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Bachelor of Technology (Electrical Engineering)

SEMESTER V

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTEE 501		ELECTRICAL MACHINES-II	3	1	2	5	60	20	20	30	20

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

To prepare the students to have a basic and practical knowledge of DC machine. To prepare the students to have a basic knowledge of 3 phase Synchronous machine.

Course Outcomes:

Upon completion of this course students will be able to:

1. Demonstrate various parts of an electrical machine.
2. Conduct Different test on DC machine.
3. Understand and analyze synchronous generator.
4. Demonstrate constructional details, principle of operation of Special Machines.

Syllabus:

UNIT I **[8 Hrs]**

DC Generators: Introduction, construction, types, emf equation, lap and wave windings, armature reaction, commutation, methods of improving commutation, equalizer rings, demagnetizing and cross magnetizing ampere turns, various characteristics of shunt, series and compound generators, voltage build up, losses and efficiency, condition for maximum efficiency.

UNIT II **[8 Hrs]**

DC Motors: Introduction, principals, back-emf, torque of motor, types, characteristics of shunt, series and compound motors, speed control (field and armature control methods), basic idea of solid state devices in controlling of DC motors, Starting of DC motors, three point and four point starters, losses and efficiency, testing (brake test, swimburnes, hopkinson test), Applications.

UNIT III **[9 Hrs]**

Synchronous Generators (Alternators): Introduction, Construction, advantages of rotating field, types of rotors, emf equation, excitation systems, equivalent circuit and their phasor diagrams, voltage regulation, synchronous impedance method, mmf method. Zero power factor method, two reaction theory of salient pole rotor, phasor diagram, power developed and power angle characteristics of salient pole machine, determination of Xd and Xq, synchronization, synchronizing power and torque, parallel operation application.

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UNIT IV **[7 Hrs]**

Synchronous Motors: Introduction, construction, principal of operation, starting of synchronous motor, equivalent circuit and phasor diagrams, power and torque, performance calculation, speed torque characteristics, power factor control-effect of change of excitation.

UNIT V **[7 Hrs]**

Synchronous Motors: V curve and inverted V curve, synchronous condenser and reactors, synchronous phase modifiers, hunting-causes and remedies, applications, synchronous induction motor application.

Text Books:

1. A. E. Fitzgerald, C. KingsleyJr and Umans, Electric Machinery, 6th Edition McGraw Hill, International Student Edition.
2. I.J. Nagrath & D.P. Kothari, Electric Machines, 3/e, Tata McGraw Hill, New Delhi.

Reference Books:

1. M.G. Say, Performance & design of AC machines, CBS publishers & distributors, Delhi, 3rd edition
2. A.E. Clayton & N.N. Nancock, The Performance & design of DC machines CBS publications & distributors, Delhi, 3rd edition
3. P.S. Bhimbra, Generalized theory of Electrical Machines, Khanna publishers, Delhi,
4. Ashfaq Husain, Electric Machines, DhanpatRai, New Delhi.
5. Syed A. Nasar, Electric Machines & Power Systems, Volume I , Tata McGraw Hill, New Delhi
6. E. Fitzerald, C. Kingsley & S.D. Umans , Electric Machinery Tata McGraw Hill ,New Delhi ,5 edition.
7. Stephen J Chapman, Electric Machinery Fundamentals, McGraw-Hill

List of Experiments: Experiments can cover any of the above topics, following is a suggestive list:

1. To obtain open circuit characteristics of self excited DC shunt generator and to find its critical resistance.
2. Speed control of D.C. shunt motor by Field current control method & plot the curve for speed verses field current.
3. Speed control of D.C. shunt motor by Armature voltage control method & plot the curve for speed verses armature voltage.
4. To perform Swinburne's test on a DC shunt machine and to calculate efficiency at full load.
5. To perform Hopkinson's test on a DC shunt machine and to calculate full load efficiency (a) when running as motor and (b) when running as generator.
6. Draw & verify open circuit characteristics of 3-Ø synchronous generator.
7. Draw & verify short circuit characteristics of 3-Ø synchronous generator.
8. Draw & verify external load characteristics of 3-Ø synchronous generator.
9. Calculate X_d & X_q parameter of synchronous machine by slip test.
10. Synchronization of a three-phase alternator with the infinite bus and control load sharing.
11. Draw & verify 'V' curve of 3-Ø synchronous motor.

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							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTEE502		POWER ELECTRONICS	3	1	2	5	60	20	20	30	20

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:
This course aims to equip the students with a basic understanding of modern power semiconductor devices, various important topologies of power converter circuits for specific types of applications. The course also equips students with an ability to understand and analyze non-linear circuits involving power electronic converters.

