Department of Electrical and Electronics Engineering

BoS Meeting

Minutes of the Meeting

Date	29.06.2021 and 30.06.2021	**Day**	Tuesday and Wednesday
Time	11.30 AM to 12.30 PM and 11.00AM to 12.15 PM	**Venue**	Virtual meeting _ Google Meet Link: meet.google.com/zis-asdu-nxp
Dept,	7th BoS Meeting	**Convener**	Dr. K. Amaresh

Number of Participants: 12

S. No.	Name	Designation	Members	S.No.	Name	Designation	Members
1	Dr. K. Amaresh	Professor & HoD	Chairman	7	Smt. Saleha Tabassum	Assistant Professor	Member
2	Smt. C.N. Arpitha	Associate Professor	Member	8	Sri P. Durga Prasad	Assistant Professor	Member
3	Sri M. Bhaskar Reddy	Associate Professor	Member	9	Dr. G. Yesuratnam	Professor (Osmania University)	Subject Expert
4	Sri K. Rama Mohan Reddy	Associate Professor	Member	10	Dr. B. Ravikumar	Associate Professor (IIT - Hyderabad)	Subject Expert
5	Dr. T. Mariprasath	Associate Professor	Member	11	Dr. P. Kiranmayi	Professor & HoD (JNTUCEA - Ananthapuramu)	University Nominee
6	Sri K. Kalyan Kumar	Assistant Professor	Member	12	Dr. T. Hari Priya	Assistant Professor (VNR VJIET, Hyderabad)	Alumni

Minutes of the Meeting:

Dr. K. Amaresh welcomed all the members to the online meeting and presented the agenda of the 7th BoS meeting (Under R18 regulations).

The resolutions are:

S. No.	Item	Presenter and discussion	Resolution	Coordinator/ Incharge
1	Course structure and syllabus	HoD explained Course structure and syllabus formed based on feedback from all stakeholders and Department Review Committee report of R 18 – B. Tech., (EEE) VII and VIII Semesters and asked BoS members for their valuable suggestions.	B. Tech., (EEE) VII & VIII Semester theory and labs are approved by the members with some modifications. The modification involving new courses, Value added courses, Certification Courses, Skill Courses, Employability and Entrepreneurship courses are as follows (i) Members suggested to add the book titled "FACTS controllers in Power Transmission and Distribution" by K.R. Padiyaar as a Text book for VII semester FACTS subject. (ii) In Electrical Distribution Systems (PE-IV) subject Indoor and outdoor substations are replaced with Air Insulated and Gas Insulated substations and also suggested to add "Gas Insulated Substations" by M.S. Naidu textbook as reference. (iii) In Distribution Generation & Micro Grid (PE - IV) subject members suggested minor changes in contents of the syllabus. (iv) In Power System Reliability (PE-IV) subject members suggested to add two references. The approved Course structure is enclosed in Annexure -1.	Dr.K.Amaresh
2	Regarding Open Electives	HoD listed out the following Open Electives and explained syllabus for suggestions: (i) Internet of Things (ii) Intelligent Control Techniques (iii) Electrical System Design & Costing	In Open Elective subjects, members suggested to change the "Electrical System Design & Estimation" subject title to "Electrical System Estimation & Costing" with modifications in the syllabus.	Dr.K.Amaresh
3	To finalize and approve the syllabus for Certification Courses and Skill courses for	Head of the Department presented the syllabus for Certification Courses and Skill Courses, designed by the	The committee appreciated the Certification Courses to be offered by department and approved the content for offering Certification Courses and Skill Courses which benefits Employability and Entrepreneurship	Dr.K.Amaresh

	Employability or Entrepreneurship	faculty after taking the feedback from Stakeholders		
4	Feedback/ Suggestions from stakeholders and action taken report	Head of the Department presented Feedback/ Suggestions from stakeholders and Department Review Committee report and also action taken by the department.	The committee approved action taken report on suggestions and feedback given by stakeholders and Department Review Committee report. The suggestions/ feedback from stakeholders and action taken report is explained.	Sri M.Bhaskar Reddy
3	Regarding NPTEL 12 Week Certification Courses	The Head of the Department proposed to allow any domain specific 12 week NPTEL course without repetition in the curriculum for credit transfer under professional elective course and any other domain 12 week NPTEL course without repetition in the curriculum for credit transfer under open elective.	The committee accepted the proposed scheme for the credit transfer under professional electives and open electives through NPTEL.	Mr.N.Siddik Department, NPTEL Coordinator

Dr. K. Amaresh, HoD and BoS chairman of EEE department conveyed thanks to all internal and external BoS members for giving suggestions and inputs for B. Tech., R18 regulations. As per the suggestions given by the BoS members, the changes have been incorporated and taken approval from the members.

Convener

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B. Tech – VI Semester (Theory - 5, Lab - 3)

S. No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	1824601	Management Science	HSMC	3	0	0	30	70	3
2	1802602	Power Semiconductor Drives	PCC	3	0	0	30	70	3
3	1802603	Switchgear & Protection	PCC	3	0	0	30	70	3
		Professional Elective -II (PE - II)							
4	1802604	Power System Deregulation	PEC	3	0	0	30	70	3
	1802605	High Voltage DC Transmission	PEC	3	0	0	30	70	3
	1802606	PLC & its Applications	PEC	3	0	0	30	70	3
	1802607	Signals & Systems	PEC	3	0	0	30	70	3
	1802608	Electric & Hybrid Vehicles	PEC	3	0	0	30	70	3
		Open Elective - I (OE-I)	OEC	3	0	0	30	70	3
5	18OE201	Fundamentals of Control Systems	OEC	3	0	0	30	70	3
	18OE202	MATLAB Programming	OEC	3	0	0	30	70	3
6	1802612	Power Electronics & Simulation Lab	PCC	0	0	3	50	50	1.5
7	1802613	Power Systems - I Lab	PCC	0	0	3	50	50	1.5
8	1802614	Internet of Things Lab	PCC	0	0	4	50	50	2
9	1802615	Internship	PROJ	0	0	0	100	00	2
10	18996M2	Constitution of India	MC	2	0	0	30	--	--
Total				17	00	10	430	500	22

B. Tech – VII Semester (Theory - 5, Lab - 3, Project - I Stage)

S. No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	1825701	Project Management	HSMC	3	0	0	30	70	3
2	1802702	Utilization of Electrical Power	PCC	3	0	0	30	70	3
		Professional Elective -III (PE - III)							
3	1802703	Flexible AC Transmission System	PEC	3	0	0	30	70	3
	1802704	Power Quality	PEC	3	0	0	30	70	3
	1802705	Digital Control Systems	PEC	3	0	0	30	70	3

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	1802706	Digital Signal Processing	PEC	3	0	0	30	70	3
	1802707	Smart Grid	PEC	3	0	0	30	70	3
		Open Elective - II (OE-II)	OEC	3	0	0	30	70	3
4	18OE203	Energy Conversion Systems	OEC	3	0	0	30	70	3
	18OE204	Internet of Things	OEC	3	0	0	30	70	3
		Open Elective - III (OE-III)	OEC	3	0	0	30	70	3
5	18OE205	Intelligent Control Techniques	OEC	3	0	0	30	70	3
	18OE206	Electrical System Estimation & Costing	OEC	3	0	0	30	70	3
6	1802708	LabView Programming	ESC	0	0	3	50	50	1.5
7	1802709	Power Systems -II Lab	PCC	0	0	3	50	50	1.5
8	1824710	Effective Technical Communication Skills Lab	HSMC	0	0	2	50	50	1
8	1802711	Project Stage - I	PROJ	0	0	6	100	00	3
9	18997M3	Universal Human Values	MC	2	0	0	30	00	0
Total				19	00	10	380	450	22

