K.S.R.M. COLLEGE OF ENGINEERING

(UGC-AUTONOMOUS)

Kadapa, Andhra Pradesh, India– 516 005

Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu.

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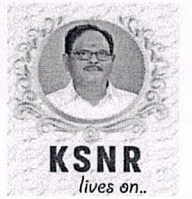

Department of Electrical and Electronics Engineering

BoS Meeting

Minutes of the Meeting

Date	17.12.2022	**Day**	Saturday
Time	11.00 AM to 1.30 PM	**Venue**	Virtual Meeting – Google Meet Link: https://meet.google.com/qgw-ssyw-dtf
Dept,	10th BoS Meeting of EEE Dept	**Convener**	Dr. M.S.Priyadarshini

Number of Participants: 13

S. No.	Name	Designation	Members	Signature	S. No.	Name	Designation	Members	Signature
1	Dr. M.S.Priyadarshini	Associate Professor & HoD	Chairman		8	Mr. P. Durga Prasad	Assistant Professor	Member	
2	Mr. M. Bhaskar Reddy	Associate Professor	Member		9	Mr. T. Kishore Kumar	Assistant Professor	Member	
3	Mr. K. Rama Mohan Reddy	Associate Professor	Member		10	Dr. N. Visali	Professor & HoD (JNTUACE, Ananthapuramu)	University Nominee	
4	Dr. T. Mariprasath	Associate Professor	Member		11	Dr. G. Yesuratnam	Professor & HoD, (Osmania University)	Subject Expert	
5	Dr. C. Kumar Reddy	Associate Professor	Member		12	Mr.J. Kumara Swamy	Manager, 765/400/220kv Digital GIS Substation, Surat, Gujarat	Industry Expert	
6	Mrs. Saleha Tabassum	Assistant Professor	Member		13	Dr. B. Pradeep Kumar	Tech Lead R&D, Pyrologics India Pvt Ltd, Chennai	Alumni Expert	
7	Mr. K. Kalyan Kumar	Assistant Professor	Member						

Minutes of the Meeting:

Dr. M.S.Priyadarshini welcomed all the members to the online meeting and presented the agenda of the 10th BoS meeting. The resolutions are:

S. No.	Item	Presenter and discussion	Resolution
1	Approval of B. Tech. (R20) – VII and VIII Semester Syllabus	HoD explained in detail B. Tech. (R20) VII Semester Structure Syllabus based on feedback from all stakeholders, action taken report and Department Review Committee to the BoS members and asked for approval and give their valuable suggestions.	In B. Tech (R20) VII syllabus, the following are the modifications: (i) BoS Members suggested to increase the number of Course Outcomes for few subjects. (ii) They suggested limiting textbooks to two and increasing the number of reference books. (iii) In the subject, 'Power Electronics For Renewable Energy Systems', BoS members suggested to add information in unit II about necessity of MPPT and different factors affecting PV Output.
2	To finalize and approve for new courses, Value added courses, Certification Courses, Skill Courses, Employability and Entrepreneurship courses	HoD explained details of Project work in VIII Semester based on feedback from all stakeholders, action taken report and Department Review Committee to the BoS members and asked for approval and give their valuable suggestions	(i) Industrial expert suggested to add latest information about Protocols used for Substation Automation System in the subject 'Industrial Automation and Control'. (ii) BoS members took clarification about skill advanced course in VII Semester and Internship and Project work in VIII Semester. They took information about the number of credits for Project work. (iii) Focus was laid on Professional Elective Courses and open Elective courses offered by department of EEE were approved in 9th BoS meeting.
3	Any other discussion with the permission of chair	The BoS members appreciated that new topics were introduced in the syllabus as per feedback from all stakeholders, action taken report and Department Review Committee	Structure and syllabus of R20 – UG VII and VIII Semesters was approved comprising of new courses, Value added courses, Certification Courses, Skill Courses, Internships, Employability and Entrepreneurship courses

Dr. M.S.Priyadarshini, HoD & BoS chairman of EEE department conveyed thanks to all internal and external BoS members for giving suggestions and inputs for B. Tech curriculum. As per the suggestions given through feedback obtained from all stakeholders, , action taken report, Department Review Committee and BoS members necessary modifications have been incorporated in the structure and syllabus of R20 – UG VII and VIII Semesters.

