIQUES	3	1	0	3
Teaching	Total contact hours - 60				

Unit-I

Non Destructive Testing Techniques : Measurement of DC Resistivity– Dielectric loss and dielectric constant of insulating materials – Schering bridge method – Transformer ratio 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 insulators-Classification of porcelain/glass insulator tests – Tests for cap and pin porcelain/Glass insulators.

Unit-III

High voltage AC testing methods-Power frequency tests-Over voltagetests on insulators, Isolators, Circuit Breakers and power cables.Artificial Contamination Tests : Contamination flashover phenomena-Contamination Severity-Artificial contamination tests-Laboratory Testing versus in-Service Performance-Case study.

Unit-IV

Impulse Testing : Impulse testing of transformers-Surge diverters and other apparatus.

Unit-V

Partial Discharge Measurement : PD equivalent model-PD currents-PD measuring circuits-Straight and balanced detectors-Location andestimation 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.

Reference Books

1 High Voltage Engineering – by E.KUFFEL and W.S.ZAENGL, Pergamon press, Oxford 1984.
2 High Voltage Engineering – by M.S.Naidu and V.Kamaraju, Tata Mc Graw Hill Publishing Company Limited, New Delhi – 2001.
3 Discharge Detection in H.V. Equipment – by KREUGER, F.H. Haywood London – 1964.
4 Outdoor Insulators – by Gorur & Cherney.
5 H.V. Testing Techniques Halfly.

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Course Outcomes

After completion of this course, a successful student will be able to:

1. Understand different testing procedures on electrical Insulating materials, Insulation Systems, Pow
2. Learn the different testing techniques adopted on electrical power apparatus.

Course Code : HIGH VOLTAGE TESTING TECHNIQUES												
Course Designed by		Department of Electrical and Electronics Engineering										
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course outcomes	CO 1	✓											
	CO 2	✓											
Category		General Humanities		Basic Sciences		Engineering Sciences And Technical			Professional Subjects				
						✓							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
2 Years M.Tech. (Power Systems (High Voltage Engineering)) Course Structure : (2020-21)
***

Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	SURGE PHENOMENON AND INSULATION CO-ORDINATION	3	1	0	3
Teaching	Total contact hours - 60				

Unit-I Traveling Waves

Transmission line equation, attenuation and distortion point-Typical cases.
Reflection of Traveling waves: Behaviors of waves at a transaction point-Typical cases. travelling waves on multiconductor systems.

Unit-II Successive Reflections

Reflection lattice, Effect of insulation capacitance. Standing waves and natural frequencies of transmission lines-Transient response of lines and systems with distributed parameters.

Unit-III Lightning Phenomena and over voltage in power systems

Mechanism of the lightning stroke – Mathematical model of the lightning stroke.Over voltages produced in power systems due to lightning – Over voltage due to faults in the system and switching surges. General principles of lightning protection – Tower – Footing resistance –Insulation withstand voltages and impulse flashover characteristics of protective gaps.

Unit-IV Surge Voltage distribution in transformer windings initial and final distribution characteristics

Protection of windings against over voltages. protection of transmission lines, transformers and rotating machines against over voltages. Use of rod gaps and lightning arresters protective characteristics. Selection of the lightning arresters.

Unit-V Insulation coordination

lightning surge and switching surge characteristics of insulation structures. Geo-metric gap factors test

procedures, correlation between insulation for protective levels. Protective devices Zno arresters,vale type-etc, protective tubes.

Reference 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.
3 E.H.V. Transmission Engineering: Rakesh Das Begmudre

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Wielly Eastern Ltd., New Delhi, 1986.

Course Outcomes

After completion of this course, a successful student will be able to:

1. Understand line concepts of travelling waves and their behavior in transmission systems.
2. Understand lighting phenomena and over voltages in power systems.
3. Understand the behavior of the transformer when surge voltages are induced in the windings.
4. Understand the insulation coordination between different protecting and protective devices in the power system.

Course Code : SURGE PHENOMENON AND INSULATION CO-ORDINATION													
Course Designed by		Department of Electrical and Electronics Engineering											
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course Outcomes	CO 1	✓	✓										
	CO 2	✓					✓						
	CO 3	✓					✓						
	CO 4	✓					✓						
Category		**General Humanities**		**Basic Sciences**		**Engineering Sciences And Technical**			**Professional Subjects**				
						✓							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
2 Years M.Tech. (Power Systems (High Voltage Engineering)) Course
Structure : (2020-21)
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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	GAS INSULATED SYSTEMS AND SUBSTATIONS	3	1	0	3
Teaching	Total contact hours - 60				

UNIT – 1

Introduction to GIS and Properties of SF6:

Characteristics of GIS, Introduction to SF6, Physical Properties, Chemical Properties, Electrical Properties, Specifications of SF6 Gas for GIS Applications, Handling of SF6 Gas Before Use, Safe Handling of SF6 Gas in Electrical Equipment, Equipment for Handling the SF6 Gas, SF6 and Environment.

UNIT – 2

Layout of GIS Stations:

Advantages of GIS Stations, Comparison with Air Insulated Substations, Economics of GIS, User Requirements for GIS, Main Features of a GIS, General Arrangement of a GIS, Planning and Installation, Components of a GIS station.

UNIT – 3

Design and Construction of GIS Stations:

Introduction, Ratings of GIS Components, Design Features, Estimation of Different types of Electrical Stresses, Design Aspects of GIS Components, Insulation Design for GIS, Thermal Considerations in the Design of GIS, Effect of Very Fast Transient over voltages(VFTO) on the GIS Design, Insulation Coordination in GIS ,GIS Grounding Systems, Gas handling and Monitoring System Design.

UNIT – 4

Testing of GIS

Introduction, Various Tests on GIS, Design Approach for Manufacturing and Type Tests, Quality Assurance in Manufacturing, Shipping and Erection, On-Site Testing of GIS, Dielectric Tests, commonly used On-site Test Methods, Experience during On-Site Testing, Condition Monitoring and Diagnostic Methods.

UNIT – 5

GIS Diagnostics and Fast Transient Phenomena in GIS

Introduction, Characteristics of imperfections in Insulation, Insulation Diagnostic Methods, PD Measurement, UHF Method, Disconnector Switching in Relation to Very Fast Transients, Origin of VFTO, Propagation and Mechanism of VFTO,VFTO Characteristics, Effect of VFTO, Testing of GIS for VFTO.

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Text Book:

1. M.S.Naidu, ―Gas Insulated Substations‖ I.K International publishing house Pvt.Ltd, New Delhi

Reference Books:

1. O.Kindsen&K.V.Menon, ―Future developments trend in GIS Technology‖ 3rd workshop & conference on EHV Technology, Indian Institute of Science, Bangalore, August 2-4, 1995.
2. V.N.Maller and M.S.Naidu ―Advances in High Voltage Insulation & Arc Interruption in SF6 and Vaccum‖, Pergamon Press, Oxford, 1982.