B. Tech – VIII Semester (Theory - 2, Project - II Stage)

S. No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
		Professional Elective - IV (PE-IV)							
1	1802801	Electrical Distribution Systems	PEC	3	0	0	30	70	3
	1802802	Power System Reliability	PEC	3	0	0	30	70	3
	1802803	Industrial Automation & Control	PEC	3	0	0	30	70	3
	1802804	SCADA & its Application	PEC	3	0	0	30	70	3
	1802805	Distributed Generation & Micro Grid	PEC	3	0	0	30	70	3
		Open Elective -IV (OE-IV)	OEC	3	0	0	30	70	3
2	18OE207	Basics of Power Electronics	OEC	3	0	0	30	70	3
	18OE208	System Reliability Concepts	OEC	3	0	0	30	70	3
3	1802806	Technical Seminar	PROJ	2	0	0	100	00	1

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4	1802807	Project Stage - II	PROJ	0	0	10	50	50	5
Total				08	0	10	210	190	12

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Department of Electrical and Electronics Engineering

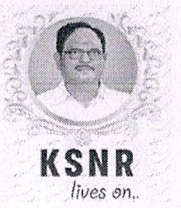
BoS Meeting

Minutes of the Meeting

Date	27.09.2021	**Day**	Monday
Time	10.30 AM to 12.15 PM and 3.00 to 4.30 PM	**Venue**	Virtual meeting - Google Meet Link: https://meet.google.com/grg-xerf-yzd?hs=224
Dept,	8th BoS Meeting	**Convener**	Dr. K. Amaresh

Number of Participants: 14

S.No	Name	Designation	Members	Signature	S.No	Name	Designation	Members	Signature
1	Dr. K. Amaresh	Professor & HoD	Chairman		8	Mr. T. Kishore Kumar	Assistant Professor	Member	
2	Mr. M. Bhaskar Reddy	Associate Professor	Member		9	Dr. C. Kumar Reddy	Assistant Professor	Member	
3	Mr. K. Rama Mohan Reddy	Associate Professor	Member		10	Dr. R. Kiranmayi	Professor in EEE, Director – Alumni & Foreign Affairs	University Nominee	
4	Dr. M. Murali	Associate Professor	Member		11	Dr. G. Yesuratnam	Professor (Osmania University)	Subject Expert	
5	Mr. K. Kalyan Kumar	Assistant Professor	Member		12	Dr. T. Gowri Manohar	Professor (SV University)	Subject Expert	
6	Smt. Saleha Tabassum	Assistant Professor	Member		13	Mr. J. Kumara Swamy	Manager (Power Grid Corporation of India Ltd)	Industry	
7	Mr. P. Durga Prasad	Assistant Professor	Member		14	Dr. B. Pradeep Kumar	Assistant Professor (KITS – Warangal)	Alumni	



Minutes of the Meeting:

Dr. K. Amaresh welcomed all the members to the online meeting and presented the agenda of the 8th BoS meeting (Under R20 regulations).
The resolutions are:

S. No.	Item	Presenter and discussion	Resolution
1	B. Tech. (R20) – Course Structure	HoD explained to the members B. Tech. (R20) Course Structure from III to VIII Semester	The members have been accepted B. Tech., R 20 Course structure from III to VIII Semester
2	B. Tech. (R20) – III and IV Semester Syllabus	HoD explained to the members B. Tech. (R20) III and IV Semester syllabus	B. Tech., (R20) III and IV Semester syllabus is accepted by the panel members.
3	Certification Courses	HoD asked for acceptance of proposed certification courses	All the certification courses are accepted by the members with the following changes (i) The modules prepared in the Application of MATLAB are not reflecting the title. Members suggested changing modules 1 to 3 with respect to different applications. (ii) Members suggested to introduce "Electrical Safety in Industries" as one of the certificate course.
4	To finalize and approve the syllabus for Certification Courses and Skill courses for Employability or Entrepreneurship	Head of the Department presented the syllabus for Certification Courses and Skill Courses, designed by the faculty after taking the feedback from Stakeholders	The committee appreciated the certification courses to be offered by department and approved the content for offering Certification Courses and Skill courses which benefits Employability or Entrepreneurship
5	Feedback/ Suggestions from stakeholders and action taken report	Head of the Department presented Feedback/ Suggestions from stakeholders and also action taken by the department	The committee approved action taken report on suggestions and feedback given by stakeholders. The suggestions/ feedback from stakeholders and action taken report is enclosed in Annexure -3.

6	Regarding NPTEL 12 Week Certification Courses	The Head of the Department proposed to allow any domain specific 12 week NPTEL course without repetition in the curriculum for credit transfer under professional elective course and any other domain 12 week NPTEL course without repetition in the curriculum for credit transfer under open elective.	The committee accepted the proposed scheme for the credit transfer under professional electives and open electives through NPTEL.
7	Any other discussion with the permission of chair	The member suggested changing the title from Electrical & Electronics Measurement to Electrical Measurements and Measuring Instruments.	

Dr. K. Amaresh, HoD and BoS Chairman of EEE department conveyed thanks to all internal and external BoS members for giving suggestions and inputs for B.Tech., R20 regulations. As per the suggestions given by the BoS members, the changes have been incorporated and taken approval from the members.

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(AUTONOMOUS)

Department of Electrical & Electronics Engineering

R20 Course Structure

Semester - 0 (Theory - 8, Lab - 7) Induction Program

S. No.	Course Name	Category	L	T	P	C
1	Physical Activities - Sports, Yoga & Meditation, plantation	MC	0	0	6	0
2	Career Counseling	MC	2	0	2	0
3	Orientation to all branches - career options, tools etc.ESC	MC	3	0	0	0
4	Orientation on admitted branch - corresponding labs, tools & platforms	EC	2	0	3	0
5	Proficiency Modules & Productivity Tools	ES	2	1	2	0
6	Assessment on basic aptitude and mathematical skills	MC	2	0	3	0
7	Remedial Training in foundation courses	MC	2	1	2	0
8	Human values & Professional ethics	MC	3	0	0	0
9	Communication skills - focus on listening, speaking, reading, writing skills	BS	2	1	2	0
10	Concepts of programming	ES	2	0	2	0

L - Lecture, T - Tutorial, P - Practical

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I Semester (Theory – 05, Labs – 04)

S. No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	2021101	Linear Algebra and Calculus	BSC	3	0	0	40	60	3
2	20AP102	Applied Physics	BSC	3	0	0	40	60	3
3	2024103	Communicative English	HSMC	3	0	0	40	60	3
4	2005103	C-Programming & Data Structures	ESC	3	0	0	40	60	3
5	2003105	Engineering Drawing	ESC	1	0	2	40	60	2
6	2003106	Engineering Drawing Lab	ESC	0	0	2	40	60	1
7	20AP107	Applied Physics Lab	BSC	0	0	3	40	60	1.5
8	2024108	Communicative English Lab	HSMC	0	0	3	40	60	1.5
9	2005108	C-Programming & Data Structures Lab	ESC	0	0	3	40	60	1.5
Total				13	00	13	310	590	19.5

II Semester (Theory – 05, Lab – 05)

S. No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	2021201	Differential Equations & Vector Calculus	BSC	3	0	0	40	60	3
2	2023202	Chemistry	BSC	3	0	0	40	60	3
3	2002203	Electrical Circuits Analysis-I	ESC	3	0	0	40	60	3
4	2004204	Electronic Devices & Circuits	ESC	3	0	0	40	60	3
5	20EW205	Engineering Workshop	ESC	0	0	3	40	60	1.5
6	2005206	IT Workshop	ESC	0	0	3	40	60	1.5
7	2023207	Chemistry Lab	BSC	0	0	3	40	60	1.5
8	2002208	Electrical Circuits Analysis-I Lab	ESC	0	0	3	40	60	1.5
9	2004209	Electronic Devices & Circuits Lab	ESC	0	0	3	40	60	1.5
10	20MC210	Environmental Science	MC	2	0	0	40	00	0.0
Total				15	00	10	350	580	19.5

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III Semester (Theory - 05, Lab - 03)