Convenor

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ESTD 1980

HOD EEE <hod.eee@ksrmce.ac.in>

10th BoS Minutes of Meeting and R20 UG VII and VIII Semesters Syllabus

HOD EEE <hod.eee@ksrmce.ac.in> 22 December 2022 at 11:58
To: nvisali@gmail.com, Yesuratnam Guduri <ratnamgy2003@gmail.com>, tgmanohar1973@rediffmail.com, Pradeep Kumar <pradeep301327@gmail.com>, jkswamy@powergrid.in
Cc: Bhaskar Reddy <mbreddyeee@ksrmce.ac.in>, Ramamohan Reddy K <ramamohanreddy@ksrmce.ac.in>, Saleha Tabassum <tabassum@ksrmce.ac.in>, Kalyan Kumar <kalyankumar@ksrmce.ac.in>, Kishore Kumar T <tkk@ksrmce.ac.in>, P Durga Prasad <durgaprasad@ksrmce.ac.in>, Kumar Reddy Cheepati <kumarreddy.c@ksrmce.ac.in>, Mariprasath Thenkaraimuth <mariprasath@ksrmce.ac.in>, "Dr. M S PRIYADARSHINI" <priyadarshini@ksrmce.ac.in>
Bcc: HOD EEE <hod.eee@ksrmce.ac.in>

Respected Sir/ Madam,

Greetings of the Day from K.S.R.M College of Engineering, Kadapa, A.P
I convey my sincere thanks to all **BoS members** for spending your valuable time in giving suggestions and inputs for B.Tech., (R20) VII and VIII Semesters Syllabus,

As per your recommendations, the changes have been done in the syllabus. The meeting minutes are enclosed herewith for your kind perusal.

I request you to kindly acknowledge the same.

Thanks & Regards

Dr. M.S.Priyadarshini M. Tech., Ph.D.,
Associate Professor & HOD,
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2 attachments

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VII & VIII Sem Syllabus KSRMCE R20 UG.docx
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VII Semester

S. No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	C R
1		Professional Elective Course - III							
	2002701	Power Quality	PEC	3	0	0	40	60	03
	2002702	Electric and Hybrid Vehicles	PEC	3	0	0	40	60	03
	2002703	Power System Reliability	PEC	3	0	0	40	60	03
2		Professional Elective Course - IV							
	2002704	Power Electronics For Renewable Energy Systems	PEC	3	0	0	40	60	03
	2002705	Electrical Distribution Systems	PEC	3	0	0	40	60	03
	2002706	Smart Grid	PEC	3	0	0	40	60	03
3		Professional Elective Course - V							
	2002707	Flexible AC Transmission Systems	PEC	3	0	0	40	60	03
	2002708	Industrial Automation & Control	PEC	3	0	0	40	60	03
	2002709	Distributed Generation & Micro Grid	PEC	3	0	0	40	60	03
4	20OExxx	Open Elective Course -III	OEC	3	0	0	40	60	03
5	20OExxx	Open Elective Course –IV	OEC	3	0	0	40	60	03
6	200670x	Humanities & Social Sciences Elective	HSMC	3	0	0	40	60	03
7	2002710	Internship	PROJ	0	0	0	100	---	03
8	2002711	Skill Advanced Course	SC	1	0	2	40	60	02
Total				19	00	02	380	420	23

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VIII Semester

S. No.	Subject Code	SUBJECT	SC	L	T	P	IM	E M	CR
1	2002801	Project Work	PR OJ	0	0	-	40	60	12
		Internship in Industry							
Total							40	60	12

B. Tech., VII Semester

Course Title	POWER QUALITY (PEC – III)				B. Tech. VII-Semester		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2002701	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs					End Exam Duration : 3 Hrs		

Course Objectives: The student is able to learn the power quality issues, voltage disturbances, power transients, concept of harmonics and their effect in power system equipment, measuring and monitoring concepts of power quality.

On successful completion of this course, the students will be able to

CO 1	Understand the different power quality problems in the power system.
CO 2	Understand the effect of harmonics in the system and the equipment
CO 3	Examine the voltage variations and over voltage transients and conventional devices for voltage regulations in the system
CO 4	Analyze the concepts on measuring and monitoring issues of quality

UNIT-I

Introduction: Definition of Power Quality- Power Quality Terminology – Classification of Power Quality Issues-Magnitude Versus Duration Plot - Power Quality Standards (IEEE & IEC) - Responsibilities of The Suppliers and Users of Electric Power-CBEMA and ITIC Curves.

UNIT-II

Transients, Short Duration and Long Duration Variations: Categories and Characteristics of Electromagnetic Phenomena in Power Systems-Impulsive and Oscillatory Transients-Interruption - Sag-Swell-Sustained Interruption - Under Voltage – Over Voltage–Outage. Sources of Different Power Quality Disturbances- Principles of Regulating the Voltage- Conventional Devices for Voltage Regulation.

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UNIT-III

Fundamentals of Harmonics : Harmonic Distortion, Voltage Versus Current Distortion, Harmonics Versus Transients, Power System Quality Under Non Sinusoidal Conditions, Harmonic Indices, Harmonic Sources From Commercial Loads, Harmonic Sources From Industrial Loads.