Course Outcomes: Upon completion of the course, the student will be able to
1. Understand the principle of operation of commonly employed power electronic converters.
2. Analyze non-linear circuits with several power electronic switches.
3. Equipped to take up advanced courses in Power Electronics and its application areas.

Syllabus:

UNIT-I
Power Semiconductor diodes and Transistors: Types of power diodes-General purpose diodes-Fast recovery diodes- Their characteristics and applications, Bipolar junction transistors, Power MOSFETS P-Channel, N-Channel, IGBTs- Basic Structure and working, Steady state and switching characteristics-Comparison of BJT, MOSFET and IGBT-Their applications.

UNIT-II
Principle of operation of SCR, Static and dynamic characteristics-Two transistor analogy, condition of turn on & off of SCR, Gate characteristics, GTO, DIAC, TRIAC, UJT, IGCT Characteristics.
Trigger circuits-R, RC and UJT triggering circuits. Various commutation methods of SCRs, Protection of SCRs, Series and Parallel operation of SCRs, String efficiency.

UNIT-III
AC-DC Converter: Principles of controlled rectification—Study of single phase and three phase half controlled and full controlled bridge rectifiers with R, RL, RLE loads Effect of source inductances. Dual Converters—circulating current mode and Non-circulating current mode, Control Strategies.

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UNIT-IV

DC-DC Converter: Classification of Choppers: A, B, C, D & E, Jones and Morgens chopper. Switching mode regulators - Study of Buck, Boost, Buck-Boost regulators.
AC-AC Converter: Principle of operation of Single Phase Bridge type cyclo-converters and their applications. Single phase and Three phase AC Voltage controllers with R & RL load.

UNIT-V

DC-AC Converter: Principle of operation of Single Phase Inverters-Three phase bridge inverters (180 and 120 Degree modes)-voltage control of invertors—Single Pulse Width Modulation-Multiple pulse width Modulation-Sinusoidal Pulse Width Modulation .Comparison of Voltage Source Inverter and Current Source Inverters.

Text Books:

1. Rashid, M.H, 'Power Electronics - Circuits, Devices and Applications', Prentice Hall Publications, 3 rd Edition, 2003.
2. M.D.Singh and K.B.Kanchandhani, 'Power Electronics', Tata McGraw-Hill Publishing Company Limited, 2nd Edition, 2006.

Reference Books:

1. Ned Mohan, Tore M. Undeland, William P. Robbins, 'Power Electronics', John Wiley & Sons Publications, 3rd Edition, 2006.
2. Vedam Subramaniam, 'Power Electronics', New Age International (P) Ltd Publishers, 2001.
3. Philip T. Krein, 'Elements of Power Electronics', Oxford University Press, 1st Edition, 2012.
4. V. R. Moorthi, 'Power Electronics- Devices, Circuits and Industrial Applications', Oxford University Press, 1st Edition, 2005. 4. P.S. Bimbhra, 'Power Electronics', Khanna Publishers, 3rd Edition, 13th Reprint, 2004

List of Experiments:

1. Show Static and dynamic characteristics of an SCR.
2. Examine Static and dynamic characteristics of TRAIC.
3. Examine Static and dynamic characteristics of DAIC.
4. Determine Characteristics of MOSFET and IGBT.
5. Analyze Single phase SCR Half controlled converter with R and RL load.
6. Analyze Single phase fully controlled (bridge) converter with R and RL load.
7. Design 3-phase SCR Half Controlled Converter (using simulation platform like MATLAB/Simulink)
8. Design of 3-phase SCR Fully Controlled Converter (using simulation platform like MATLAB /Simulink)
9. Recall of classes of commutation A, B, C, D, E, F.
10. Simulation of Chopper circuit using SCR.

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							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTEE 503		CONTROL SYSTEM ENGINEERING	3	1	2	5	60	20	20	30	20

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

The course will provide understanding of control system and mathematical modeling of the system

Course Outcomes:

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

1. Demonstrate the understanding of basic element and modeling of the control system.
2. Analyze the stability in time domain and frequency domain
3. Design the controller and compensators for the system

Syllabus:

UNIT I **8 Hrs**

Introduction: Basic Elements of Control System, Open loop and Closed loop systems, Differential equation, Transfer function, Modeling of Electric systems, Translational and rotational mechanical systems, Block diagram reduction Techniques, Signal flow graph, Constructional and working concept of ac servomotor.

