GODAVARI INSTITUTE OF ENGINEERING & TECHNOLOGY

GR-.19

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

4 Years B.Tech. (Electrical & Electronics Engineering) Course Structure : (2019-20)

I YEAR I SEMESTER

S. No.	Subject Code	Course Category	Subject Title	Periods per week			C	Scheme of Examination Maximum Marks		
				L	T	P		Int.	Ext.	Total
1	19199101	BSC	Mathematics-I	3	0	0	3	30	70	100
2	19199102	HSMC	Communicative English-I	3	0	0	3	30	70	100
3	19192106	PCC	Engineering Electromagnetic s	3	0	0	3	30	70	100
4	19199103	BSC	Engineering Chemistry	3	0	0	3	30	70	100
5	19195105	ESC	Problem Solving & Programming in 'C '	2	1	0	3	30	70	100
6	19199194	MC	Professional Ethics and Human Values	2	0	0	0	30*	-	-
7	19199114	BSC	Engineering Chemistry Laboratory	0	0	3	1.5	50	50	100
8	19193112	ESC	Basic Engineering Workshop	0	0	3	1.5	50	50	100
9	19199111	HSMC	Communicative English Lab-I	0	0	3	1.5	50	50	100
10	19195113	ESC	Problem Solving & Programming Laboratory using C	0	0	3	1.5	50	50	100
TOTAL				**16**	**1**	**12**	**21**	**350**	**550**	**900**
BSC-7.5	HSMC-4.5	PCC-03		ESC-6	MC-0					

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

4 Years B.Tech. (Electrical & Electronics Engineering) Course Structure : (2019-20)

I YEAR II SEMESTER

S. No.	Subject Code	Course Category	Subject Title	Periods per week			C	Scheme of Examination Maximum Marks		
				L	T	P		Int.	Ext.	Total
1	19199201a	BSC	Mathematics-II	3	0	0	3	30	70	100
2	19199204	BSC	Engineering Physics	3	0	0	3	30	70	100
3	19199202	HSMC	Communicative English-II	3	0	0	3	30	70	100
4	19199296a	MC	Environmental Studies	2	0	0	0	30*	-	-
5	19192203	PCC	Electrical circuit analysis-I	3	0	0	3	30	70	100
6	19193275	ESC	Engineering Graphics	1	0	3	2.5	30	70	100
7	19199212	BSC	Engineering Physics Laboratory	0	0	3	1.5	50	50	100
8	19199211	HSMC	Communicative English Lab- II	0	0	3	1.5	50	50	100
9	19192213	PCC	Electrical Engineering workshop	0	0	3	1.5	50	50	100
				15	**0**	**12**	**19**	**300**	**500**	**800**
BSC-7.5		HSMC-4.5	PCC-4.5	ESC-2.5	MC-0					

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

4 Years B.Tech. (Electrical & Electronics Engineering) Course Structure : (2019-20)

II YEAR I SEMESTER

S. No.	Subject Code	Course Category	Subject Title	Periods per week			C	Scheme of Examination Maximum Marks		
				L	T	P		Int.	Ext.	Total
1	19120301	BSC	Complex Variables and Transform techniques	3	0	0	3	30	70	100
2	19120302	PCC	Electrical Circuits Analysis-II	3	0	0	3	30	70	100
3	19120303	PCC	Electrical Machines – I	3	0	0	3	30	70	100
4	19120304	PCC	Electronic Devices & Circuits	3	0	0	3	30	70	100
5	19120305	PCC	Electrical Measurements	3	0	0	3	30	70	100
6	19120306	MC	Design Thinking & Product Innovation	2	0	0	0	30*	-	-
7	19120312	PCC	Electrical Circuits Lab	0	0	3	1.5	50	50	100
8	19120313	PCC	Electrical Machines –I Lab	0	0	3	1.5	50	50	100
9	19120314	PCC	Electrical Measurements Lab	0	0	3	1.5	50	50	100
10	19124311	PCC	Electronic Devices & Circuits Lab	0	0	3	1.5	50	50	100
TOTAL				17	0	12	21	350	550	900
BSC-03	PCC-13.5	ESC-4.5	MC-0							

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

4 Years B.Tech. (Electrical & Electronics Engineering) Course Structure : (2019-20)

II YEAR II SEMESTER

S. No.	Subject Code	Course Category	Subject Title	Periods per week			C	Scheme of Examination Maximum Marks		
				L	T	P		Int.	Ext.	Total
1	19129401	BSC	Numerical Methods and Probability & Statistics	3	0	0	3	30	70	100
2		OEC	**Open Elective-I**	3	0	0	3	30	70	100
	19123464a		Mech - Robotics							
	19123464b		CSE- Operating Systems							
	19123464c		ECE- Internet of Things							
	19123464d		CE- Environmental Pollution & Control							
	19123464e		AME – Basic Automobile Engineering							
	19123464f		MM – Elements of Mining Technology							
3	19120405	PCC	Power systems -I	3	0	0	3	30	70	100
4	19120406	PCC	Electrical Machines – II	3	0	0	3	30	70	100
5	19123403	ESC	Fluid Mechanics & Hydraulic Machinery	3	0	0	3	30	70	100
6	19124402	ESC	Internet of things	2	0	2	3	30	70	100
7	19120412	PCC	Electrical Machines – II Lab	0	0	3	1.5	50	50	100
8	19123411	ESC	Fluid Mechanics & Hydraulic Machinery Lab	0	0	3	1.5	50	50	100
TOTAL				17	0	8	21	280	520	800

BSC - 03	OEC-03	PCC-12	ESC-3

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

4 Years B.Tech. (Electrical & Electronics Engineering) Course Structure : (2019-20)

III YEAR I SEMESTER

S. No.	Subject Code	Course Category	Subject Title	Periods per week			C	Scheme of Examination Maximum Marks		
				L	T	P		Int.	Ext.	Total
1	19120503	PCC	Control Systems	3	0	0	3	30	70	100
2	19120504	PCC	Power Systems-II	3	0	0	3	30	70	100
3	19124501	PCC	Digital Electronics	3	0	0	3	30	70	100
4		PEC	**Professional Elective - I**	3	0	0	3	30	70	100
	19120565a		Power system dynamics & control							
	19120565b		Special electrical machines							
	19120565c		Advanced control systems							
	19120565d		Advanced power conversion systems							
5		OEC	**Open Elective – II**	3	0	0	3	30	70	100
	19123562a		Mech - MEMS							
	19123562b		CSE- Information Security							
	19123562c		ECE – Digital Image Processing							
	19123562d		CE – Solid Waste Management							
	19123562e		AME – Hybrid and Electric Vehicles							
	19123562f		MM – Disaster Management in Mining							
6	19120512	PCC	Control Systems Lab	0	0	3	1.5	50	50	100
7	19124511	PCC	Digital Electronics Lab	0	0	3	1.5	50	50	100
8	19129596	MC	Constitution of India	2	0	0	0	30*	-	-
9	19120521	PR	Mini Project-I/ Study Project/ Internship	-	-	-	2	100	_	100
10	19120522	PR	Community service oriented project	0	0	1	0.5	100	-	100
TOTAL				17	0	7	20.5	450	450	900
PCC-12	PEC-03		OEC-03	MC-0	PR-2.5					

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

4 Years B.Tech. (Electrical & Electronics Engineering) Course Structure : (2019-20)

III YEAR II SEMESTER

S. No.	Subject Code	Course Category	Subject Title	Periods per week			C	Scheme of Examination Maximum Marks		
				L	T	P		Int.	Ext.	Total
1		PEC	**Professional Elective - II**	3	0	0	3	30	70	100
	19120665a		Utilization of electrical energy							
	19120665b		Power semi-conductor drives							
	19120665c		Digital control systems							
	19120665d		Solar energy systems							
2		OEC	**Open Elective - III**	3	0	0	3	30	70	100
	19125662a		CSE – Human Computer Interaction							
	19125662b		ECE – Data Communication							
	19125662c		CE – Global Environment: Problems & Policies							
	19125662d		AME – Modern Vehicle Technology							
	19125662e		MM- Remote Sensing & GIS in Mining							
3		PCC	Power Electronics	3	0	0	3	30	70	100
4	19124601	PCC	Microprocessors & Micro-controllers and applications	3	0	0	3	30	70	100
5	19124603	PCC	Switch Gear & Protection	3	0	0	3	30	70	100
6	19124604	PCC	Power system analysis	3	0	0	3	30	70	100
7	19124611	PCC	Microprocessors & Micro-controllers and applications Lab	0	0	3	1.5	50	50	100
8	19120612	PCC	Power Electronics Lab	0	0	3	1.5	50	50	100
9	19129696	HSMC	Soft Skills	0	0	3	1.5	50	50	100
			Total	15	0	9	22.5	330	570	900
PEC-03	OEC-03	PCC-15	HSMC-1.5							

IV YEAR I SEMESTER

S. No.	Subject Code	Course Category	Subject Title	Periods per week			C	Scheme of Examination Maximum Marks		
				L	T	P		Int.	Ext.	Total
1		PEC	**Professional Elective - III**	3	0	0	3	30	70	100
	19120764a		Electrical distribution systems							
	19120764b		Advanced power electronic converters							
	19120764c		Modern control theory							
	19120764d		Wind energy systems							
2		PEC	**Professional Elective - IV**	3	0	0	3	30	70	100
	19120765a		Flexible Alternating Current Transmission Systems							
	19120765b		High Voltage Engineering							
	19120765c		Adaptive Control Systems							
	19120765d		Operation of restructured power systems							
3		OEC	**Open Elective – IV(MGMT)**	3	0	0	3	30	70	100
	19129761a		MEFA							
	19129761b		Organizational behavior							
	19129761c		Human Resource management							
	19129761d		Entrepreneurship Qualities for Engineers							
	19129761e		Principles of Management							
	19129761f		Financial Management for Engineers							
	19129761g		Operations management							

	19129761h		Digital Marketing							
	19129761i		Total Quality Management							
4	19120702	PCC	HVDC transmission	3	0	0	3	30	70	100
5	19120703	PCC	Power System Operation & Control	3	0	0	3	30	70	100
6	19120711	PCC	Power systems Lab	0	0	3	1.5	50	50	100
7	19120712	PCC	Electrical Simulation Lab	0	0	3	1.5	50	50	100
8	19129796	MC	Intellectual Property Rights and Patents	2	0	0	0	30*	_	-
9	19120721	PR	Internship/Mini Project II	-	-	-	2	100	_	100
TOTAL				17	0	6	20	350	450	800
PEC-06	OEC-03	PCC-09	PR-02							

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

4 Years B.Tech. (Electrical & Electronics Engineering) Course Structure : (2019-20)

IV YEAR II SEMESTER

S. No.	Subject Code	Course Category	Subject Title	Periods per week			C	Scheme of Examination Maximum Marks		
				L	T	P		Int.	Ext.	Total
1		PEC	**Professional Elective - V**	3	0	0	3	30	70	100
2	19120862a		Smart Grid							
	19120862b		Power Quality							
	19120862c		Non Linear Control Systems							
	19120862d		Electric Vehicles							
3	19120801	PCC	Energy Audit, Conservation & Management	3	0	0	3	30	70	100
4	19120841	PR	Project Work	-	-	18	9	80	120	200
			TOTAL	6	0	0	15	140	260	400
PEC-03	PCC-03	PR-09								

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

4 Years B.Tech. (Electrical & Electronics Engineering) Course Structure : (2019-20)

OPEN ELECTIVE-I	OPEN ELECTIVE-II	OPEN ELECTIVE-III	OPEN ELECTIVE-IV
Mech - Robotics	Mech - MEMS	Mech – Nano Technology	Managerial Economics and Financial Analysis
CSE- Operating Systems	CSE- Information Security	CSE – Human Computer Interaction	Entrepreneurship Qualities for Engineers
EEE- Utilization of Electrical Energy	EEE – Energy management	EEE – Renewable Energy Resources	Principles of Management
ECE- Internet of Things	ECE – Digital Image Processing	ECE – Data Communication	Financial Management for Engineers
CE- Environmental Pollution & Control	CE – Solid Waste Management	CE – Global Environment: Problems & Policies	Operations management
AME – Basic Automobile Engineering	AME – Hybrid and Electric Vehicles	AME – Modern Vehicle Technology	Digital Marketing
MM – Elements of Mining Technology	MM – Disaster Management in Mining	MM- Remote Sensing & GIS in Mining	Total Quality Management
			Organizational behavior
			Human Resource management

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

4 Years B.Tech. (Electrical & Electronics Engineering) Course Structure : (2019-20)

Professional Electives	POWER SYSTEMS	POWER ELECTRONICS & DRIVES	CONTROL SYSTEMS	ENERGY SYSTEMS
ELECTIVE-I	POWER SYSTEM DYNAMICS & CONTROL	SPECIAL ELECTRICAL MACHINES	ADVANCED CONTROL SYSTEMS	ADVANCED POWER CONVERSION SYSTEMS
ELECTIVE-II	UTILIZATION OF ELECTRICAL ENERGY	POWER SEMI-CONDUCTOR DRIVES	DIGITAL CONTROL SYSTEMS	SOLAR ENERGY SYSTEMS
ELECTIVE-III	ELECTRICAL DISTRIBUTION SYSTEMS	ADVANCED POWER ELECTRONIC CONVERTERS	MODERN CONTROL THEORY	WIND ENERGY SYSTEMS
ELECTIVE-IV	FACTS	HIGH VOLTAGE ENGINEERING	ADAPTIVE CONTROL	OPERATION OF RESTRUCTURED POWER SYSTEMS
ELECTIVE-V	SMART GRIDS	POWER QUALITY	NON LINEAR CONTROL	ELECTRIC VEHICLES

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

4 Years B.Tech. (Electrical & Electronics Engineering) Course Structure : (2019-20)

CATEGORY	EEE DEPARTMENT ALLOCATED CREDITS	AICTE	APSCHE
BSC	21	25	24
HSMC	10.5	12	13
PCC	72.0	48	59
ESC	16.0	24	24
MC	0	0	0
OEC	12	18	12
PEC	15	18	12
PR	13.5	15	13
LC	-	-	03
	160	160	160

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	I B.Tech. I Sem (1 semester)			
Course Code	**ENGINEERING ELECTROMAGNETICS**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): semi conductor Physics , mathematics		3	0	0	3

COURSE OBJECTIVES:

1. To introduce the basic mathematical concepts related to electromagnetic vector fields
2. To impart the concepts of Electrostatic fields, electrical potential, energy density and their applications..
3. To Analyze the relation between the fields under time varying situations.
4. To Discuss the principles of propagation of uniform plane waves.
5. To Justify the concepts of electromagnetic waves, means of transporting energy or information, in the form of radio waves, TV signals, radar beams and light rays.

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1:	Analyze field potentials due to static changes and static magnetic fields
CO2:	Explain how materials affect electric and magnetic fields.
CO3:	Analyze the relation between the fields under time varying situations.
CO4:	Discuss the principles of propagation of uniform plane waves.
CO5:	Justify the concepts of electromagnetic waves, means of transporting energy or information, in the form of radio waves, TV signals, radar beams and light rays.

UNIT I STATIC ELECTRIC FIELD

Vector Algebra, Coordinate Systems, Vector differential operator, Gradient, Divergence, Curl, Divergence theorem, Stokes theorem, Coulombs law, Electric field intensity, Point, Line, Surface and Volume charge distributions, Electric flux density, Gauss law and its applications, Gauss divergence theorem, Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density.

UNIT II CONDUCTORS AND DIELECTRICS

Conductors and dielectrics in Static Electric Field, Current and current density, Continuity equation, Polarization, Boundary conditions, Method of images, Resistance of a conductor, Capacitance, Parallel plate, Coaxial and Spherical capacitors, Boundary conditions for perfect dielectric materials, Poisson‟s equation, Laplace‟s equation, Solution of Laplace equation, Application of Poisson‟s and Laplace‟s equations.

UNIT III STATIC MAGNETIC FIELDS

Biot -Savart Law, Magnetic field Intensity, Estimation of Magnetic field Intensity for straight and circular conductors, Ampere‟s Circuital Law, Point form of Ampere‟s Circuital Law, Stokes theorem, Magnetic flux and magnetic flux density, The Scalar and Vector Magnetic potentials, Derivation of Steady magnetic field Laws.

UNIT IV MAGNETIC FORCES AND MATERIALS

Force on a moving charge, Force on a differential current element, Force between current elements, Force and torque on a closed circuit, The nature of magnetic materials, Magnetization and permeability,

Magnetic boundary conditions involving magnetic fields, The magnetic circuit, Potential energy and forces on magnetic materials, Inductance, Basic expressions for self and mutual inductances, Inductance evaluation for solenoid, toroid, coaxial cables and transmission lines, Energy stored in Magnetic fields.

UNIT V TIME VARYING FIELDS AND MAXWELL'S EQUATIONS

Fundamental relations for Electrostatic and Magnetostatic fields, Faraday‟s law for Electromagnetic induction, Transformers, Motional Electromotive forces, Differential form of Maxwell‟s equations, Integral form of Maxwell‟s equations, Potential functions, Electromagnetic boundary conditions, Wave equations and their solutions, Poynting‟s theorem, Time harmonic fields, Electromagnetic Spectrum.

TEXT BOOKS:

1. Mathew N. O. Sadiku, 'Principles of Electromagnetics', 6th Edition, Oxford University Press Inc. Asian edition, 2015.
2. William H. Hayt and John A. Buck, 'Engineering Electromagnetics', McGraw Hill Special Indian edition, 2014.
3.Kraus and Fleish, 'Electromagnetics with Applications', McGraw Hill International Editions, Fifth Edition, 2010.

REFERENCES

1. V.V.Sarwate, 'Electromagnetic fields and waves', First Edition, Newage Publishers, 1993.
2. J.P.Tewari, 'Engineering Electromagnetics – Theory, Problems and Applications', Second Edition, Khanna Publishers.
3. Joseph. A.Edminister, 'Schaum's Outline of Electromagnetics, Third Edition (Schaum's Outline Series), McGraw Hill, 2010.
4. S.P.Ghosh, Lipika Datta, 'Electromagnetic Field Theory', First Edition, McGraw Hill Education(India) Private Limited, 2012.
5. K A Gangadhar, 'Electromagnetic Field Theory', Khanna Publishers; Eighth Reprint : 2015

Web Links:

1. www.electrical4u.com
2. www.nptel.com

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	-	-	2	-	-	-	-	2
CO2	3	-	2	2	-	1	2	1	1	-	1	2
CO3	2	1	2	1	-	-	2	-	1	-	-	2
CO4	1	2	2	2	-	2	1	1	-	-	-	2
CO5	2	2	2	1	1	1	2	-	1	1	2	3

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	I B.Tech. II Sem (2 semester)			
Course Code	**ELECTRICAL CIRCUIT ANALYSIS - I**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Mathematics		3	0	0	3

Course Objective:

1. To study the concepts of passive elements, types of sources and various network reduction techniques.
2. To understand the applications of network topology to electrical circuits.
3. To study the concept of magnetic coupled circuit.
4. To understand the behavior of RLC networks for sinusoidal excitations.
5. To study the performance of R-L, R-C and R-L-C circuits with variation of one of the parameters and to understand the concept of resonance.
6. To understand the applications of network theorems for analysis of electrical networks.

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1:	Analyse electrical networks in presence of active and passive elements.
CO2:	Analyse magnetic circuit with various dot conventions.
CO3:	Analyse steady state circuits
CO4:	Analyze series and parallel resonant circuits.
CO5:	Analyze electric circuits using Network Theorems.

Syllabus:

UNIT –I Introduction to Electrical Circuits

Basic Concepts of passive elements of R, L, C and their V-I relations, Sources (dependent and independent), Kirchoff's laws, Network reduction techniques (series, parallel, series - parallel, star-to- delta and delta-to-star transformation), source transformation technique, nodal analysis and mesh analysis to DC networks with dependent and independent voltage and current sources.

UNIT –II Network theorems (DC & AC Excitations)

Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millman's theorem and compensation theorem.

UNIT –III Magnetic Circuits

Basic definition of MMF, flux and reluctance, analogy between electrical and magnetic circuits, Faraday's laws of electromagnetic induction – concept of self and mutual inductance, Dot convention coefficient of coupling and composite magnetic circuit, analysis of series and parallel magnetic circuits.

UNIT –IV Single Phase A.C Systems

Periodic waveforms (determination of rms, average value and form factor), concept of phase angle and phase difference – waveforms and phasor diagrams for lagging, leading networks,

complex and polar forms of representations.

Steady state analysis of R, L and C circuits, power factor and its significance, real, reactive and apparent power, waveform of instantaneous power and complex power

UNIT –V Analysis of AC Networks

Extension of node and mesh analysis to AC networks, series and parallel resonance, selectively band width and Quality factor, introduction to locus diagram.

Text Books:

1. Engineering Circuit Analysis by William Hayt and Jack E.Kemmerley,McGraw Hill Company,6 th edition
2. Fundamentals of Electrical Circuits by Charles K.Alexander and Mathew N.O.Sadiku, McGraw Hill Education (India)
3. Networks and Systems by D. Roy Choudhury, New Age International publishers

Reference Books:

1.Network synthesis: Van Valkenburg; Prentice-Hall of India Private Ltd
2. Introduction to circuit analysis and design by TildonGlisson. Jr, Springer Publications.
3. Circuits by A.Bruce Carlson , Cengage Learning Publications
4. Network Theory Analysis and Synthesis by SmarajitGhosh, PHI publications
5. Electric Circuits by David A. Bell, Oxford publications
6. Circuit Theory (Analysis and Synthesis) by A.Chakrabarthi,Dhanpat Rai&Co.