UNIT-IV

Power Quality Monitoring: Power Quality Benchmarking-Monitoring Considerations- Choosing Monitoring Locations- Permanent Power Quality Monitoring Equipment-Historical Perspective of Power Quality Measuring Instruments- Power Quality Measurement Equipment-Types of Instruments- Assessment of Power Quality Measurement Data- Power Quality Monitoring Standards.

UNIT-V

Power Quality Enhancement Using Custom Power Devices: Introduction to Custom Power Devices-Network Reconfiguring Type: Solid State Current Limiter (SSCL)-Solid State Breaker (SSB) -Solid State Transfer Switch (SSTS) - Compensating Type: Dynamic Voltage Restorer (DVR)-Unified Power Quality Conditioner (UPQC)-Principle of Operation Only.

Text Books

1 Electrical Power Systems Quality, Roger C. Dugan, Mark F. McGranaghan, Surya Santoso, H. Wayne Beaty, 2nd Edition, TMH Education Pvt. Ltd., 2008.

2 Power quality, C. Sankaran, CRC Press, 2002.

Reference Books

1 Understanding Power quality problems, Math H. J. Bollen IEEE Press, 2007.

2 Power quality enhancement using custom power devices, Arindam Ghosh, Gerard Ledwich, Kluwer academic publishers, 2002.

3 Fundamentals of Electric Power Quality, Surya Santoso, Create Space, 2010.

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Course Title	Electric & Hybrid Vehicles (PEC-III)				B. Tech. VII Semester		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2002702	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration : 2Hrs					End Exam Duration : 3Hrs			

Course Objectives: The main objective of the course is to learn upcoming technology of hybrid systems, different aspects of drives application & electric traction.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand electric drive in vehicles / traction
CO 2	Evaluate energy efficiency of the vehicle for its drive trains
CO 3	Analyze and design of hybrid and electric vehicles
CO 4	Acquire knowledge about fundamental concepts, principles of hybrid and electric vehicles

-UNIT - I

Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics and mathematical models to describe vehicle performance.

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.

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, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switched Reluctance Motor drives, drive system efficiency.

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, Super

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Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

UNIT - V

Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

Text Books

1 Hybrid Electric Vehicles: Principles and applications with Practical Perspectives by C. Mi, M. A. Masrur and D. W. Gao, John Wiley & Sons, 2011.

2 Hybrid Electric Vehicles: Energy Management Strategies by S. Onori, L. Serrao and G. Rizzoni, Springer, 2015.

Reference Books

1 Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design by Ehsani, Gao, Gay, Emadi, 2005 by CRC Press.

2 Electric and Hybrid Vehicles by T. Denton, Routledge, 2016.

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Course Title	Power System Reliability (PEC – III)				B. Tech. VII Semester		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2002703	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3Hrs		

Course Objectives: The objective of the course is to learn the basic reliability concepts, density and distribution functions, random variables and networks, reliability functions and time dependent reliability evaluation of different networks, Markov modeling and component repairable models for frequency and duration and reliability applications to generation, transmission and distribution systems.

On successful completion of this course, the students will be able to

CO 1	Understand the basic reliability concepts, density and distribution functions and network modeling.
CO 2	Apply different reliability functions and time dependent reliability evaluation for different networks.
CO 3	Understand the concepts of markov modeling and component repairable models for frequency and duration techniques
CO 4	Apply various reliability fundamental techniques to power systems.

UNIT I

Basic probability theory: Introduction-rules for combining probabilities of events, Bernoulli's trials, Probability Density and Distribution Functions, Binomial Distribution- Expected Value and Standard Deviation, Problems.

Network Reliability: Analysis of Series, Parallel, Series – Parallel Networks, Complex Networks – Decomposition Method, Problems

UNIT II

Reliability Functions: Functions – f(t), R(t), F(t), h(t) and their relationships – Exponential Distribution – Expected Value and Standard Deviation – Reliability Analysis of Series – parallel Networks using Exponential Distribution, Problems, Bath – tub Curve – Reliability Measures. MTTF, MTTR, MTBF.

UNIT III

Markov Modeling

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Discrete Markov Chains – Concept of STPM, Evaluations of Limiting State Probabilities, Problems.

Continuous Markov Process: Single component repairable model – Time Dependent Probabilities - Evaluation by using Laplace Transform and STPM Approach – Two Component Reliability Models - evaluation of LSP's using STPM Approach.

Frequency and Duration Concept: Evaluation of Frequency of Encountering State, Mean Cycle Time for One and Two Component Repairable Models.

Evaluation of Cumulative Probability and Cumulative Frequency of Encountering of Merged States, Problems

UNIT IV

Generation System Reliability Analysis: Reliability Model of a Generation System, Recursive Relation for Unit Addition and Removal, Load Modeling, Problems.