UNIT II **8 Hrs**

Time Domain Analysis: Standard test signals ,Time response of first order systems ,Characteristic Equation of Feedback control systems, Transient response of second order systems ,Time domain specifications , Steady state response , Steady state errors and error constants , P, PI, PD and PID Compensation

UNIT III **8 Hrs**

Stability Analysis and Root locus: The concept of stability – Routh's stability criterion – qualitative stability and conditional stability – limitations of Routh's stability.The root locus concept - construction of root loci-effects of adding poles and zeros to G(s) H(s) on the root loci.

UNIT IV **8 Hrs**

Frequency domain Analysis: Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and Phase margin and Gain margin-Stability Analysis from Bode Plots. Polar Plots, Nyquist Plots,Stability analysis. Compensation techniques – Lag, Lead, Lead-Lag Controllers design in frequency Domain

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UNIT V **8 Hrs**

State Space Analysis of Continuous Systems: Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and it's Properties – Concepts of Controllability and Observability.

Text Books:

1. I.J.Nagrath and M.Gopal," Control System Engineering", New Age International Pu blishers, 5th Edition, 2008.
2. Richard C Dorf; Robert H Bishop, "Modern control system", Pearson Education, 13th Edition, 2017.

References Books:

1. M F Golnaraghi and Benjamin C Kuo, "Automatic control systems", New York McGraw-Hill Education, 9th Edition, 2017.
2. M.Gopal, Digital Control and State Variable Methods, Tata McGraw- Hill 4th Edition, 2014.
3. Joseph J DiStefano, Allen R Stubberud and Ivan J Williams , Schaum's Outline Series, "Feedback and Control Systems", Tata McGraw- Hill, 2nd Edition 2014.
4. John J.D'azzo & Constantine H.Houpis, 'Linear control system analysis and design', Tata McGraw-Hill., 4th Edition 2000 .

List of Practicals:

1. Perform step response of a transfer function
2. Perform impulse response of a transfer function
3. Perform ramp response of a transfer function
4. Analyze torque speed characteristics and determine the transfer function of a DC servomotor.
5. Analyze characteristics of a small AC servomotor and determine its transfer function.
6. Perform the transient and frequency response of a second order network.
7. Perform the performance of various types of controllers used to control the temperature of an oven.
8. Draw nyquist plot from a transfer function
9. Draw root locus from a transfer function
10. Draw bode plot from a transfer function

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							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTEE 504		**SWITCHGEAR AND PROTECTION**	3	0	2	4	60	20	20	30	20

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

To introduce the students the different types of faults, circuit breakers and protective relays for protecting power system equipments.

Course Outcomes:

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

1. Gain knowledge on protective relays and circuit breakers.
2. Understand the concept of protection of generators, transformers and bus bars.
3. Gain knowledge in different types of microprocessor based relays.
4. Understand the concept of lightning and its protection.

Syllabus:

UNIT I **[7 Hrs]**

Fault Analysis

Faults in power systems (Symmetrical & Unsymmetrical), Fault analysis in per unit System, representation of power system as Single line and equivalent impendence diagram. Symmetrical components and its application to power systems, Sequence networks and their interconnection for different types of faults, Effect of fault impedance, Current limiting reactors, its location and application, Short circuit calculation.

UNIT II **[9 Hrs]**

Protective Relays

Requirement of relays, Primary & backup protection, Desirable qualities of relays, Concept of Pickup, reset & drop-off, Drop off/ Pickup ratio, inverse time & definite time characteristics. Types of Relay: Attracted armature, Balanced Beam, Induction disc, Induction cup, Moving coil & moving Iron, Rectifier , Thermal, Bimetal directional relay, Frequency, DC, all or nothing relays, Pilot & negative sequence, Over current, Over Voltage, Directional, Differential and Distance relays, R-X diagram, Impedance mho & reactance relay. Introduction of static analog & digital relays. Thermal Imaging- Types, Fault Detection on transmission lines using thermal imaging, Applications.

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UNIT III **[9 Hrs]**

Circuit Breakers

Elementary principle of arc quenching, recovery & re-striking voltage, arc quenching devices, description and operation of Bulk oil, Minimum oil, Air break, Air blast, SF6, Vacuum circuit breakers and DC circuit breakers, their comparative merits, LT Switch gear, HRC fuses, current limiting reactor & influence of reactors in CB ratings, Testing of circuit breaker.

UNIT IV **[9 Hrs]**

System Protection

Protection of Generators -Earth Fault, percentage, differential, Loss of excitation, Prime mover failure, Over current, Turn to turn fault, Negative phase sequence, heating, Reverse power protection schemes Protection of Transformers Internal & external fault protection, Differential, Earth fault, Over Current, Overheating, Protection schemes, Protection of transmission lines, Over current, Distance and carrier current protection schemes.