Course Outcomes: At the end of the course, student will be able to

1. Know the Properties of SF6
2. Understand design and construction of G.I.S Substations
3. Analyze transient Phenomenon and testing of G.I.S
4. Analyze diagnostics of GIS

Course Code : GAS INSULATED SYSTEMS AND SUBSTATIONS													
Course Designed by		Department of Electrical and Electronics Engineering											
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course Outcomes	CO 1	✓											
	CO 2			✓									
	CO 3		✓										
	CO 4		✓										
Category		**General Humanities**		**Basic Sciences**		**Engineering Sciences And Technical**			**Professional Subjects**				
						✓							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
2 Years M.Tech. (Power Systems (High Voltage Engineering)) Course
Structure : (2020-21)
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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	PULSE POWER ENGINEERING	3	1	0	3
Teaching	Total contact hours - 60				

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.

Unit- III

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- IV

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. **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

Unit- V

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 Books

1 Pulsed Power Engineering by Professor Dr.Hasjoachim Bluhm.
2 Explosive Pulsed Power -L. L. Altgilbers, J. Baird, B. Freeman, C. S. Lynch, and S. I. Shkuratov -Imperial College Press.
3 Advances in Pulsed Power Technology, Vol. 1 & 2, Plenum Press.
4 Pulsed Power Systems: Principles and Applications- Dr.Hasjoachim Bluhm-Springer.

Course Outcomes

After completion of this course, a successful student will be able to:

1. Know Various energy storage devices, repetitive generators and cumulative pulse lines.

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2. Know Pulse forming networks and their applications.
3. Know Pulse power generators.

Course Code : PULSE POWER ENGINEERING												
Course Designed by		Department of Electrical and Electronics Engineering										
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course Outcome	CO 1	✓											
	CO 2	✓											
	CO 3	✓											
Category		General Humanities		Basic Sciences		Engineering Sciences And Technical			Professional Subjects				
						✓							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
2 Years M.Tech. (Power Systems (High Voltage Engineering)) Course Structure : (2020-21)
***

Regulation	GR - 20 (M.Tech.)	L	T	P	C
Course/ Code	FLEXIBLE ALTERNATING CURRENT TRANSMISSION SYSTEMS	3	1	0	3
Teaching	Total contact hours - 60				

Unit -I

FACTS: concepts, Transmission interconnections, power flow in an AC System, loading capability limits, Dynamic stability considerations, importance of controllable parameters, basic types of FACTS controllers, benefits from FACTS controllers.

Unit–II

Voltage source converters : Single phase, three phase, full wave bridge converters, transformer connections for 12 pulse, 24 and 48 pulse operation. Three level voltage source converter, pulse width modulation converter, basic concept of current source converters, and comparison
of current source converters with voltage source converters.

Unit–III

Static shunt compensation : Objectives of shunt compensation, midpoint voltage regulation, voltage instability prevention, improvement of transient stability, Power oscillation damping, methods of controllable var generation, variable impedance type static var generators, switching converter type var generators, hybrid var generators.

Unit-IV

SVC and STATCOM : The regulation and slope transfer function and dynamic performance, transient stability enhancement and power oscillation damping, operating point control and summary of compensation control.

Unit-V

Static series compensators : Concept of series capacitive compensation, improvement of transient stability, power oscillation damping, functional requirements. GTO thyristor controlled series
capacitor (GSC), thyristor switched series capacitor (TSSC), and thyristor controlled series capacitor (TCSC), control schemes for GSC, TSSC and TCSC.

Course Outcomes

After completion of this course, a successful student will be able to:

1. Know the performance improvement of transmission system with facts.
2. Get the knowledge of effect of static shunt and series compensation.
3. Know the effect of upfc.
4. Determine an appropriate facts device for different types of applications.

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Course Code : FLEXIBLE ALTERNATING CURRENT TRANSMISSION SYSTEMS													
Course Designed by		Department of Electrical and Electronics Engineering											
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Reference Books 1	CO 1	✓											
	CO 2	✓		✓									
	CO 3	✓											
	CO 4					✓							
Category		**General Humaniti**		**Basic Sciences**		**Engineering Sciences And Technical**			**Professional Subjects**				
						✓							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

Text Books

1 Understanding FACTS Devices, N.G.Hingorani and L.Guygi, IEEE Press. Indian Edition is available:—Standard Publications
2 Flexible AC Transmission systems ,Sang.Y.H and John.A.T, IEEE Press (2006).
3 HVDC & FACTS Controllers: applications of static converters in power systems-Vijay K.Sood- Springer publishers

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
2 Years M.Tech. (Power Systems (High Voltage Engineering)) Course Structure : (2020-21)
***

Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	EHVAC TRANSMISSION	3	1	0	3
Teaching	Total contact hours - 60				

UNIT – 1

E.H.V. A.C. Transmission, line trends and preliminary aspects, standard transmission voltages – power handling capacities and line losses – mechanical aspects.
Calculation of line resistance and inductance: resistance of conductors, temperature rise of conductor and current carrying capacity. Properties of bundled conductors and geometric mean radius of bundle, inductance of two conductor lines and multi conductor lines, Maxwell's coefficient matrix. Line capacitance calculation. Capacitance of two conductor line, and capacitance of multi conductor lines, potential coefficients for bundled conductor lines, sequence inductances and capacitances and diagonalization.

UNIT – 2

Calculation of electro static field of AC lines - Effect of high electrostatic field on biological organisms and human beings. Surface voltage Gradient on conductors, surface gradient on two conductor bundle and cosine law, maximum surface voltage gradient of bundle with more than 3 sub conductors, Mangolt formula.

UNIT – 3

Corona : Corona in EHV lines – corona loss formulae – attenuation of traveling waves due to corona – Audio noise due to corona, its generation, characteristics and limits, measurement of audio noise.

UNIT – 4

Power Frequency voltage control : Problems at power frequency, generalized constants, No load voltage conditions and charging currents, voltage control using synchronous condenser, cascade connection of components : Shunt and series compensation, sub synchronous resonance in series
– capacitor compensated lines

UNIT – 5

Reactive power compensating systems: Introduction, SVC schemes, Harmonics injected into network by TCR, design of filters for suppressing harmonics injected into the system.

Text Books:

1. Extra High Voltage AC Transmission Engineering – Rakesh Das Begamudre, Wiley Eastern ltd., New Delhi – 1987.
2. EHV Transmission line reference book – Edison Electric Institute (GEC) 1986.

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Course Outcomes: At the end of the course, student will be able to

1. Calculate the transmission line parameters.
2. Calculate the field effects on EHV and UHV AC lines.
3. Determine the corona, RI and audible noise in EHV and UHV lines.
4. Analyze voltage control and compensation problems in EHV and UHV transmission systems.
5. Understand reactive power compensation using SVC and TCR

Course Code : EHVAC TRANSMISSION													
Course Designed by		Department of Electrical and Electronics Engineering											
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course Outcomes	CO 1	✓											
	CO 2	✓		✓									
	CO 3	✓											
	CO 4					✓							
	CO 5	✓				✓	✓						
Category		**General Humanities**		**Basic Sciences**		**Engineering Sciences And Technical**			**Professional Subjects**				
						✓							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
2 Years M.Tech. (Power Systems (High Voltage Engineering)) Course Structure : (2020-21)
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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	SMART GRID TECHNOLOGIES	3	1	0	3
Teaching	Total contact hours - 60				

Unit-I

Introduction to Smart Grid: Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Functions of Smart Grid, Opportunities & Barriers of Smart Grid, Difference between conventional & smart grid, Concept of Resilient & Self Healing Grid, Present development & International policies on Smart Grid. Case study of Smart Grid.