Web Links:

1. www.elecrtical4u.com
2. www.nptel.ac.in

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	
CO2	3	-	-	2	-	-	-	-	-	2	2	1
CO3	3	3	3	-	-	-	-	-	-	-	-	-
CO4	3	-	3	-	-	-	-	-	-	-	-	-
CO5	3	3		-	-	-	-	-	-	-	-	-

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	I B.Tech. II Sem (2 semester)			
Course Code	**Electrical Engineering Workshop**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Basics of Electricity		0	0	3	1.5

Course Objective:

1. To demonstrate the usage of measuring equipment.
2. To train the students in setting up simple wiring circuits.
3. To impart methods in electrical machine wiring.
4. To identify the types of different suitable devices for conducting of experiment.
5. To understand Kirchhoff's laws.

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1:	Explain the limitations, tolerances, safety aspects of electrical systems & wiring.
CO2:	Select wires/cables and other accessories used in different types of wiring.
CO3:	Make simple lighting and power circuits.
CO4:	Measure current, voltage and power in a circuit.
CO5:	Make disassembling and assembling of PC.

List of Experiments:

1. Study of various electrical tools and symbols.
2. Identify different types of cables/wires and switches, fuses & fuse carriers, MCGB and ELCB, MCCB with ratings and usage.
3. Identification of types of resistors and capacitors.
4. Wiring of light/fan circuit using two way/ three way control (stair case wiring)
5. Go-down wiring/Tunnel wiring
6. Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, main switch and energy.
7. Measurement of voltage, current, resistance in DC circuit.
8. Measurement of voltage, calculate the power factor of the circuit.
9. Wiring of backup power supply including inverter, battery and load for domestic.
10. Types of earthing, physical implementation.
11. Identification of terminals of different semiconductor devices.
12. Identification of the peripherals of a computer. To prepare a report containing the block diagram of the CPU along with the configuration of each peripheral and its functions. Description of various I/O devices, power rating of computers.
13. A practice on disassembling the components of a PC and Assembling them to back to working condition.
14. Hardware trouble shooting (Demonstration): Identification of a problem and fixing a defective PC (improper assembly of peripherals).
15. Software troubleshooting (Demonstration): Identification of a problem and fixing the PC for any software issues.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	3	2	-	-	-	-	-	-	-	-	
CO2	-	-	2	-	-	-	-	-	-	-	-	
CO3	1	-	-	-	-	-	-	-	-	-	3	
CO4	-	-	-	-	-	-	-	-	2	-	-	
CO5	-	3	-	-	-	-	-	-	2	-	-	

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	II B.Tech. I Sem (3 semester)			
Course Code	**Design Thinking & Product Innovation**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Engineering physics		2	0	0	0

Course Objective:

1. Build mindsets & foundations essential for designers
2. Learn about the Human-Centered Design methodology and understand their real-world applications
3. Use Design Thinking for problem solving methodology for investigating illdefined problems.
4. Undergo several design challenges and work towards the final design challenge

Apply Design Thinking on the following Streams to

- Project Stream 1: Electronics, Robotics, IOT and Sensors
- Project Stream 2: Computer Science and IT Applications
- Project Stream 3: Mechanical and Electrical tools
- Project Stream4: Eco-friendly solutions for waste management, infrastructure, safety, alternative energy sources, Agriculture, Environmental science and other fields of engineering.

HOW TO PURSUE THE PROJECT WORK?

- The first part will be learning-based-masking students to embrace the methodology by exploring all the phases of design thinking through the wallet/ bag challenge and podcasts.
- The second part will be more discussion-based and will focus on building some necessary skills as designers and learning about complementary material for human- centered design.
- The class will then divide into teams and they will be working with one another for about 2 – 3 weeks. These teams and design challenges will be the basis for the final project and final presentation to be presented.
- The teams start with Design Challenge and go through all the phases more in depth from coming up with the right question to empathizing to ideating to prototyping and to testing.
- Outside of class, students will also be gathering the requirements, identifying the challenges, usability, importance etc
- At the end, Students are required to submit the final reports, and will be evaluated by the faculty.

TASKS TO BE DONE:

Task 1: Everyone is a Designer

- Understand class objectives & harness the designer mindset

Task 2: The Wallet/Bag Challenge and Podcast

- Gain a quick introduction to the design thinking methodology
- Go through all stages of the methodology through a simple design challenge
- Podcast: Observe, Listen and Engage with the surrounding environment and identify a design challenge.

Task 3: Teams & Problems

- Start Design Challenge and learn about teams & problems through this
- Foster team collaboration, find inspiration from the environment and learn how to identify problems.

Task 4: Empathizing

- Continue Design Challenge and learn empathy
- Learn techniques on how to empathize with users
- Go to the field and interview people in their environments
- Submit Activity Card

Task 5: Ideating

- Continue Design Challenge and learn how to brainstorm effectively
- Encourage exploration and foster spaces for brainstorming
- Submit Activity Card

Task 6: Prototyping

- Continue Design Challenge and learn how to create effective prototypes
- Build tangible models and use them as communication tools
- Start giving constructive feedback to classmates and teammates
- Submit Activity Card

Task 7: Testing

- Finish Design Challenge and iterate prototypes and ideas through user feedback
- Evolve ideas and prototypes through user feedback and constructive criticism
- Get peer feedback on individual and group performance
- Submit Activity Card

Task 8:

- Final Report Submission and Presentation

Note: The colleges may arrange for Guest Speakers from Various Design Fields: Graphic Design, Industrial Design, Architecture, Product Design, Organizational Design, etc to enrich the students with Design Thinking Concept.

REFERENCES:

1. Tom Kelly, The Art of Innovation: Lessons in Creativity From IDEO, America's Leading Design Firm (Profile Books, 2002)
2. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation (HarperBusiness, 2009)
3. Jeanne Liedtka, Randy Salzman, and Daisy Azer, Design Thinking for the Greater Good: Innovation in the Social Sector (Columbia Business School Publishing, 2017)

OTHER USEFUL DESIGN THINKING FRAMEWORKS AND METHODOLOGIES:

- Human-Centered Design Toolkit (IDEO); https://www.ideo.com/post/design-kit
- Design Thinking Boot Camp Bootleg (Stanford D-school); https://dschool.stanford.edu/resources/the-bootcamp-bootleg
- Collective Action Toolkit (frogdesign); https://www.frogdesign.com/wpcontent/o uploads/2016/03/CAT_2.0_English.pdf
- Design Thinking for Educators (IDEO); https://designthinkingforeducators.com/

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	1	-	-	-	-	-	-	-	3	-
CO2	-	2	2	-	2	-	-	-	-	-	3	-
CO3	-	-	-	-	2	-	-	2	-	-	3	-
CO4	-	2	2	-	-	-	-	-	-	-	3	-
CO5	-	-	2	-	-	-	-	-	-	-	3	-

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	II B.Tech. I Sem (3 semester)			
Course Code PCC	**ELECTRICAL CIRCUIT ANALYSIS II**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): BASIC ELECTRICAL ENGINEERING & ECA-I		3	0	0	3

Course Objectives:

1. To study the concepts of balanced and unbalanced three-phase circuits.
2. To study the transient behaviour of electrical networks with DC, pulse and AC excitations.
3. To study the performance of a network based on input and output excitation/response.
4. To understand the realization of electrical network function into electrical equivalent passive elements.
5. To understand the application of fourier series and fourier transforms for analysis of electrical circuits.

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1:	Able to solve three- phase circuits under balanced and unbalanced condition
CO2:	Learn transient response of electrical networks for different types of excitations.
CO3:	To find parameters for different types of network.
CO4:	To realize electrical equivalent network for a given network transfer function.
CO5:	To extract different harmonics components from the response of a electrical network.

UNIT-I Balanced & Unbalanced Three Phase Circuits

Phase sequence- star and delta connection - relation between line and phase voltages and currents - analysis of balanced three phase circuits - measurement of active and reactive power. Analysis of three phase unbalanced circuits: Loop method – Star-Delta transformation technique, Two wattmeter method for measurement of three phase power.

UNIT-II Transient Analysis in DC and AC Circuits

Transient response of R-L, R-C, R-L-C circuits for DC and AC excitations, Solution using differential equations and Laplace transforms.

UNIT-III Two Port Networks

Two port network parameters – Z, Y, ABCD and Hybrid parameters and their relations, Cascaded networks - Poles and zeros of network functions.

UNIT-IV Network Synthesis

Positive real function - Basic synthesis procedure - LC immittance functions - RC impedance functions and RL admittance function - RL impedance function and RC admittance function Foster and Cauer methods.

UNIT-V Fourier Analysis and Transforms

Fourier theorem- Trigonometric form and exponential form of Fourier series, Conditions of Symmetry-, Analysis of electrical circuits to nonsinusoidal periodic waveforms. Fourier integrals and Fourier transforms – properties of Fourier transforms physical significance of the Fourier Transform and its application to electrical circuits.

Text Books:

1. Engineering Circuit Analysis by William Hayt and Jack E.Kemmerley,McGraw Hill Company,6 th edition
2. Fundamentals of Electrical Circuits by Charles K.Alexander and Mathew N.O.Sadiku, McGraw Hill Education (India)
3. Networks and Systems by D. Roy Choudhury, New Age International publishers

Reference Books:

1.Network synthesis: Van Valkenburg; Prentice-Hall of India Private Ltd
2. Introduction to circuit analysis and design by TildonGlisson. Jr, Springer Publications.
3. Circuits by A.Bruce Carlson , Cengage Learning Publications
4. Network Theory Analysis and Synthesis by SmarajitGhosh, PHI publications
5. Electric Circuits by David A. Bell, Oxford publications
6. Circuit Theory (Analysis and Synthesis) by A.Chakrabarthi,Dhanpat Rai&Co.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	-	-	2	-	-	2	-	-	-
CO2	3	3	3	2	-	2	-	-	2	2	-	-
CO3	3	3	3	2	-	1	2	-	2	-	-	-
CO4	3	3	3	-	-	1	-	-	-	-	-	-
CO5	3	3	3	-	-	1	-	-	-	-	-	-

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	II B.Tech. 1Sem (3 semester)			
Course Code	**Electrical Circuits Lab**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Electrical Circuit analysis		0	0	3	1.5

Course Objective:

1. To apply mesh and nodal analysis to solve electrical circuit problems
2. To analyze circuits in the sinusoidal steady-state domain
3. To apply network theorems for the analysis of circuits and two port networks
4. To measure active and reactive powers
5. To measure Network parameters

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1:	Apply mesh and nodal analysis to solve electrical circuit problems
CO2:	Analyze circuits in the sinusoidal steady-state domain
CO3:	Apply network theorems for the analysis of circuits and two port networks
CO4:	Measure active and reactive powers
CO5:	Measure Network parameters

List of Experiments:

1. Verification of Thevenin's theorem and Norton's theorem
2. Verification of superposition and Reciprocity theorem
3. Verification of Maximum power transfer theorem
4. Verification of Compensation theorem
5. Verification of Milliman's theorem
6. Locus diagrams of RL series circuits
7. Determination of self, mutual inductances and co-efficient of coupling
8. Z parameters and Y parameters
9. Measurement of active power for star connected balanced loads
10. Measurement of active power for delta connected balanced loads
11. Measurement of reactive power for star connected balanced loads
12. Measurement of 3-ph power by 2- wattmeter method for unbalanced loads

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	-	2	-	-	-	-	-	2	-
CO2	2	3	2	-	2	-	-	-	-	-	2	-
CO3	2	3	2	-	2	-	-	-	-	-	2	-
CO4	2	3	2	-	2	-	-	-	-	-	2	-
CO5	2	3	2	-	2	-	-	-	-	-	2	-

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	II B.Tech. 1 Sem (3 semester)			
Course Code	**ELECTRICAL MACHINES – I LAB**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Electrical machines-1		0	0	3	1.5

Course Objective:

1. To determine the performance of DC shunt machine
2. To determine the performance of DC series machine
3. To determine the performance of DC compound machine
4. To connect DC machines in parallel
5. To control speed of DC machine

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1:	Determine the performance of DC shunt machine
CO2:	Determine the performance of DC series machine
CO3:	Determine the performance of DC compound machine
CO4:	Connect DC machines in parallel
CO5:	Control speed of DC machine

List of Experiments:

1. Magnetization characteristics of DC Shunt Generator.
2. Brake test on DC shunt motor. Determination of performance curves.
3. Brake test on Dc compound motor. Determination of performance curves.
4. Load test on DC Shunt Generator.
5. Speed Control of DC shunt Motor by Field control method and Armature control method.
6. Swinburne's Test and Predetermination of efficiency DC machine
7. Load test on DC compound Generator .
8. Hopkinson's test on DC shunt machine. Predetermining efficiency of as a generator and as a motor.
9. Retardation test on DC shunt motor. Determination of losses at rated speed.
10. Brake Test on DC series motor
11. Parallel operation of two D.C shunt generators.
12. Field test on two identical D.C series machines.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	3	2	-	-	-	-	-	1	1	2	-
CO2	-	3	2	-	-	-	-	-	1	1	2	-
CO3	-	3	2	-	-	-	-	-	1	1	2	-
CO4	-	2	2	-	-	-	-	-	2	-	-	-
CO5	-	-	3	-	-	-	-	-	3	2	2	-

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	II B.Tech. I Sem (3 semester)			
Course Code	**ELECTRICAL MACHINES - I**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Electrical circuit analysis		3	0	0	3

Course Objective:

1. To teach principles of magnetic circuits and electromechanical energy conversion
2. To make students to learn construction and operation of dc machines
3. To train students to conduct tests on dc machines to determine performance by direct and indirect methods
4. To train students to find the performance of transformers from the results of practical tests
5. To Analyze poly phase transformers connections.

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1:	Analyze the conditions required of self excitation of dc generators and parallel operation of dc generators the operation of dc machines
CO2:	Determine the performance of dc machine using the results of tests
CO3:	Distinguish the operation of various dc machine configurations.
CO4:	Determine the voltage regulation and efficiency of single phase transformer.
CO5:	Analyse poly phase transformers connections

Syllabus:

Unit-I D.C. Generators Construction, Armature windings – lap and wave windings, Numerical problems, commutation Process – methods of improving commutation, Compensating windings – Inter poles Types of DC generators: separately excited and self excited generators. Numerical problems, O.C.C– build-up of E.M.F - critical field resistance and critical speed - causes for failure of inducing E.M.F and remedial measures. Internal & External characteristics of shunt, series and Compound generator, Applications, Losses and Efficiency. applications of dc generators.

UNIT – II D.C. Motors D.C Motors – Principle of operation – Back E.M.F. -–characteristics of shunt, series and compound motors – Armature reaction and commutation, Torque equation, Speed torque characteristics, Losses and Efficiency, 3- point and 4- point starters – Numerical problems, applications of dc motors.

UNIT – III Speed Control and Testing of D.C. Machines Speed control Methods: D.C. Shunt motor-Armature voltage and field flux control methods, speed control of D.C. Series motor. Testing of D.C. machines: Brake test, Swinburne's test, Hopkinson's test(Regenerative method) - Retardation test and separation of losses.

UNIT – IV Single Phase Transformers Construction & Operation— types of transformers, emf equation - operation on no-load and on-load-phasor diagrams for lagging, leading and unity power factors, Equivalent circuit –Regulation – losses and efficiency - effect of variation of frequency & supply voltage on iron losses-- All day efficiency OC and SC tests - Sumpner's test -separation of losses -parallel operation- equal and unequal voltage ratios - auto transformers-equivalent circuit - comparison with two winding transformers, Numerical problems

UNIT – V 3-phase Transformers Poly phase connections - Y/Y, Y/Δ, Δ/Y, Δ/Δ and open Δ -- Third harmonics in phase voltages-three winding transformers : tertiary windings-determination of Zp, Zs and Zt -- transients in switching - off load and on load tap changers -- Scott connection-Numerical problems.

Text books:

1. J. . Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
2. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.

Reference Books:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
3. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.

Web Links:

1. www.electrical4u.com
2. www.nptel.com

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	1	-	-	-	-	-	-	-	3	-
CO2	-	2	2	-	2	-	-	-	-	-	3	-
CO3	-	-	-	-	2	-	-	2	-	-	3	-
CO4	-	2	2	-	-	-	-	-	-	-	3	-
CO5	-	-	2	-	-	-	-	-	-	-	3	-

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	II B.Tech. I Sem (3 semester)			
Course Code	**ELECTRONIC DEVICES AND CIRCUITS LAB**				
Teaching	Total contact hours-45	L	T	P	C
Prerequisite(s):Knowledge of Engineering physics related to semiconductor, mathematics like trigonometry, integration etc.		0	0	3	1.5

Course Objective:

1. To Observe the working nature of different electronic measuring equipment's
2. To Observe the characteristics of different diodes and transistors
3. To plot the characteristics of different amplifier circuits
4. To implement the biasing circuits
5. To observe the characteristics of LED and LDR.

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1:	Able to understand the working nature of different electronic measuring equipment
CO2:	Understand the characteristics of different diodes and transistors
CO3:	Able to understand the working of amplifiers for different frequencies
CO4:	Understand the need of biasing and also knows the different biasing methods
CO5:	Understand the working of LED and LDR

Syllabus:

List of Experiments:

PART A: Electronic Workshop Practice

1. Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Coils, Gang Condensers, Relays, Bread Boards.
2. Identification, Specifications and Testing of active devices, Diodes, BJTs, JFETs, LEDs, LCDs, SCR, UJT.
3. Soldering Practice- Simple circuits using active and passive components.
4. Study and operation of Ammeters, Voltmeters, Analog and Digital Multimeters, Function Generator, Regulated Power Supply and CRO.

PART B: List of Experiments

(For Laboratory Examination-Minimum of Ten Experiments)

1. P-N Junction Diode Characteristics
   Part A: Germanium Diode (Forward bias& Reverse bias)
   Part B: Silicon Diode (Forward Bias only)
2. Zener Diode Characteristics
   Part A: V-I Characteristics
   Part B: Zener Diode as Voltage Regulator
3. Rectifiers (without and with c-filter)
   Part A: Half-wave Rectifier
   Part B: Full-wave Rectifier

4. BJ T Characteristics (CE Configuration)
   Part A: Input Characteristics
   Part B: Output Characteristics
5. BJ T Characteristics (CB Configuration)
   Part A: Input Characteristics
   Part B: Output Characteristics
6. FET Characteristics (CS Configuration)
   Part A: Drain Characteristics
   Part B: Transfer Characteristics
7. SCR Characteristics
8. UJ T Characteristics
9. Transistor Biasing
10. BJT-CE Amplifier
11. Emitter Follower-CC Amplifier
12. FET-CS Amplifier
13. LED Characteristics
14. LDR Characteristics
15. Photo Diode Characteristics
16. Diode Applications

PART C: Equipment required for Laboratory

1. Bread boards.
2. Ammeters (Analog or Digital)
3. Voltmeters (Analog or Digital)
4. Active & Passive Electronic Components
5. Regulated Power supplies
6. Analog/Digital Storage Oscilloscopes
7. Analog/Digital Function Generators
8. Digital Multimeters
9. Decade resistance Boxes/Rheostats
10. Decade Capacitance

Web Links:

1. www.iitkgp.ac.in
2. www.nptel.com

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	2	3	2	1	1	1	1	1
CO2	1	1	1	1	3	1	1	2	1	1	3	2
CO3	2	2	1	1	1	3	1	1	1	1	1	1
CO4	3	1	1	1	1	1	2	2	1	1	1	3
CO5	1	1	1	2	3	2	1	1	1	1	1	1

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	II B.Tech. I Sem (3 semester)			
CourseCode	**ELECTRONIC DEVICES AND CIRCUITS** (common for ECE, EEE)				
Teaching	Totalcontacthours-45	L	T	P	C
Prerequisite(s):Knowledge of Engineering physics related to semiconductor, mathematics like trigonometry, integration etc.		3	0	0	3

Course Objective:

1. To learn the basics of Semiconductor physics.
2. To study the operation and construction different diodes and their characteristics.
3. To learn the principle of operation of different rectifiers and filter circuits.
4. To study the operation of different transistors and FETS and their biasing circuits and also to learn the basics of small signal amplifier models using h-parameters.

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1:	Apply the Knowledge of semiconductor physics for designing the circuits of electronic devices.
CO2:	Obtain the characteristics of diode in forward and reverse bias and perform mathematical modeling of diode as a resistor and capacitor.
CO3:	Perform analysis and design of a complete AC to DC converter (Eg: Mobile Charger) consisting of Rectifiers, Filters and regulators.
CO4:	Describe the construction and working of a Transistor in various modes and design circuits for stabilization and compensation of both BJT and FET
CO5:	Gain Knowledge of Small Signal Low Frequency Transistor Amplifier Models.

Syllabus:

Unit-I: Semi Conductor Physics:
Introduction to metals classification using energy band diagrams, mobility and conductivity, electrons and holes in intrinsic semi-conductors, extrinsic semi conductors, drift and diffusion, charge densities in semiconductors, Hall effect, continuity equation, Mass Action Law, Fermi levels in intrinsic and extrinsic Semiconductors.