Two-level representation of daily load, Merging of Generation with Load Model – Evaluation of Transition Rates for Merged State Model - LOLP, LOLE, Problems.

UNIT V

Composite System Reliability Analysis: System and Load Point Reliability Indices, Weather Effects on Transmission Lines - Weighted Average Rate and Markov Model.

Distribution System Reliability Analysis: Basic Reliability Indices for Radial Networks, Performance Indices - Customer Oriented, Load and Energy Oriented Indices, problems

Text Books:

1 Reliability Evaluation of Engg. System – R. Billinton, R. N. Allan, Plenum Press, New York, Reprinted in India by B. S. Publications, 2006.

2 Reliability Evaluation of Power Systems – R. Billinton, R. N. Allan, Plenum Press, New York, Reprinted in India by B. S. Publications, 2006.

Reference Books

1 System Reliability Concepts by V. Sankar, Himalaya Publishing House, 2015.

2 Reliability Engineering by E. Balagurusamy, Tata McGraw Hill, 2003.

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Course Title	Power Electronics For Renewable Energy Systems (PEC – IV)				B. Tech. VII Semester		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2002704	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3 Hrs		

Course Objectives:

- To create awareness on various non-conventional energy sources
- To understand role of power converters for solar PV systems
- To gain knowledge on wind energy conversion systems
- To know the grid connection and its issues
- To attain knowledge on importance of hybrid power systems

On successful completion of this course, the students will be able to

CO 1	Understand the various Non-Conventional sources of energy
CO 2	Acquire knowledge on various power converters for Solar energy system
CO 3	analyze the Power converter utilized by the wind energy conversion system
CO 4	Understand the concepts of grid connection and its issues.
CO 5	Recognize the hybrid operation of wind and PV systems and features of MPPT tracking

UNIT I

INTRODUCTION TO RENEWABLE ENERGY RESOURCES

World and Indian energy scenario - Wind, Solar, Hydro, and Geothermal: Availability and Power extraction - Environmental impacts of Renewable energy sources.

UNIT II

POWER CONVERTERS FOR SOLAR PV SYSTEM

Solar Photovoltaic System – P-V and I-V Characteristics –Different factors affecting PV output- Necessity of MPPT's- different types of MPPT- Buck, Boost, buck-boost converters - Isolated and Non isolated converters -Standalone PV system – Solar PV system calculation for specific applications- Battery Charging- Charge Controllers

UNIT III

POWER CONVERTERS FOR WIND ENERGY SYSTEM

Wind Energy Conversion System - Power Converters for Wind: AC voltage Controller - Matrix converter – Bi directional converter- flyback converter - Standalone operation of fixed and variable speed wind energy conversion systems - Static Kramer Drive for DFIG – Static Scherbius using cycloconverters for DFIG – Rating of Converter for WECS

UNIT IV

GRID CONNECTED SYSTEM

Grid interface - Grid connection issues: leakage current, Islanding, harmonics, Active / reactive Power feeding, unbalance Grid Interactive inverter: Line Commutated Inverter – Self Commutated Inverter – Selection of inverter – Rating of Inverters for Grid connected System.

UNIT V

HYBRID ENERGY SYSTEM

Need for hybrid systems- Range and type of Hybrid systems- Case studies of Wind and PV system – PV-Diesel System – Wind-Diesel Hybrid System – Energy Storage Devices for Hybrid Energy System - Maximum Power Point Tracking (MPPT) - MPPT schemes.

TEXT BOOKS

1. Sudipta Chakraborty, Marcelo G. Simes, and William E. Kramer, "Power Electronics for Renewable and Distributed Energy Systems: A Sourcebook of Topologies, Control and Integration", Springer Science & Business, 2013.

2. Nicola Femia, Giovanni Petrone, Giovanni Spagnuolo, Massimo Vitelli, "Power Electronics and control for maximum Energy Harvesting in Photovoltaic Systems", CRC Press, 2013.

REFERENCES

1. Rashid .M. H "Power electronics Hand book", Academic press, 2001.

2. Ion Boldea, "Variable speed generators", Taylor & Francis group, 2006.

3. Rai. G.D, "Non conventional energy sources", Khanna publishes, 2009.

4. Gray, L. Johnson, "Wind energy system", Prentice Hall INC, 1995. 5. B.H.Khan, "Non-conventional Energy sources", Tata McGraw-Hill Publishing Company, New Delhi, 2017.