Unit-II

Smart Grid Technologies: Part 1: Introduction to Smart Meters, Real Time Prizing, Smart Appliances, Automatic Meter Reading(AMR), Outage Management System(OMS), Plug in Hybrid Electric Vehicles(PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation, Phase Shifting Transformers.

Unit-III

Smart Grid Technologies: Part 2: Smart Substations, Substation Automation, Feeder Automation. Geographic Information System(GIS), Intelligent Electronic Devices(IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System(WAMS), Phase Measurement Unit(PMU).

Unit-IV

Microgrids and Distributed Energy Resources: Concept of microgrid, need & applications of microgrid, formation of microgrid, Issues of interconnection, protection & control of microgrid. Plastic & Organic solar cells, Thin film solar cells, Variable speed wind generators, fuelcells, microturbines, Captive power plants, Integration of renewable energy sources.

Unit-V

Power Quality Management in Smart Grid: Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit. **Information and Communication Technology**

for Smart Grid: Advanced Metering Infrastructure (AMI), Home Area Network (HAN), Neighborhood Area Network (NAN), Wide Area Network (WAN).

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Course Outcomes

After completion of this course, a successful student will be able to:

1. Understand smart grids and analyse the smart grid policies and developments in smart grids.
2. Develop concepts of smart grid technologies in hybrid electrical vehicles etc.
3. Understand smart substations, feeder automation, GIS etc.
4. Analyse micro grids and distributed generation systems.
5. Analyse the effect of power quality in smart grid and to understand latest developments in ICT for smart grid.

Text Books

1. Integration of Green and Renewable Energy in Electric Power Systems, Ali Keyhani, Mohammad N. Marwali, Min Dai, Wiley
2. The Smart Grid: Enabling Energy Efficiency and Demand Response ,Clark W. Gellings,CRC Press Grid: Technology and Applications ,Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama,—Smart", Wiley
3. Smart Grids,Jean Claude Sabonnadière, Nouredine Hadjsaïd, Wiley Blackwell 19
4. Smart Power: Climate Changes, the Smart Grid, and the Future of Electric Utilities Peter S. Fox Penner, Island Press; 1 edition 8 Jun 2010.
5. Microgrids and Active Distribution Networks Institution of Engineering and Technology,S. Chowdhury, S. P. Chowdhury, P. Crossley, —, 30 Jun 2009.
6. Smart Grids (Power Engineering),Stuart Borlase,CRC Press

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
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Reference Books

1. The Advanced Smart Grid: Edge Power Driving Sustainability: 1,Andres Carvallo, John Cooper, Artech House Publishers July 2011
2. Control and Automation of Electric Power Distribution Systems (Power Engineering),James Northcote, Green, Robert G. Wilson, CRC Press
3. Substation Automation (Power Electronics and Power Systems).Mladen Kezunovic, Mark G. Adamiak, Alexander P. Apostolov, Jeffrey George Gilbert, Springer
4. Electrical Power System Quality ,R. C. Dugan, Mark F. McGranghan, Surya Santoso, H. Wayne Beaty, 2nd Edition, McGraw Hill Publication
5. Communication and Networking in Smart Grids , Yang Xiao, CRC Press

Course Code : SMART GRID TECHNOLOGIES												
Course Designed by		Department of Electrical and Electronics Engineering										
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course Outcomes	CO 1	✓											
	CO 2		✓					✓					
	CO 3	✓											
	CO 4					✓							
	CO 5					✓	✓						
Category		**General Humanities**		**Basic Sciences**		**Engineering Sciences And Technical**			**Professional Subjects**				
						✓							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

2 Years M.Tech. (Power Systems (High Voltage Engineering)) Course Structure : (2020-21)

***

Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	SIMULATION LAB II	3	1	0	3
Teaching	Total contact hours - 60				

List of Experiments

1. Simulation of Marx circuit (5 stages).
2. Simulation of Tesla-coil circuit.
3. Simulation and generation of Lightening, Switching and pulse current/voltage waveform
4. Simulation of Transient circuits with travelling waves.
5. Simulation of capacitance switching.
6. Simulation of current growth in the gap with the help of Townsend theory.
7. Simulation of series resonant circuit.
8. Simulation of Impulse current generation circuit.
9. Simulation of Impulse voltage generation circuit.
10. Simulation of Paschen's law curve.

Course Outcomes:

1. The student should be able to design and analyze the different high voltage generation circuits and the behavior of lines due to switching operations.

Course Code : SIMULATION LAB II													
Course Designed by		Department of Electrical and Electronics Engineering											
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course Outcomes	CO 1	✓				✓							
Category		General Humaniti		Basic Sciences		Engineering Sciences And Technical			Professional Subjects				
						✓							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	POWER SYSTEMS LAB	3	1	0	3
Teaching	Total contact hours - 60				

List of Experiments:

1. Determination of Sequence Impendence of an Alternator by direct method.
2. Determination of Sequence impedance of an Alternator by fault Analysis.
3. Measurement of sequence impedance of a three phase transformer (a). by application of sequence voltage. (b). using fault analysis.
4. Power angle characteristics of a salient pole Synchronous Machine.
5. Poly-phase connection on three single phase transformers and measurement ofphase displacement.
6. Determination of equivalent circuit of 3-winding Transformer.
7. Measurement of ABCD parameters on transmission line model.
8. Performance of long transmission line without compensation.
9. Study of Ferranti effect in long transmission line.
10. Performance of long transmission line with shunt compensation.

Course Outcomes:

1. After the Completion of lab they will understand procedure for determination of various parameters used in power system as well as performance of transmission line.

Course Code : POWER SYSTEMS LAB												
Course Designed by		Department of Electrical and Electronics Engineering										
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course Outcomes	CO 1	✓				✓							
		General Humaniti		**Basic Sciences**		**Engineering Sciences And Technical**			**Professional Subjects**				
						✓							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	MINI PROJECT	3	1	0	3
Teaching	Total contact hours - 60				

Syllabus content:

A Student has to select one paper published in any of the IEEE Transactions and simulate the same. The student has to present the progress of the work at the middle of the semester. At the end of the semester, the student has to present the results by explaining the idea of the topic, methodology, finding of the simulations. A Student should also submit a report of the entire work carried out under this course. The end semester presentation must be video recorded and preserved.

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2 Years M.Tech. (Power Systems (High Voltage Engineering)) Course
Structure : (2020-21)
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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	CONSTITUTION OF INDIA	3	1	0	3
Teaching	Total contact hours - 60				

UNIT I History of Making & Philosophy of the Indian Constitution
History - Drafting Committee, (Composition & Working) - Preamble Salient Features

UNIT II Contours of Constitutional Rights & Duties

Fundamental Rights - Right to Equality - Right to Freedom - Right against Exploitation - Right to Freedom of Religion - Cultural and Educational Rights - Right to Constitutional Remedies - Directive Principles of State Policy - Fundamental Duties.