S. No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	2002301	Switching Theory & Logic Design	PCC	3	0	0	40	60	3
2	2002302	Electromagnetic Field Theory	PCC	3	0	0	40	60	3
3	2002303	Electrical Circuit Analysis - II	PCC	3	0	0	40	60	3
4	2002304	Electrical Measurements & Measuring Instruments	PCC	3	0	0	40	60	3
5	2002305	DC Machines & Transformers	PCC	3	0	0	40	60	3
6	2002306	Electrical Circuit Analysis - II Lab	PCC	0	0	3	40	60	1.5
7	2002307	Electrical Measurements & Measuring Instruments Lab	PCC	0	0	3	40	60	1.5
8	2002308	DC Machines & Transformers Lab	PCC	0	0	3	40	60	1.5
9	2002309	Skill Oriented Course	SC	1	0	2	40	60	2.0
10	20MC310	Human Values & Professional Ethics	MC	2	0	0	40	00	0.0
Total				18	00	11	400	540	21.5

IV Semester (Theory - 05, Lab - 03)

S. No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	2021401	Special Functions & Complex Analysis	BSC	3	0	0	40	60	3
2	2025402	Fundamentals of Management for Engineers	HSMC	3	0	0	40	60	3
3	2002403	Induction Motors & Synchronous Machines	PCC	3	0	0	40	60	3
4	2002404	Linear Control Systems	PCC	3	0	0	40	60	3
5	2002405	Power Systems - I	PCC	3	0	0	40	60	3
6	2002406	Induction Motors & Synchronous Machines Lab	PCC	0	0	3	40	60	1.5
7	2002407	Control Systems Lab	PCC	0	0	3	40	60	1.5

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8	2005408	Python Programming Lab	ESC	0	0	3	40	60	1.5
9	2002409	Skill Oriented Course	SC	1	0	2	40	60	2.0
Total				16	00	11	360	540	21.5

V Semester (Theory - 05, Lab - 02)

S. No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	2002501	Linear Digital IC Applications	PCC	3	0	0	40	60	3
2	2002502	Power System - II	PCC	3	0	0	40	60	3
3	2002503	Power Electronics	PCC	3	0	0	40	60	3
		Open Elective - I (OE - I)							
4	20OE201	Data Structures	OEC	3	0	0	40	60	3
	20OE202	OOPS through JAVA	OEC	3	0	0	40	60	3
		Professional Elective - I (PE-I)							
5	2002504	Internet of Things	PEC	3	0	0	40	60	3
	2002505	Advanced Control Systems	PEC	3	0	0	40	60	3
	2002506	Energy Conversion Systems	PEC	3	0	0	40	60	3
6	2002507	Power Systems - I Lab	PCC	0	0	3	40	60	1.5
7	2002508	Internet of Things Lab	PCC	0	0	3	40	60	1.5
8	2025509	Soft Skill Oriented Course	SC	1	0	2	40	60	2.0
9	2002510	Internship/Socially Relevant Project	INT	0	0	0	100	00	1.5
10	20MC512	Constitution of India	MC	2	0	0	40	00	00
Total				18	00	08	460	480	21.5

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B. Tech., VII Semester

Course Title	Utilization of Electric Power					B. Tech. VII Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1802702	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	100
Mid Exam Duration: 2Hrs						End Exam Duration : 3Hrs		
Course Objectives: The objective of the course is to learn the concepts of illumination, Electrical heating, Welding, Electrolytic Process and Electric Traction.								
On successful completion of this course, the students will be able to								
CO 1	Understand different types of electric drives, heating, welding and illumination.							
CO 2	Understand the basic principle of electric traction including speed– time curves of different traction services							
CO 3	Understand the method of calculation of various traction systems for braking, acceleration and other related parameters							
CO 4	Choose appropriate drive for the industrial purpose, proper illumination strategy for good lighting system, the traction system for better performance							

UNIT - I

Illumination: Introduction, terms used in illumination, laws of illumination, polar curves, photometry, integrating sphere, sources of light, discharge lamps, MV and SV lamps – Comparison between tungsten filament lamps and fluorescent tubes- Basic principles of light control- Types of lighting schemes -factory lighting, street lighting and flood lighting.

UNIT - II

Electric Heating & Welding: Advantages and methods of electric heating - types and applications of electric heating equipment- Resistance ovens-induction heating –dielectric heating-Electric welding –resistance welding and arc welding techniques - arc furnaces.

UNIT –III

Electric Drives: Types of Electric drives, Choice of motor, starting and running characteristics, Speed control, temperature rise, particular applications of electric drives, types of industrial loads, continuous, intermittent and variable loads, load equalization.

UNIT –IV

Systems of Electric Traction and Track Electrification: Review of existing electric traction systems in India. Special features of traction motors, methods of electric braking – plugging, rheostatic braking and regenerative braking.

UNIT –V

Mechanism of Train Movement: Speed-time curves for different services – Trapezoidal and quadrilateral speed time curves – Calculations of tractive effort, power, specific energy consumption for a given run, the effect of varying acceleration and braking retardation, adhesive weight and coefficient of adhesion.

Text Books:

1. Utilization of Electric energy by E. Openshaw Taylor and V. V. L. Rao, Universities Press, 2009.
2. Art & Science of Utilization of Electrical Energy by H. Partab, Dhanpat Rai & Co, 2004.
3. Electric Traction: A Treatise on the Application of Electric Power to Tramways and Railways by Alfred Thomas Dove, Franklin Classics Trade Press (11 November 2018)

Reference Books:

1. Generation, Distribution and Utilization of Electrical energy by C. L. Wadhwa, New Age International (P) Limited, 1997.
2. Utilization of Electrical Power including Electric Drives and Electric Traction by N. V. Suryanarayana, New Age International (P) Limited, 1996.

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Course Title	Flexible AC Transmission Systems (PE – III)					B. Tech. VII Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1802703	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	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.

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 Gyuygyi, 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.
3. Flexible AC Transmission Systems by Suman Bhowmick, CRC Press, 2015.

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	POWER QUALITY (PE – III)				B. Tech. VII-Semester		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1802704	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3Hrs		

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.

UNIT-III

Fundamentals of Harmonics & Applied 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. Applied Harmonics: Effects Of Harmonics, Harmonic Distortion Evaluations, Principles of Controlling Harmonics, Devices for Controlling Harmonic Distortion.

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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<table>
<tr><td>Course Title</td><td colspan="5">Digital Control Systems (PE – III)</td><td colspan="3">B. Tech. VII-Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">1802705</td><td rowspan="2">Professional Elective (PEC)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 2 Hrs</td><td colspan="3">End Exam Duration : 3Hrs</td></tr>
<tr><td colspan="8">Course Objectives: The student is able to learn basics of digital control systems, Z-plane analysis of discrete time control systems, Design of systems by conventional methods, state space analysis and design of pole placement and state observer.</td></tr>
<tr><td colspan="8">On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="7">Understand the basic concepts of digital control systems, Z-transforms & inverse Z-transforms</td></tr>
<tr><td>CO 2</td><td colspan="7">Analyze z-plane for various discrete time control systems, liapunov stability</td></tr>
<tr><td>CO 3</td><td colspan="7">Design control systems by using conventional methods, pole placement and state observer</td></tr>
<tr><td>CO 4</td><td colspan="7">Apply state space for solving discrete and continuous state space equations</td></tr>
</table>

UNIT- I

Introduction: Digital Control Systems, quantization and quantization error, Z-transform, Z-transforms of elementary functions, properties of Z-transform, Inverse Z-transform, Z-transform method for solving difference equations.

UNIT-II

Z-plane Analysis of Discrete time Control Systems: Introduction, Impulse sampling and data hold, pulse transfer function, realization of digital controllers and digital filters.

UNIT-III

Design of Digital control systems by Conventional methods: Introduction, Mapping between s-plane and z-plane, transient and steady-state response analysis, Design based on frequency response methods, Analytical Design method.

UNIT- IV

State Space Analysis: State space representation of digital systems, solving discrete state space equations, pulse transfer function matrix, discretization of continuous time state space equations, Liapunov stability analysis.

UNIT-V

Pole placement and State Observers design: Controllability, Observability, useful transformations of state space analysis and design, Design through pole placement, state observer.