Unit-II: Junction Diode Characteristics:
Open circuited p-n junction, Biased p-n junction, p-n junction diode, current components in PN junction Diode, diode equation, V-I Characteristics, temperature dependence on V-I characteristics, Diode resistance, Diode capacitance, energy band diagram of PN junction Diode.
Special Semiconductor Devices
Zener Diode, Breakdown mechanisms, Zener diode applications, LED, Photo diode, Varactor diode, Tunnel Diode, Thyristors (DIAC, TRIAC, SCR), UJT Construction, operation and characteristics of all the diodes is required to be considered.

Unit-III: Rectifiers and Filters:
Basic Rectifier setup, Half wave rectifier, full wave rectifier, bridge rectifier, derivations of characteristics of rectifiers, rectifier circuits-operation, input and output waveforms; Filters; Inductor filter, Capacitor filter, L- section filter, π- section filter, comparison of various filter circuits in terms of ripple factors, Voltage regulators- series and shunt, IC Voltage Regulators.

Unit-IV: Transistor Characteristics, Biasing and Thermal Stabilization:
Bipolar Junction transistor, transistor current components, transistor equation, transistor configurations, transistor as an amplifier, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, punch through/ reach through effect, Photo transistor.
FET: FET types, construction, operation, characteristics, parameters, MOSFET-types, construction, operation, characteristics

Unit-V: Biasing and Thermal Stabilization, Transistor Amplifier Models:
Need for biasing, operating point, load line analysis, BJT biasing- methods, Stability factors, (S, Si, S"), compensation techniques, Thermal runaway, Thermal stability, Introduction to Heat Sinks.
FET biasing methods and stabilization
BJT: Two port network, Transistor hybrid model, determination of h- parameters, , generalized analysis of transistor amplifier model using h- parameters.

Text books:

1. Electronic Devices and Circuits- J. Millman, C. Halkias, Tata Mc-Graw Hill, Second Edition.
2. Electronic Devices and Circuits-B.P.Singh, RekhaSingh,Pearson Publications, Second Edition.

Reference Books:

1. Electronic Devices and Circuits-Salivahanan, Kumar, Vallavaraj, Tata Mc-Graw Hill, Second Edition.
2. Electronic Devices and Circuit Theory-R.L. Boylestad and Louis Nashelsky, Pearson Publications, Tenth Edition

Web Links:

1. www.iitkgp.ac.in
2. www.electronic4u.com
3. www.nptel.com
4. http://www.satishkashyap.com/

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	2	3	2	1	1	1	1	1
CO2	1	1	1	1	3	1	1	2	1	1	3	2
CO3	2	2	1	1	1	3	1	1	1	1	1	1
CO4	3	1	1	1	1	1	2	2	1	1	1	3
CO5	1	1	1	2	3	2	1	1	1	1	1	1

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	II B.Tech. II Sem (4 semester)			
Course Code	**Electrical Machines - II lab**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Electrical machines-II		0	0	3	1.5

Course Objective:

1. To determine the performance of transformer
2. To determine the performance of 1-Ø Induction motor.
3. To determine the regulation of three–phase alternator by various methods
4. To determine the performance of synchronous machine.
5. To determine the performance of induction machine

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1:	Determine the efficiency and regulation of transformers and asses their performance.
CO2:	Determine the performance of 1-Ø Induction motor.
CO3:	Determine the regulation of three–phase alternator by various methods
CO4:	Find X_d / X_q ratio of alternator and asses the performance of three–phase synchronous generator.
CO5:	Experiment various tests on Induction motor for assessing its performance

List of Experiments:

1. O.C. & S.C. Tests on Single phase Transformer
2. Sumpner's test on single phase transformers
3. Scott connection of transformers
4. No–load & Blocked rotor tests on three phase slip ring Induction motor
5. Regulation of a three –phase alternator by synchronous impedance method and MMF method .
6. V and Inverted V curves of a three—phase synchronous motor.
7. Equivalent Circuit of a single phase induction motor
8. Brake test on three phase squirrel cage Induction Motor.
9. Separation of core losses of a single phase transformer.
10. Determination of X_d and X_q of a salient pole synchronous machine
11. Load test on single phase transformer
12. Synchronization of three phase alternator with infinite bus bars.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	3	-	-	-	-	-	-	1	-	-	-
CO2	-	3	2	-	-	-	-	-	-	-	-	-
CO3	-	2	2	-	-	-	-	-	-	-	-	-
CO4	-	2	2	-	-	-	-	-	-	-	-	-
CO5	-	3	2	-	-	-	-	-	-	-	-	-

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	II B.Tech. II Sem (4 semester)			
Course Code	**Electrical Machines - II**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Electrical machines-1		3	0	0	3

Course Objective:

1. To teach students to understand operation and working of 3-Ph induction motor
2. To train students to determine the performance of induction machines from different tests
3. To teach students to understand working and performance of synchronous generator
4. To train students to conduct tests to determine voltage regulation of alternators and parallel connection of alternators
5. To teach students to understand the concepts of synchronous motor's working and methods to start 1-phase induction motor.

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1:	Demonstrate ability to understand operation and working of 3-Ph induction motor
CO2:	Analyze performance alternator when connected in parallel with infinite bus or with another alternator
CO3:	Determine the voltage regulation of alternator through indirect methods and parallel operation of alternators
CO4:	Demonstrate ability to understand the concepts of synchronous motor's working and methods to start synchronous motor.
CO5:	Explain the working and starting methods of 1-phase induction motor.

Syllabus:

UNIT-I

3-phase Induction Motors

construction details: squirrel cage and wound rotors-skewing-production of rotating magnetic field - principle of operation - slip- rotor induced e.m.f and rotor frequency - rotor current and p.f. at standstill and running conditions, Numerical problems.

Rotor input power, rotor copper loss, mechanical power developed - equivalent circuit - Numerical problems, Torque equation- expressions for maximum torque and starting torque – slip-torque characteristics. No load and blocked rotor tests- Circle diagram for predetermination of efficiency

Starting methods-from stator side and rotor side- Induction generator- double cage rotor - crawling and cogging

UNIT-II Synchronous Generator

Constructional features of non–salient and salient pole type – Armature windings –Distributed and concentrated windings – Distribution– Pitch and winding factors –E.M.F equation– Improvements of waveform and armature reaction– Numerical problems.

UNIT – III

Voltage regulation of synchronous generator

Voltage regulation by synchronous impedance method– MMF method and Potier triangle method–Phasor diagrams– Two reaction analysis of salient pole machines and Phasor diagram– Numerical problems.

Parallel operation of synchronous generators

Parallel operation with infinite bus and other alternators – Synchronizing power – Load sharing –Transfer of real and reactive power– Numerical problems.

UNIT–IV

Synchronous motor – operation

Synchronous Motor principle and theory of operation– Phasor diagram – Starting torque– Variation of current and power factor with excitation – Synchronous condenser – Mathematical analysis for power developed– Numerical problems.

Starting methods and performance of Synchronous motor

Excitation and power circles – Hunting and its suppression – Methods of starting – Synchronous induction motor.

UNIT–V

1-Phase Induction Motors:

Construction and working of 1-Phase Induction Motors, Double field revolving theory, Starting methods. Types of 1-Phase Induction Motors, Applications.

AC Series motor-working - Applications

Text Books:

1. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
2. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
3. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
4. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2007"

Reference Books:

1. A.E.Fitzgerald and C. Kingsley, "Electric Machinery",McGrawHillEducation,2013.
2. A. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 1984.

Web-Resources:

1. www.electrical4u.com
2. www.nptel.com

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	2	-	-	-	-	-	-	-	-	-
CO2	-	3	2	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	2	-
CO4	-	2	2	-	-	-	-	-	-	-	-	-
CO5	-	-	3	-	-	-	-	-	-	-	-	-

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	II B.Tech. II Sem (4 semester)			
Course Code	**ELECTRICAL MEASUREMENTS LAB**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Electrical measurements		0	0	3	1.5

Course Objective:

1. To calibrate the performance of an energy meter and 1-Ø dynamo meter type wattmeter.
2. To measure the unknown value of given resistance, capacitance and inductance
3. To measure active and reactive powers and also the measurement of power with CTs.
4. To test transformer oil for its effectiveness.
5. To measure the choke coil parameters in a 1-Ø transformer on any one of the sides.

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1:	Measure accurately the electrical parameters voltage, current, power, energy
CO2:	Electrical characteristics of resistance, inductance and capacitance.
CO3:	Measure illumination of electrical lamps.
CO4:	Test transformer oil for its effectiveness.
CO5:	Measure the parameters of inductive coil in a 1-Ø transformer.

List of Experiments:

1. Calibration and Testing of single phase energy meter
2. Calibration of dynamometer wattmeter using phantom loading UPF
3. Crompton D.C. Potentiometer – Calibration of PMMC ammeter and PMMC voltmeter
4. Calibration of LPF wattmeter – by direct loading
5. Kelvin's double Bridge – Measurement of resistance – Determination of Tolerance
6. Capacitance Measurement using Schering bridge
7. Inductance Measurement using Anderson bridge
8. Resistance strain gauge – strain measurements and Calibration
9. Parameters of a choke coil
10. Measurement of 3 phase reactive power with single–phase wattmeter for balanced loading
11. Measurement of 3 phase power with single watt meter and 2 No's of C.T
12. Measurement of Power by 3 Voltmeter and 3 Ammeter methods
13. Dielectric oil testing using H.T. testing Kit
14. Strain gauge measurement

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	3	2	-	-	-	-	-	2	-	-	2
CO2	-	3	2	-	-	-	-	-	2	-	-	2
CO3	-	3	2	-	-	-	-	-	2	-	-	2
CO4	-	3	2	-	-	-	-	-	2	-	-	2
CO5	-	3	2	-	-	-	-	-	2	-	-	2

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	II B.Tech. II Sem (4 semester)			
Course Code	**ELECTRICAL MEASUREMENTS**				
Teaching	Total contact hours – 45	L	T	P	C
Prerequisite(s): Electrical circuits		3	0	0	3

Course Objective:

1. To Know principles of different electrical measurement instruments and to measure voltage and current
2. To understand different types of instruments for measurement of Power and Energy.
3. To understand about different types of A.C and D. C Potentiometers. And to Measure resistance, capacitance, inductance and frequency by using various bridges.
4. To Know about the magnetic measurements
5. To understand about digital measurements.

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1:	Know principles of different electrical measurement instruments and to measure voltage and current and different types of instruments for measurement of Power and Energy.
CO2:	Understand about different types of A.C and D. C Potentiometers.
CO3:	Measure resistance, capacitance, inductance and frequency by using various bridges.
CO4:	Know about the magnetic measurements
CO5:	Understand about digital measurements

Syllabus:

UNIT-I

Measuring Instruments

Classification – deflecting, control and damping torques – Ammeters and Voltmeters – PMMC, moving iron type instruments – expression for the deflecting torque and control torque – Errors and compensations. Extension of range using shunts and series resistance -CT and PT: Ratio and phase angle errors – design considerations

UNIT –II

Measurement of Power and Energy

Single phase and three phase dynamometer wattmeter, LPF and UPF, expression for deflecting and control torques – Extension of range of wattmeter using instrument transformers – Measurement of active and reactive powers in balanced and unbalanced systems. . Type of P.F. Meters – single phase and three phase dynamometer and moving iron type. Single phase induction type energy meter – driving and braking torques – errors and compensations –testing by phantom loading using R.S.S. meter. Three phase energy meter – trivector meter, maximum demand meters.

UNIT – III

Potentiometers

Principle and operation of D.C. Crompton's potentiometer – standardization – Measurement of unknown resistance, current, voltage. A.C. Potentiometers: polar and coordinate types - standardization – applications

Measurement of Parameters

Method of measuring low, medium and high resistance – sensitivity of Wheatstone's bridge – Carey Foster's bridge- Kelvin's double bridge for measuring low resistance– loss of charge method for measurement of high resistance. Measurement of inductance, Quality Factor - Maxwell's bridge, Hay's bridge, Anderson's bridge, Owen's bridge. Measurement of capacitance and loss angle - Desauty bridge-Wien's bridge – Schering Bridge- Wagner's erthing device.

UNIT – IV

Magnetic Measurements:

Ballistic galvanometer – equation of motion – flux meter – constructional details. Determination of B-H Loop methods of reversals six point method – A.C. testing – Iron loss of bar samples– core loss measurements by bridges and potentiometers.

UNIT-V Digital Meters

Digital Voltmeter-Successive approximation, ramp and integrating type-Digital frequency meter-Digital multimeter-Digital Tachometer

Text Books

1. Electrical Measurements and measuring Instruments – by E.W. Golding and F.C. Widdis, fifth Edition,Wheeler Publishing.
2. Electrical & Electronic Measurement & Instruments by A.K.SawhneyDhanpatRai& Co. Publications.
3. Electrical Measurements: Fundamentals, Concepts, Applications – by Reissland, M.U, New Age International (P) Limited, Publishers.

Reference Books

1. Electrical Measurements – by Buckingham and Price, Prentice – Hall
2. Electrical Measurements by Harris.
3. Electronic Instrumentation-by H S Kalsi, Tata McGraw-Hill Education

Web-Resources:

1. www.electrical4u.com
2. www.nptel.com

CO-PO Mapping:

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	3	-	-	-	-	-	-	-	2	2
CO2	-	-	3	-	-	-	-	-	-	-	2	2
CO3	-	3	-	-	-	-	-	-	-	-	2	2
CO4	-	2	3	-	-	-	-	-	-	-	2	2
CO5	-	2	3	-	-	-	-	-	-	-	2	2

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	II B.Tech. II Sem (4 semester)			
CourseCode	**INTERNET OF THINGS** (common for CSE, ECE, EEE, Mining, ME, AME, CE)				
Teaching	Totalcontacthours-45	L	T	P	C
Prerequisites: Knowledge of Logic Gates, Relays, Registers, Counter, Microcontroller, Microprocessor, Sensors Interfacing, Digital		3	0	0	3

Course Objectives:

1. Understand the Concepts of IOT Development Infrastructure.
2. Understand the principles of wired and wireless communication protocols
3. Understand the Threats and Securities issues in the development of IOT.
4. Understand the types of measurement errors and sensors.
5. Understand design and development of IOT Platform.

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1:	Learn about the IOT Development cycles, Infrastructure, Challenges and Requirements.
CO2:	Learn about the Wired and Wireless Communication Protocols implementation.
CO3:	Learn about Privacy, Types of Threats and Security challenges present in IOT and IoT Clouds.
CO4:	Learn about types of measurement errors and its impact on measurement and various sensor operation and construction mechanism.
CO5:	Learn about Development platform "Arduino IDE", Sensors Libraries and Programming

Syllabus:

UNIT-1 Fundamental of IoT

Internet of things definition, IoT Functional view Internet of things today, Internet of things tomorrow, potential success factors, internet of things vision, future communication challenges-5G scenario, fundamental characteristics of IoT,IOT Layered Architecture, detailed IoT layered architecture, IoT Enabling technologies, IoT Smart Environment and smart space creation. IoT Applications and use case scenarios. Resource management for IoT.

UNIT-2 Communication Protocols for IoT

Wired Communication Protocols:

I2C, SPI, One Wire,RS232, Ethernet, RS 485, UART, USART, USB,

Wireless Communication Protocols:

Blue tooth, ZigBee, Z-Wave, LoWPAN, WiFi-ah, NFC, RFID), Application Protocols MQTT, CoAP, HTTP.

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UNIT-3 Threats, Security, Privacy and IoT Cloud

IoT as Interconnection of Threats:

Phase attach, Attack as per Architecture, Attach based on Components.

Security Engineering for IOT Development:

Building Security into design and development, Secure Design: Safety and Security Design, Processes and Agreements, Technology Selection.

Mitigating to Privacy Concern:

Privacy Challenges introduced by IoT, Guide to perform PIA, PbD Principles, Privacy Engineering Recommendations

IOT Cloud:

Concepts of Cloud, Your Organization and Cloud Computing, Cloud Computing Services (IaaS, PaaS, SaaS).

Case Study: ThingSpeak Cloud, Blynk Cloud, MQTT Cloud

UNIT-4 Measurement Errors and Sensors

Measurement Errors:

Gross Error, Systemic error, Absolute Error, Relative Error, Accuracy, Precision, Resolution, Significant Figure, Measurement Error Combinations, Basics of Statistical Analysis.

Sensors and Transducers:

Passive and Active Sensors, Resistive Sensors, Capacitive Sensors and Inductive Sensors, Temperature Sensor, Humidity Sensor, Ultra-Sonic Sensor, IR Sensor, PIR Sensor, Vibration Sensor, Gas Sensor, Hall Effect Sensor.

UNIT-5: Development Platform: Hardware, Software, Programming Language

Hardware:

Arduino Uno Board, NodeMCU Board

Software Tools:

Arduino IDE, Compilers, Cross-Compilers, Linkers, Libraries, Debuggers, Simulators, Emulators, Serial Monitor, Intel Hex File and Motorola Hex File Format.

Programming Language:

Arduino Programming Structure, Data Types, Operators, Control Statements (IF, IF-ELSE, WHILE, DO-WHILE, FOR, SWITCH-CASE, SWITCH-CASE-BREAK, SWITCH-CASE-CONTINUE) and Precompiled Functions.

Case Studies:

Home Automation, Agriculture 3.0, Health Care, Industry 4.0

Text books:

1. O.Vermesan, P.Friess, " Internet of Things-From Research and Innovation to Market Deployment", River Publishers, 2014.
2. B. Russell and D.VanDuren, "PracticalInternetofThingsSecurity", -PacktPublishing, 2016.
3. A. T. Velte, T. J. Velte, R.Elsenpeter, "Cloud Computing – A Practical Approach" Mg-Graw Hill, 2010.
4. R. B. Northrop, " Introduction to Instrumentation and Measurement" Second Edition, CRC Taylor and Francis 2005.

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(Dr.D.Ravi Kishore)

Reference Books:

1. A. T. Velte, T. J. Velte, R.Elsenpeter, "Cloud Computing – A Practical Approach" Mg-Graw Hill, 2010.
2. R. B. Northrop, " Introduction to Instrumentation and Measurement" Second Edition, CRC Taylor and Francis 2005.

Web Links:

1. https://thingspeak.com
2. https://www.blynk.cc/getting-started
3. https://www.arduino.cc
4. https://mqtt.org
5. https://coap.technology

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	1	2	1	3	2	1	1	3	3
CO2	2	3	2	1	2	2	1	2	3	3	1	2
CO3	2	1	2	3	3	2	3	1	3	1	3	3
CO4	1	3	2	3	1	2	3	3	2	1	3	2
CO5	3	3	2	2	3	1	1	2	3	2	3	3

Chairman-BOS
(Dr.D.Ravi Kishore)

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	II B.Tech. II Sem (4 semester)			
Course Code	**POWER SYSTEMS - I**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Fluid mechanics & Hydraulic machinery		3	0	0	3

Course Objective:

The objectives of the course are to make the student learn about

1. Principle of operation of different types of conventional power generating stations
2. Classification of Distribution system and its design.
3. Classification of Substations
4. Types of Underground cables
5. Economic aspects and tariff

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1:	Understand the Principle of operation of different types of conventional power generating stations.
CO2:	Classify Distribution system and its design
CO3:	Classify Substations
CO4:	Types of Underground cables
CO5:	Understand Economic aspects and tariff

Syllabus:

UNIT-I

Thermal Power Stations

Layout of a thermal power plant- path of coal, steam, water, air, ash and flue gasses,- ash handling system- Description of components: Boilers, Super heaters, Economizers, electrostatic precipitators, -steam Turbines: Impulse and reaction turbines, Condensers, feed water circuit, Cooling towers, and Chimney.

Nuclear Power Stations

Nuclear fission- Nuclear fuels, chain reaction- Nuclear reactor Components: Moderators, Control roads, Reflectors and Coolants. Types of Nuclear reactors - description of PWR, BWR and FBR. - Radiation: Radiation hazards and Shielding, nuclear waste disposal.

UNIT-II

D.C.distribution : Classification of distribution systems- design features of distribution systems- radial distribution, ring main distribution,- voltage drop calculations: DC distributors for following cases: radial DC distributor fed at one end and at both ends (equal / unequal voltages), ring main distributor, with inter connector- stepped distributor

AC distribution:.- voltage drop calculations: AC distributor- fed at one end -fed at both ends (equal / unequal voltages)- ring main distributor- with inter connector. Comparison of DC and AC distribution.

UNIT-III

Air insulated substations - Indoor & Outdoor substations: Substations layout of 33/11KV -Bus bar arrangements in the Sub-Stations - single bus bar- sectionalized single bus bar- double bus bar with one and two circuit breakers- main and transfer bus bar system.

Gas insulated substations (GIS) – Advantages of Gas insulated substations, different types of gas insulated substations, single line diagram of gas insulated substations, bus bar, construction aspects of GIS, Installation and maintenance of GIS, Comparison of Air insulated substations and Gas insulated substations.

UNIT-IV

Underground Cables: Types of Cables- Construction- Types of insulating materials- Calculations of insulation resistance and stress in insulation,- power factor of cable- Numerical Problems.Capacitance of single core and 3-Core belted Cables- Numerical Problems -Grading of Cables-Capacitance grading, Numerical Problems, Inter sheath Grading

UNIT-V

Economic Aspects : Load curve, load duration and integrated load duration curves, discussion on economic aspects: connected load, maximum demand, demand factor, load factor, diversity factor, power capacity factor, plant use factor, Base and peak load plants - Numerical Problems.