UNIT III Organs of Governance
Parliament – Composition - Qualifications and Disqualifications - Powers and Functions – Executive – President – Governor - Council of Ministers - Judiciary, Appointment and Transfer of Judges, Qualifications - Powers and Functions

UNIT IV Local Administration
Distric's Administration head: Role and Importance - Municipalities: Introduction, Mayor and role of Elected Representative, CE of Municipal Corporation. - Pachayati raj: Introduction, PRI: ZilaPachayat. - Elected officials and their roles, CEO Zila Pachayat: Position and role. - Block level: Organizational Hierarchy (Different departments), - Village level: Role of Elected and Appointed officials, - Importance of grass root democracy
***
UNIT V Election Commission
Election Commission: Role and Functioning - Chief Election Commissioner and Election Commissioners. - State Election Commission: Role and Functioning. - Institute and Bodies for the welfare of SC/ST/OBC and women.

References

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

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Course Outcomes:

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956.

Course Code : CONSTITUTION OF INDIA												
Course Designed by		Department of Electrical and Electronics Engineering										
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course Outcomes	CO 1									✓			✓
	CO 2								✓			✓	
	CO 3								✓				
	CO 4										✓		
Category		**General Humanities**		**Basic Sciences**		**Engineering Sciences And Technical**			**Professional Subjects**				
						✓							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
2 Years M.Tech. (Power Systems (High Voltage Engineering)) Course
Structure : (2020-21)
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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	PEDAGOGY STUDIES	3	1	0	3
Teaching	Total contact hours - 60				

UNIT I : Introduction and Methodology - Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education. - Conceptual framework, Research questions**. -** Overview of methodology and Searching.

UNIT II : Thematic overview - Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. - Curriculum, Teacher education.

UNIT III : Evidence on the effectiveness of pedagogical practices - Methodology for the in depth stage: quality assessment of included studies. - How can teacher education (curriculum and practicum) and the school - curriculum and guidance materials best support effective pedagogy? - Theory of change. - Strength and nature of the body of evidence for effective pedagogical practices. - Pedagogic theory and pedagogical approaches. – Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT IV: Professional development: alignment with classroom practices and follow-up support - Peer support - Support from the head teacher and the community. - Curriculum and assessment - Barriers to learning: limited resources and large class sizes

UNIT V: Research gaps and future directions **-** Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.

References

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245- 261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, _learning to read' campaign.

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7. www.pratham.org/images/resource%20working%20paper%202.pdf.

Course Outcomes:

Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

Course Code : PEDAGOGY STUDIES												
Course Designed by		Department of Electrical and Electronics Engineering										
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course Outcome	CO 1	✓											
	CO 2	✓											
	CO 3	✓											
Category		**General Humanities**		**Basic Sciences**		**Engineering Sciences And Technical**			**Professional Subjects**				
						✓							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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2 Years M.Tech. (Power Systems (High Voltage Engineering)) Course Structure : (2020-21)
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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	ENERGY AUDIT CONSERVATION & MANAGEMENT	3	1	0	3
Teaching	Total contact hours - 60				

UNIT– 1
Basic Principles of Energy Audit
Energy audit- definitions, concept , types of audit, energy index, cost index ,pie charts, Sankey diagrams and load profiles, Energy conservation schemes- Energy audit of industries- energy saving potential, energy audit of process industry, thermal power station, building energy audit.

UNIT– 2
Energy Management
Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting. Energy manager, qualities and functions, language, Questionnaire – check list for top management

UNIT– 3
Energy Efficient Motors and Lighting
Energy efficient motors, factors affecting efficiency, loss distribution, constructional details, characteristics – variable speed , variable duty cycle systems, RMS - voltage variation-voltage unbalance-over motoring-motor energy audit. lighting system design and practice, lighting control, lighting energy audit

UNIT– 4
Power Factor Improvement and energy instruments
Power factor – methods of improvement, location of capacitors, Power factor with non-linear loads, effect of harmonics on p.f, p.f motor controllers – Energy Instruments- watt meter, data loggers, thermocouples, pyrometers, lux meters, tongue testers, application of PLC's

UNIT– 5

Economic Aspects and their computation
Economics Analysis depreciation Methods, time value of money, rate of return, present worth method, replacement analysis, lifecycle costing analysis – Energy efficient motors. Calculation of simple payback method, net present value method- Power factor correction, lighting – Applications of lifecycle costing analysis, return on investment.

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Text Books:

- Energy management by W.R.Murphy & G.Mckay Butter worth, Heinemann
- publications, 1982 Energy management hand book by W.C Turner, John Wiley and sons, 1982.

Reference Books:

1. Energy efficient electric motors by John.C. Andreas, Marcel Dekker Inc Ltd-2nd edition,1995
2. Energy management by Paul o' Callaghan, Mc-graw Hill Book company-1st edition, 1998
3. Energy management and good lighting practice : fuel efficiency- booklet12-EEO

Course Outcomes: At the end of the course, student will be able to

1. Understand the principle of energy audit and their economic aspects.
2. Recommend energy efficient motors and design good lighting system.
3. Understand advantages to improve the power factor.
4. Evaluate the depreciation of equipment.

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Course Code : ENERGY AUDIT CONSERVATION & MANAGEMENT													
Course Designed by		Department of Electrical and Electronics Engineering											
	Program	PO 1	PO	PO	PO 4	PO 5	PO	PO	PO 8	PO	PO	PO	PO
Course Outcomes	CO 1	✓											
	CO 2	✓				✓		✓					
	CO 3							✓					
	CO 4	✓										✓	
Category		**General Humaniti**		**Basic Sciences**		**Engineering Sciences And Technical**			**Professional Subjects**				
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	POWER QUALITY	3	1	0	3
Teaching	Total contact hours - 60				

UNIT– 1

Introduction to power quality: Overview of Power Quality, Concern about the Power Quality, General Classes of Power Quality Problems, Voltage Unbalance, Waveform Distortion, Voltage fluctuation, Power Frequency Variations, Power Quality Terms, Voltage Sags, swells, flicker and Interruptions - Sources of voltage and current interruptions, Nonlinear loads.

UNIT– 2

Transient and Long Duration Voltage Variations: Source of Transient Over Voltages - Principles of Over Voltage Protection, Devices for Over Voltage Protection, Utility Capacitor Switching Transients, Utility Lightning Protection, Load Switching Transient Problems. - Principles of Regulating the Voltage, Device for Voltage Regulation, Utility Voltage Regulator - Application, Capacitor for Voltage Regulation, End-user Capacitor Application, Regulating Utility - Voltage with Distributed generation

UNIT– 3

Harmonic Distortion and solutions: Voltage vs. Current Distortion, Harmonics vs. Transients - Power System Quantities under Non-sinusoidal Conditions, Harmonic Indices, Sources of harmonics, Locating Sources of Harmonics, System Response Characteristics, Effects of Harmonic Distortion, Inter harmonics, Harmonic Solutions Harmonic Distortion Evaluation, Devices for Controlling Harmonic Distortion, Harmonic Filter Design, Standards on Harmonics

UNIT– 4

Custom Power Devices: Custom power and custom power devices, voltage source inverters, reactive power and harmonic compensation devices, compensation of voltage interruptions and current interruptions, static series and shunt compensators, compensation in distribution systems, interaction with distribution equipment, installation considerations.