Text Books

1. Katsuhiko Ogatta, "Discrete time Control Systems" Second Edition, Prentice Hall of India (2005)
2. I. J. Nagrath, "State Space methods and digital control systems", New Age International (2004).

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Course Title	Digital Signal Processing (PE – III)					B. Tech. VII-Semester		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1802706	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3Hrs		

Course Objectives: The objective of the course is to learn about Discrete Fourier Transform and its efficient computation, various IIR and FIR realization techniques, design of IIR and FIR filters.

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

CO 1	Interpret, represent and process discrete/digital signals and systems
CO 2	Understand discrete and fast Fourier transforms
CO 3	Apply Z-transforms in digital system design
CO 4	Design FIR and IIR Digital Filter for the desired characteristics

UNIT-I

Introduction: Definition and Classification of Signals, Elementary signals, Basic operations on signals.

Discrete-time signals: Sequences, Discrete-time systems, Linear-time invariant systems and its properties, linear constant coefficient difference equations, Frequency-domain representation of discrete-time signals and systems

UNIT-II

Discrete Fourier Transform: The Fourier Transform of periodic signals, sampling the Fourier transform, the discrete Fourier transform, properties of DFT, linear convolution of sequences using DFT.

Fast Fourier Transforms: Efficient computation of the DFT, Decimation in time and decimation in frequency FFT algorithms, Implementation of FFT algorithms and FFT algorithms for composite N.

UNIT-III

Z–Transforms: Introduction, The z-transform, properties of the Region of Convergence for the z-transform, The Inverse z-transform, z-transform properties, the inverse z-transform using contour integration.

Realization of Digital Filters: Block diagram representation of linear constant-coefficient difference equations, basic structures of IIR filters- direct form I, direct form II, transposed form, cascade form, parallel forms, basic structures of FIR filters-Direct form, Cascade form, Linear phase structure, Lattice structures.

UNIT-IV

IIR Digital Filters: General considerations-Causality and its implications, Characteristics of Practical Frequency-selective filters, IIR filter design by Impulse Invariance, Bilinear

transformation, Design of IIR filters from analog filters-Butterworth and chebyshev approximations, design examples: frequency transformations, Illustrative Problems.

UNIT-V

FIR Digital Filters: Symmetric and Anti-symmetric FIR filters, Design of Linear Phase FIR digital filters using windows, Frequency sampling technique, comparison of IIR and FIR filters, Illustrative Problems,

Applications of DSP (Dual Tone Multi frequency signal detection, Spectral analysis of sinusoidal and non stationary signals).

Text Books

1. A.V.Oppenheim and R.W. Schaffer, & J R Buck, "Discrete Time Signal Processing," 2nd ed., Pearson Education, 2012.
2. John G. Proakis, Dimitris G. Manolakis, "Digital signal processing, principles, Algorithms and Aapplications", Pearson Education/PHI, 4th Edition, 2007.
3. Sanjit K Mitra, "Digital signal processing", A computer base approach- Tata McGraw-Hill, 3rd Edition, 2009.

Reference Books

1. Andreas Antoniou, Digital signal processing: Tata McGraw-Hill, 2006.
2. Digital signal processing: M H Hayes, Schaum's Outlines, Tata McGraw-Hill, 2007.
3. A. Anand Kumar, "Digital Signal Processing," PHI Learning, 2011.

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<table>
<tr><td>Course Title</td><td colspan="4">Smart Grid (PE – III)</td><td colspan="3">B. Tech. VII-Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">1802707</td><td rowspan="2">Professional Elective (PEC)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 2 Hrs</td><td colspan="3">End Exam Duration : 3Hrs</td></tr>
<tr><td colspan="8">Course Objectives: The student is able to learn fundamentals, Architecture and analysis of smart grid with communication, networking and measuring technologies involved in it.</td></tr>
<tr><td colspan="8">On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="7">Understand the features, fundamental components and architecture of smart grid</td></tr>
<tr><td>CO 2</td><td colspan="7">Explain information, communication and networking technologies involved with the smart grid</td></tr>
<tr><td>CO 3</td><td colspan="7">Explain operation and importance of PMU, WAMPS and smart storage systems in smart grid</td></tr>
<tr><td>CO 4</td><td colspan="7">Analyze Microgrid with various concepts and challenges in future</td></tr>
</table>

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 - Phase Measurement Unit (PMU).

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

Reference Books

1. A.G. Phadke and J.S. Thorp, "Synchronized Phasor Measurements and their Applications", Springer Edition, 2e, 2017.
2. James Northcote, Green, Robert G. Wilson "Control and Automation of Electric Power Distribution Systems (Power Engineering)", CRC Press.
3. Andres Carvallo, John Cooper, "The Advanced Smart Grid: Edge Power Driving Sustainability", Artech House Publishers July 2011.
4. 4. Clark W Gellings, "The Smart Grid, Enabling Energy Efficiency and Demand Side Response"- CRC Press, 2009.

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Course Title	Labview Programming				B. Tech. VII Semester		
Course Code	Category	Hours / Week		Credits	Maximum Marks		
1802708	Engineering Science Course (ESC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	3	1.5	50	50	100
						End Exam Duration : 3Hrs		

Course Objectives: The objective of the course is to learn, write, test and debug simple Labview Programs.

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

CO 1	Understand, test and debug simple Labview Programs
CO 2	Demonstrate operations on arrays and strings
CO 3	Apply conditional statements with Labview
CO 4	Make use of SubVI's for structuring Labview Programs
CO 5	Make use of Read and write data from/to files in Labview

LIST OF PROGRAMS

1. Basic arithmetic operations (Add, mul, div, compound arithmetic, expression node, express formula and formula node)
2. Boolean operations (truth table verification of logic gates, Half Adder and Full Adder, convert binary to decimal value, convert BCD to Gray and Vice-Versa)
3. String operations (Length, concatenation, insert string, sub-string, replace string, reverse string, rotate string, etc)
4. Sum of 'N' numbers using feedback loop (use 'for ' loop and 'while' loop)
5. Factorial of a give number using shift register (use 'for' loop and 'while' loop)
6. Generate Fibonacci series for N iteration (use 'for' loop)
7. Create a VI to increase the tank level from 0 to 100 & decrease the value from 100 to 0 using while loop in a single process.
8. Create a VI to implement and, or & not gates(or arithmetic operations) using case structure
9. Build a VI that generates a 1D array of random numbers and sort the array in descending and ascending order and find the following:
    a) Maximum and min value of array elements
    b) Size of the array
    c) Sum and product of array elements
    d) Rotate array by 1 position
    e) Split the array after 2 elements
10. Build an array of cluster controls in which each cluster consists of a numeric control and 1D numeric array. This forms the database of students. The numeric control indicates the

roll no and array indicates the test marks of 4 subjects. Build the logic to modify the mark in a particular subject of a particular student. Input the roll number, subject in which mark is to be changed and new mark. Display the database on a separate array indicator.

11. Create a VI to implement Full Adder circuit using SubVI.

12. Any application using Flat and stacked sequence

Software Used: LABVIEW Software for Windows/Linux

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Course Title	Power Systems – II Lab				B. Tech. VII Semester		
Course Code	Category	Hours / Week		Credits	Maximum Marks		
1802709	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	3	1.5	50	50	100
						End Exam Duration : 3Hrs		

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

- To present a problem oriented knowledge of power system analysis methods.
- To address the underlying concepts & approaches behind analysis of power system network using software tools.
- To identify & formulate solutions to problems relevant to power system using software tools.

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

CO 1	Understand the concept of MATLAB programming and ETAP in solving power systems problems.
CO 2	Acquire knowledge on formation of Bus Admittance matrix.
CO 3	Analyze the power flow using GS, NR method and DC load flow method.
CO 4	Analyze various fault studies on power system.
CO 5	Understand power system planning and operational studies.