Tariff Methods : Costs of Generation and their division into Fixed, Semi-fixed and Running Costs, Desirable Characteristics of a Tariff Method, Tariff Methods: Simple rate, Flat Rate, Block-Rate, two-part, three –part, and power factor tariff methods, numerical problems

Text Books:

1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakraborti, DhanpatRai& Co. Pvt. Ltd., 1999.
2. Principles of Power Systems by V.K Mehta and Rohit Mehta S.CHAND& COMPANY LTD., New Delhi 2004.

Reference Books:

1. Elements of Power Station design and practice by M.V. Deshpande, Wheeler Publishing.
2. Electrical Power Systems by C.L.Wadhawa New age International (P) Limited, Publishers 1997.
3. Electrical Power Generation, Transmission and Distribution by S.N.Singh., PHI, 2003.
4. Gas turbine performance, by PP Wals, P.Fletcher, Blackwell Publisher, 2004.

Wed Resources:

1.http://www.electrical4u.com
2.http://www.mtu.edu/ece/department/faculty/

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	--	---	2	--	--	--	--	--	--	--	--	2
CO2	--	2	2	--	--	--	--	--	--	--	--	--
CO3	--	2	3	--	--	--	--	--	--	--	--	--
CO4	--	2	2	--	--	--	--	--	--	--	--	--
CO5	2	--	--	--	--	--	--	--	--	--	2	--

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	III B.Tech. I Sem (5th semester)			
Course Code	**ADVANCED CONTROL SYSTEMS**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Knowledge on Optimal controls in systems		3	0	0	3

Course Objectives:

The objectives of the course are to make the student learn about

1. To understand energy efficiency, scope, conservation and technologies.
2. To design energy efficient lighting systems.
3. To estimate/calculate power factor of systems and propose suitable compensation Techniques.
4. To understand energy conservation in HVAC systems.

Course Outcomes:

After successful completion of the course, a successful student will be able to	
C01:	State space representation of control system and formulation of different state models are reviewed.
C02:	Design of control system using the pole placement technique is given after introducing the concept of controllability and observability.
C03:	Analyses of nonlinear system using the describing function technique and phase plane analysis.
CO4:	Analyze the stability analysis using liapunov method

Syllabus

UNIT – I

State space analysis: State Space Representation – Solution of state equation – State transition matrix, –Canonical forms – Controllable canonical form – Observable canonical form, Jordan Canonical Form.

UNIT – II

Controllability, observability and design of pole placement: Tests for controllability and observability for continuous time systems – Time varying case – Minimum energy control – Time invariant case – Principle of duality – Controlled and observability form Jordan canonical form and other canonical forms – Effect of state feedback on controllability and observability – Design of state feedback control through pole placement.

UNIT – III

Describing function analysis: Introduction to nonlinear systems, Types of nonlinearities, describing functions, Introduction to phase–plane analysis.
Stability analysis: Stability in the sense of Liapunov – Liapunov stability and Liapunov instability theorems – Direct method of Liapunov for the linear and nonlinear continuous time autonomous systems.

UNIT–IV

Calculus of variations: Minimization of functional of single function – Constrained minimization – Minimum principle – Control variable inequality constraints – Control and state variable inequality constraints – Euler lagrangian equation.

UNIT –V

Optimal control: Linear quadratic optimal regulator (LQR) problem formulation – Optimal regulator design by parameter adjustment (Liapunov method) – Optimal regulator design by continuous time algebraic riccatti equation (CARE) - Optimal controller design using LQG framework

Text Books:

1. Hand Book of Energy Audit by Sonal Desai- Tata McGraw hill
2. Energy efficient electric motors by John .C. Andreas, Marcel Dekker Inc Ltd–2ndedition, 1995

Reference Books:

1. Energy management by W.R. Murphy & G. Mckay Butter worth, Elsevier publications.
2. Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill publishing company Ltd. New Delhi.
3. Energy management by Paul o' Callaghan, Mc–Graw Hill Book company–1st edition.
4. Energy management hand book by W.C.Turner, John wiley and sons.
5. Energy management and conservation –k v Sharma and pvenkataseshaiah-I K International Publishing House pvt.ltd,2011.

Web-Resources:

1. www.electrical4u.com
2. www.nptel.com

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01		✓										
C02		✓										
C03			✓									
C04			✓					✓				

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	III B.Tech. I Sem (5th semester)			
Course Code	**ADVANCED POWER CONVERSION SYSTEMS**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Power Systems		3	0	0	3

Course Objectives:

The objectives of the course are to make the student learn about

1. To learn the principles of power conversion using converters& energy conversion with electric drives
2. To learn about the principles of energy conversion from renewable energy sources
3. To know the power conversion techniques in electric vehicles
4. To learn about the applications of electrical energy

Course Outcomes:

On Completion of the course, the students will be able to-	
C01:	Understands the basics in the electric power conversion using power switching devices
C02:	Evaluate the conversion for range of renewable energy sources with the help of available electrical machines drives
C03:	Analyzes the different energy storage systems
C04:	Identify the various Industrial and domestic applications

Syllabus:

UNIT-I

Power Devices and Converters: Characteristics of Voltage controlled devices, principles of power conversion using Converters and Inverters.

UNIT II

Performance of Electric Drives: Energy conversion with DC, AC and Special machine drives

UNIT III

Energy Conversion from Renewable Energy Sources: Construction and working principles of solar panels, Solar Tracking system, energy conversion from wind and other renewable energy sources, grid interconnected systems.

UNIT IV

Electric Vehicles: Energy storage in different types of batteries, Super capacitors, pumped storage systems, fly-wheels and electric vehicles applications

UNIT V

Electrical Energy Applications: Induction heating: melting, hardening, lighting applications and their control, UPS, battery chargers.

Reference Books:

1. M.H. Rashid: Power electronics-circuits, Devices and applications, Prentice Hall India, New Delhi,2009
2. P.S. Bhimbra: Power electronics, Khanna publishers, New Delhi,2012
3. Ned Mohan, Undeland and Robbin: Power electronics converters, applications and design, John Willey & Sons, Inc. NewYork,2006.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlafion)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01	✓	✓										
C02	✓							✓				
C03	✓				✓							
C04	✓		✓									

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	III B.Tech. I Sem (5th semester)			
Course Code	**COMMUNITYSERVICE ORIENTED PROJECT**				
Teaching		L	T	P	C
Prerequisite(s):		0	0	1	0.5

The following are examples for students to do community service oriented projects

- Deliver demonstrations on energy conservation to schools, PTA, service clubs, etc.
- Offer to do home surveys to advise on weatherproofing and energy conservation.
- Present science demonstrations in elementary schools.
- Tutor younger kids who have trouble in science
- Mentor young children to introduce them to computers.
- Make wooden holiday gifts for needy children etc

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	III B.Tech. I Sem (5th semester)			
Course Code	**CONSTITUTION OF INDIA**				
Teaching	Total contact hours - 32	L	T	P	C
Prerequisite(s):		2	0	0	0

Course Objectives:

The objectives of the course are to make the student learn about

1. To Enable the student to understand the importance of constitution
2. To understand the structure of executive, legislature and judiciary & philosophy of fundamental rights and duties
3. To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and election commission of India.
4. To understand the central and state relation financial and administrative.

Course Outcomes:

On Completion of the course, the students will be able to-	
C01:	Understand historical background of the constitution making and its importance for building a democratic India
C02:	Understand the functioning of three wings of the government ie., executive, legislative and judiciary & the value of the fundamental rights and duties for becoming good citizen of India
C03:	Analyze the decentralization of power between central, state and local self-government
C04:	Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

Syllabus

UNIT-I

Introduction to Indian Constitution: Constitution' meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

UNIT-II

Union Government and its Administration Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions;

UNIT-III

State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

UNIT-IV

A. Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation Pachayati Raj: Functions PRI: Zilla Panchayat, Elected officials and their roles, CEO Zilla Panchayat: 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 of Chief Election Commissioner and Election Commissioner ate State Election Commission:, Functions of Commissions for the welfare of SC/ST/OBC and women

REFERENCES:

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi
2. Subash Kashyap, Indian Constitution, National Book Trust
3. J.A. Siwach, Dynamics of Indian Government & Politics
4. D.C. Gupta, Indian Government and Politics
5. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
6. J.C. Johari, Indian Government and Politics Hans
7. J. Raj Indian Government and Politics
8. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi
9. Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012

E-RESOURCES:

1. nptel.ac.in/courses/109104074/8
2. nptel.ac.in/courses/109104045/
3. nptel.ac.in/courses/101104065/
4. www.hss.iitb.ac.in/en/lecture-details
5. www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01						✓						
C02						✓						
C03						✓						
C04						✓						

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	III B.Tech. I Sem (5th semester)			
Course Code	**CONTROL SYSTEMS LAB**				
Teaching	Total contact hours - 30	L	T	P	C
Prerequisite(s): Control Systems		0	0	3	1.5

Course Objectives:

The objectives of the course are to make the student learn about

1. To learn about the modeling of dynamical systems and characteristics of control components.
2. To Formulate different types of analysis in frequency domain to explain the nature of stability of the system
3. To know about Lag and Lead Compensators
4. To learn about the Routh Hurwitz Criterion, Nyquist plot and Bode plots

Course Outcomes:

On Completion of the course, the students will be able to-	
C01:	Derive the transfer function of physical systems and determination of overall transfer function using block diagram algebra and signal flow graphs.
C02:	Determine time response specifications of second order systems and to determine error constants
C03:	Analyze absolute and relative stability of LTI systems using Routh's stability criterion and the root locus method
C04:	Analyze the stability of LTI systems using frequency response methods

All the experiments are to be done compulsorily

1. Time response of Second order system
2. Lag compensation – Magnitude and phase plot
3. Lead compensation – Magnitude and phase plot
4. Potentiometer as an error detector
5. To study the Characteristics of magnetic amplifier-series connection
6. To study the Characteristics of magnetic amplifier-parallel connection
7. To study the Characteristics of magnetic amplifier-self saturated
8. Study of DC position control system
9. Effect of P controller on a second order system
10. Effect of PD controller on a second order system
11. Effect of PI controller on a second order system
12. Effect of PID Controller on a second order system
13. Study the Temperature controller using PID

14. Experimentally determine Transfer function of DC motor
15. To study Characteristics of DC servo motor
16. Study the effect of feedback on DC servo motor
17. To study the characteristics of AC servo motor
18. To study the characteristics of Synchros
19. Programmable logic controller – characteristics of stepper motor
20. Frequency response of second order system

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01		✓								✓		
C02			✓								✓	
C03			✓									
C04				✓								

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	III B.Tech. I Sem (5th semester)			
Course Code	**CONTROL SYSTEMS**				
Teaching	Total contact hours – 45	L	T	P	C
Prerequisite(s): Mathematics- I		3	0	0	3

Course Objectives:

The objectives of the course are to make the student learn about

1. To learn about the principle of Operation of different types of Special Electrical Machines
2. To Formulate different types of analysis in frequency domain to explain the nature of stability of the system
3. To know about Lag and Lead Compensators
4. To learn about the Routh Hurwitz Criterion, Nyquist plot and Bode plots

Course Outcomes:

On Completion of the course, the students will be able to-	
C01:	Derive the transfer function of physical systems and determination of overall transfer function using block diagram algebra and signal flow graphs.
C02:	Determine time response specifications of second order systems and to determine error constants
C03:	Analyze absolute and relative stability of LTI systems using Routh's stability criterion and the root locus method
C04:	Analyze the stability of LTI systems using frequency response methods

UNIT – I

Mathematical modeling of control systems: Introduction of control systems, Classification of control systems, Open Loop and closed loop control systems and their differences, Feed-Back Characteristics, transfer function of linear system, Differential equations of electrical networks, Translational and Rotational mechanical systems, Transfer Function of DC Servo motor - AC Servo motor- Synchro-transmitter and Receiver, Block diagram algebra – Representation by Signal flow graph - Reduction using Mason's gain formula.

UNIT-II

Time response analysis: Standard test signals - Time response of first order systems –Time response of second order systems - Time domain specifications - Steady state errors and error constants – Effects of P, PI, PD, PID controllers.

UNIT – III

Stability and rootlocus technique: The concept of stability – Routh's stability criterion – limitations of Routh's stability – The root locus concept - construction of root loci (Simple problems).

UNIT–IV

Frequency response analysis and Classical control design techniques: Introduction, Frequency domain specifications-Bode diagrams- transfer function from the Bode Diagram-Phase margin and Gain margin-Stability Analysis from Bode Plots, Polar Plots, Nyquist Stability criterion- Lag, Lead, Lag-Lead compensators, design of compensators – using Bode plots.

UNIT–V

State space analysis of continuous systems: Concepts of state, state variables and state model, state space representation of transfer function, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and it's Properties – Concepts of Controllability and Observability.

Text Books

1. Modern Control Engineering, Kotsuhiko Ogata, Prentice Hall of India.
2. Automatic control systems, Benjamin C.Kuo, Prentice Hall of India, 2nd Edition

Reference Books

1. Control Systems, ManikDhanesh N, Cengagepublications .
2. Control Systems principles and design, M.Gopal, Tata McGraw Hill education Pvt Ltd., 4th Edition.
3. Control Systems Engineering, S.Palani, Tata McGraw Hill Publications.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01		✓								✓		
C02											✓	
C03			✓									
C04			✓	✓								

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	III B.Tech. I Sem (5th semester)			
Course Code	**DIGITAL ELECTRONICS LAB**				
Teaching	Total contact hours - 30	L	T	P	C
Prerequisite(s): Digital Electronics		0	0	3	1.5

Course Objectives:

The objectives of the course are to make the student learn about

1. Design Adder and subtractor using logic gates.
2. Design multiplexer and demultiplexer using logic gates.
3. Design of Synchronous counter
4. Apply IC's to different applications.

Course Outcomes:

On Completion of the course, the students will be able to-	
C01:	Design Adder and subtractor using logic gates.
C02:	Simplify Boolean expression using NAND-NAND and NOR-NOR realization.
C03:	Design multiplexer and demultiplexer using logic gates.
C04:	Apply IC's to different applications.

The following experiments are required to be conducted as compulsory experiments:

1. Verification of Logic gates & Universal gates.
2. Implementation of Boolean laws and theorems.
3. Simplification & Implementation of Boolean expression using basic gates.
4. Design and implementation of Half adder & Full adder circuits
5. Design & Implementation of subtractor circuit.
6. Simplify & Implementation of Boolean expression using NAND-NAND realization.
7. Simplify & Implementation of Boolean expression using NOR-NOR realization.
8. Design & Implementation of Excess-3 code converter using logic gates.
9. Design & Implementation of binary to gray code converter using gates.
10. Design & Implementation of gray to binary code converter using gates.
11. Implementation of 1*4 multiplexer using logic gates.
12. Implementation of 4*1 De-Multiplexer using logic gates.

13. Implementation of Decoder circuits using logic gates.
14. Implementation of Encoder circuits using logic gates.
15. Implement 2-bit comparator using logic gates.
16. Design & Implement Flip-flop using logic gates.
17. Design & Implement Mod-10 counter using IC7490.
18. Design & Implement binary counter using IC7493.
19. Design & Implement Shift register using IC7495.
20. Design & Implement synchronous counter using IC's.
21. Design & Construct of Synchronous Counter

Text Books

1. Anandkumar. A 8th printing (second edition) – January 2015.
2. Digital design – Moris Mano, PHI, 2/e

Reference Books

1. Micro Electronics– MillimanMcGraw Hill.
2. Analog Electronics– L.K.Maheswari, PHI.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01	✓	✓										
C02	✓		✓									
C03	✓				✓							
C04	✓				✓			✓				

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	III B.Tech. I Sem (5th semester)			
Course Code	**DIGITAL ELECTRONICS**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Electronic Devices and circuits		3	0	0	3

Course Objectives:

1. To know different number systems, its conversions,
2. To know different types of logic gates and fundamentals of karnaugh maps.
3. To understand the design of combinational and sequential circuits using logic gates
4. To understand the fundamentals of op-amps, its circuits and parameters

Course Outcomes:

On Completion of the course, the students will be able to-	
C01:	Analyze different number systems, its conversions
C02:	Analyze different types of logic gates and fundamentals of karnaugh maps
C03:	Understand the design of combinational and sequential circuits using logic gates
C04:	Understand the fundamentals of op-amps, its circuits and parameters

Syllabus

Unit-I

Review of number systems & codes: Representation of different radix, Number systems base conversion methods, complements of numbers, r's, r – 1's compliment of signed numbers, problem solving.4-bit codes, BCD, excess-3, gray code.

Logic operations**:** Basic Logic gates- NOT, OR,AND, Universal building blocks, EX-OR, EX-NOR gates, standard SOP and standard POS.

Unit-II

Minimization of switching functions: Boolean theorems, Minimization of logic functions using theorems, K – map up to 6-variables, Minimization using Quine Mccluskey method

UNIT–III

Combinational Circuits: Design of half adder, full adder, half sub tractor, full subtractor, applications of full adders, 4-bit binary adder, 4-bit binary subtractor, BCD adder, excess – 3 adder, carry look – a – head adder. Design of decoder, encoder, multiplexer, de-multiplexer, priority encoder, comparators

UNIT-IV

Sequential logic circuits: Classification of sequential circuits, flip-flops with truth tables and excitation tables. Conversion of flip-flops. Design of ripple counters, synchronous counters, Johnson and ring counters. Design of buffer register, control buffer register, shift register, bi – directional shift register and universal shift register.

UNIT-V

Introduction to Operational Amplifier: Block diagram of Typical Op–Amp With Various Stages– BJT Differential Amplifier With RE DC Analysis– AC Analysis – inverting, non inverting, virtual ground, Adders, subtractors, summing amplifier, voltage follower, op-amp parameters, voltage to current convertor , integrator, differentiator, differential amplifier, Logarithmic amplifier.

Text Books

1. Anandkumar. A 8th printing (second edition) – January 2015.
2. Digital design – Moris Mano, PHI, 2/e.
3. OP–AMPS and liner integrator circuits by Ramakanth A Gayakwad (PHI).
4. Linear Integrated Circuits by D.Roy chowdary, New age international.
5. Op–amp and linear integrated circuits by sanjay sharma, S.K.Kataria & son's New Delhi.
6. Digital Design Principles & Practices – John F.Wakerly, PHI/ Pearson Education Asia, 3rd Edition, 2005

Reference Books

1. Switching and Finite automata theory – ZviKohavi, Tata Mcgraw – Hill, 1978,2/e.
2. Fundamentals of Logic Design – Charles H.RothJr, Jaico Publishers.
3. Micro Electronics– Milliman Mc Graw Hill.
4. Linear Integrated circuits by S.Salivahan, TMH.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01	✓	✓										
C02	✓		✓									
C03	✓				✓							
C04	✓				✓			✓				

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	III B.Tech. I Sem (5th semester)			
Course Code	**MINI PROJECT –I/ STUDY PROJECT/ INTERNSHIP**				
Teaching		L	T	P	C
Prerequisite(s):		0	0	0	2

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	III B.Tech. I Sem (5th semester)			
Course Code	**POWER SYSTEMS-II**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Power Systems-I, Mathematics- I		3	0	0	3

Course Objectives:

The objectives of the course are to make the student learn about

1. To understand the electrical power plant operation and control with respect to its economic aspect
2. To expose the students to the different electrical & mechanical aspects of the power network along with its environmental and safety constraints.
3. To know the importance of compensation in power system and study the different compensating techniques
4. Study about different transients and their protection those are introduced in power system
5.

Course Outcomes:

On Completion of the course, the students will be able to-	
C01:	Understand the parameters of various types of transmission lines and to understand the performance of short, medium, long transmission lines
C02:	Understand the effects of skin, proximity, Ferranti, corona effects on transmission lines
C03:	Understand the power system transients & sag, mechanical design of overhead lines and insulators
C04:	Understand different methods of generation, distribution, control and compensation involved in the operation of power systems

UNIT–I

Transmission Line Parameters: Types of conductors – Calculation of resistance for solid conductors – Calculation of inductance for single phase and three phase– Single and double circuit lines– Concept of GMR and GMD–Symmetrical and asymmetrical conductor configuration with and without transposition– Numerical Problems–Calculation of capacitance for 2 wire and 3 wire systems – Effect of ground on capacitance – Capacitance calculations for symmetrical and asymmetrical single and three phase–Single and double circuit lines–Numerical Problems.

UNIT–II

Performance of Short and Medium Length Transmission Lines: Classification of Transmission Lines – Short, medium, long line and their model representations –Nominal-T–Nominal-Pie and A, B, C, D Constants Mathematical Solutions to estimate regulation and efficiency of all types of lines – Numerical Problems.

UNIT–III

Performance of Long Transmission Lines: Long Transmission Line–Rigorous Solution – Evaluation of A,B,C,D Constants–Interpretation of the Long Line Equations – Incident, Reflected and Refracted Waves –Surge Impedance and SIL of Long Lines–Wave Length and Velocity of Propagation of Waves – Representation of Long Lines – Equivalent-T and Equivalent Pie network models (Numerical Problems).

UNIT–IV

Performance of transmission lines under transients: Types of System Transients – Travelling or Propagation of Surges – Termination of lines with different types of conditions – Open Circuited Line–Short Circuited Line – T-Junction– Lumped Reactive Junctions-Skin and Proximity effects – Description and effect on Resistance of Solid Conductors –Ferranti effect – Charging Current – Effect on Regulation of the Transmission Line–Corona – Description of the phenomenon–Factors affecting corona–Critical voltages and power loss – Radio Interference- Shunt Compensation – Power factor improvement methods-numerical problems.