UNIT– 5

Application of custom power devices in power systems: Static and hybrid Source Transfer Switches, Solid state current limiter - Solid state breaker. P-Q theory – Control of P and Q, Dynamic Voltage Restorer (DVR): Operation and control – Interline Power Flow Controller (IPFC): Operation and control of Unified Power Quality Conditioner (UPQC); Generalized power quality conditioner

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Text Books:

1. Electrical Power Systems Quality, Dugan R C, McGranaghan M F, Santoso S, and Beaty H W, Second Edition, McGraw-Hill, 2002.
2. Understanding Power Quality Problems: Voltage Sags and Interruptions, Bollen M H J, First Edition, IEEE Press; 2000.
3. Guidebook on Custom Power Devices, Technical Report, Published by EPRI, Nov 2000
4. Power Quality Enhancement Using Custom Power Devices – Power Electronics and Power Systems, Gerard Ledwich, ArindamGhosh, Kluwer Academic Publishers, 2002.

Reference Books:

1. Power Quality Primer, Kennedy B W, First Edition, McGraw-Hill, 2000.
2. Power System Harmonics, Arrillaga J and Watson N R, Second Edition, John Wiley & Sons, 2003.
3. Electric Power Quality control Techniques, W. E. Kazibwe and M. H. Sendaula, Van Nostrad Reinhold, New York.
4. Power Quality c.shankaran, CRC Press, 2001
5. Harmonics and Power Systems –Franciso C.DE LA Rosa-CRC Press (Taylor & Francis).
6. Power Quality in Power systems and Electrical Machines-EwaldF.fuchs, Mohammad A.S. Masoum- Elsevier
7. Power Quality, C. Shankaran, CRC Press, 2001
8. Instantaneous Power Theory and Application to Power Conditioning, H. Akagiet.al., IEEE Press, 2007.
9. Custom Power Devices - An Introduction, ArindamGhosh and Gerard Ledwich, Springer, 2002
A Review of Compensating Type Custom Power Devices for Power Quality Improvement, Yash Pal et.al., Joint International Conference on Power System Technology and IEEE Power India Conference, 2008. POWERCON 2008.

Course Outcomes:

At the end of the course, student will be able to

1. Identify the issues related to power quality in power systems.
2. Address the problems of transient and long duration voltage variations in power systems.
3. Analyze the effects of harmonics and study of different mitigation techniques.
4. Identify the importance of custom power devices and their applications.
5. Acquire knowledge on different compensation techniques to minimize power quality disturbances.

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Course Code : POWER QUALITY												
Course Designed by		Department of Electrical and Electronics Engineering										
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course Outcomes	CO 1				✓								
	CO 2	✓									✓		✓
	CO 3	✓					✓						
	CO 4						✓	✓					
	CO 5								✓				
Category		**General Humanities**		**Basic Sciences**		**Engineering Sciences And Technical**			**Professional Subjects**				
						✓							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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2 Years M.Tech. (Power Systems (High Voltage Engineering)) Course Structure : (2020-21)
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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	POWER SYSTEM TRANSIENTS	3	1	0	3
Teaching	Total contact hours - 60				

Unit 1 : Basic Concepts and Simple Switching Transients;- Switching an LR,LC,RLC circuits Transients Analysis of Three-Phase power Systems: – Symmetrical components inthree-phase Systems, Sequence Components for Unbalanced Network Impedances, the Sequence Networks, analysis of Unsymmetrical Three-Phase Faults-single line-to-Ground Fault, Three phase-toground fault.

Unit 2 : 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, bewley-lattice diagram. travelling waves and multi conductor system.

Unit 3 :Switching Transients:- arc interruption in circuit breaker , transient recovery voltage, arc-circuit interaction, interruption of capacitive currents, interruption of inverse currents, interruption of fault current in transmission line and transformers.

Unit 4 : 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 5 : 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, lightning protection scheme. Numerical simulation of electrical transients, The Electromagnetic Transient Program, principles of numerical techniques used in transient simulation.

Text Books:
1. Electrical Transients in Power System by Allen Greenwood, McGraw Hill 1990
2. Bewley LV —travelling waves on transmission system Dover publications Inc.,

Reference Books :
1. Power system grounding & transients by A.P.SakisMeliopolous.
2. —Transients in power systems by Lou Van Sluis
3. Walter Diesendorf, Insulation co-ordination in high-voltage electric

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power systems, Butterworths, London, (1974),
4. J. G. Anderson: EHV Transmission Line Reference Book (Edison Electric Institute, New York, 1968) p. 126.

Course Outcomes:

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

1. Understand the severity of over voltages due to faults on a given power system.
2. To limit the effects of lightning over voltages in power systems.
3. Understand the various transient over voltages and their effects on power system.

Course Code : POWER SYSTEM TRANSIENTS												
Course Designed by		Department of Electrical and Electronics Engineering										
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course Outcome	CO 1	✓											
	CO 2							✓					
	CO 3						✓	✓					
Category		**General Humanities**		**Basic Sciences**		**Engineering Sciences And Technical**			**Professional Subjects**				
						✓							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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Structure : (2020-21)
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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	OPERATIONS RESEARCH	3	1	0	3
Teaching	Total contact hours - 60				

Unit 1:
Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Unit 2
Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Unit 3:
Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem
- CPM/PERT

Unit 4
Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

Unit 5
Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation.

References:
1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimization: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009

5. Pannerselvam, Operations Research: Prentice Hall ofIndia 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

Course Outcomes:
At the end of the course, the student should be able to

1. Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.
2. Students should able to apply the concept of non-linear programming
3. Students should able to carry out sensitivity analysis
4. Student should able to model the real world problem and simulate it.

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Course Code : OPERATIONS RESEARCH												
Course Designed by		Department of Electrical and Electronics Engineering										
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course Outcomes	CO 1	✓										✓	
	CO 2	✓										✓	
	CO 3	✓					✓	✓					
	CO 4	✓						✓		✓			✓
Category		**General Humanities**		**Basic Sciences**		**Engineering Sciences And Technical**			**Professional Subjects**				
						✓							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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2 Years M.Tech. (Power Systems (High Voltage Engineering)) Course Structure :(2020-21)
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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	NANOTECHNOLOGY FOR ENERGY SYSTEMS	3	1	0	3
Teaching	Total contact hours - 60				

UNIT-I: INTRODUCTION

Nanotechnology for sustainable energy-Materials for light emitting diodes-batteries-advanced turbines- catalytic reactors-capacitors-fuel cells

UNIT-II: RENEWABLE ENERGY TECHNOLOGY

Energy challenges, development and implementation of renewable energy technologies - nanotechnology enabled renewable energy technologies - Energy transport, conversion and storage, Nano, micro and meso scale phenomena and devices.