List of Experiments (Any Eight)

1. Modelling of a Transmission Line with Lumped parameters.
2. Formation of Y-bus for a given power system network.
3. AC Load flow analysis of a simple 3-bus system using Gauss Seidel method.
4. AC Load flow analysis of a simple 3-bus system using Newton Raphson method.
5. Study on D C Load Flow
6. Study on Economic Load Dispatch.
7. Short circuit analysis.
8. Simulation of single area load frequency control system.
9. Simulation of Automatic Voltage Regulator.
10. Tripping characteristics of Fuse & MCB.
11. Tripping sequence of protective devices.
12. Characteristics of over current relay.

Note: All the above experiments are simulated using MATLAB/ETAP Software/Power World Simulator

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Course Title	Project Stage - I				B. Tech. VII Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
1802711	PROJ	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		--	--	6	3	100	--	100

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 utilising a systems approach.
CO 4	Communicate with engineers and the community at large in written an oral form
CO 5	Demonstrate the knowledge, skills and attitudes of a professional engineer

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B. Tech., VIII Semester

Course Title	Electrical Distribution Systems (PE – IV)				B. Tech. VIII Semester		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1802801	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	100
Mid Exam Duration: 2 Hrs					End Exam Duration : 3Hrs		

Course Objectives: The student is able to learn load modelling 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.

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.
3. Electric Distribution Systems by Abdelhay A. Sallam, Om P. Malik, IEEE Press, Wiley Publishers, 2nd Edition, 2018.
4. Control and Automation of Electrical Power Distribution Systems by James Northcote-Green, Robert G. Wilson, CRC Press (Taylor & Francis), 1st Edition, 2006.

Reference Books

1. Electric Power Distribution Automation by Dr. M. K. Khedkar and Dr. G. M. Dhole, University Science Press, 2010.
2. Electrical Power Distribution Systems by V. Kamaraju, Jain Book Depot. 2012.
3. Electrical Power Systems for Industrial Plants by Kamalesh Das, JAICO Publishing House, 2008.
4. Hand Book of Electric Power Distribution by G. Ramamurthy, 2nd Edition, Universities Press, 2009.

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Course Title	Power System Reliability (PE – IV)				B. Tech. VIII Semester		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1802802	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	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 modelling 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

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.
3. Reliability Engineering-Methods and Applications by Mange Ram,CRC publications.
4. Reliability of Power Systems by G.F.Kovaley,L.M.Lebedeva,Sringer Publications

Reference Books

1. System Reliability Concepts by V. Sankar, Himalaya Publishing House, 2015.
2. Stochastic Models in Reliability Engineering by Lirong Cui,IIia Frenkel,Antoly Lisnianski, CRC Publications.
3. Fundamentals of Reliability Engineering by Indra Gunawan,Wiley publications.
4. An Introduction to Reliability and Maintainability Engineering by Charles E. Ebeling, 3rd Edition, Kindle Edition.

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Course Title	Industrial Automation & Control (PE – IV)					B. Tech. VIII Semester		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1802803	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	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 basic of automation, how system works and importance of PLC, SCADA and robots in automation. This course will provide 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). Industrial bus systems: modbus & profibus

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.

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
3. Industrial Instrumentation, Control and Automation, S. Mukhopadhyay, S. Sen and A.K. Deb, Jaico Publishing House, 2013
4. Programmable logic controller, Dunning, Delmar

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

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Course Title	SCADA & Its Applications (PE – IV)				B. Tech. VIII Semester		
Course Code	Category	Hours/ Week		Credits	Maximum Marks		
1802804	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	100
Mid Exam Duration: 2 Hrs					End Exam Duration : 3Hrs		

Course Objectives: The student is able to learn

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

CO 1	Describe the basic tasks of Supervisory Control Systems (SCADA) as well as their typical applications.
CO 2	Acquire knowledge about SCADA architecture, various advantages and disadvantages of each system
CO 3	Acquire knowledge about single unified standard architecture IEC 61850
CO 4	Acquire knowledge about SCADA system components: remote terminal units, PLCs, intelligent electronic devices, HMI systems, SCADA server
CO 5	Acquire knowledge about SCADA communication, various industrial communication technologies, open standard communication protocols
CO 6	Learn and understand about SCADA applications in transmission and distribution sector, industries etc
CO 7	Gain knowledge and understanding for the design and implementation of a SCADA system

UNIT - I

Introduction to SCADA: Data acquisition systems, Evolution of SCADA, Communication technologies, Monitoring and supervisory functions, SCADA applications in Utility Automation, Industries

UNIT - II

SCADA System Components: Schemes- Remote Terminal Unit (RTU), Intelligent Electronic Devices (IED), Programmable Logic Controller (PLC), Communication Network, SCADA Server, SCADA/HMI Systems

UNIT - III

SCADA Architecture: Various SCADA architectures, advantages and disadvantages of each system - single unified standard architecture -IEC 61850

UNIT - IV

SCADA Communication: various industrial communication technologies -wired and wireless methods and fiber optics. Open standard communication protocols

UNIT - V

SCADA Applications: Utility applications- Transmission and Distribution sector - operations, monitoring, analysis and improvement. Industries - oil, gas and water.

Text Books

1. Stuart A. Boyer: SCADA-Supervisory Control and Data Acquisition, Instrument Society of America Publications, USA,2004.
2. Gordon Clarke, Deon Reynders: Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems, Newnes Publications, Oxford, UK,2004.

Reference Books

1. William T. Shaw, Cyber security for SCADA systems, PennWell Books, 2006.
2. David Bailey, Edwin Wright, Practical SCADA for industry, Newnes, 2003.
3. Michael Wiebe, A guide to utility automation: AMR, SCADA, and IT systems for electric power, Penn Well 1999

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Course Title	Distributed Generation & Micro Grid (PE – IV)					B. Tech. VIII Semester		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1802805	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	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 system 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 micro grid 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.

UNIT - IV

Introduction to Micro grid: Micro grid Configurations – CERTS Micro grid 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 Micro grid - Grid Connected Mode – Islanded mode – Battery Charging mode – design of parallel inverters – Micro grid application - Brick Busses Software Frame work.

UNIT - V

Control in Micro grid: Impact of load characteristics – Local control – Centralized Control-Decentralized Control Micro grid control for islanded 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 Micro grid" , Wiley-IEEE Press, 2014.
2. S. Chowhury, S. P. Chowdury and Peter Crossley," Micro grids and Active Distribution Networks" ISBN978-1-84919-014-5, IET renewable Energy series, 2009.

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Course Title	Technical Seminar				B. Tech. VIII Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
1802806	PROJ	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		2	-	-	1	100	--	100

Course Objectives: The main objective of the seminar helps to develop in an emerging field at the intersection of multidisciplinary understandings of culture and education. The students also explore and develop in new perspectives.

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

CO 1	Understand the theme of the seminar.
CO 2	Identify and discuss current real-world issues.
CO 3	Distinguish and integrate differing forms of knowledge and academic disciplinary approaches with that of the student's own academic discipline and apply a multidisciplinary strategy to address current, real-world issues.
CO 4	Improve oral and written communication skills
CO 5	Explore an appreciation of the self in relation to its larger diverse social and academic contexts.
CO 6	Apply principles of ethics and respect in interaction with others.

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Course Title	Project Stage - II				B. Tech. VIII Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
1802807	PROJ	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		--	--	10	5	50	50	100

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 systems approach.
CO 4	Communicate with engineers and the community at large in written an oral form
CO 5	Demonstrate the knowledge, skills and attitudes of a professional engineer

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B. Tech., III Semester

<table>
<tr><td>Course Title</td><td colspan="5">Switching Theory & Logic Design</td><td colspan="3">B. Tech. III Semester (EEE)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2002301</td><td rowspan="2">Professional Core (PCC)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>--</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration : 2Hrs</td><td colspan="3">End Exam Duration : 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives: This course provides in-depth knowledge of switching theory and the design techniques of digital circuits, which is the basis for design of any digital circuit.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to,</td></tr>
<tr><td>CO 1</td><td colspan="8">Change numeric information in different forms</td></tr>
<tr><td>CO 2</td><td colspan="8">Change simple Boolean expressions using the theorems and postulates of Boolean algebra and to minimize combinational functions</td></tr>
<tr><td>CO 3</td><td colspan="8">Design and analyze small combinational circuits and to use standard combinational functions/building blocks to build larger more complex circuits.</td></tr>
<tr><td>CO 4</td><td colspan="8">Design and analyze small sequential circuits and devices and to use standard sequential functions/building blocks to build larger more complex circuits.</td></tr>
<tr><td>CO 5</td><td colspan="8">Understand different types of Programmable Logic Devices</td></tr>
</table>

UNIT - I

Number Systems and Codes: Introduction to Number systems, Basic Conversion Methods, Arithmetic's of Number systems, Complements of Numbers- 1's complement,2's Complement,9's complement,10's complement, Classification of Binary Codes-BCD Code ,XS-3 Code, Gray Code, Error detection and Correction

UNIT - II

Logic Gates and Boolean algebra: Basic Logic Gates, Universal Gates, XOR gate and it's Properties, Boolean Algebra-logic Operations, Laws, Boolean Expression in SOP and POS Form, Minimization of Switching Functions using K-Maps-2 variable,3 variable,4 variable, Don't Care Combination, tabulation Method.