UNIT V **[9 Hrs]**

Surge Protection & insulation co-ordination

Switching surges, Phenomena of Lightning, over voltage due to lightning, Protection against lightning, Lightning arrestors, selection of lightning arrestors, Surge absorbers and diverters, Rod gap, Horn gap expulsion type & valve type lightning arrestors, solid resistance and reactance earthing, Arc suppression coil, Earthing transformers, Earth wires, Earthing of appliances, insulation co-ordination,

Text Books:

1. Switchgear & protection, by Sunil S. Rao. Khanna Publication, 2008.
2. Electrical Power systems, by CL Wadhwa, New age International, 2009.
3. A. Davies, "Handbook of Condition Monitoring, Techniques and Methodology", Springer-Science+Business Media, B.V. 1998

Reference Books:

1. B. Ravindran and M Chander, Power System protection and Switchgear, New Age International reprint 2006.
2. B.K.N. Rao, "Handbook of Condition Monitoring", Elsevier Science Ltd., First Edition 1996

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List of Practical's:

1. Determination of drop out factor of an instantaneous over current relay.
2. Determination of operating characteristic of IDMT relay.
3. Determination of operating characteristic of differential relay.
4. Study and operation of gas actuated protective relay.
5. Study and operation of static over current relay.
6. Determination of transmission line parameters using MATLAB.
7. Analysis of power system faults (Symmetrical & Asymmetrical) using MATLAB.
8. Study of SF6 circuit breaker
9. Simulation of protection of generator and Transformer.
10. Simulation of protection of Feeder & Motor protection.

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							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTEE 511		POWER QUALITY	3	0	0	3	60	20	20	0	0

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:
This course aims to study the production of voltages sags, overvoltage and harmonics and methods of control and also study various methods of power quality monitoring

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

1. Demonstrate the major power quality problems.
2. Understand equipments that are required to measure the quality of power, as well as techniques available to mitigate power quality problems.

Syllabus:

UNIT I **[8 Hrs]**
INTRODUCTION TO POWER QUALITY
Terms and definitions: Overloading - under voltage - over voltage. Concepts of transients - short duration variations such as interruption - long duration variation such as sustained interruption. Sags and swells - voltage sag - voltage swell - voltage imbalance - voltage fluctuation - power frequency variations. International standards of power quality. Computer Business Equipment Manufacturers Association (CBEMA) Curve.

UNIT II **[8 Hrs]**
VOLTAGE SAGS AND INTERRUPTIONS
Sources of sags and interruptions - estimating voltage sag performance. Thevenin's equivalent source - analysis and calculation of various faulted condition. Voltage sag due to induction motor starting. Estimation of the sag severity - mitigation of voltage sags, active series compensators. Static transfer switches and fast transfer switches.

UNIT III **[7 Hrs]**
OVERVOLTAGES
Sources of over voltages - Capacitor switching – lightning - ferro resonance. Mitigation of voltage swells - surge arresters - low pass filters - power conditioners. Lightning protection – shielding - line arresters - protection of transformers and cables.

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UNIT IV **[8 Hrs]**

HARMONICS

Harmonic sources from commercial and industrial loads, locating harmonic sources. Power system response characteristics - Harmonics Vs transients. Effect of harmonics - harmonic distortion - voltage and current distortion - harmonic indices - inter harmonics – resonance. Harmonic distortion evaluation - devices for controlling harmonic distortion - passive and active filters. IEEE and IEC standards.

UNIT V **[7 Hrs]**

POWER QUALITY MONITORING

Monitoring considerations - monitoring and diagnostic techniques for various power quality problems - modeling of power quality (harmonics and voltage sag) problems by mathematical simulation tools - power line disturbance analyzer – quality measurement equipment - harmonic / spectrum analyzer - flicker meters - disturbance analyzer. Applications of expert systems for power quality monitoring.

Text Books:

1. R.C. Duggan, "Electrical Power Systems Quality", TMH publication, Third Edition, 2012.
2. C.Sankaran, "Power Quality" by CRC publication, 2001.

Reference Books:

1. J. Vikramarajan, " Enhancement of the Power Quality and Power Factor in Power System" 2014.
2. **Chattopadhyay, "**Electric Power Quality",springer, 2011

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							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTEE 512		RELIABILITY ENGINEERING	3	0	0	3	60	20	20	0	0

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

The overall aim of this course is to provide knowledge of basic reliability evaluation theories with applications for electric power systems. The course gives a thoroughly introduction to reliability theory and generally used models. It aims to arm the students with the concepts of evaluation of generation, transmission and distribution system reliability and their impacts on system planning.