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Course Title	Electrical Distribution Systems (PEC – IV)				B. Tech. VII Semester		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2002705	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3Hrs		

Course Objectives: The student is able to learn load modeling characteristics, classification of distribution systems and various substations, improvement of power factor in substations and distribution automation

On successful completion of this course, the students will be able to

CO 1	Understand The Concept of Load Characteristics, SCADA, Distribution Automation Systems
CO 2	Classify Various Loads In Distribution Systems And Substations
CO 3	Estimate Voltage and Current In Feeders
CO 4	Analyze Distribution Feeder Configurations, Bus bar Arrangements In Substations
CO 5	Analyze Voltage Drop and Power Loss Calculations for Radial Networks and Power Factor Improvement

UNIT- I

Load Modeling and Characteristics: 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

Classification of Distribution Systems: Classification of Distribution Systems - Comparison of DC Vs AC–comparison of Under-Ground Vs Over - Head Distribution Systems- Requirements and Design Features of Distribution Systems-

Design Considerations of Distribution Feeders: Radial and Loop Types of Primary Feeders,- Voltage Levels, Feeder Loading, Basic Design Practice of the Secondary Distribution System.

Voltage Drop & Current Calculations (Numerical Problems) in D.C. Distributors.

UNIT-III

Substations: Location of Substations, Rating of Distribution Substation, Service Area within Primary Feeders. Benefits Derived Through Optimal Location of Substations.

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Classification of Substations: Air Insulated & Gas insulated Substations, Substation Layouts and functioning of different components of the substations, Merits & Demerits of GIS over AIS, Busbar arrangements in the Sub-Stations with Relevant Diagrams.

UNIT-IV

Power Factor Improvement: 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.

Causes of Low P. F -Methods of Improving P. F -Phase Advancing and Generation of Reactive KVAR Using Static Capacitors-Most Economical P.F. for Constant KW Load and Constant KVA Type Loads, Numerical Problems.

UNIT-V

Distribution Automation: Distribution Automation (DA) – Project Planning – Definitions – Communication – Sensors – Supervisory Control and Data Acquisition (SCADA) – Consumer Information Service (CIS) – Geographical Information System (GIS) – Automatic Meter Reading (AMR) – Automation Systems.

Text Books

1 Electric Power Distribution System, Engineering by Turan Gonen, Mc Graw-hill Book Company, 1986.

2 Electric Power Distribution by A. S. Pabla, Tata Mc Graw-hill Publishing Company, 4th edition, 1997.

Reference Books

1 Electrical Power Distribution Systems by V. Kamaraju, Jain Book Depot. 2012.

2 HandBook of Electric Power Distribution by G. Ramamurthy, 2nd Edition, Universities Press, 2009.

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Course Title	Smart Grid (PEC – IV)				B. Tech. VII-Semester		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2002706	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3Hrs		

Course Objectives: The student is able to learn fundamentals, Architecture and analysis of smart grid with communication, networking and measuring technologies involved in it.

On successful completion of this course, the students will be able to

CO 1	Understand the features, fundamental components and architecture of smart grid
CO 2	Explain information, communication and networking technologies involved with the smart grid
CO 3	Explain operation and importance of PMU, WAMPS and smart storage systems in smart grid
CO 4	Analyze Microgrid with various concepts and challenges in future

UNIT-1

Introduction to Smart Grid: Working definitions of Smart Grid and Associated Concepts – Need of Smart Grid – Smart Grid Functions – Opportunities & Barriers of Smart Grid - Conventional Power Grid and Smart Grid -Concept of Resilient & Self-Healing Grid.

UNIT-II

Smart Grid Architecture: Components and Architecture of Smart Grid – Review of Proposed Architectures for Smart Grid – The Fundamental Component of Smart Grid Designs – Transmission Automation – Distribution Automation –Renewable Integration.

UNIT-III

Information and Communication Technology: Smart sensors, Wired and wireless communication Technology, Network Structures (**HAN, LAN, NAN, WAN**), Introduction to Smart Meters – Advanced Metering Infrastructure (AMI).

UNIT-IV

Smart Grid Technologies: Geographic Information System (GIS) - Intelligent Electronic Devices (IED) - Smart storage like Battery- SMES - Pumped Hydro - Compressed Air Energy Storage - Wide Area Measurement System (WAMS) – SCADA - Phasor Measurement Unit (PMU).

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UINT – V

Micro grids and Distributed Energy Resources: Concept of micro grid, need & application of micro grid, formation of micro grid, Issues of interconnection, protection & control of micro grid, Plastic & Organic solar cells, thin film solar cells, Variable speed wind generators, and fuel cells.

Text Books

1 Janaka Ekanayake, Kithsir iLiyanage, Jian zhong. Wu, Akihiko Yokoyama, Nick Jenkins, "Smart Grid: Technology and Applications"- Wiley, 2012.

2 Stuart Borlase, Smart Grids, Infrastructure, Technology and Solutions, CRC Press, 1e, 2013.

Reference Books

1 James Northcote, Green, Robert G. Wilson "Control and Automation of Electric Power Distribution Systems (Power Engineering)", CRC Press.