UNIT–V

Sag and Tension Calculations and Overhead Line Insulators: Sag and Tension calculations with equal and unequal heights of towers– Effect of Wind and Ice on weight of Conductor–Numerical Problems – Stringing chart and sag template and its applications–Types of Insulators – String efficiency and Methods for improvement–Numerical Problems – Voltage distribution–Calculation of string efficiency–Capacitance grading and Static Shielding.

Text Books

1. Electrical power systems – by C.L. Wadhwa, New Age International (P) Limited, Publishers, 1998.
2. Modern Power System Analysis by I.J. Nagarath and D.P.Kothari, Tata McGraw Hill, 2nd Edition.
3. Electrical Power Systems by P.S.R. Murthy, B.S. Publications.

Reference Books

1. Power system Analysis–by John J Grainger William D Stevenson, TMC Companies, 4th edition
2. Power System Analysis and Design by B.R. Gupta, Wheeler Publishing.
3. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S. Bhatnagar A .Chakrabarthy, DhanpatRai& Co Pvt. Ltd.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01		✓					✓					
C02			✓								✓	
C03				✓								
C04								✓				

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	III B.Tech. I Sem (5th semester)			
Course Code	**Power System Dynamics & Control**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Power System Analysis		3	0	0	3

Course Objectives: The objectives of the course are to make the students learn about:

1. The kinds of power stability problems & The basic concepts of modelling and analysis of dynamical systems.
2. Modelling of power system components - generators, transmission lines, excitation and prime mover controllers.
3. Stability of single machine and multi-machine systems is analyzed using digital simulation and small-signal analysis techniques.
4. The impact of stability problems on power system planning and operation.

Course Outcomes:

On Completion of the course, the students will be able to-	
C01:	Understand the power stability problems
C02:	Understand the basic concepts of modelling of synchronous machine and power system components
C03:	Analyse the stability issues in interconnected systems
C04:	Understand the power system stability analysis tools and enhancement of power system stability

Unit – I:

Introduction to Power System Stability: Power System Operation and Control - Stability Problems faced by Power Systems - Impact on Power System Operation and Control - Analysis of Dynamical Systems - Concept of Equilibria, Small and Large Disturbance Stability - Example: Single Machine Infinite Bus System - Modal Analysis of Linear Systems - Analysis using Numerical Integration Techniques - Issues in Modelling: Slow and Fast Transients, Stiff Systems

Unit – II:

Modelling of a Synchronous Machine: Physical Characteristics - Rotor Position Dependent model - D-Q Transformation - Model with Standard Parameters - Steady State Analysis of Synchronous Machine - Short Circuit Transient Analysis of a Synchronous Machine - Synchronous Machine Connected to Infinite Bus.

Unit – III:

Modelling of power system components: Physical Characteristics and Models - Control system components - Excitation System Controllers - Prime Mover Control Systems - Transmission Line Physical Characteristics - Transmission Line Modelling - Load Models - induction machine model - Other Subsystems - HVDC, protection systems.

Unit – IV:
Stability Issues in Interconnected Power Systems: Single Machine Infinite Bus System - Multi-machine Systems - Stability of Relative Motion - Frequency Stability: Centre of Inertia Motion - Concept of Load Sharing: Governors - Single Machine Load Bus System: Voltage Stability - Torsional Oscillations

Unit – V:
Enhancing System Stability: Planning Measures - Stabilizing Controllers (Power System Stabilizers) - Operational Measures- Preventive Control - Emergency Control - Power System Stability Analysis Tools: Small Signal Analysis Program - Transient Stability Program - Real-Time Simulators.

Text Books:

1. K.R.Padiyar, Power System Dynamics, Stability & Control, 2nd Edition, B.S. Publications, Hyderabad, 2002.
2. P.Kundur, Power System Stability and Control, McGraw Hill Inc, New York, 1995.

Reference Books

1. P.Sauer&M.A.Pai, Power System Dynamics & Stability, Prentice Hall, 1997.
2. Jan Machowski, JanuszBialek, James Richard Bumby, Power system dynamics and control , John Wiley & Sons, 1997.

Web-Resources:

1. www.electrical4u.com
2. www.nptel.com

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01					✓					✓		
C02		✓	✓									
C03										✓		
C04											✓	

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	III B.Tech. I Sem (5th semester)			
Course Code	**SPECIAL ELECTRICAL MACHINES**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Basic Knowledge on Electrical Machines		3	0	0	3

Course Objectives:

The objectives of the course are to make the student learn about

1. To learn about the principle of Operation of different types of Special Electrical Machines
2. To learn about the theory of torque production in brushless DC motor
3. To know about the features of electric motors for traction application
4. To learn about the control aspect of special electrical machines

Course Outcomes:

On Completion of the course, the students will be able to-	
C01:	Explain theory of operation and control of switched reluctance motor
C02:	Explain the performance and control of stepper motors, and their applications
C03:	Describe the operation and characteristics of permanent magnet dc motor
C04:	Understand operation and characteristic of brush less dc motor**.**

UNIT I

Stepper Motors: Construction – Principle of operation – Theory of torque production – Hybrid stepping motor –Variable reluctance stepping motor – Open loop and closed loop control.

UNIT II

Switched Reluctance Motor: Principle of operation – Design of stator and rotor pole arc – Power converter for switched reluctance motor – Control of switched reluctance motor.

UNIT III

Permanent Magnet DC Motors: Construction – Principle of working – Torque equation and equivalent circuits – Performance characteristics – Moving coil motors.

UNIT IV

Permanent Magnet Brushless DC (BLDC) Motor: Construction – Principle of operation – Theory of brushless DC motor as variable speed synchronous motor – sensor based and Sensor less control of BLDC motors

UNIT V

Linear motors: Linear induction motor: Construction– principle of operation– applications. Linear synchronous motor: Construction – principle of operation– applications.

Text Books:

1. Special Electrical Machines, K.Venkata Ratnam, University press, 2009, New Delhi.
2. Brush less Permanent magnet and Reluctance Motor Drives, Clarenden press, T.J.E. Miller, 1989, Oxford.
3. Special Electrical Machines, E.G. Janardhanan, PHI learning private limited, 2014.

Reference Books:

1. Fractional and Sub fractional HP electric motors- Cyril G. Veinott - TMH Intrrnational 1987

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01		✓								✓		
C02			✓								✓	
C03			✓									
C04				✓								

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	III B.Tech. II Sem (6th semester)			
Course Code	**DIGITAL CONTROL SYSTEMS**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Control Systems		3	0	0	3

Course Objectives:

The objectives of the course are to make the student learn about

1. Knowledge about principles and techniques of A/D and D/A conversions and basics of Z-transform
2. Knowledge in stability analysis of digital control systems
3. Knowledge about the design of digital control systems for different engineering model

Course Outcomes:

On Completion of the course, the students will be able to-	
C01:	learn the advantages of discrete time control systems and the "know how" of various associated accessories
C02:	understand z–transformations and their role in the mathematical analysis of different systems(like Laplace transforms in analog systems).
C03:	learn stability criterion for digital systems and methods adopted for testing
C04:	understand the conventional and state space methods of design

UNIT – I:

Introduction and signal processing: Introduction to analog and digital control systems – Advantages of digital systems – Typical examples – Signals and processing – Sample and hold devices – Sampling theorem and data reconstruction – Frequency domain characteristics of zero order hold.

UNIT–II:

z–transformations: z–Transforms – Theorems – Finding inverse z–transforms – Formulation of difference equations and solving – Block diagram representation – Pulse transfer functions and finding open loop and closed loop responses.

UNIT–III:

State space analysis and the concepts of Controllability and observability **:** State space representation of discrete time systems – State transition matrix and methods of evaluation – Discretization of continuous – Time state equations – Concepts of controllability andobservability – Tests(without proof).

UNIT – IV:

Stability analysis: Mapping between the s–Plane and the z–Plane – Primary strips and Complementary strips – Stability criterion – Modified Routh's stability criterion and Jury's stability test.

UNIT – V:

Design of discrete–time control systems by conventional methods: Transient and steady state specifications – Design using frequency response in the w–plane for lag and lead compensators – Root locus technique in the z–plane. State feedback controllers: Design of state feedback controller through pole placement – Necessary and sufficient conditions – Ackerman's formula.

Text Book:

1. Discrete–Time Control systems – K. Ogata, Pearson Education/PHI, 2nd Edition.
2. Digital Control and State Variable Methods by M.Gopal, TMH, 4th Edition.

Reference Books:

1. Digital Control Systems, Kuo, Oxford University Press, 2nd Edition, 2003.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012

C01		✓								✓		
C02			✓								✓	
C03			✓									
C04				✓								

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	III B.Tech. II Sem (6th semester)			
Course Code	**MICROPROCESSORS & MICRO CONTROLLERS AND APPLICATIONS LAB**				
Teaching	Total contact hours - 30	L	T	P	C
Prerequisite(s)**:** MPMC		0	0	3	1.5

Course Objectives:

The objectives of the course are to make the student learn about

1. To Study the Architecture of 8085 & 8086 microprocessor.
2. To Learn the design aspects of I/O and Memory Interfacing circuits
3. Study the Architecture of 8051 microcontroller
4. To Understand the concepts related to I/O and memory interfacing

Course Outcomes:

On Completion of the course, the students will be able to-	
C01:	Do assembly language programming.
C02:	Do interfacing design of peripherals like I/O, A/D, D/A, timer etc.
C03:	Develop systems using different microcontrollers
C04:	learn hardware and software interaction and integration

All the experiments are to be done compulsorily

1. Unsigned arithmetic operation
2. Arithmetic operation – Multi byte addition and subtraction
3. ASCII – Arithmetic operation
4. Multiplication and division – Signed
5. Logic operations – Shift and rotate
6. Converting packed BCD to unpacked BCD, BCD to ASCII conversion
7. By using string operation and Instruction prefix**:** Move block, Reverse string, Length of the string, String comparison
8. String manipulations: Sorting
9. String manipulations: Inserting and Deleting
10. Dos/BIOS programming: Reading keyboard (Buffered with and without echo)
11. Interfacing 8255–PPI
12. Programs using special instructions like swap, bit/byte, set/reset etc
13. Programs based on short, page, absolute addressing
14. Interfacing 8259 – Interrupt Controller
15. Interfacing 8279 – Keyboard Display
16. Stepper motor control using 8253/8255
17. Reading and Writing on a parallel port
18. Timer in different modes

19.Serial communication implementation.

20.Understanding three memory areas of 00 – FF (Programs using above areas).Using external interrupts

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01		✓								✓		
C02			✓								✓	
C03			✓									
C04				✓								

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	III B.Tech. II Sem (6th semester)			
Course Code	**MICROPROCESSORS & MICRO CONTROLLERS AND APPLICATIONS**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s)**:** Switching theory and logic design		3	0	0	3

Course Objectives:

The objectives of the course are to make the student learn about

1. To develop an in-depth understanding of the operation of microprocessor
2. To develop an in-depth understanding of the operation of microcontrollers,
3. To understand machine language programming
4. To understand interfacing techniques

Course Outcomes:

On Completion of the course, the students will be able to-	
C01:	Do assembly language programming.
C02:	Do interfacing design of peripherals like I/O, A/D, D/A, timer etc.
C03:	Develop systems using different microcontrollers
C04:	learn hardware and software interaction and integration

UNIT–I

Introduction to Microprocessor Architecture

Introduction and evolution of Microprocessors– Architecture of 8086– Register Organization of 8086–Memory organization of 8086– General bus operation of 8086–Introduction to 80286–80386 and 80486 and Pentium.

UNIT–II

Minimum and Maximum Mode Operations

Instruction set, Addressing modes– Minimum and Maximum mode operations of 8086–8086 Control signal interfacing–Read and write cycle timing diagrams Assembly Directives–Macro's

UNIT–III

I/O Interface

Static memory interfacing with 8086– 8255 PPI– Architecture of 8255–Modes of operation–Interfacing I/O devices to 8086 using 8255- Stepper motor interfacing–DMA controller (8257)–Architecture–Interfacing 8257 DMA controller– Programmable Interrupt Controller (8259)–Command words and operating modes of 8259– Interfacing of 8259–Keyboard/display controller (8279)– Architecture–Modes of operation–Command words of 8279– Interfacing of 8279.

UNIT–IV

Introduction to 8051 Micro Controller

Overview of 8051 Micro Controller– Architecture– Register set–I/O ports and Memory Organization– Interrupts–Timers and Counters–Serial Communication. Addressing modes and Instruction set of 8051

UNIT–V

Cyber physical systems and industrial applications of 8051

Applications of Micro Controllers– Interfacing 8051 to LED's–Push button– Relay's and Latch Connections– Keyboard Interfacing– Interfacing Seven Segment Display–ADC and DAC Interfacing

Text Books

1. Microprocessors and Interfacing, Dpouglas V Hall, Mc–Graw Hill, 2nd Edition.
2. Kenneth J Ayala, "The 8051 Micro Controller Architecture, Programming and Applications", Thomson Publishers, 2nd Edition.
3. Ray and Burchandi, "Advanced Micro Processors and Interfacing", Tata McGraw–Hill.

Reference Books

1. R.S. Kaler, " A Text book of Microprocessors and Micro Controllers", I.K. International Publishing House Pvt. Ltd.
2. Ajay V. Deshmukh, "Microcontrollers – Theory and Applications", Tata McGraw–Hill Companies –2005.
3. Ajit Pal, "Microcontrollers – Principles and Applications", PHI Learning Pvt Ltd, 2011.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01		✓								✓		
C02			✓								✓	
C03			✓									
C04				✓								

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	III B.Tech. II Sem (6th semester)			
Course Code	**POWER ELECTRONICS LAB**				
Teaching	Total contact hours - 30	L	T	P	C
Prerequisite(s): Power Electronics		0	0	3	1.5

Course Objectives:

The objectives of the course are to make the student learn about

1. To make the students to design triggering circuits of SCR
2. To introduce power electronics components from which the characteristics of SCR, TRIAC, IGBT and MOSFET are obtained.
3. To perform the experiments on various converters
4. To perform commutation techniques

Course Outcomes:

On Completion of the course, the students will be able to-	
C01:	know the characteristics of various power electronic devices and analyze firing circuit and commutation circuits of SCR
C02:	analyze the performance of single–phase and three–phase full– wave bridge converters, single–phase dual converter with both resistive and inductive loads
C03:	Understand the operation of AC voltage controller and cyclo converter with resistive and inductive loads.
C04:	Understand the working of Buck converter, Boost converter, single–phase bridge inverter and PWM inverter.

All the experiments are to be done compulsorily

1. Experimental study of input output Characteristics of SCR,
2. Experimental study of input output Characteristics of MOSFET
3. Experimental study of input output Characteristics of IGBT
4. Experimental study of different types of Gate firing circuits for SCR's- half wave triggering
5. Experimental study of different types of Gate firing circuits for SCR's- full wave triggering
6. Experimental study of different types of Gate firing circuits for SCR's-UJT
7. Experimental study of Single -Phase Half controlled converter with RL load
8. Experimental study of Single -Phase Half controlled converter with RL load
9. Experimental study of Single -Phase fully controlled bridge converter with R load
10. Experimental study of Single -Phase fully controlled bridge converter with RL load

11. Experimental study of Single -Phase AC Voltage Controller with R load
12. Experimental study of Single -Phase AC Voltage Controller with RL load
13. Experimental study of Single -Phase Cyclo–converter with R and RL loads
14. Experimental study of Single -Phase Bridge Inverter with R and RL Loads
15. Experimental study of Single -Phase dual converter with RL loads
16. Experimental study of Three -Phase half controlled bridge converter with RL load.
17. Experimental study of Three- Phase full converter with RL–load.
18. Experimental study of DC–DC buck converter.
19. Experimental study of DC–DC boost converter.
20. Experimental study of Single -phase PWM inverter.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01		✓								✓		
C02			✓								✓	
C03			✓									
C04				✓								

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	III B.Tech. II Sem (6th semester)			
Course Code	**POWER ELECTRONICS**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Electronic devices & circuits		3	0	0	3

Course Objectives:

The objectives of the course are to make the student learn about

1. To understand and acquire knowledge about various power semiconductor devices
2. To prepare the students to analyze and design different power converter circuits.
3. Understand, simulate and design single-phase and three-phase thyristor converter
4. Learn basic magnetic concepts, analyze transformer-isolated switch-mode power supplies and design high-frequency inductors and transform

Course Outcomes:

On Completion of the course, the students will be able to-	
C01:	Demonstrate the characteristics of various power semiconductor devices
C02:	Analyse different electrical parameters of single phase AC-DC converters and semi converters for different loads and to evaluate the converters performance.
C03:	Analyse different electrical parameters of three phase AC-DC converters, 3-phase controlled rectifiers, DC-DC converters for different loads and to evaluate the converters performance.
C04:	Understand the working of AC-AC voltage regulators, inverters and application of PWM techniques for voltage and harmonic mitigation.

UNIT–I:

Power Semi-Conductor Devices**:** Thyristors– static characteristics of Silicon controlled rectifiers (SCR's) and TRIAC Turn on and turn off Methods–Dynamic characteristics of SCR– Snubber circuit design– Basic requirements of Gating circuits for SCR – series and parallel operation of SCR Characteristics of power MOSFET and Power IGBT– Basic theory of operation of SCR– Static characteristics- gate driving circuits.

UNIT–II:

AC-DC Single-Phase Converters: 1-phase half wave controlled rectifiers – R - load and RL - load with and without freewheeling Diode – 1-phase full wave controlled rectifiers – center tapped configuration and bridge Configuration- R - load and RL - load with and without freewheeling diode – continuous and Discontinuous conduction – single phase semi converter– Effect of source inductance in 1-phase fully controlled bridge Rectifier with continuous conduction.

UNIT–III:

AC-DC 3-Phase Converters and AC-AC voltage regulators : 3-phase half wave and Full wave uncontrolled rectifier – 3-phase half wave controlled Rectifier with R and RL - load – 3-phase fully controlled rectifier with R and RL - load – 3-phase Semi controlled rectifier with R and RL - load- 1-phase AC-AC regulator - phase angle control and integrated cycle control with R and RL - load – For continuous and discontinuous conduction- 3-Phase AC-AC regulators with R - load only

UNIT–IV:

DC–DC Converters: Analysis of Buck, boost, buck-boost converters in Continuous Conduction Mode (CCM) and Discontinuous conduction Modes (DCM) – Output voltage equations using volt-sec balance in CCM & DCM, output voltage ripple & inductor current, ripple for CCM only – Principle of operation of forward and fly back converters in CCM.

UNIT – V:

DC–AC Converters: 1- Phase half-bridge and full bridge inverters with R and RL - loads – 3-phase square wave Inverters – 120^0 conduction and 180^0 conduction modes of operation – PWM inverters – Quasi-square wave pulse width modulation – Sinusoidal pulse width modulation – Prevention of shoot through fault in Voltage Source Inverter (VSI) – Current Source Inverter (CSI) – Introduction to Auto Sequential Commutated Current Source Inverter (ASCCSI).

Text Books

1. Power Electronics: Circuits, Devices and Applications – by M. H. Rashid, Prentice Hall of India, 2nd edition, 1998
2. Power Electronics: converters, applications & design -by Ned Mohan, Tore M. Undeland, Robbins by Wiley India Pvt. Ltd.
3. Power Converter Circuits -by William Shepherd, Li zhang, CRC Taylor & Francis Group.

Reference Books

1. Power Electronics – Devices, Converters and Applications", by Vedam Subramanyam Revised 2nd edition, New Age Publications
2. Power electronics By M D Singh and K B Khanchandani by TMH publication 2 edition.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01		✓								✓		
C02			✓								✓	
C03			✓									
C04				✓								

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	III B.Tech. II Sem (6th semester)			
Course Code	**POWER SYSTEM ANALYSIS**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Basic Knowledge On Mathematics, Electric Circuit Theory		3	0	0	3

Course Objectives:

The objectives of the course are to make the student learn about

1. Solve power flow problems by application of the Newton method
2. Represent elements of a power system including generators, transmission lines, and transformers.
3. Understand the functioning of a synchronous machine and represent it with simple models.
4. Generate the elements of the impedance matrix from the elements of the admittance matrix without a matrix inversion.

Course Outcomes:

On Completion of the course, the students will be able to-	
C01:	Draw an impedance diagram and SLD for a power system network and form a Y_{bus} matrix for a power system network with or without mutual couplings.
C02:	find out the load flow solution of a power system network using different types of load flow methods.
C03:	formulate the Zbus for a power system network.
C04:	find out the fault currents for all types faults with a view to provide data for the design of protective devices

UNIT –I:

Graph Theory Concepts: Per Unit Quantities–Single line diagram– Impedance diagram of a power system–Graph theory definition – Formation of element node incidence and bus incidence matrices – Primitive network representation – Formation of Y–bus matrix by singular transformation and direct inspection methods.

UNIT –II:

Power Flow Studies : Necessity of power flow studies – Derivation of static power flow equations – Power flow solution methods: Gauss-Seidel Method – Newton Raphson Method (Rectangular and polar
coordinates form) –Decoupled and Fast Decoupled methods – Algorithmic approach – Numerical Problems (3–bus system only.)