UNIT - III

Combinational Circuits: Introduction, Adders-Half Adder, Full Adder ,Subtractors-Half Subtractor, Full Subtractor, Realization of Adder and Subtractor using Universal gates, Look Ahead carry adder, BCD Adder, Multiplexers, De-multiplexers, Encoders, Decoders.

UNIT - IV

Sequential Circuits: Introduction, Flip Flops- Truth Table, Characteristic Table and Excitation Tables, Conversion of Flip-Flops, Shift Registers-SISO, SIPO, PISO, PIPO,

Bidirectional and Universal Shift Registers, Counters-Design of Synchronous and Asynchronous Counters, Ring Counter, Johnson's counter.

UNIT - V

Programmable Logic Devices: Introduction to PLC, ROM Organization, Types of ROMs, PAL, PLA, PROM, Comparison of PLD's.

Text Books

1. ZVI Kohavi, Switching & Finite Automata theory –, TMH, 2nd Edition.
2. Morris Mano, "Digital Design", PHI, 3rd Edition, 2006.
3. A. Anand Kumar, "Switching Theory & Logic Design", 2008, PHI.
4. John M. Yarbrough, "Digital Logic Applications and Design", Thomson Publications, 2006.

Reference Books

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th edition, 2009.
2. W.H. Gothmann, "Digital Electronics- An introduction to theory and practice", PHI, 2nd edition, 2006.
3. D.V. Hall, "Digital Circuits and Systems", Tata McGraw Hill, 1989.
4. William I. Fletcher, "An Engineering Approach to Digital Design", PHI.

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Course Title	Electromagnetic Field Theory					B. Tech. III Semester (EEE)		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2002302	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	--	--	3	40	60	100
Mid Exam Duration : 2Hrs						End Exam Duration : 3Hrs		

Course Objectives: The objective of the course is to learn the concepts of electric and magnetic fields under static conditions which will be used in theory of transmission lines and electrical machines.

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

CO 1	Understand electric and magnetic fields due to electric charges and Steady Currents, time varying electric and magnetic fields.
CO 2	Analyze Maxwell's equations for both time variant and invariant electric and magnetic fields.
CO 3	Evaluate electric fields and magnetic fields by various laws such as Coulomb's Law, Gauss's Law, Biot Savart's law, Ampere's circuital law. etc.
CO 4	Determine potential, potential gradient, electric dipole, current and current density, polarization, boundary conditions and capacitance of a capacitor
CO 5	Determine force, torque, self inductance, statically and dynamically induced EMFs and displacement current.

UNIT - I

Electric Field & Gauss Law: Coulomb's law, electric field intensity (efi), efi due to a line charge, surface charge and volume charge, work done in moving a point charge in an electric field, gauss law, gauss law using infinite line charge and coaxial cable, gauss law in point form (Maxwell first law, div($\mathbf{D}$) = ρ_v), numeric problems

Electric Potential & Dipole: Electric potential, potential gradient electric dipole, dipole moment – potential & EFI due to an electric dipole, numerical problems.

UNIT - II

Conductors: Current and current density, conduction and convection current densities, continuity equation, behavior of conductors in electric fields, ohm's law in point form, numeric problems.

Polarization & Capacitance: Polarization, boundary conditions – dielectric -conductor, dielectric - dielectric. capacitance – capacitance of parallel plate, spherical and co-axial capacitors, numeric problems.

UNIT - III

Magneto Static Fields: Biot-savart's law, MFI due to a straight current carrying filament, circular and solenoid current carrying wire. maxwell's second equation,

Ampere's Law: Ampere's circuital law and its applications, ampere's circuital law in point form, maxwell third equation , numerical problems. Scalar and Vector magnetic Potential

UNIT - IV

Magnetic Force: Lorentz force equation, Force on a current element in a magnetic field, Force on a straight and long current carrying conductors in magnetic fields, the force between two and straight parallel current carrying conductors, Numeric Problems.

Torque & Inductance: Torque on a current loop placed in a magnetic dipole. Self Inductance, Application of self inductance of a Solenoid and Toroid, numerical Problems

UNIT - V

Time varying Fields: Faraday's laws of electromagnetic induction, its integral and point forms, Maxwell's fourth equation. statically and dynamically induced emfs, modification of maxwell's equation for time varying fields, displacement current, and maxwell's equation in differential and integral form, numerical problems.

Text Books:

1. Principles of Electromagnetics, Mathew N. O. Sadiku, Oxford (I) student 4th edition
2. Electromagnetic Fields, Dr. S. Kamakshaiah, Right Publishers, 2007.
3. Engineering Electromagnetics, William H. Hayt and John A. Buck, TMH, 7th edition 2006.
4. Electromagnetic Waves & Radiating Systems, Edward C. Jordan and Keith G. Balmain, Prentice Hall of India Pvt. Ltd.

Reference Books:

1. Electromagnetics, J. D. Kraus, TMH, 4th edition 1992.
2. Electromagnetic Fields, TVS Arun Murthy, S. Chand & Company Ltd., 1st edition 2008
3. Field Theory, K. A. Gangadhar, P. M. Ramanathan, Khanna Publishers, 15th edition, 2003.
4. Electromagnetics, J. P. Tewari, Khanna Publishers

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Course Title	Electrical Circuit Analysis - II				B. Tech. III Semester (EEE)		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2002303	Professional Core (PCC)	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 concept of locus diagrams, the application of resonance, transients applied for ac and dc circuits, necessary conditions for network functions, various parameters and its relationships.

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

CO 1	Understand the basic concepts of resonance, network functions and locus diagrams.
CO 2	Analyze R-L,R-C and R-L-C circuits for DC and AC transient response.
CO 3	Analyze two port network behavior for various parameters.
CO 4	Evaluate the time domain response for various DC and AC networks

UNIT - I

Resonance: Series, parallel circuits, concept of half power frequencies, bandwidth and q factor. simple problems.

Locus diagrams: Impedance and admittance locus diagrams of series and parallel combinations R-L, R-C, R-L-C with variation of various parameters.

UNIT - II

Network Functions: Single port and multiport networks, immittance functions of two port parameters, necessary conditions for driving point and transfer functions, poles and zeros, time domain response from pole zero plots, restrictions from pole zero locations.

UNIT - III

Two Port Networks: Two port networks, impedance, admittance, transmission parameters, hybrid and inverse hybrid parameters, relationships between parameters, conditions for symmetry and reciprocity.

UNIT - IV

DC Transient Analysis: Determination of initial conditions – transient response of R-L, R-C and R-L-C circuits for DC–solution method using differential equation and laplace transforms.

UNIT - V

AC Transient Analysis: Transient response of R-L, R-C and R-L-C series circuits for sinusoidal excitations – solution method using differential equation and laplace transforms.

Text Books

1. Theory and Problems of Electrical Circuits – Joseph A. Edminister, Schaum Series
2. Circuit Theory - A.Chakrabarty
3. Electrical Engineering Fundamentals V. Del Toro, Prentice Hall International, 2nd Edition, 2019
4. Network Analysis – Van Valkenburg - 3rd edition.