Course Outcomes:

At the end of the course, the students will be able to:

1. Understand the concept of probability theory, distribution, network modelling and reliability analysis.
2. Analyze the reliability functions with their relationships and Markov modeling.
3. Evaluate reliability models using frequency and duration techniques and generate various reliability models.
4. Explicate the reliability of composite systems and distribution systems.

Syllabus:

UNIT I **[8 hours]**

Probability Theory: Introduction to Probability, Probability distributions: Random variables, density and distribution functions. Mathematical expectation. Binominal distribution, Poisson distribution, normal distribution, exponential distribution, Weibull distribution. Normal Gaussian, Gamma and Beta distribution. Correlation and regression.

UNIT II **[8 hours]**

Basic Tools and Techniques- Random processes methods & Markov process, Computation of power system reliability measures by using Markov reward models, Evaluation of reliability indices, Universal Generating Function (UGF) Method, Monte Carlo simulation.

UNIT III **[8 hours]**

Generation System Reliability Analysis: Capacity Outage Calculations, Reliability indices using the loss of load probability method, unit commitment and operating constraints, optimal reserve management, single and multi-stage expansion. Interconnected System, Factors affecting interconnection under emergency assistance.

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UNIT IV **[6 hours]**

Transmission System Reliability Analysis: Introduction, Objectives of Transmission Planning, Network Reconfiguration, System and Load Point Indices, Data required for Composite System Reliability.

UNIT V **[10 hours]**

Distribution System Reliability Analysis: Radial Networks– Introduction, Network Reconfiguration, Evaluation Techniques, Effects of Lateral Distribution Protection, Bus Bar Failure, Scheduled Maintenance, Temporary and Transient Failure, Weather Effects, Breaker Failure.

Text Books:

1. R. Billinton, R.N.Allan, Reliability Evaluation of Power systems, 1996 Plenum Press, New York.
2. Marko Cepin, "Assessment of Power System Reliability- Methods and Applications", Springer-Verlag London Limited 2011.

Reference Books:

1. Sharles E.Ebeling. "An Introduction to Reliability and Maintainability Engineering", TMH.
2. J.Endrenyi , "Reliability Modelling in Electric Power Systems", John Wiley & sons, NY.
3. Athanasios Papoulis and S.Unnikrishna Pillai ,"Probability, Random variables and Stochastic Processes, 4th edition, Tata McGraw Hill, 2002.

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							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTEE 514		INTRODUCTION OF IOT IN ELECTRICAL ENGINEERING	3	0	0	3	60	20	20	0	0

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives: The objective of study of IOT in Electrical Engineering is to:

1. Study Telematics devices
2. Study IoT Sensors
3. Study Smart grid and Micro grid
4. Study Smart Space Security System

Course Outcomes:

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

1. Attain knowledge of IoT in Electrical Engineering
2. Attain knowledge on Telematic Devices
3. Analyze and work on IoT sensors
4. Attain knowledge on Smart grid and Micro grid
5. Learn Smart Space Security System.

Syllabus:

UNIT- I

INTRODUCTION TO IOT **[9 hrs]**

Introduction – Need of IoT in Electrical Engineering – Challenges in Implementation of IoT – Trends in Electrical Engineering – Configuration and Scalability – Efficiency – Quality of Service

UNIT II

TELEMATICS **[9 hrs]**

Smart Devices – Smart Apps – Wearable Technology – Vehicle Telemetry – Smart Homes and Building Automation – Vehicle Charging Station

UNIT III

SMART ENERGY **[9 hrs]**

Generation – Transmission – Distribution and Metering – Storage – Smart Monitoring and Diagnostics System at Major Power Plants –Micro grid and Virtual Power

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UNIT IV

INDUSTRIAL IOT **[9 hrs]**

Real-Time Monitoring and Control of Processes – Deploying Smart Machine – Smart Sensor – Smart Controllers – SCADA – Proprietary Communication

UNIT V

SECURITY MEASURES **[9 hrs]**

Securing Smart Spaces and Smart Grid – Smart Grid – Service that need to be Secure - Security Requirement – Security Smart Spaces – Smart Tracking Firewall – Cryptographic Key in the IoT

Text Books:

1. George Mastorakis , (2016), Internet of Things (IoT) in 5G Mobile Technologies, 1st ed. Edition, Publisher SPRINGER.

Reference Books:

1. Enterprise IoT: Strategies and Best Practices for Connected Products and Services, Dirk Slama, Frank Puhlmann, Jim Morrish, Rishi M Bhatnagar, Publisher O'REILLY

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