UNIT- III: MICRO FUEL CELL TECHNOLOGY

Micro-fuel cell technologies, integration and performance for micro-fuel cell systems - thin film and microfabrication methods - design methodologies - micro-fuel cell power sources

UNIT- IV: MICROFLUIDIC SYSTEMS

Nano-electromechanical systems and novel microfluidic devices - nano engines - driving mechanisms - power generation - microchannel battery - micro heat engine (MHE) fabrication - thermocapillary forces
- Thermocapillary pumping (TCP) - piezoelectric membrane

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UNIT- V: HYDROGEN STORAGE METHODS

Hydrogen storage methods - metal hydrides - size effects - hydrogen storage capacity - hydrogen reaction kinetics - carbon-free cycle- gravimetric and volumetric storage capacities - hydriding/dehydriding kinetics - high enthalpy of formation - and thermal management during the hydriding reaction - distinctive chemical and physical properties - multiple catalytic effects - degradation of the sorption properties - hydride storage materials for automotive applications.

REFERENCES

1. J. Twidell and T. Weir, Renewable Energy Resources, E & F N Spon Ltd, London, 1986.
2. Hydrogen from Renewable Energy Sources by D. Infield,
3. Fuel Storage on Board Hydrogen Storage in Carbon Nanostructures by R.A. Shatwell,
4. Fuel cell technology handbook. Hoogers. CRC Press, 2003.

Course Outcomes:

1. To cover various renewable energy technologies.
2. To study hydrogen production and storage techniques.
3. To study solar energy generation and enhancement of conversation efficiency microfluidics and fuel cell technology will be covered.

Course Code : NANOTECHNOLOGY FOR ENERGY SYSTEMS													
Course Designed by		Department of Electrical and Electronics Engineering											
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course Outcome	CO 1							✓					
	CO 2	✓						✓					
	CO 3	✓						✓					
Category		**General Humanities**		**Basic Sciences**		**Engineering Sciences And Technical**			**Professional Subjects**				
						✓							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	Composite Materials, Cost Management of Engineering Projects	3	1	0	3
Teaching	Total contact hours - 60				

UNIT–I:
INTRODUCTION: Definition – Classification and characteristics of Composite materials.Advantages and application of composites.Functional requirements of reinforcement and matrix.Effectof reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT – II:
REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers,carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particlereinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT – III:
MANUFACTURING OF METAL MATRIX COMPOSITES: Casting – Solid State diffusion technique,Cladding – Hot isostaticpressing. Properties and applications. Manufacturing of Ceramic MatrixComposites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carboncomposites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–IV:
MANUFACTURING OF POLYMER MATRIX COMPOSITES: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – V:
STRENGTH: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum straincriteria, interacting failure criteria, hydrothermal failure. Laminate first play failure-insight strength;Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

Text Books:

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1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr.,
Adapted by R Balasubramaniam, John Wiley & Sons, NY, Indian edition,
2007.

References Books:

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

Course Outcomes: At the end of the course, students should be able to

1. Understand characteristics and advantages of composite materials
2. Acquire knowledge of reinforcement, glass fiber, etc.
3. Identify the usage of metal matrix composites
4. Understand manufacturing of polymer matrix composites
5. Understand manufacturing of polymer matrix composites
6. Identify different types of failures.

Course Code : COMPOSITE MATERIALS												
Course Designed by		Department of Electrical and Electronics Engineering										
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course Outcomes	CO 1							✓					
	CO 2	✓						✓	✓				
	CO 3	✓						✓	✓				
	CO 4							✓					
	CO 5	✓						✓	✓				
	CO 6	✓						✓	✓				
Category		**General Humanities**		**Basic Sciences**		**Engineering Sciences And Technical**			**Professional Subjects**				
						✓							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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Approved by AICTE, Accredited by NBA & NAAC 'A' Grade, Recognized under 2(f) and 12(b) of UGC, Permanently Affiliated to JNTUK, Kakinada.

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
2 Years M.Tech. (Power Systems (High Voltage Engineering)) Course Structure : (2020-21)
***

Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	PRODUCT DESIGN AND DEVELOPMENT	3	1	0	3
Teaching	Total contact hours - 60				

UNIT I

Introduction: Classification/Specifications of Products, Product life cycle. Product mix, Introduction to product design, Modern product development process, Innovative thinking.

UNIT II

Morphology of design. Conceptual Design: Generation, selection & embodiment of concept.Product architecture, Industrial design: process, need, Robust Design: Taguchi Designs & DOE, Design Optimization.

UNIT III

Design for Mfg & Assembly: Methods of designing for Manufacturing and assembly, Designs for Maintainability, Designs for Environment, Product costing, Legal factors and social issues, Engineering ethics and issues of society related to design of products. Value Engineering / Value Analysis. : Definition. Methodology, Case studies.

UNIT IV

Economic analysis: Qualitative & Quantitative. Ergonomics / Aesthetics: Gross human autonomy, Anthropometry, Man-Machine interaction, Concepts of size and texture, colour .Comfort criteria, Psychological & Physiological considerations.

UNIT V

Creativity Techniques: Creative thinking, conceptualization, brain storming, primary design, drawing, simulation, detail design. Concurrent Engineering, Rapid prototyping, Tools for product design – Drafting / Modeling software, CAM Interface, Patents & IP Acts. Overview, Disclosure preparation.

Text Books:

1. Karl T Ulrich, Steven D Eppinger , — Product Design & Development.| Tata McGrawhill New Delhi 2003.
2. David G Ullman, —The Mechanical Design Process.| McGrawhill Inc Singapore 1992 N J M Roozenberg , J Ekels , N F M Roozenberg — Product Design Fundamentals and Methods .| John Willey & Sons 1995.
3. Kevin Otto & Kristin Wood Product Design: —Techniques in Reverse Engineering and New Product Development.| 1 / e 2004 , Pearson Education New Delhi.

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References:

1. L D Miles —Value Engineering.|
2. Hollins B & Pugh S —Successful Product Design.| Butter worths London.
3. Baldwin E N &Neibel B W —Designing for Production.| Edwin Homewood Illinois
4. Jones J C —Design Methods.| Seeds of Human Futures. John Willey New York.
5. Bralla J G —Handbook of Product Design for Manufacture, McGrawhillNewYork

Course Outcomes: At the end of the course, students should be able to

1. Understand product life cycle and Modern product development process
2. Acquire knowledge of design and concept of optimization .
3. Understand Engineering ethics and issues of society related to design of products
4. Understand Psychological & Physiological considerations of design

Course Code : PRODUCT DESIGN AND DEVELOPMENT													
Course Designed by		Department of Electrical and Electronics Engineering											
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course Outcomes	CO 1	✓											
	CO 2		✓						✓				
	CO 3								✓				
	CO 4				✓			✓					
Category		**General Humaniti**		**Basic Sciences**		**Engineering Sciences And Technical**			**Professional Subjects**				
						✓							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
2 Years M.Tech. (Power Systems (High Voltage Engineering)) Course
Structure : (2020-21)
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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	MACHINE LEARNING	3	1	0	3
Teaching	Total contact hours - 60				

UNIT I INTRODUCTION

- Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants – Perceptron – Linear Separability – Linear Regression.