Reference Books

1. Circuits & Networks – A. Sudhakar, Shayammohan. S. Pillai, 4th Edition – TMH.
2. Theodore F. Bogart "Electrical Circuits", McGraw Hill International Edition Series.
3. Network Analysis with applications – Stanely - Pearson education 4th edition.
4. Network Analysis by G.K. Mittal, Khanna Publishers

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<table>
<tr><td>Course Title</td><td colspan="5">Electrical Measurements & Measuring Instruments</td><td colspan="3">B. Tech. III Semester (EEE)</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2002304</td><td rowspan="2">Professional Core (PCC)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>--</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration : 2Hrs</td><td colspan="3">End Exam Duration : 3Hrs</td></tr>
<tr><td colspan="8">Course Objectives: The objective of the course is to learn about the measuring instruments, ac and dc bridges, instrument transformer, potentiometer and CRO.</td></tr>
<tr><td colspan="8">Course Outcomes: On successful completion of this course, the students will be able to,</td></tr>
<tr><td>CO 1</td><td colspan="7">Classify the types of instruments and bridges.</td></tr>
<tr><td>CO 2</td><td colspan="7">Choose a suitable instrument to measure Voltage, Current, Power, Energy and lissajous patterns.</td></tr>
<tr><td>CO 3</td><td colspan="7">Determine circuit parameters using Bridges.</td></tr>
<tr><td>CO 4</td><td colspan="7">Measure Phase angle errors from CT's and PT's, magnitude and frequency from the CRO.</td></tr>
</table>

UNIT - I

Measuring Instruments: Classification, deflecting, control and damping torques, ammeters and voltmeters, PMMC, moving iron, dynamometer type instruments, expression for the deflecting torque and control torque, errors and compensations, extension of range using shunt and multipliers, numeric problems.

UNIT - II

Measurement of Power: Single phase dynamometer wattmeter, expression for deflecting and control torques, types of p.f. meters – dynamometer and moving iron type

Measurement of Energy: Single phase induction type energy meter, driving and braking torques, errors and compensations.

UNIT - III

D.C. Bridges: Method of measuring low, medium and high resistance – sensitivity of wheatstone's bridge – kelvin's double bridge for measuring low resistance,measurement of high resistance – loss of charge method.

A.C Bridges: Measurement of inductance - maxwell's bridge, anderson's bridge, measurement of capacitance and loss angle, desauty's bridge, schering bridge- frequency measurement- wien's bridge.

UNIT - IV

Instrument Transformers: CT and PT – ratio and phase angle errors–design considerations.

Potentiometers: Principle and operation of d.c. crompton's potentiometer, standardization, measurement of unknown resistance, current and voltage. a.c. potentiometers: polar and coordinate types, standardization – applications.

UNIT - V

Electronic Measurements: Cathode ray oscilloscope – cathode ray tube – application of CRO – measurement of phase, frequency, current & voltage – lissajous pattern.

Digital meters: Digital voltmeter – successive approximation, ramp and integrating type.

Text Books

1. Electrical measurements and measuring Instruments – by E.W. Golding and F.C. Widdis, 5th Edition, Reem Publications.
2. Electrical & Electronic Measurement & Instruments by A. K. Sawhney, Dhanpat Rai & Co. Publications.
3. Electronic Instrumentation and measurement techniques by William D Cooper- Prentice Hall Publishers.
4. Electrical Measurements-Martin U. Reisland,New Age International Publishers.

Reference Books

1. Electrical Measurements – by Buckungham and Price, Prentice – Hall
2. Electrical Measurements: Fundamentals, Concepts, Appliations – by Ressland, M.U, New Age International (P) Limited, Publish.
3. Electronic Instrumentation by H. S. Kalsi, Tata Grawhill Mc, 3rd Edition.
4. Principles of Electrical Measurements, Authur Whitemore Smith,classic reprint series.

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Course Title	DC Machines & Transformers					B. Tech. III Semester (EEE)		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2002305	Professional Core (PCC)	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 principle, operation, construction, characteristics of dc machines, and transformers

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

CO 1	Understand the principle, operation and constructional details of dc machines and transformers
CO 2	Analyze the characteristics & parallel operation of dc machines, Speed control and starting of DC motors, phasor diagrams and parallel operation of single phase transformers
CO 3	Compare losses and efficiency by conducting different test on dc machines and transformers
CO 4	Illustrate the Auto transformers, Scott connection and connections types of 3-phase transformers.

UNIT - I

DC Generators: Construction, principle of operation, emf equation, armature reaction, commutation, numerical problems. Types of dc generators, open circuit characteristics, load characteristics of shunt, series and compound generators, parallel operation of dc generators, numeric problems.

UNIT - II

DC Motors: Principle of operation, back emf, torque equation, characteristics and application of series, shunt and compound motors, numerical problems.

Speed Control: Speed control of dc shunt & series motors, starters (3 & 4point) numerical problems.

UNIT - III

Testing of DC Machines: Losses & efficiency, condition for maximum efficiency, brake test, swinburne's test, hopkinson's test, field's test,separation of stray losses in a dc motor, numerical problems.

UNIT - IV

1Φ Transformer: Construction, principle of operation, types, emf equation, operation on no load and load, phasor diagrams, equivalent circuit, losses, efficiency & regulation, all day efficiency, numerical problems.

Testing of Transformer: OC & SC tests, sumpner's test, predetermination of efficiency & regulation, separation of losses test, numeric problems.

UNIT - V

Parallel Operation & Auto transformer: Parallel operation with equal & unequal voltage ratios, auto transformer, equivalent circuit, comparison with two winding transformer, numeric problems.

3Φ Transformer: Types of connections, Y-Y, Y-Δ, Δ-Y, Δ-Δ, open delta, scott connection.

Text Books

1. Electrical Machines, P. S. Bimbra, Khanna Publishers
2. Electrical Machines, I.J. Nagarath & D.P. Kothari, TMH, 7th Edition 2005
3. Electrical Machines, J.B. Gupta, Kataria Publications.
4. Electrical Machines-Fundamentals of Electromechnical conversion, Jacek F.Gieras,

Reference Books

1. Electrical Machinery, A. E. Fitzgerland, C. Kingsley and S. Umlauts, TMH,5th Edition
2. Performance and Design of DC machines, Clayton and Hancock, BPB Publishers, 2004
3. DC Machines & Transformers, R.K. Rajput, Laxmi Publications.
4. A text Book of Electric Machinery, Haris J Ryan,Vol 1.

Course Title	Electrical Circuits Analysis - II Lab				B. Tech. III Semester (EEE)		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2002306	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		--	--	3	1.5	40	60	100
						End Exam Duration : 3Hrs		

Course Objectives: The objective of the course is to determine and verify various network parameters using simulation software.

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

CO 1	Verify DC and AC circuits using MATLAB/SIMULINK
CO 2	Apply theorems for DC and AC circuits using MATLAB/SIMULINK
CO 3	Analyze transient response behavior in MATLAB/SIMULINK
CO 4	Determine the two port parameters using MATLAB/SIMULINK

List of Experiments (Any Eight)

1. Verification of Kirchhoff's current and Voltage law
2. Verification of superposition and reciprocity theorem
3. Verification of compensation theorem
4. Verification of Millman's theorem
5. Determination of average, rms value, form factor, peak factor of sinusoidal wave
6. Determination of Z and Y parameters.
7. Determination of ABCD and h parameters.
8. Analysis of RLC series and parallel resonance.
9. Determine the transient response of RL and RC series networks.
10. Determine the transient response of RLC series networks.

Note: All the above experiments are simulated using MATLAB/OCTAVE/MULTISIM

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Course Title	Electrical Measurements & Measuring Instruments Lab				B. Tech. III Semester (EEE)		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2002307	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		--	--	3	1.5	40	60	100
						End Exam Duration : 3Hrs		

Course Objectives: The objective of the course is to calibrate instruments and measure various circuit parameters.