2 Andres Carvallo, John Cooper, "The Advanced Smart Grid: Edge Power Driving Sustainability", Artech House Publishers July 2011.

3 Clark W Gellings, "The Smart Grid, Enabling Energy Efficiency and Demand Side Response"- CRC Press, 2009.

4 James Momoh, "Smart Grid: Fundamentals of Design and Analysis"- Wiley, IEEE Press, 2012.

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Course Title	Flexible AC Transmission Systems (PEC – V)				B. Tech. VII Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
2002707	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2Hrs						End Exam Duration : 3Hrs		

Course Objectives: The objective of the course is to learn the fundamentals of FACTS controllers, types of FACTS controllers, voltage source converters, shunt and series compensation, control of STATCOM and SVC.

On successful completion of this course, the students will be able to

CO 1	Understand the operating principles of various FACTS devices.
CO 2	Choose proper controllers for specific application based on system requirement
CO 3	Understand the importance of compensation methods in power system network
CO 4	Analyze the role of SVC & STATCOM in improving the power system dynamics.
CO 5	Analyze the use of control schemes of TCSC, TSSC, GSC in improving the power quality

UNIT - I

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

UNIT - II

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

UNIT - III

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

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UNIT - IV

Static VAR Compensator(SVC) and Static Synchronous Compensation(STATCOM): The regulation and slope transfer function and dynamic performance, transient stability enhancement and power oscillation damping operating point control and summary of compensator control.

UNIT - V

Static Series Compensators: concept of series capacitive compensation, improvement of transient stability, power oscillation damping.

Functional requirements, GTO thyristor controlled Series Capacitors (GSC), Thyristor Switched Series Capacitor (TSSC) and Thyristor Controlled Series Capacitor (TCSC) control schemes for GSC, TSSC and TCSC.

Text Book

1 Concepts and Technology of Flexible AC Transmission Systems-Understanding FACTS by Narain G. Hingorani and Laszlo Gyugyi, Standard Publishers Distributors, IEEE Press Publications, 1st Edition, 2001.

2 FACTS Controllers in Power Transmission & Distribution by K. R. Padiyaar, New Academic Science Publishers, 2020.

Reference Books

1 Thyristor based FACTS Controllers for Electrical Transmission Systems by R. Mohan Mathur, Rajiv K. Varma, IEEE Press Series on Power Engineering, 2002.

2 Flexible AC Transmission Systems by Yong Hua Song and Alln T Johns, The Institute of Electrical Engineers, London, UK, 1999.

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Course Title	Industrial Automation & Control (PEC – V)					B. Tech. VII Semester		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2002708	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3Hrs		

Course Objectives: The student is able to learn Automation is playing a key role in Industries. Industries rely heavily on automation for economic viability and mass production. It is important for the students to learn the basics of automation, how systems work and the importance of PLC, SCADA and robots in automation. This course will provide an opportunity to learn industrial automation techniques.

On successful completion of this course, the students will be able to

CO 1	Understand various automation components and systems
CO 2	Draw block diagram of industrial automation and control system
CO 3	Explain architecture of industrial automation system
CO 4	Measure industrial parameters like temperature, pressure, force, displacement, speed, flow, level, humidity and pH.

UNIT – I

Introduction: Automation overview, Requirement of automation systems, Architecture of Industrial Automation system, Introduction of PLC and supervisory control and data acquisition (SCADA)-Types of Protocols-Substation automation system IEC61850 protocol-Process bus based Substation automation system

UNIT - II

Automation components: Sensors for temperature, pressure, force, displacement, speed, flow, level, humidity and pH measurement. Actuators, process control valves, power electronics devices DIAC, TRIAC, power MOSFET and IGBT. Introduction of DC and AC servo drives for motion control.

UNIT – III

Computer aided measurement and control systems: Role of computers in measurement and control, Elements of computer aided measurement and control, man-machine interface, computer aided process control hardware, process related interfaces, Communication and networking, Industrial communication systems, Data transfer techniques, Computer aided process control software, Computer based data acquisition system, Internet of things (IoT) for plant automation

UNIT –IV

Programmable logic controllers: Programmable controllers, Programmable logic controllers, Analog digital input and output modules, PLC programming, Ladder diagram, Sequential flow chart, PLC Communication and networking, PLC selection, PLC Installation, Advantage of using PLC for Industrial automation, Application of PLC to process control industries.

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UNIT – V

Distributed Control System: Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS.