UNIT –III:
Z–Bus formulation: Formation of Z–Bus**:** Partial network– Algorithms for the Modification of Z_{bus} Matrix under addition of link and branch (Derivations and Numerical Problems).– Modification of Z–Bus for the changes in network (Problems).

UNIT – IV:
Symmetrical Fault Analysis: Transients on a Transmission line-Short circuit of synchronous machine(on no-load) - 3– Phase short circuit currents and reactances of synchronous machine– Short circuit MVA calculations -Series reactors – selection of reactors.
Symmetrical Components & Unsymmetrical Fault analysis
Definition of symmetrical components - symmetrical components of unbalanced three phase systems – Power in symmetrical components – Sequence impedances – Synchronous generator – Transmission line and transformers – Sequence networks –Various types of faults LG– LL– LLG on unloaded alternator–unsymmetrical faults on power system.

UNIT – V:
Power System Stability Analysis: Elementary concepts of Steady state, Dynamic and Transient Stabilities– Description of Steady State Stability Power Limit–Transfer Reactance–Synchronizing Power Coefficient – Power Angle Curve and Determination of Steady State Stability –Derivation of Swing Equation–Determination of Transient Stability by Equal Area Criterion Methods to improve steady state and transient stability.

Text Books

1. Electrical Power Systems by P.S.R.Murthy, B.S.Publications
2. Modern Power system Analysis – by I.J.Nagrath&D.P.Kothari: Tata McGraw–Hill Publishing Company, 2nd edition.
3. Power System Analysis by Grainger and Stevenson, Tata McGraw Hill.
4. Power System Analysis and Design by J.Duncan Glover, M.S.Sarma, T.J. Overbye – CengageLearning publications.

Reference Books

1. Power System Analysis by B.R.Gupta, Wheeler Publications.
2. Power System Analysis – by A.R.Bergen, Prentice Hall, Inc.
3. Power System Analysis by HadiSaadat – TMH Edition.

CO-PO Mapping:
(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01		✓								✓		
C02			✓								✓	
C03			✓									
C04			✓	✓								

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	III B.Tech. II Sem (6th semester)			
Course Code	**POWER SEMICONDUCTOR DRIVES**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Power Electronics, Electrical Machines- I & II		3	0	0	3

Course Objectives:

The objectives of the course are to make the student learn about

1. Understanding of power semiconductor drives operations, modes, characteristics.
2. Understanding How to control machines using power semiconductor drives.
3. Understanding to differentiate the classical and newly developed control methods.
4. Understanding motoring and braking operation.

Course Outcomes:

On Completion of the course, the students will be able to-	
C01:	Know the fundamentals of electric drive and different electric braking methods
C02:	Analyse the operation of three phase converter controlled dc motors and four quadrant operation of dc motors using dual converters.
C03:	Know the converter control of dc motors in various quadrants
C04:	Know the concept of speed control of induction motor by using AC voltage controllers and voltage source inverters

UNIT–I

Fundamentals of Electric Drives: Electric drive – Fundamental torque equation – Load torque components – Nature and classification of load torques – Steady state stability – Load equalization– Four quadrant operation of drive (hoist control) – Braking methods**:** Dynamic – Plugging – Regenerative methods.

UNIT–II

Three Phase Converter Controlled DC Motor Drives: Revision of speed control techniques – Separately excited and series motors controlled by full converters – Output voltage and current waveforms – Speed-torque expressions – Speed-torque characteristics – Numerical problems – Four quadrant operation using dual converters.

UNIT–III

DC-DC converters Controlled DC Motor Drives: Single quadrant – Two quadrant and four quadrant chopper fed separately excited and series excited motors – Continuous current operation– Output voltage and current waveforms – Speed–torque expressions – Speed–torque characteristics –Four quadrant operations – Closed loop operation (Block diagram only).

UNIT–IV

Control of Induction Motor Drives **:** Stator side**:** Variable voltage characteristics–Control of Induction Motor by AC Voltage Controllers – Waveforms –Speed torque characteristics– Variable Voltage Variable Frequency control of induction motor by voltage source inverter – PWM control – Closed loop operation of induction motor drives (Block Diagram Only).

Rotor side: Static rotor resistance control – Slip power recovery schemes – Static Scherbius drive – Static Kramer drive – Performance and speed torque characteristics – Advantages – Applications.

UNIT–V

Control of Synchronous Motor Drives: Separate control & Self-control of synchronous motor Drives – Operation of self-controlled synchronous motor by VSI– Closed Loop control operation of synchronous motor drives (Block Diagram Only) –Variable frequency control–Pulse width modulation

Text Books

1. Fundamentals of Electric Drives – by G K Dubey Narosa Publications
2. Power Semiconductor Drives, by S.B. Dewan, G.R.Slemon, A.Straughen, Wiley-India Edition.

Reference Books

1. Electric Motors and Drives Fundamentals, Types and Applications, by Austin Hughes and Bill Drury, Newnes.
2. Thyristor Control of Electric drives – Vedam Subramanyam Tata McGraw Hill Publications.
3. Power Electronic Circuits, Devices and applications by M.H. Rashid, PHI.
4. Power Electronics handbook by Muhammad H.Rashid, Elsevier.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01		✓								✓		
C02			✓								✓	
C03			✓									
C04				✓								

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	III B.Tech. II Sem (6th semester)			
Course Code	**SWITCHGEAR & PROTECTION**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Power Systems- I		3	0	0	3

Course Objectives:

The objectives of the course are to make the student learn about

1. To understand the need of protection of electric equipment and their protection schemes
2. To understand operations & characteristics of various electromagnetic and static relays.
3. To understand the operations of various types of circuit breakers and their ratings
4. To understand the unit protection and over voltage protection of different apparatus in power system

Course Outcomes:

On Completion of the course, the students will be able to-	
C01:	understand the principles of arc interruption for application to high voltage circuit breakers of air, oil, vacuum, SF_6 gas type.
C02:	to understand the working principle and constructional features of different types of electromagnetic protective relays
C03:	Knowledge of faults that is observed to occur in high power generator and transformers and protective schemes used for all protections.
C04:	Understand about static relays and various types of protective schemes used for feeders and bus bar protection

UNIT–I

Circuit Breakers: Elementary principles of arc interruption– Restrike Voltage and Recovery voltages– Restrike phenomenon– Average and Max. RRRV– Current chopping and Resistance switching– Miniature Circuit Breaker(MCB)– Introduction to oil circuit breakers– Description and operation of AirBlast, Vacuum and SF6 circuit breakers– CB ratings and specifications– Auto reclosing

UNIT–II

Electromagnetic Protection: Principle of operation and construction of attracted armature– Balanced beam– induction disc and induction cup relays– Relays classification– Instantaneous– DMT and IDMT types– Applications of relays**:** Over current/under voltage relays– Directional relays– Differential relays and percentage differential relays– Universal torque equation– Distance relays**:** Impedance– Reactance– Mho and offset mho relays– Characteristics of distance relays and comparison.

UNIT–III

Generator Protection: Protection of generators against stator faults– Rotor faults and abnormal conditions– restricted earth fault and inter turn fault protection– Numerical examples.

Transformer Protection: Protection of transformers**:** Percentage differential protection– Design of CT's ratio– Buchholz relay protection–Numerical examples.

UNIT–IV

Feeder and Bus bar Protection: Over current– Carrier current and three zone distance relay using impedance relays–Translay relay–Protection of bus bars– Differential protection.

Static and Digital Relays**:** Static relay components– Static over current relay– Static distance relay– Micro processor based digital relays.

UNIT–V

Protection against over voltage and grounding: Generation of over voltages in power systems– Protection against lightning over voltages– Valve type and zinc–Oxide lighting arresters– Insulation coordination– BIL– impulse ratio– Standard impulse test wave– volt~time characteristics– Grounded and ungrounded neutral systems–Effects of ungrounded neutral on system performance– Methods of neutral grounding**:** Solid–resistance–Reactance–Arcing grounds and grounding Practices.

Text Books

1. Protection and SwitchGear by BhaveshBhalja, R.P. Maheshwari, NileshG. Chothani, Oxford University Press, 2013
2. Power system protection- Static Relays with microprocessor applications. by T.S. Madhava Rao, TMH
3. Electrical Power System Protection by C. CHRISTOPOULOS and A. Wright, Springer publications

Reference Books

1. Power System Protection and Switchgear by Badari Ram, D.N Viswakarma, TMH Publications.
2. Fundamentals of Power System Protection by Paithankar and S.R. Bhide, PHI, 2003.
3. Art & Science of Protective Relaying – by C R Mason, Wiley Eastern Ltd.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01	✓									✓		
C02											✓	
C03		✓										
C04			✓	✓								

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	III B.Tech. II Sem (6th semester)			
Course Code	**SIGNALS & SYSTEMS**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Mathematics-I		3	0	0	3

Course Objectives:

The objectives of the course are to make the student learn about

1. To explain signals and systems representations/classifications and also describe the time and frequency domain analysis of continuous time signals with Fourier series, Fourier transforms and Laplace transforms.
2. To understand Sampling theorem, with time and frequency domain analysis of discrete time signals with DTFS, DTFT and Z-Transform.
3. To present the concepts of convolution and correlation integrals and also understand the properties in the context of signals/systems and lay down the foundation for advanced courses.
4. Understand the application of Fourier analysis to ideal filtering

Course Outcomes:

On Completion of the course, the students will be able to-	
C01:	Understand the concepts of continuous time and discrete time systems.
C02:	Analyze systems in complex frequency domain.
C03:	Understand sampling theorem and its implications.
C04:	Understand the application of Fourier analysis

UNIT 1

Introduction to Signals and Systems**:** Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some

special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability. Examples.

UNIT 2:

Behavior of continuous and discrete-time LTI systems: Impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix andits Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.

UNIT 3

Fourier, Laplace and z- Transforms: Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier
Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem.

UNIT 4

Fourier, Laplace and z- Transforms: Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.

UNIT 5

Sampling and Reconstruction: The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.

Text/References:

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, “Signals and systems”, Prentice Hall India, 1997.
2. J. G. Proakis and D. G. Manolakis, “Digital Signal Processing: Principles, Algorithms, and Applications”, Pearson, 2006.
3. H. P. Hsu, “Signals and systems”, Schaum’s series, McGraw Hill Education, 2010.
4. S. Haykin and B. V. Veen, “Signals and Systems”, John Wiley and Sons, 2007.
5. A. V. Oppenheim and R. W. Schafer, “Discrete-Time Signal Processing”, Prentice Hall, 2009.
6. M. J. Robert “Fundamentals of Signals and Systems”, McGraw Hill Education, 2007.
7. B. P. Lathi, “Linear Systems and Signals”, Oxford University Press, 2009.

CO-PO Mapping:
(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01	✓		✓									
C02		✓	✓									
C03					✓						✓	
C04	✓											✓

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	III B.Tech. II Sem (6th semester)			
Course Code	**SOLAR ENERGY SYSTEMS**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Renewable Energy systems		3	0	0	3

Course Objectives:
The objectives of the course are to make the student learn about

1. To learn the basic terms of solar energy
2. To learn the design of solar collector plates
3. To learn about solar heating and cooling systems
4. To learn PV applications

Course Outcomes:

On Completion of the course, the students will be able to-	
C01:	Understand various terms in solar energy
C02:	Design solar collector plates
C03:	Understand solar heating and cooling systems and solar energy storage techniques
C04:	Analyze the PV system applications and know the government support for solar energy

Unit I:

Introduction**:** Solar angles, day length, angle of incidence on tilted surface, Sunpath diagrams, Shadow determination, Extraterrestrial characteristics, Effect of earth atmosphere, Measurement & estimation on horizontal and tilted surfaces

Flat-plate Collectors - Effective energy losses; Thermal analysis; Heat capacity effect; Testing methods; Evacuated tubular collectors; Air flat-plate Collectors: types; Thermal analysis; Thermal drying.

Unit II:
Concentrating Collector Designs**:** Classification, design and performance parameters, Tracking systems, Compound parabolic concentrators, Parabolic trough concentrators, Concentrators with point focus, Heliostats, Comparison of various designs: Central receiver systems, parabolic trough systems, Solar power plant, Solar furnaces

Unit III:
Solar Heating & Cooling System : Liquid based solar heating system, Natural, forced and gravity flow, mathematical modeling, Vapor absorption refrigeration cycle, Water, ammonia & lithium bromide-water absorption refrigeration systems, Solar operated refrigeration systems, Solar desiccant cooling, Solar Thermal Energy Storage - Sensible storage, Latent heat storage, Thermo-chemical storage.

Unit IV:
Solar Cell Physics: P-N junction: homo and hetro junctions, Metal-semiconductor interface, Dark and illumination characteristics, Figure of merits of solar cell, Efficiency limits, Variation of efficiency with band-gap and temperature, Efficiency measurements, High efficiency cells, Tandem structure
.
Unit V:
SPV Applications: Centralized and decentralized SPV systems; Stand alone, hybrid and, grid connected system, System installation, operation and maintenances; Field experience; PV market analysis and economics of SPV systems – Government Schemes and Polices

References:

1. Garg H P., Prakash J., Solar Energy: Fundamentals & Applications, Tata McGraw Hill, New Delhi, 1997
2. S P Sukhatme, Solar Energy, Tata McGraw Hill, 2008
3. J F Kreider and Frank Kreith, Solar Energy Handbook, McGraw Hill, 2000
4. D Y Goswami, Frank Kreith and J F Kreider, Principles of Solar Engineering, Taylor & Francis, 1998
5. Tiwari G.N., Suneja S., Solar Thermal Engineering System, Narosa Publishing House, New Delhi, 1997.
6. Alan L Fahrenbruch and Richard H Bube , Fundamentals of Solar Cells: PV Solar Energy Conversion, Academic Press, New York , 1983
7. Larry D Partain (ed.), Solar Cells and their Applications, John Wiley and Sons, Inc, New York, 1995
8. Richard H Bube, Photovoltaic Materials, Imperial College Press, 1998 H S Rauschenbach, Solar Cell Array Design Handbook, Van Nostrand Reinfold Company, New York, 1980.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01	✓		✓									
C02		✓	✓									
C03					✓						✓	
C04	✓											✓

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	III B.Tech. II Sem (6th semester)			
Course Code	**UTILIZATION OF ELECTRICAL ENERGY**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Power Systems		3	0	0	3

Course Objectives:

The objectives of the course are to make the student learn about

1. To Understanding of selection of drives for industrial application.
2. To Understanding the heating and welding methods for industrial applications.
3. To Understanding of the concepts of Electrolysis processes and illumination engineering.
4. To Understanding of electric traction system and drives.

Course Outcomes:

On Completion of the course, the students will be able to-	
C01:	Identify most appropriate heating or welding techniques for suitable applications
C02:	understand various level of luminosity produced by different illuminating sources
C03:	Identify a suitable motor for electric drives and industrial applications
C04:	Identify the various types of Industrial loads

UNIT – I

Electric Heating: Advantages and methods of electric heating–Resistance heating, induction heating and dielectric heating.

Electric Welding: Electric welding–Resistance and arc welding–Electric welding equipment–Comparison between AC and DC Welding

UNIT – II

Illumination Fundamentals: Introduction, terms used in illumination–Laws of illumination–Polar curves– Integrating sphere–Lux meter–Sources of light

Various Illumination Methods: Discharge lamps, MV and SV lamps – Comparison between tungsten filament lamps and fluorescent tubes–Basic principles of light control– Types and design of lighting and flood lighting–LED lighting.

UNIT – III

Selection of Motors: Choice of motor, type of electric drives, starting and running characteristics– Speed control–Temperature rise–Applications of electric drives–Types of industrial loads–continuous–Intermittent and variable loads–Load equalization.

UNIT – IV

Electric Traction – I: System of electric traction and track electrification– Review of existing electric traction systems in India– Special features of traction motor– Mechanics of train

movement–Speed–time curves for different services – Trapezoidal and quadrilateral speed time curves.

UNIT – V

Electric Traction – II: Calculations of tractive effort– power –Specific energy consumption for given run–Effect of varying acceleration and braking retardation–Adhesive weight and braking retardation adhesive weight and coefficient of adhesion– Principles of energy efficient motors.

Text Books:

1. Utilization of Electric Energy – by E. Openshaw Taylor, Orient Longman.
2. Art & Science of Utilization of electrical Energy – by Partab, DhanpatRai& Sons.

Reference Books:

1. Utilization of Electrical Power including Electric drives and Electric traction – by N.V.Suryanarayana, New Age International (P) Limited, Publishers, 1996.
   Generation, Distribution and Utilization of electrical Energy – by C.L. Wadhwa, New Age

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01	✓	✓										
C02	✓							✓				
C03	✓				✓							
C04	✓		✓									

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	IV B.Tech. I Sem (7th semester)			
Course Code	**ADAPTIVE CONTROL SYSTEMS**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Control Systems		3	0	0	3

Course Objectives:

The objectives of the course are to make the student learn about

1. To study adaptive control system fundamentals.
2. To study about deterministic self-tuning regulators.
3. To study stochastic and predictive self-tuning regulators.
4. To understand model – reference adaptive system.

Course Outcomes:

After successful completion of the course, a successful student will be able to	
C01:	Development adaptive control system fundamentals.
C02:	Deterministic self-tuning regulators.
C03:	Design of stochastic and predictive self-tuning regulators.
C04:	Understanding of model – reference adaptive system.

Syllabus:

UNIT-I: INTRODUCTION

Development of adaptive control problem-The role of Index performance (IP) in adaptive systems- Parametric models of dynamical systems - Adaptive Schemes- The adaptive Control Problem- Applications. Gain scheduling: The principle - Design of gain scheduling controllers-Nonlinear transformations -application of gain scheduling - Auto-tuning techniques- Methods based on Relay feedback.

UNIT-II: DETERMINISTIC SELF-TUNING REGULATORS

Pole Placement design - Indirect Self-tuning regulators - Continuous time self tuners direct self-tuning regulators – Disturbances with known characteristics.

UNIT-III: STOCHASTIC AND PREDICTIVE SELF-TUNING REGULATORS

Design of minimum variance controller - Design of moving average controller - stochastic self-tuning regulators - Unification of direct self tuning regulators - Linear Quadratic STR - Adaptive Predictive Control.

UNIT-IV: MODEL – REFERENCE ADAPTIVE SYSTEM

MIT rule – Determination of adaptation gain - Lyapunov theory –Design of MRAS using Lyapunov theory – Relations between MRAS and STR- Case Study.

UNIT-V: PROPERTIES OF ADAPTIVE SYSTEMS

Nonlinear dynamics, Analysis of Indirect discrete time self-tuners, Stability of direct discrete time algorithms, Averaging, Application of averaging techniques, averaging in stochastic systems, robust adaptive controllers.

Text Books:

1. Karl J Astrom and Bjorn Wittenmark, "Adaptive Control", Pearson Education Inc., New Delhi, 2008.
2. Ioannou P A and Sun J, "Robust Adaptive Control", Prentice Hall, 1996.
3. Krstic M, Kanellakopoulos I and Kokotovic P, "Nonlinear and Adaptive Control Design", Wiley - Interscience, 1995.

Reference Books:

1. Chalam V V, "Adaptive Control Systems – Techniques and Applications", Marcel Dekkar Inc., New Jersey, 1987.
2. Shankar Sastry and Marc Bodson, "Adaptive Control – Stability, Convergence and Robustness", Prentice Hall Englewood Cliffs, New Jersey, 1989.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01	✓											
C02			✓									
C03			✓									
C04			✓									

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	IV B.Tech. I Sem (7th semester)			
Course Code	**ADVANCED POWER ELECTRONIC CONVERTERS**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Power Electronics		**3**	**0**	**0**	**3**

Course Objectives:

The objectives of the course are to make the student learn about

1. To learn about the multi-level inverters.
2. To learn about the choppers.
3. To learn about the switched mode rectifiers.
4. To learn about the boost converters and resonant converters.

Course Outcomes:

After successful completion of the course, a successful student will be able to	
C01:	Analyze and design Load Commutated CSI and PWM CSI.
C02:	Demonstrate the working of series Inverters.
C03:	Recommend the Switched Mode Rectifiers and APFC for any application.
C04:	Explain the resonant mode converters and their operation and control.

Syllabus:

UNIT-I: Multi-Level Inverters

Multi-Level Inverters of Diode Clamped Type and Flying Capacitor Type and suitable modulation strategies - Multi-level inverters of Cascade Type Special Inverter Topologies - Current Source Inverter, Ideal Single Phase CSI operation, analysis and waveforms - Analysis of Single Phase Capacitor Commutated CSI, Series Inverters, Analysis of Series Inverters, Modified Series Inverter, Three Phase Series Inverter.

UNIT-II: Choppers

D.C. chopper circuits, Type-A, B, C, D and E configurations, Analysis of Type-A chopper with R-L load, Voltage and current commutated Choppers, AC Choppers, Application of AC and DC choppers.

UNIT-III: Switched Mode Rectifiers

Operation of Single/Three Phase bilateral Bridges in Rectifier Mode. Control Principles, Control of the DC Side Voltage, Voltage Control Loop, The inner Current Control Loop. Single phase and three phases boost type APFC and control, three phase utility interfaces and control.

UNIT-IV: Boost Converters

Single Phase and 3 Phase Boost type APFC - DCM, BCM, CCM design and control strategies, Single Phase and 3 Phase bidirectional converters in rectifier mode - control of DC voltage - control of Input Current. Hysteresis control in Single Phase and 3 Phase - Frequency control in hysteresis, Constant switching frequency control methods.