UNIT II LINEAR MODELS

Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multi-layer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back-Propagation – Radial Basis Functions and Splines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines

UNIT III TREE AND PROBABILISTIC MODELS

Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms – Vector Quantization – Self Organizing Feature Map

UNIT IV DIMENSIONALITY REDUCTION AND EVOLUTIONARY MODELS

Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization – Evolutionary Learning – Genetic algorithms – Genetic Offspring: - Genetic Operators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting Lost Example – Markov Decision Process

UNIT V GRAPHICAL MODELS

Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo
– Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods

TEXT BOOKS:

1. Stephen Marsland, ―Machine Learning – An Algorithmic Perspective‖, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

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2. Tom M Mitchell, ―Machine Learning‖, First Edition, McGraw Hill Education, 2013.

REFERENCES:

1. Peter Flach, ―Machine Learning: The Art and Science of Algorithms that Make Sense of Data‖, First Edition, Cambridge University Press, 2012.
2. Jason Bell, ―Machine learning – Hands on for Developers and Technical Professionals‖, First Edition, Wiley, 2014
3. Ethem Alpaydin, ―Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)‖, Third Edition, MIT Press, 2014

COURSE OUTCOMES:

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

1. Distinguish between, supervised, unsupervised and semi-supervised learning
2. Apply the apt machine learning strategy for any given problem
3. Suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem
4. Design systems that uses the appropriate graph models of machine learning
5. Modify existing machine learning algorithms to improve classification efficiency

Course Code : MACHINE LEARNING													
Course Designed by		Department of Electrical and Electronics Engineering											
	Program	PO 1	PO	PO	PO 4	PO 5	PO 6	PO	PO 8	PO	PO	PO	PO
Course Outcomes	CO 1	✓											
	CO 2		✓										
	CO 3				✓								
	CO 4						✓	✓					
	CO 5				✓			✓					
Category		**General Humanities**		**Basic Sciences**		**Engineering Sciences And Technical**			**Professional Subjects**				
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	CYBER SECURITY	3	1	0	3
Teaching	Total contact hours - 60				

UNIT I INTRODUCTION TO CYBER SECURITY

Introduction -Computer Security - Threats -Harm - Vulnerabilities - Controls - Authentication - Access Control and Cryptography - Web—User Side - Browser Attacks - Web Attacks Targeting Users - Obtaining User or Website Data - Email Attacks

UNIT II SECURITY IN OPERATING SYSTEM & NETWORKS

Security in Operating Systems - Security in the Design of Operating Systems -Rootkit - Network security attack- Threats to Network Communications - Wireless Network Security - Denial of Service - Distributed Denial-of-Service.

UNIT III DEFENCES: SECURITY COUNTERMEASURES

Cryptography in Network Security - Firewalls - Intrusion Detection and Prevention Systems - Network Management - Databases - Security Requirements of Databases - Reliability and Integrity - Database Disclosure - Data Mining and Big Data.

UNIT IV PRIVACY IN CYBERSPACE

Privacy Concepts -Privacy Principles and Policies -Authentication and Privacy - Data Mining -Privacy on the Web - Email Security - Privacy Impacts of Emerging Technologies - Where the Field Is Headed.

UNIT V MANAGEMENT AND INCIDENTS

Security Planning - Business Continuity Planning - Handling Incidents - Risk Analysis - Dealing with Disaster - Emerging Technologies - The Internet of Things - Economics - Electronic Voting - Cyber Warfare- Cyberspace and the Law - International Laws - Cyber crime - Cyber Warfare and Home Land Security

REFERENCES:

1. Charles P. Pfleeger Shari Lawrence Pfleeger Jonathan Margulies, Security in Computing, 5th Edition
, Pearson Education , 2015
2. George K.Kostopoulous, Cyber Space and Cyber Security, CRC Press, 2013.
3. Martti Lehto, Pekka Neittaanmäki, Cyber Security: Analytics, Technologyand Automation edited, Springer International Publishing Switzerland 2015
4. Nelson Phillips and Enfinger Steuart, ―Computer Forensics and Investigations‖, Cengage Learning, New Delhi, 2009.

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COURSE OUTCOMES:
Upon completion of the course, the students will be able to understand

1. The difference between threat, risk, attack and vulnerability.
2. How threats materialize into attacks.
3. Where to find information about threats, vulnerabilities and attacks.
4. Typical threats, attacks and exploits and the motivations behind them.

Course Code : CYBER SECURITY													
Course Designed by		Department of Electrical and Electronics Engineering											
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course Outcomes	CO 1	✓											
	CO 2	✓											
	CO 3	✓											
	CO 4	✓											
Category		**General Humanities**		**Basic Sciences**		**Engineering Sciences And Technical**			**Professional Subjects**				
						✓							
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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Structure : (2020-21)
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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	INTERNET OF THINGS AND APPLICATIONS	3	1	0	3
Teaching	Total contact hours - 60				

UNIT I INTRODUCTION TO IoT

Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology

UNIT II IoT ARCHITECTURE

M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model
- Domain model - information model - functional model - communication model - IoT reference architecture

UNIT III IoT PROTOCOLS

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus– Zigbee Architecture – Network layer – 6LowPAN - CoAP – Security

UNIT IV BUILDING IoT WITH RASPBERRY PI & ARDUINO

Building IOT with RASPERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python - Other IoT Platforms - Arduino.

UNIT V CASE STUDIES AND REAL-WORLD APPLICATIONS

Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT – Software & Management Tools for IoT Cloud Storage Models & Communication APIs - Cloud for IoT - Amazon Web Services for IoT.

REFERENCES:

1. Arshdeep Bahga, Vijay Madisetti, ―Internet of Things – A hands-on approach‖, Universities Press, 2015
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), ―Architecting the Internet of Things‖, Springer, 2011.

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3. Honbo Zhou, ―The Internet of Things in the Cloud: A Middleware Perspective‖, CRC Press, 2012.
4. Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
5. Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things – Key applications and Protocols‖, Wiley, 2012

COURSE OUTCOMES:

Upon completion of this course, the students should be able to:

1. Analyze various protocols for IoT
2. Develop web services to access/control IoT devices.
3. Design a portable IoT using Rasperry Pi
4. Deploy an IoT application and connect to the cloud.
5. Analyze applications of IoT in real time scenario

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Course Code : IOT & ITS APPLICATIONS												
Course Designed by		Department of Electrical and Electronics Engineering										
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course Outcomes	CO 1		✓										
	CO 2	✓											
	CO 3	✓						✓					
	CO 4							✓					
	CO 5						✓						

Category	General Humaniti	Basic Sciences	Engineering Sciences And Technical	Professional Subjects
			✓	

Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
2 Years M.Tech. (Power Systems (High Voltage Engineering)) Course
Structure : (2020-21)
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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	REAL TIME OPERATING SYSTEMS	3	1	0	3
Teaching	Total contact hours - 60				

UNIT I: INTRODUCTION

Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Dead-lines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.