Text Books

1 Industrial Instrumentation and Control By. S.K. Singh The McGraw Hill Companies

2 Process Control Instrumentation Technology By. C.D. Johnson, PHI

Reference Books

1 Groover, Mikell. P: Automation, Production systems and Computer integrated Manufacturing –Prentice hall India-2004.

2 Mark W Spong& M Vidyasagar: Robot Dynamics and Control, John Wiley & Sons, 1989

3 Robert J Schilling: Fundamentals of Robotics, Analysis and Control. Printice Hall of India 1996

4 R.K. Mittal and I.J. Nagarath: Robotics and Control, TMH-2003.

5 Industrial Instrumentation, Control and Automation, S. Mukhopadhyay, S. Sen and A.K. Deb, Jaico Publishing House, 2013

6 Programmable logic controller, Dunning, Delmar

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Course Title	Distributed Generation & Micro Grid (PEC – V)				B. Tech. VII Semester		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2002709	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3Hrs		

Course Objectives: The student is able to learn about different distributed generations, energy storage devices and Micro grid systems and Understanding the concepts of system development and relevant issues.

On successful completion of this course, the students will be able to

CO 1	Understand the synchronization and other distributing resources such as energy storage and fuel cell
CO 2	Understanding of the microgrid types and configurations
CO 3	Applications of power electronics in Micro grid and acquire the knowledge of multifunction grid connected converters
CO 4	Analyze the various types of control in micro grid in islanded and grid connected operation

UNIT - I

Introduction to Distributed Generation: DG Units - Micro turbines, reciprocating engines, wind generators, photovoltaic generators, fuel cells, biomass, and tidal sources - Need for Distributed generation, renewable sources in distributed generation, current scenario in Distributed Generation, Planning of DGs – Sitting and sizing of DGs – optimal placement of DG sources in distribution systems.

UNIT - II

Grid integration of DGs: Synchronization - Different types of interfaces - Inverter based DGs and rotating machine based interfaces - Aggregation of multiple DG units - Distributed resources to electric power systems: IEEE 1547. Energy storage elements: Batteries, ultra-capacitors, flywheels.

UNIT - III

Economics and Regulatory Aspects of DGs: Selection of sources, regulatory standards/ framework, Standards for interconnecting DG installation classes, security issues in DG implementations. Economic and control aspects of DGs –Market facts, issues and challenges - Limitations of DGs.

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UNIT - IV

Introduction to Micro grid: Micro grid Configurations – CERTS Microgrid Test Bed – DC Micro grid- HFAC Micro grid –LFAC – Micro grid – Hybrid DC- and AC- Coupled Micro grid.

Power Electronics in Micro grid: Power Electronics based Microgrid - Grid Connected Mode – Islanded mode – Battery Charging mode – design of parallel inverters – Microgrid application - Brick Busses Software Framework.

UNIT - V

Control in Micro grid: Impact of load characteristics – Local control – Centralized Control- Decentralized Control Microgrid control for island operation – PQ Control - Droop control methods – Frequency/Voltage Control – Control of Inverter Output Impedance.

Text Books

1 N. Jenkins, J.B. Ekanayake and G. Strbac, 'Distributed Generation', IET Press, 2010.

2 Nikos Hatziargyiou, "Micro grids: Architectures and Control", Wiley-IEEE Press, December 2013.

Reference Books

1 Suleiman M. Sharkh, Mohammad A. Abu-Sara, Georgios I. Orfanoudakis, Babar Hussai, "Power Electronic Converters for Microgrid" , Wiley-IEEE Press, 2014.

2 S. Chowdhury, S. P. Chowdury and Peter Crossley," Microgrids and Active Distribution Networks" ISBN978-1-84919-014-5, IET renewable Energy series, 2009.

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Course Title	HUMAN RESOURCE DEVELOPMENT				B.Tech. VI Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2006701	Humanities & Social Sciences Elective (HSMC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2Hrs						External Exam Duration: 3Hrs		

Course Objectives: The main objective of the course is to learn

- To develop capability of all individuals working in an organization in relation to their present role
- To develop team spirit.
- To develop co-ordination among different units of an organization.
- To develop organization health by continuous reveal of individual capability keeping peace with the technological changes.
- To develop better interpersonal & employer-employee relationships in an organization.

Course Outcomes: On success Completion This course, the students will be able to

CO1	To understand key functions in management as applied in practice.
CO2	To understand in more specific management related areas from planning till controlling.
CO3	To understand about the authority and responsibility, and different organizational structure..
CO4	To understand about the role of leadership, motivation and communication in an organization.
CO5	To understand the importance of globalization and diversity in modern organizations.