UNIT-V: Resonant Converters

Introduction to Resonant Converters, Classification of Resonant Converters, Basic Resonant Circuit Concepts, Load Resonant Converter. Resonant Switch Converter, Zero Voltage Switching Clamped Voltage Topologies, Resonant DC Link Inverters with Zero Voltage Switching, High Frequency Link Integral Half Cycle Converter, Resonant converters for induction heating.

Text Books:

1. Ned Mohan “Power electronics: converters, applications, and design” John Wiley and Sons, 2006.
2. Bin Wu , "High-Power Converters And Ac Drives", IEEE Press, A John Wiley & Sons, Inc., Publication
3. Rashid “Power Electronics” Prentice Hall India 2007.
4. G.K.Dubey “Thyristorised Power Controllers” Wiley Eastern Ltd., 2005, 06.

Reference Books:

1. Dewan & Straughen “Power Semiconductor Circuits” John Wiley & Sons., 1975.
2. G.K. Dubey & C.R. Kasaravada “Power Electronics & Drives” Tata McGraw Hill., 1993.
3. IETE Press Book Power Electronics Tata McGraw Hill, 2003.
4. Cyril W Lander “Power Electronics” McGraw Hill., 2005
5. B. K Bose “Modern Power Electronics and AC Drives” Pearson Education (Asia)., 2007
6. Abraham I Pressman “Switching Power Supply Design” McGraw Hill Publishing Company. 2001.
7. Daniel M Mitchell “DC-DC Switching Regulator Analysis” McGraw Hill Publishing Company.-1988.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], 4 : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01	✓											
C02			✓									
C03					✓							
C04					✓							

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	IV B.Tech. I Sem (7th semester)			
Course Code	**ELECTRICAL DISTRIBUTION SYSTEMS**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): TRANSIENTS POWER SYSTEMS II		**3**	**0**	**0**	**3**

Course Objectives:

The objectives of the course are to make the student learn about

1. To learn the basic concepts in distribution systems
2. To learn the design of substations and feeders
3. To learn the calculations of voltage drop in distribution lines
4. To learn the operation of various protective and coordinating equipment

Course Outcomes:

After successful completion of the course, a successful student will be able to	
C01:	Understand the various factors of distribution system.
C02:	Design the substation and feeders.
C03:	Determine the voltage drop and power loss.
CO4	Understand the operation of various protective and coordinating equipment

Syllabus:

UNIT-I: General Concepts

Introduction to distribution systems, Load modeling and characteristics – Coincidence factor – Contribution factor loss factor – Relationship between the load factor and loss factor – Classification of loads (Residential, commercial, Agricultural and Industrial) and their characteristics.

UNIT-II: Substations

Location of substations: Rating of distribution substation – Service area within primary feeders – Benefits derived through optimal location of substations.

Distribution Feeders: Design Considerations of distribution feeders**:** Radial and loop types of primary feeders – Voltage levels – Feeder loading – Basic design practice of the secondary distribution system. (CO2)

UNIT-III: System Analysis

Voltage drop and power–loss calculations**:** Derivation for voltage drop and power loss in lines – Manual methods of solution for radial networks – Three phase balanced primary lines.

UNIT-IV: Protection

Objectives of distribution system protection – Types of common faults and procedure for fault calculations – Protective devices: Principle of operation of fuses – Circuit reclosures – Line sectionalizes and circuit breakers.

Coordination: Coordination of protective devices: General coordination procedure, fuse-fuse, recloser-fuse, circuit breaker-fuse, circuit breaker-recloser, recloser-recloser

UNIT-V: Compensation for Power Factor Improvement

Capacitive compensation for power–factor control – Different types of power capacitors – shunt and series capacitors – Effect of shunt capacitors (Fixed and switched) – Power factor correction – Capacitor allocation – Economic justification – Procedure to determine the best capacitor location.

Voltage Control: Equipment for voltage control – Effect of series capacitors– Effect of AVB/AVR – Line drop compensation.

Text Books:

1. "Electric Power Distribution system, Engineering" – by Turan Gonen, McGraw–hill Book Company.

Reference Books:

1. Electrical Distribution Systems by Dale R. Patrick and Stephen W. Fardo, CRC press.
2. Electric Power Distribution – by A.S. Pabla, Tata McGraw–hill Publishing Company, 4th edition, 1997.
3. Electrical Power Distribution Systems by V. Kamaraju, Right Publishers.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], 4 : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01	✓											
C02			✓									
C03					✓							
C04	✓		✓									

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	IV B.Tech. I Sem (7th semester)			
Course Code	**FLEXIBLE ALTERNATING CURRENT TRANSMISSION SYSTEMS**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s):	Basic knowledge on transmission systems	**3**	**0**	**0**	**3**

Course Objectives:

The objectives of the course are to make the student learn about

1. To learn various types of FACTS controllers
2. To learn the operation of VSC and CSC
3. To learn about reactive power compensation methods
4. To learn combined controllers

Course Outcomes:

On Completion of the course, the students will be able to-	
C01:	Learn the basics of power flow control in transmission lines by using FACTS controllers.
C02:	Explain the operation and control of voltage source converter.
C03:	Discuss compensation methods to improve stability and reduce power oscillations in the transmission lines.
C04:	Learn the method of shunt compensation by using static VAR compensators.

Syllabus:

UNIT-I: Introduction to FACTS

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 – Requirements and characteristics of high power devices – Voltage and current rating – Losses and speed of switching – Parameter trade–off devices.

UNIT-II: Voltage Source and Current Source Converters

Concept of voltage source converter (VSC) – Single phase bridge converter – Square–wave voltage harmonics for a single–phase bridge converter – Three–phase full wave bridge converter– Three–phase current source converter – Comparison of current source converter with voltage source converter.

UNIT-III: Compensation Methods

Objectives of shunt compensation – Mid–point voltage regulation for line segmentation – End of line voltage support to prevent voltage instability – Improvement of transient stability – Power oscillation damping.

Methods of controllable VAR generation

Variable impedance type static VAR generators – Thyristor Controlled Reactor (TCR) and Thyristor Switched Reactor (TSR).

UNIT-IV: Shunt Compensators

Thyristor Switched Capacitor (TSC) – Thyristor controlled Reactor (TCR). Static VAR compensator (SVC) and Static Compensator (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: Series Compensators

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).

Combined Controllers: Schematic and basic operating principles of unified power flow controller (UPFC) and Interline power flow controller (IPFC).

Text Books:

1. "Understanding FACTS" N.G. Hingorani and L. Guygi, IEEE Press. Indian Edition is available:—Standard Publications, 2001.
2. "Flexible ac transmission system (FACTS)" Edited by Yong Hue Song and Allan T Johns, Institution of Electrical Engineers, London.

Reference Books:

1. Thyristor-based FACTS Controllers for Electrical Transmission Systems, by R. Mohan Mathur and Rajiv K. Varma, Wiley.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlafion)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01	✓											
C02			✓									
C03					✓							
C04					✓							

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	IV B.Tech. I Sem (7th semester)			
Course Code	**HVDC TRANSMISSION**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Power Electronics		3	0	0	3

Course Objectives:

The objectives of the course are to make the student learn about

1. To introduce students with the concept of HVDC Transmission system.
2. To familiarize the students with the HVDC converters and their control system.
3. To expose the students to the harmonics and faults occur in the system and their prevention.
4. To learn the control strategies used in HVDC transmission system

Course Outcomes:

After successful completion of this course, a student will be able to:	
C01:	Understand the advantages of DC transmission over ac transmission
C02:	Understand the operation of Line Commutated Converters and Voltage Source Converters.
C03:	Understand the control strategies used in HVDC transmission system.
C04:	Understand the improvement of power system stability using an HVDC system.

Syllabus:

UNIT 1: DC Transmission Technology:

Comparison of AC and DC Transmission (Economics, Technical Performance and Reliability). Application of DC Transmission. Types of HVDC Systems. Components of a HVDC system. Line Commutated Converter and Voltage Source Converter based systems.

Line Commutated Converters (LCCs): Six pulse converter, Analysis neglecting commutation overlap, harmonics, Twelve Pulse Converters. Inverter Operation. Effect of Commutation Overlap Expressions for average DC voltage, AC current, Reactive power absorbed by the converters. Effect of Commutation Failure, Misfire and Current Extinction in LCC links

UNIT 2: Analysis of Voltage Source Converters:

Voltage Source Converters (VSCs): Two and Three-level VSCs. PWM schemes: Selective Harmonic Elimination, Sinusoidal Pulse Width Modulation. Analysis of a six pulse converter. Equations in the rotating frame. Real and Reactive power control using a VSC.

UNIT 3: Control of HVDC Converters:

Principles of Link Control in a LCC HVDC system. Control Hierarchy, Firing Angle Controls –

Phase-Locked Loop, Current and Extinction Angle Control, Starting and Stopping of a Link. Higher level Controllers Power control, Frequency Control, Stability Controllers. Reactive Power Control. Principles of Link Control in a VSC HVDC system: Power flow and DC Voltage Control. Reactive Power Control/AC voltage regulation.

UNIT 4: Components of HVDC systems:
Smoothing Reactors, Reactive Power Sources and Filters in LCC HVDC systems DC line: Corona Effects. Insulators, Transient Over-voltages. DC line faults in LCC systems. DC line faults in VSC systems. DC breakers. Monopolar Operation. Ground Electrodes.

UNIT 5:Stability Enhancement using HVDC Control:
Basic Concepts: Power System Angular, Voltage and Frequency Stability. Power Modulation: basic principles – synchronous and asynchronous links. Voltage Stability Problem in AC/DC systems.

Text/References:

1. K. R. Padiyar, "HVDC Power Transmission Systems", New Age International Publishers, 2011.
2. J. Arrillaga, "High Voltage Direct Current Transmission", Peter Peregrinus Ltd., 1983.
3. E. W. Kimbark, "Direct Current Transmission", Vol.1, Wiley-Interscience, 1971.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01	✓								✓			
C02		✓							✓			
C03				✓								
C04					✓							

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	IV B.Tech. I Sem (7th semester)			
Course Code	**HIGH VOLTAGE ENGINEERING**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s):	Power Systems-II, Switchgear & Protection	3	0	0	3

Course Objectives:

The objectives of the course are to make the student learn about

1. To get a fair knowledge about the generation of high voltages and currents
2. Understand the generation and measurement of high voltages and currents.
3. Understand the concept of solid, liquid and gaseous dielectrics.
4. Gain knowledge in testing of high voltage equipments.

Course Outcomes:

After successful completion of this course, a student will be able to:	
C01:	Understand theory of breakdown and withstand phenomena of all types of dielectric Materials.
C02:	Acquaint with the techniques of generation of AC,DC and Impulse voltages
C03:	Know the techniques of testing various equipment‘s used in HV engineering.
C04	Transient voltages and their propagation characteristics

Syllabus:

UNIT–I

Introduction to High Voltage Technology: Electric Field Stresses – Uniform and non–uniform field configuration of electrodes – Estimation and control of electric Stress – Numerical methods for electric field computation.

UNIT–II

Break down phenomenon in gaseous, liquid and solid insulation: Gases as insulating media – Collision process – Ionization process – Townsend’s criteria of breakdown in gases – Paschen’s law – Liquid as Insulator – Pure and commercial liquids – Breakdown in pure and commercial liquid – Intrinsic breakdown – Electromechanical breakdown – Thermal breakdown –Breakdown of solid dielectrics in practice – Breakdown in composite dielectrics used in practice.

UNIT–III

Generation of High voltages and High currents: Generation of high DC voltages – Generation of high alternating voltages – Generation of impulse voltages – Generation of impulse currents – Tripping and control of impulse generators.

Measurement of high voltages and High currents: Measurement of high AC, DC and Impulse voltages – Voltages and measurement of high currents – Direct, alternating and Impulse.

UNIT–IV

Non–destructive testing of material and electrical apparatus: Measurement of DC resistivity – Measurement of dielectric constant and loss factor – Partial discharge measurements.

UNIT–V

High voltage testing of electrical apparatus: Testing of insulators and bushings – Testing of isolators and circuit breakers– Testing of cables – Testing of transformers – Testing of surge arresters – Radio interference measurements.

Text Books:

1. High Voltage Engineering by M.S.Naidu and V. Kamaraju – TMH Publications, 3rd Edition.
2. High Voltage Engineering : Fundamentals by E.Kuffel, W.S. Zaengl, J. Kuffel by Elsevier, 2nd Edition.
3. High Voltage Engineering and Technology by Ryan, IET Publishers.

Reference Books:

1. High Voltage Engineering by C.L.Wadhwa, New Age Internationals(P) Limited, 1997.
2. High Voltage Insulation Engineering by Ravindra Arora, Wolfgang Mosch, New.Age International (P) Limited, 1995.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01		✓								✓		
C02			✓								✓	
C03			✓									
C04			✓					✓				

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	IV B.Tech. I Sem (7th semester)			
Course Code	**INTELLECTUAL PROPERTY RIGHTS AND PATENTS**				
Teaching	Total contact hours - 32	L	T	P	C
Prerequisite(s):		2	0	0	0

Course Objectives:

The objectives of the course are to make the student learn about

1. To study the rights afforded by Copyright law
2. To study intellectual property law, issues related to paralegal tasks and cyber
3. To understand trademark and trade secret law, Registration process, Rights
4. To know patent law, application process, Rights and limitations

Course Outcomes:

On Completion of the course, the students will be able to-	
C01:	Examine the legal principles relating to IPR
C02:	Identify the various policies and procedures related to trademarks
C03:	Summarise the principles and subject matter of the copyright law.
C04:	Outline the various policies and procedures related to patents.

Syllabus:

UNIT I

Introduction to Intellectual Property Law – Evolutionary past – Intellectual Property Law Basics - Types of Intellectual Property - Innovations and Inventions of Trade related Intellectual Property Rights – Agencies Responsible for Intellectual Property Registration – Infringement - Regulatory – Over use or Misuse of Intellectual Property Rights - Compliance and Liability Issues.

UNIT II

Introduction to Copyrights – Principles of Copyright – Subject Matters of Copyright – Rights Afforded by Copyright Law –Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works –Rights of Distribution – Rights of performers – Copyright Formalities and Registration– Limitations – Infringement of Copyright – International Copyright Law- Semiconductor Chip Protection Act.

UNIT III

Introduction to Patent Law – Rights and Limitations – Rights under Patent Law – Patent Requirements – Ownership and Transfer – Patent Application Process and Granting of Patent –

Patent Infringement and Litigation – International Patent Law – Double Patenting – Patent Searching – Patent Cooperation Treaty – New developments in Patent Law- Invention Developers and Promoters.

UNIT IV

Introduction to Trade Mark – Trade Mark Registration Process – Post registration procedures – Trade Mark maintenance – Transfer of rights – Inter parties Proceedings – Infringement – Dilution of Ownership of Trade Mark – Likelihood of confusion – Trade Mark claims – Trade Marks Litigation – International Trade Mark Law.

UNIT V

Introduction to Trade Secrets – Maintaining Trade Secret – Physical Security– Employee Access Limitation – Employee Confidentiality Agreement –Trade Secret Law – Unfair Competition – Trade Secret Litigation – Breach of Contract – Applying State Law.

Introduction to Cyber Law – Information Technology Act - Cyber Crime and E-commerce – Data Security – Confidentiality – Privacy - International aspects of Computer and Online Crime

REFERENCE BOOKS:

1. Deborah E.Bouchoux: “Intellectual Property”. Cengage learning , New Delhi
2. Kompal Bansal &Parishit Bansal "Fundamentals of IPR for Engineers", BS Publications (Press)
3. Cyber Law. Texts & Cases, South-Western’s Special Topics Collections
4. PrabhuddhaGanguli: ‘ Intellectual Property Rights” Tata Mc-Graw – Hill, New Delhi
5. Richard Stim: "Intellectual Property", Cengage Learning, New Delhi.
6. R. Radha Krishnan, S. Balasubramanian: "Intellectual Property Rights", Excel Books. New Delhi.
7. M. Ashok Kumar and Mohd. Iqbal Ali: “Intellectual Property Right” Serials Pub.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01		✓								✓		
C02			✓								✓	
C03			✓									
C04				✓								

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	IV B.Tech. I Sem (7th semester)			
Course Code	**MODERN CONTROL THEORY**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Control Systems		**3**	**0**	**0**	**3**

Course Objectives:

The objectives of the course are to make the student learn about

1. To explain the concepts of basic and modern control system for the real time analysis and design of control systems.
2. To explain and apply concepts of state variables analysis.
3. To study and analyze non linear systems.
4. To analyze the concept of stability of nonlinear systems and categorization.

Course Outcomes:

After successful completion of the course, a successful student will be able to	
C01:	Understand the concepts of state variable analysis.
C02:	Apply the knowledge of basic and modern control system for the real time analysis and design of control systems.
C03:	Analyze the concept of stability of nonlinear systems and optimal control
C04	To understand and analyze non linear systems.

Syllabus:

UNIT-I: Mathematical Preliminaries

Fields, Vectors and Vector Spaces – Linear combinations and Bases – Linear Transformations and Matrices – Scalar Product and Norms – Eigen-values, Eigen Vectors and a Canonical form representation of Linear operators – The concept of state – State Equations for Dynamic systems – Time invariance and Linearity – Non-uniqueness of state model – State diagrams for Continuous-Time State models.

UNIT-II: State Variable Analysis

Linear Continuous time models for Physical systems– Existence and Uniqueness of Solutions to Continuous-Time State Equations – Solutions of Linear Time Invariant Continuous-Time State Equations – State transition matrix and its properties. General concept of controllability – General concept of Observability – Controllability tests for Continuous-Time Invariant Systems –

Observability tests for Continuous-Time Invariant Systems – Controllability and Observability of State Model in Jordan Canonical form – Controllability and Observability Canonical forms of State model.

UNIT-III: Non Linear Systems

Introduction – Non Linear Systems – Types of Non-Linearities – Saturation – Dead-Zone – Backlash – Jump Phenomenon etc;– Singular Points – Introduction to Linearization of nonlinear systems, Properties of Non-Linear systems – Describing function–describing function analysis of nonlinear systems – Stability analysis of Non-Linear systems through describing functions. Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, singular points, phase-plane analysis of nonlinear control systems.

UNIT-IV: Stability Analysis

Stability in the sense of Lyapunov, Lyapunov's stability, and Lypanov's instability theorems – Stability Analysis of the Linear continuous time invariant systems by Lyapunov second method Generation of Lyapunov functions – Variable gradient method – Krasooviski's method. State feedback controller design through Pole Assignment – State observers: Full order and Reduced order.

UNIT-V: Optimal Control

Introduction to optimal control – Formulation of optimal control problems – calculus of variations – fundamental concepts, functional, variation of functional – fundamental theorem of theorem of Calculus of variations – boundary conditions – constrained minimization – formulation using Hamiltonian method – Linear Quadratic regulator.

Text Books:

1. Modern Control System Theory by M. Gopal – New Age International -1984.
2. Control System Engineering, Nagrath and Gopal – New Age International – Fourth Edition

Reference Books:

1. Optimal control by Kirck, Dover Publications.
2. Advanced Control Theory A. Nagoor Kani, RBA Publications, 1999.
3. Modern Control Engineering by Ogata. K – Prentice Hall – 1997

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01	✓				✓							
C02			✓				✓					
C03									✓			
C04									✓			

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	IV B.Tech. I Sem (7th semester)			
Course Code	**INTERNSHIP/MINI PROJECT-II**				
Teaching	Total contact hours -	L	T	P	C
Prerequisite(s):		0	0	0	2

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	IV B.Tech. I Sem (7th semester)			
Course Code	**OPERATION OF RESTRUCTURED POWER SYSTEMS**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Power Systems		3	0	0	3

Course Objectives:

The objectives of the course are to make the student learn about

1. To study the need for restructuring of Power Systems, discuss different market models, different stakeholders and market power
2. To learn and generalize the functioning and planning activities of ISO.
3. To study about transmission open access pricing issues and congestion management.
4. To study ancillary services and understand reactive power as ancillary service and management through synchronous generator

Course Outcomes:

After successful completion of the course, a successful student will be able to	
C01:	Understand the need of restructuring of power systems and to discuss different markets
C02:	Understand the transfer capability issues and methodologies
C03:	Understand the electricity pricing and forecasting
CO4:	Understand the Ancillary services management

Syllabus

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

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

Unit - IV

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.

Unit - V

Ancillary Services Management: Introduction – Reactive power as an ancillary service – A review – Synchronous generators as ancillary service providers.

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.