UNIT II: REAL TIME SCHEDULING

Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Rate Monotonic Algorithm, Offline Versus Online Scheduling, Scheduling Aperiodic and Sporadic jobs in Priority Driven and Clock Driven Systems.

UNIT III: RESOURCES SHARING

Effect of Resource Contention and Resource Access Control (RAC), Non-preemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority- Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Preemption Ceiling Protocol, Access Control in Multiple-Module Resources, Controlling Concurrent Accesses to Data Objects.

UNIT IV: REAL TIME COMMUNICATION

Basic Concepts in Real time Communication, Soft and Hard RT Communication systems, Model of Real Time Communication, Priority-Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols.

UNIT V: REAL TIME OPERATING SYSTEMS AND DATABASES

Features of RTOS, Time Services, UNIX as RTOS, POSIX Issues, Characteristic of Temporal data, Temporal Consistency, Con-currency Control, Overview of Commercial Real Time databases.

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TEXT BOOKS

1. Real Time Systems – Jane W. S. Liu, Pearson Education Publication

REFERENCE BOOKS

1. Real Time Systems – Mall Rajib, Pearson Education
2. Real-Time Systems: Scheduling, Analysis, and Verification – Albert M. K. Cheng, Wiley.

COURSE OUTCOMES:

1. Student will be able to summarize the issues in real time computing
2. Student will be able to explain and give examples of real time operating systems.
3. Student will be able to solve scheduling problems and can apply them in real time applications in industry.
4. Student can also design an RTOS and will be able to interpret the feasibility of a task set to accomplish or not.
5. Analyze the situation of fault occurrence and will be able to apply solutions accordingly.

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Course Designed by		Department of Electrical and Electronics										
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course Outcomes	CO 1	✓											
	CO 2	✓			✓						✓		
	CO 3	✓			✓								
	CO 4					✓							
	CO 5		✓			✓		✓					
Category		General Humaniti		Basic Sciences		Engineering Sciences And Technical			Professional Subjects				
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
2 Years M.Tech. (Power Systems (High Voltage Engineering)) Course
Structure : (2020-21)
***

Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	ENERGY AUDIT, CONSERVATION & MANAGEMENT	3	0	0	3
Teaching	Total contact hours - 45				

UNIT 1: Energy Scenario

Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features.

UNIT 2: Basics of Energy and its various forms

Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.

UNIT 3: Energy Management & Audit

Definition, energy audit, need, types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams.

UNIT 4: Energy Efficiency in Electrical Systems

Electrical system: Electricity billing, electrical load management and maximum demand control, performance assessment of PF capacitors, distribution and transformer losses. Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors.

UNIT 5: Energy Efficient Technologies in Electrical Systems

Maximum demand controllers, automatic power factor controllers, energy efficient motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls, energy saving potential of each technology.

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Text/Reference Books

1. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects (available online)
2. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-3, Electrical Utilities (available online)
3. S. C. Tripathy, "Utilization of Electrical Energy and Conservation", McGraw Hill, 1991. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org)

COURSE OUTCOMES:

1. Understand the current energy scenario and importance of energy conservation.
2. Understand the concepts of energy management.
3. Understand the methods of improving energy efficiency in different electrical systems.
4. Understand the concepts of different energy efficient devices.

c												
Course Designed by		Department of Electrical and Electronics										
	Program Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Course Outcomes	CO 1	✓											
	CO 2	✓			✓						✓		
	CO 3	✓			✓								
	CO 4					✓							
	CO 5		✓			✓		✓					
Category		General Humaniti		Basic Sciences		Engineering Sciences And Technical			Professional Subjects				
Mode of Evaluation : Quiz, Assignment, Seminar, Written Examination													

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
2Years M.Tech. (Power Systems (High Voltage Engineering)) Course Structure : (2020-21)
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Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	PARTIAL DISCHARGES IN HIGH VOLTAGE EQUIPMENT	3	1	0	3
Teaching	Total contact hours - 60				

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, 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 impulses, 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.

Course Outcomes

After completion of this course, a successful student will be able to:

CO-1. Know Types of partial discharge that occurs in the insulation systems
CO-2. Understand Detection of discharges using different detection circuits.
CO-3. Understsand Location of partial discharge in electrical apparatus and systems.

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Reference Books

1 Partial Discharges in HV Equipment by F..Kruguer, Butterworths & Co., Publications Ltd., 1989.
2 Partial Discharges in Electrical Power Apparatus. by Dieter Konig, Y. Narayana Rao- VDE-Verlag publisher.
3 Partial Discharges in Electrical Power Apparatus. by Dieter.

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
2 Years M.Tech. (Power Systems (High Voltage Engineering)) Course
Structure : (2020-21)

Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	POWER SYSTEM REFORMS	3	1	0	3
Teaching	Total contact hours - 60				

Unit - I

Over view of key issues in electric utilities Introduction – Restructuring models – Independent system operator (ISO) – Power Exchange – Market operations – Market Power – Standard cost – Transmission Pricing – Congestion Pricing – Management of Inter zonal/Intra zonal Congestion.

Unit - II

OASIS: Open Access Same–Time Information System Structure of OASIS – Processing of Information – Transfer capability on OASIS – Definitions Transfer Capability Issues – ATC – TTC – TRM – CBM calculations – Methodologies to calculate ATC.

Unit - III

Congestion Management Introduction to congestion management – Methods to relieve congestion Ancillary Services Management: Introduction – Reactive power as an ancillary service – A review – Synchronous generators as ancillary service providers.

Unit - IV

Electricity Pricing: Introduction – Electricity price volatility electricity price indexes – Challenges to electricity pricing – Construction of forward price curves – Short–time price forecasting.

Unit - V

Power system operation in competitive environment: Introduction – Operational planning activities of ISO – The ISO in pool markets – The ISO in bilateral markets – Operational planning activities of a Genco.

Text Books

1. Kankar Bhattacharya, Math H.J. Boller, Jaap E.Daalder, 'Operation of Restructured Power System' Klum,er Academic Publisher – 2001
2. Mohammad Shahidehpour, and Muwaffaq alomoush, – "Restructured electrical Power systems" Marcel Dekker, Inc. 2001
3. Loi Lei Lai; "Power system Restructuring and Deregulation", Jhon Wiley & Sons Ltd., England
4. Electrical Power Distribution Case studies from Distribution reform, upgrades and Management (DRUM) Program, by USAID/India, TMH.

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Course Outcomes

After completion of this course, a successful student will be able to:

CO-1. Know the key issues in electric utilities

CO-2. Understand OASIS principle.

CO-3. Know about Congestion Management and Electricity Pricing

CO-4. Apply the Operational planning activities of ISO

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2 Years M.Tech. (Power Systems (High Voltage Engineering)) Course Structure : (2020-21)

Regulation	GRMT - 20 (M.Tech.)	L	T	P	C
Course/ Code	Dissertation Phase - I			20	10
Teaching	Total contact hours - 60				