Unit I

Introduction to Human Resource Development: Meaning, significance and objectives of Human Resource Development, Human Resource Management and Human Resource development functions, Human Resource Development challenges

Unit II

HRD Need Assessment & Designing of HRD programs: Strategic/ Organizational Analysis- Task Analysis- Person Analysis- prioritizing HRD needs, defining the objectives of HRD Intervention - Selecting the trainer - Selecting the Training methods - Preparing training material Scheduling an HRD program

Unit III

Implementation &Evaluation of HRD programs: Training methods - Classroom training Approaches - Computer based Training, Purpose of HRD Evaluation- Kirkpatrick's evaluation frame work - Data collection for HRD Evaluation - Assessing the impact of HRD programs in Monetary Terms

Unit IV

Career Management and Development: Introduction to Career management, meaning - Stages of life and Career Development - process of career Development - Issues in career development.

Unit V

HRD & Diversity: Introduction – Organizational culture – Labor Market changes and discrimination adapting to demographic changes

Text books:

1 Jon M Werner,Randy L DeSimone: Human Resource development (Thomson/Cengage)

2 Raymond A Noe: Employee Trainee Development (Tata McGraw Hill)

3 Dr. D.K Bhattacharya, Himalaya Publishing House

References:

1 John P. Wilson Human Resource Development (Kogan Page Business Books)

2 Tripathi P.C : Human Resource Development (Sultan Chand & Sons)

3 Uday Kumar Haldar : Human Resource Development (Oxford)

Course Title	Internship				B. Tech. VII Semester		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2002710	Internship (PROJ)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	0	1.5	100	00	100

Course Objectives: The main objective of the course is to learn

- Develop and improve business skills in communication, technology, quantitative reasoning, and teamwork
- Observe and participate in business operations and decision-making
- Meet professional role models and potential mentors who can provide guidance, feedback, and support

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Assess interests and abilities in their field of study and Integrate theory and practice
CO 2	Develop communication, interpersonal and other critical skills in the job interview process
CO 3	Acquire employment contacts leading directly to a full-time job following graduation from college
CO 4	Identify and carry out performance objectives related to their job assignment

Course Title	Skill Advanced Course (Introduction to Machine Learning using Python)				B. Tech. EEE VII Sem		
Course Code	Category	Hours/week		Credits	Maximum Marks		
2002711	Skill Course SC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		1	-	2	2	40	60	100
						End Exam Duration: 3Hrs		

Course Objectives:

- To create awareness on machine learning
- To understand significance of notebooks for machine learning applications
- To understand the supervised, unsupervised and reinforced algorithms
- To know the architecture of ANN and deep neural networks.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand fundamentals of Machine Learning
CO 2	Able to develop a machine learning model using notebooks
CO 3	Apply concepts of Machine learning in real time problems
CO 4	Develop ANN and deep neural network models for real time applications

List of Experiments

1. Introduction on Machine Learning
3. Data Preprocessing
4. Supervised Machine Learning
   - 4.1 Simple Linear Regression
   - 4.2 Multiple Linear Regression
   - 4.3 Polynomial Linear Regression
   - 4.4 Support Vector Machine
   - 4.5 Decision Tree Regression
   - 4.6 Random Forest Regression
   - 4.7 Regression model selection
5. Classification
   - 5.1 Logistic Regression
   - 5.2 K-Nearest Neighbors (K-NN)
   - 5.3 Support Vector Machine (SVM)
   - 5.4 Kernel SVM
   - 5.5 Naive Bayes
   - 5.6 Decision Tree Classification
   - 5.7 Random Forest Classification
   - 5.8 Classification model selection

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6. Clustering

6.1 K-Means Clustering

6.2 Hierarchical Clustering

7.Artificial Neural network

7.1 Feedforward neural network

7.2 Back propagation neural network

Text Books:

1.AurélienGéron, "Hands-On Machine Learning with Scikit-Learn and TensorFlowConcepts,Tools, and Techniques to Build Intelligent Systems", O'reilly publishers, 2017

2. Chris albon, "Machine Learning with Python cookbook", O'reilly publishers, 2018

Reference Books:

1. Oliver Theobald, "Machine Learning For Absolute Beginners", A Plain English Introduction (2nd Edition)

2. John Paul Mueller and Luca Massaron, "Machine Learning (in Python and R) For Dummies"(1st Edition)

B. Tech., VIII Semester

CourseTitle	Project Work					B. Tech. VIII Semester		
CourseCode	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	Total
2002801	PROJ	0	0	--	12	40	60	100
Internship in Industry						--	--	--

Course Objectives: The objective of the course is to,

1. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
2. Acquire and apply new knowledge as needed, using appropriate learning strategies.
3. Apply knowledge of probability and statistics to applications in electrical engineering..

Course Outcomes: On successful completion of this course, the students will be able to,

CO 1	Demonstrate a sound technical knowledge of their selected project topic.
CO 2	Understand problem identification, formulation and solution.
CO 3	Design engineering solutions to complex problems utilizing a systemsapproach.
CO 4	Communicate with engineers and the community at large in written an oralform.
CO 5	Demonstrate the knowledge, skills and attitudes of a professional engineer.

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