References:

1. Loi Lei Lai; "Power system Restructuring and Deregulation", John Wiley & Sons Ltd., England.
2. http://nptel.iitm.ac.in

Web-Resources:

1. www.electrical4u.com
2. www.nptel.com

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01		✓										
C02		✓										
C03			✓									
C04			✓					✓				

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	IV B.Tech. I Sem (7th semester)			
Course Code	**POWER SYSTEMS LAB**				
Teaching	Total contact hours – 30	L	T	P	C
Prerequisite(s): Power Systems-II, Power System Analysis,(MAT LAB)		0	0	3	1.5

Course Objectives:

The objectives of the course are to make the student learn about

1. Analyze the performance of transmission lines and relays
2. Calculate the steady-state power flow in a power system.
3. Analyze different types of short-circuit faults which occur in power systems
4. Analyze Load frequency control of single area and Double area systems

Course Outcomes:

After successful completion of this course, a student will be able to:	
C01:	Understand the parameters of various types of transmission lines and to understand the performance of short, medium, long transmission lines.
C02:	Understand the effects of skin, proximity, Ferranti, corona effects on transmission lines
C03	Understand about Load frequency controls
C04	Understand about the different types of faults identification in transformers and alternators

All the experiments are to be done compulsory

1. Determination of Sequence impedances of three phase alternator by fault analysis
2. Determination of Sequence impedances of three phase transformer
3. Determination of ABCD parameters of Transmission line
4. Dielectric strength of Transformer oil.
5. Calibration of Tong Tester.
6. Load frequency control without controller
7. Load frequency control with controller
8. Load flow study using GS method
9. Economic load dispatch without considering losses
10. Economic load dispatch with considering losses
11. Determination of Sequence impedances of three phase alternator by direct method
12. Load flow study by Fast decoupled method
13. Active power control of synchronous machine connected to infinite bus
14. Reactive power control of synchronous machine connected to infinite bus
15. Voltage control by capacitor compensation and tap changing transformers

16. Study of corona phenomenon
17. Power Angle Characteristics of 3phase Alternator with infinite bus bars.
18 Comparison of different Load flow methods.
19. Economic load dispatch considering losses
20. Transient Stability Analysis

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01		✓								✓		
C02			✓								✓	
C03		✓								✓		
C04			✓								✓	

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	IV B.Tech. I Sem (7th semester)			
Course Code	**POWER SYSTEM OPERATION & CONTROL**				
Teaching	Total contact hours – 45	L	T	P	C
Prerequisite(s): Power System Analysis		3	0	0	3

Course Objectives:

The objectives of the course are to make the student learn about

1. Understand the solution methods of economic dispatch and static state estimation and explain the automatic generation control of a multi-area system;
2. Understand the solution methods of economic dispatch and static state estimation and explain the automatic generation control of a multi-area system;
3. Apply the Lagrange's method to the economic dispatch of thermal units;
4. Explain the automatic generation control and carry out a small-signal analysis of a multi-area system;

Course Outcomes:

After successful completion of this course, a student will be able to:	
C01:	Compute optimal scheduling of Generators
C02:	Understand hydrothermal scheduling
C03:	Understand importance of the frequency
C04:	Understand the automatic generation control and carry out a small signal analysis of multi area system

Syllabus:

UNIT–I

Economic Operation of Power Systems: Optimal operation of Generators in Thermal power stations, – Heat rate curve– Cost Curve – Incremental fuel and Production costs – Input–output characteristics – Optimum generation allocation with line losses neglected – Optimum generation allocation including the effect of transmission line losses – Loss Coefficients – General transmission line loss formula.

UNIT–II

Hydrothermal Scheduling: Optimal scheduling of Hydrothermal System**:** Hydroelectric power plant models – Scheduling problems – Short term Hydrothermal scheduling problem.

Unit Commitment: Optimal unit commitment problem – Need for unit commitment – Constraints in unit commitment – Cost function formulation – Solution methods – Priority ordering – Dynamic programming.

UNIT–III

Load Frequency Control (LFC): Modeling of steam turbine – Generator – Mathematical modeling of speed governing system – Transfer function – Modeling of Hydro turbine – Necessity of keeping frequency constant – Definitions of Control area – Single area control – Block diagram representation of an isolated power system – Steady state analysis – Dynamic response – Uncontrolled case – Load frequency control of two area system – Uncontrolled case and controlled case – Tie–line bias control.

UNIT–IV

Load Frequency Controllers: Proportional plus Integral control of single area and its block diagram representation – Steady state response – Load Frequency Control and Economic dispatch control.

UNIT–V

Reactive Power Control: Overview of Reactive Power control – Reactive Power compensation in transmission systems – Advantages and disadvantages of different types of compensating equipment for transmission systems – Load compensation – Specifications of load compensator – Uncompensated and compensated transmission lines**:** Shunt and series compensation – Need for FACTS controllers.

Text Books:

1. Electric Energy systems Theory – by O.I.Elgerd, Tata McGraw–hill Publishing Company Ltd., Second edition.
2. Power System stability & control, PrabhaKundur,TMH
3. Modern Power System Analysis – by I.J.Nagrath&D.P.Kothari Tata McGraw – Hill Publishing Company Ltd, 2nd edition.

Reference Books:

1. Power System Analysis and Design by J.Duncan Glover and M.S.Sarma, THOMPSON, 3rd Edition.
2. Power System Analysis by Grainger and Stevenson, Tata McGraw Hill.
3. Power System Analysis by HadiSaadat – TMH Edition.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01		✓										
C02			✓								✓	
C03		✓								✓		
C04			✓								✓	

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	IV B.Tech. I Sem (7th semester)			
Course Code	**ELECTRICAL SIMULATION LAB**				
Teaching	Total contact hours -30	L	T	P	C
Prerequisite(s): MAT LAB		0	0	3	1.5

Course Objectives:

The objectives of the course are to make the student learn about

1. To present a problem oriented knowledge of power system analysis methods.
2. To address the underlying concepts & approaches behind analysis of power system network using software tools.
3. To identify & formulate solutions to problems relevant to power system using software tools..
4. To understand Load flow studies

Course Outcomes:

After successful completion of this course, a student will be able to:	
C01:	simulate control systems & machine models
C02:	CO-2: simulate transmission line models
C03:	CO-3: perform transient analysis of RLC circuit and single machine connected to infinite bus
C04:	Simulate power electronic converters

All the experiments are to be done compulsorily

1. Simulation of step response of RLC circuits
2. Simulation of impulse response of RLC circuits
3. Simulation of transient response of RLC circuits to sinusoidal input
4. Plotting of Bode plots for the transfer functions of systems up to 5^{th} order
5. Plotting of root locus for the transfer functions of systems up to 5^{th} order
6. Plotting of nyquist plots for the transfer functions of systems up to 5^{th} order
7. Integrator circuit using op–amp.
8. Differentiator circuits using op–amp.
9. Simulation of separately excited DC motor using transfer function approach
10. Analysis of three phase circuit representing the generator transmission line and load.
11. Power system load flow using Newton–Raphson technique.
12. Modeling of transformer and simulation of lossy transmission line

13. Transient analysis of single machine connected to infinite bus (SMIB).
14. Simulation of three phase full converter with RL & RLE load
15. Simulation of Boost converter
16. Simulation of single phase inverter with PWM control
17. Simulation of single–phase full converter using RLE loads
18. Simulation of single phase AC voltage controller using RL loads.
19. Simulation of Buck converter
20. Modeling of transformer and simulation of lossless transmission line

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01		✓								✓		
C02			✓								✓	
C03		✓								✓		
C04			✓								✓	

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	IV B.Tech. I Sem (7th semester)			
Course Code	**WIND ENERGY SYSTEMS**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): RESS		**3**	**0**	**0**	**3**

Course Objectives:

The objectives of the course are to make the student learn about

1. To know the historical background of wind energy.
2. To learn the nature and characteristics of wind.
3. To learn the design of wind turbine blades.
4. To learn the design procedure of wind farms.
5. To learn various control strategies

Course Outcomes:

After successful completion of the course, a successful student will be able to	
C01:	Know the historical aspects of wind power plants.
C02:	Understand the characteristics of wind
C03:	Able to design wind turbine blades
C04:	Able to design wind farms

Syllabus:

UNIT-I: Introduction

Historical developments, latest developments, state of art of wind energy technology, turbine rating, cost of energy, wind power plant economics, installation and operation costs, decommissioning, Indian scenario and worldwide developments, present status and future trends.

UNIT-II: Nature and Characteristics of Wind

Nature of atmospheric winds; wind resource characteristics and assessment; anemometry; wind statistics; speed frequency distribution, effect of height, wind rose, Weibull distribution, atmospheric turbulence, gust wind speed, effect of topography.

UNIT-III: Design of Wind Turbine

Design of wind turbine blade; effect of stall and blade pitch on coefficient of power VS tip speed ratio and cut-out wind speeds, blade materials, design characteristics, multiple stream tube theory, vortex wake structure; tip losses; rotational sampling, wind turbine design programs, aerodynamic loads, tower shadow, wind shear, blade coning, gyroscopic, transient and extreme loads.

UNIT-IV: Control Strategies

Pitch control, yaw control, Electrical and Mechanical aerodynamic braking, teeter mechanism. Wind turbine dynamics with DC and AC generators: induction and synchronous generators, variable speed operation, effect of wind turbulence. Power electronics Converter and Inverter interfaces for wind energy utilization system for isolated and grid connected system.

UNIT-V: Design of Wind Farms

Wind farm electrical design, planning of wind farms, special application for developing countries, maintenance and operation, wind farm management, site selection. Environmental assessment; noise, visual impact etc. Instrumentation, data loggers, remote monitoring and control.

Text Books:

1. Paul Gipe, Wind Energy Comes of Age, John Wiley & Sons Inc.
2. Ahmed: Wind Energy Theory and Practice, PHI, Eastern Economy Edition, 2012.
3. L.L. Freris, Wind Energy Conversion System, Printice Hall

Reference Books:

1. Tony Burton et al, Wind energy Hand Book, John Wiley & Sons Inc.
2. Directory, Indian Wind Power 2004, CECL, Bhopal.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01	✓											
C02			✓									
C03					✓							
C04					✓							

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	IV B.Tech. II Sem (8th semester)			
Course Code	**ENERGY AUDIT, CONSERVATION & MANAGEMENT**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): MEFA, Mathematics		3	0	0	3

Course Objectives:

The objectives of the course are to make the student learn about

1. To provide students with a general awareness on the importance of energy and its conservation,
2. To provide students on its impact on society, various energy sources
3. To provide students on energy conversion processes, energy management
4. To provide energy audit and energy conservation measures.

Course Outcomes:

After successful completion of this course, a student will be able to:	
C01:	Understand the current energy scenario and importance of energy conservation.
C02:	Understand the concepts of energy management.
C03:	Understand the methods of improving energy efficiency in different electrical systems.
C04:	Understand the concepts of different energy efficient devices.

Syllabus:

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.

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)

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium] 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01	✓								✓			
C02			✓							✓		
C03			✓									
C04			✓									

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	IV B.Tech. II Sem (8th semester)			
Course Code	**ELECTRIC VEHICLES**				
Teaching	Total contact hours - 48	L	T	P	C
Prerequisite(s):		3	0	0	3

Course Objectives:

The objectives of the course are to make the student learn about

1. To present a comprehensive overview of Electric and Hybrid Electric Vehicles Syllabus.
2. Introduction to Hybrid Electric Vehicles, Conventional Vehicles, Hybrid Electric Drive-trains, Electric.
3. Propulsion unit, Configuration and control of DC Motor drives, Induction Motor drives, Permanent Magnet.
4. Motor drives, switched reluctance motor, Energy Storage Requirements in Hybrid and Electric Vehicles.

Course Outcomes:

After successful completion of the course, a successful student will be able to	
C01:	Choose a suitable drive scheme for developing an electric hybrid vehicle depending on resources.
C02:	Design and develop basic schemes of electric vehicles and hybrid electric vehicles
C03:	Choose proper energy storage systems for vehicle applications
C04:	Identify various communication protocols and technologies used in vehicle networks

Syllabus:

UNIT-I: Introduction to Hybrid Electric Vehicles

History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance.

UNIT-II: Hybrid Electric Drive-trains

Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis. Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

UNIT-III: Electric Propulsion unit

Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives.

UNIT-IV: Energy Storage

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Hybridization of different energy storage devices.

UNIT-V: Sizing the drive system

Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology.

Text Books:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.

Reference Books:

1. James Larminie, John Lowry, Electric Vehicle Technology Explained Wiley, 2003.

2. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01	✓											
C02			✓									
C03					✓							
C04					✓							

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	IV B.Tech. II Sem (8th semester)			
Course Code	**NON LINEAR CONTROL SYSTEMS**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Control Systems		3	0	0	3

Course Objectives:

The objectives of the course are to make the student learn about

1. To study about the behaviour of a nonlinear system and about Non linearities.
2. To describe Function Fundamentals &functions of common nonlinearities.
3. To study phase plane analysis.
4. To understand about liapunov stability theory.

Course Outcomes:

After successful completion of the course, a successful student will be able to	
C01:	To study about the behavior of a nonlinear system and about Non linearities.
C02:	To describe Function Fundamentals &functions of common nonlinearities.
C03:	To phase plane analysis.
C04:	To study about lyapunov stability theory.

Syllabus:

UNIT-I: INTRODUCTION

Nonlinear system behavior- Common Nonlinearities in control systems- Autonomy - Analysis and design methods of nonlinear control systems.

UNIT-II: DESCRIBING FUNCTION

Describing Function Fundamentals -Describing functions of common nonlinearities – Describing function analysis of nonlinear systems: Existence and stability of limit cycles - Dual input describing function for typical nonlinearities: Relay, hysteresis and polynomial type nonlinearity.

UNIT-III: PHASE PLANE ANALYSIS

Singular points - Construction of phase plane using Isocline, delta and Lienard's methods - Existence of Limit cycles: Poincare index and Bendixon theorems - Stability.

UNIT-IV: LYAPUNOV STABILITY THEORY

Concepts of Stability-Linearization and Local Stability-Lyapunov's Direct Method –Generation of Lyapunov functions: Krasovski's, Lure's and Variable Gradient Method- Popov's stability

criterion. Concepts of stability for non autonomous systems. Concepts of passivity formalism in linear systems.

UNIT-V: NONLINEAR CONTROL SYSTEMS DESIGN

Method of feedback linearization-Mathematical tools- Input-state linearization of SISO systems- Input-output linearization of SISO Systems- Basic concepts of variable structure systems - Sliding surfaces- Filippov's construction of equivalent dynamics- Conditions for existence of sliding regions – Case Study- Back stepping method for non-feedback linearizable systems.

Text Books:

1. Jean Jacques Slotine and Weiping Li, "Applied Nonlinear Control", Prentice Hall Inc., 1991.
2. Zoran Vukic, Ljubomir Kuljaca, Dali Donlagic and Sejid Tesnjak, "Nonlinear Control Systems", Marcel Dekker Inc, 2003.
3. Horacio J Marquez, "Nonlinear Control Systems: Analysis and Design", John Wiley & Sons Inc, 2003.

Reference Books:

1. Wilfrid Peruquetti and Jean Pierre Barabot, "Sliding Mode Control in Engineering", Marcel Dekker Inc, 2002.
2. Gopal M "Digital Control and State Variable Methods", Tata McGraw- Hill Ltd, New Delhi, 2003.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium] 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01		✓						✓				
C02			✓						✓			
C03			✓						✓			
C04				✓						✓		

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	IV B.Tech. II Sem (8th semester)			
Course Code	**POWER QUALITY**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s): Power systems		3	0	0	3

Course Objectives:

The objectives of the course are to make the student learn about

1. To impart knowledge about the power quality and its assessments.
2. To enable the students to understand how power quality studies are carried out in a distribution system.
3. To enable the students to understand the factors that causes the harmonics and their effect on the power system.
4. To understand the necessity of power quality and its importance in the power system

Course Outcomes:

After successful completion of this course, a student will be able to:	
C01:	Understand the concepts of power quality and voltage imperfections in power systems and power factor improvement
C02:	Know the concepts of harmonic distortion and distributed generation and power quality issues
C03:	Know the power quality monitoring and instrumentation, applications of intelligence systems
C04:	Proper assessment of power quality through different measurement techniques.

Syllabus:

UNIT–I

Introduction: Overview of power quality – Concern about the power quality – General classes of power quality and voltage quality problems – Transients – Long– duration voltage variations – Short–duration voltage variations – Voltage unbalance – Waveform distortion – Voltage fluctuation – Power frequency variations.

UNIT–II

Voltage imperfections in power systems: Power quality terms – Voltage sags – Voltage swells and interruptions –Sources of voltage sag, swell and interruptions – Nonlinear loads – IEEE and IEC standards. Source of transient over voltages – Principles of over voltage protection – Devices for over voltage protection – Utility capacitor switching transients.

UNIT–III

Voltage Regulation and power factor improvement: 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 resources – Flicker – Power factor penalty – Static VAR compensations for power factor improvement.

UNIT– IV

Harmonic distortion and solutions: Voltage distortion vs. Current distortion – Harmonics vs. Transients – Harmonic indices – Sources of harmonics – Effect of harmonic distortion – Impact of capacitors, transformers, motors and meters – Point of common coupling – Passive and active filtering – Numerical problems.

UNIT–V

Distributed Generation and Power Quality: Resurgence of distributed generation – DG technologies – Interface to the utility system – Power quality issues and operating conflicts – DG on low voltage distribution networks.

PQ Monitoring and Instrumentation: Power quality monitoring and considerations – Historical perspective of PQ measuring instruments – PQ measurement equipment – Assessment of PQ measuring data – Application of intelligent systems – PQ monitoring standards.

Textbooks:

1. Electrical Power Systems Quality, Dugan R C, McGranaghan M F, Santoso S, and Beaty H W, Second Edition, McGraw–Hill, 2012, 3rd edition.
2. Electric power quality problems –M.H.J. Bollen IEEE series-Wiley india publications, 2011.
3. Power Quality Primer, Kennedy B W, First Edition, McGraw–Hill, 2000.

Reference Books:

1. Understanding Power Quality Problems: Voltage Sags and Interruptions, Bollen M HJ, First Edition, IEEE Press; 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).

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium] 3: Substantial[High], '-' : No Correlation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01	✓			✓			✓			✓		
C02		✓			✓			✓			✓	
C03		✓			✓			✓			✓	
C04			✓			✓			✓			✓

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	IV B.Tech. II Sem (8th semester)			
Course Code	**PROJECT WORK**				
Teaching	Total contact hours -	L	T	P	C
Prerequisite(s		0	0	18	9

Regulation GRBT-19	Godavari Institute of Engineering & Technology (Autonomous)	IV B.Tech. II Sem (8th semester)			
Course Code	**SMART GRID**				
Teaching	Total contact hours - 45	L	T	P	C
Prerequisite(s):	Basic knowledge on grid operation	3	0	0	3

Course Objectives:

The objectives of the course are to make the student learn about

1. To understand the basic concepts, components and architecture of smart grid
2. To understand the various measurement technologies in smart grid
3. To educate the importance of renewable energy in smart
4. To brief about role of Electric Vehicles in smart grid

Course Outcomes:

After successful completion of this course, a student will be able to:	
C01:	Explain the smart grids components and architecture.
C02:	Describe different measuring methods and sensors used in smart grid
C03:	Summarize various renewable energy technologies.
C04:	Summarize the importance of Electric Vehicles in smart grid

Syllabus:

UNIT-I

The Smart Grid: Introduction, Ageing Assets and Lack of Circuit capacity, Thermal constraints, Operational constraints, security of supply, National Initiatives, Early smart grid initiatives, Active distribution networks, virtual power plant, Other Initiatives and Demonstrations, Overview of te Technologies Required for the smart grid.

UNIT-II

Communication Technologies: Introduction, Dedicated and shared communication channels, switching Techniques, Circuit Switching, Message Switching, Packet Switching, communication channels, wired communication, optical fiber, Radio communication, Cellular Mobile communication, Layered architecture and protocols, The ISO/OSI Model, TCP/IP IEEE 802 Series, Mobiles Communications, Multi protocol Label Switching, Power line communication, Standards for information Exchange, Standards for smart meteting, Modbus, DNP3, IEC61850.

UNIT-III

Information Security for the Smart Grid: Introduction, Encryption and Decryption, Symmetric key encryption, Public key Encryption, Authentication, Authentication based on shared secret key, Authentication based on key distribution center, digital signature, Secret key signature, Public key

signature, Message digest, Cyber Security standards, IEEE 1686: IEEE standard for substation intelligent Electronic Devices(IEDs) Cyber security capabilities, IEC 62351: power systems management and Association information exchange-data and communication security.

UNIT-IV

Smart Metering**:**Introduction, Smart metering- evolution of electricity metering, key components of smart metering, Smart meters: An Overview of the hardware used – signal acquisition, signal conditioning, analogue to digital conversion, computation, input/output and communication. Communication infrastructure and protocols for smart metering- Home area network, Neighborhood area network, data concentrator, meter management system, protocols for communication.

UNIT-V

Demand Side Integration- Services provided by DSI, Implementation of DSI, hardware support, Flexibility delivered by prosumers from the demand side, system support from DSI.

Transmission and Distribution Management Systems:Data sources, Energy management system, wide area Applications, Visualization Techniques, Data sources and Associated external systems, SCADA, customer information system, modeling and analysis Tools, distribution system modeling, Topology analysis, load forecasting, power flow analysis, Fault calculations, state estimation, applications, system monitoring, operation, management Outage management system, Energy storage technologies, Batteries, flow battery, Fuel cell and Hydrogen Electrolyser, Fly wheels, superconducting Magnetic energy storage systems, super capacitors.

Text Books:

1. Smart grid, Janaka Ekanayake, Liyanage, Wu, Akihiko yokoyama, Jenkins, Wiley publications, 2012.

Reference Books:

1. Smart Grid: Fundamentals of Design and Analysis, James Momoh, Wiley, IEEE Presss., 2012.

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	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO11	P012
C01										✓		
C02		✓									✓	
C03		✓			✓							
C04			✓			✓						