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

CO 1	Compare and calibrate various measuring Instruments
CO 2	Identify balanced conditions among bridges
CO 3	Measure the percentage errors among measuring instruments

List of Experiments (Any Eight Experiments)

1. Calibration and testing of single phase energy meter
2. Calibration of dynamometer power factor meter.
3. Crompton d.c. potentiometer – calibration of pmmc ammeter and pmmc voltmeter.
4. Kelvin's double bridge – measurement of resistance – determination of tolerance.
5. Measurement of Three Phase Power by using Two Wattmeter Method
6. Schering bridge
7. Anderson bridge
8. Measurements of 3 phase reactive power with single phase wattmeter.
9. Measurement of parameters of a choke using 3 voltmeter and 3 ammeter methods.
10. Calibration LPF wattmeter – by phantom testing.
11. Characteristics of Strain Gauge
12. Study and Calibration of LVDT for Displacement Measurement

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Course Title	DC Machines & Transformers Lab				B. Tech. III Semester (EEE)		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2002308	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		--	--	3	1.5	40	60	100
						End Exam Duration : 3Hrs		

Course Objectives: The objective of the course is to learn and illustrate the performance of DC machines and transformers.

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

CO 1	Analyze performance characteristics of DC machines and transformers
CO 2	Evaluate regulation and efficiency of transformers
CO 3	Distinguish various tests between DC motor and DC generator

List of Experiments (Any Eight)

1. OCC Characteristics of DC shunt Generator
2. Brake test on DC shunt motor
3. Swinburne's test
4. Speed control of DC shunt motor
5. Fields test on DC series machines
6. Hopkinson's test on DC shunt machines
7. Load test on DC shunt generator
8. OC and SC Test on single phase transformer
9. Brake test on DC compound motor
10. Load test on DC compound Generator
11. Load test on DC series generator
12. Sumpner's test on single phase transformer
13. Scott connection of three phase transformer
14. Load test on single phase transformer

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Course Title	Control Systems Lab				B. Tech. EEE IV Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2002407	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		--	--	3	1.5	40	60	100
						End Exam Duration : 3Hrs		

Course Objectives: The objective of the course is to learn the performance of a second order system, PID controller, synchros and characteristics of servo motor. Stability analysis in time and frequency domain, state space analysis in MATLAB.

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

CO 1	Understand the performance of second order system, PID controller, synchros and armature voltage controlled DC motor
CO 2	Analyze the characteristics of magnetic amplifier and servo motor
CO 3	Evaluate stability of linear systems in time and frequency domain using MATLAB
CO 4	Convert transfer function to state space and vice versa using MATLAB

List of the experiments (Any Ten - 8 from Conventional, 2 from MATLAB)

1. Time response of Second order system
2. Characteristics of Synchros
3. Effect of feedback on DC servo motor
4. Transfer function of DC Machine
5. Effect of P, PI, PID Controller on a second order systems
6. Characteristics of magnetic amplifiers
7. Characteristics of AC servo motor
8. Lag and lead compensator design in the frequency domain using MATLAB.
9. Linear system analysis (Time domain analysis) using MATLAB.
10. Stability analysis (Bode, Root Locus) of Linear Time Invariant system using MATLAB
11. State space model for classical transfer function using MATLAB – Verification.

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Course Title	Python Programming Lab				B. Tech. EEE IV Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2005408	Engineering Sciences (ESC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		--	--	3	1.5	40	60	100
						End Exam Duration : 3Hrs		

Course Objectives: The objective of the course is to learn syntax and semantics, create functions in python, Handle Strings and files in Python, understand lists, dictionaries and regular expressions in Python.

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

CO 1	Examine python syntax and semantics and be fluent in the use of python flow control and functions
CO 2	Demonstrate proficiency in handling Strings and file Systems
CO 3	Create, run and manipulate Python programs using core data structures like lists, dictionaries and regular Expressions.

List of Experiments (Any Eight)

2. Compute the GCD of two numbers.
3. Find the square root of a number (Newton's method)
4. Exponentiation (power of a number)
5. Find the maximum of a list of numbers
6. Linear search and Binary search
7. Selection sort, Insertion sort
8. Merge sort
9. First 'n' prime numbers
10. Multiply matrices
11. Programs that take command line arguments (word count)
12. Find the most frequent words in a text read from a file
13. Simulate elliptical orbits in Pygame
14. Simulate bouncing ball using Pygame

Software Required: Python 3 interpreter for Windows/Linux.

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Course Title	Skill Oriented Course (2-D Graphics & Symbolic Processing using MATLAB)				B. Tech. IV Semester (EEE)		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2002409	Skill Oriented Course (SS)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		1	--	2	2	40	60	100
						End Exam Duration : 3Hrs		

Course Objectives: The objective of the course is to learn the knowledge on graphical representation of data using Two Dimensional Graphical features in MATLAB and to gain knowledge to solve problems using symbolic processing techniques.

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

CO 1	Understand basic features of Two-Dimensional graphics
CO 2	Illustrate subplots, interactive plotting tools and specialized 2-D plots
CO 3	Analyze Interpolation and Curve fitting techniques
CO 4	implement symbolic techniques for problem solving

Module-1: 10hrs

2-D Graphics: The Plot function - Line styles, Markers and Colors – Plot Grids, Axes Box, Labels – Multiple plots – Multiple Figures – Subplots – Interactive plotting tools.

Module-2: 10hrs

Specialized 2-D plots–area, fill, bar, pie, stairs and stem. Data Interpolation and curve fitting.

Module-3: 10hrs

Symbolic Processing: Symbolic Expressions and Algebra – Manipulating Trigonometric expressions – Evaluating and Plotting Symbolic Expressions – Solving Algebraic and Transcendental equations - Calculus.

Text books:

1. Mastering MATLAB by Hanselman, Littlefield– Pearson Publications, 1st Edition, 2012.
2. MATLAB Programming by David C. Kuncicky -Prentice Hall, 2004.
3. MATLAB Programming for Engineers by Stephen J. Chapman, Cengage Learning India Pvt. Ltd., 6th Edition, 2019.
4. MATLAB and its Applications in Engineering by Raj Kumar Bansal, Ashok Kumar Goel and Manoj Kumar Sharma, Pearson Education, 2nd Edition 2016.

B. Tech – VII Semester (Theory - 5, Lab - 3, Project - I Stage)

S. No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	1825701	Project Management	HSMC	3	0	0	30	70	3
2	1802702	Utilization of Electrical Power	PCC	3	0	0	30	70	3
3		**Professional Elective -III (PE - III)**							
	1802703	Flexible AC Transmission System	PEC	3	0	0	30	70	3
	1802704	Power Quality	PEC	3	0	0	30	70	3
	1802705	Digital Control Systems	PEC	3	0	0	30	70	3
	1802706	Digital Signal Processing	PEC	3	0	0	30	70	3
	1802707	Smart Grid	PEC	3	0	0	30	70	3
4	--	**Open Elective - II (OE-II)**	PEC	3	0	0	30	70	3
5	--	**Open Elective - III (OE-III)**	PEC	3	0	0	30	70	3
6	1802708	Labview Programming	ESC	0	0	3	50	50	1.5
7	1802709	Power Systems -II Lab	PCC	0	0	3	50	50	1.5
8	1824710	Effective Technical Communication Skills Lab	HSMC	0	0	2	50	50	1
8	1802711	Project Stage - I	PROJ	0	0	6	100	00	3
9	18997M3	Universal Human Values	MC	2	0	0	30	00	0
			Total	19	00	14	380	450	22

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B. Tech – VIII Semester (Theory - 2, Project - II Stage)

S. No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1		**Professional Elective - IV (PE-IV)**							
	1802801	Electrical Distribution Systems	PEC	3	0	0	30	70	3
	1802802	Power System Reliability	PEC	3	0	0	30	70	3
	1802803	Industrial Automation & Control	PEC	3	0	0	30	70	3
	1802804	SCADA & its Application	PEC	3	0	0	30	70	3
	1802805	Distributed Generation & Micro Grid	PEC	3	0	0	30	70	3
2	--	**Open Elective -IV (OE-IV)**	OEC	3	0	0	30	70	3
3	1802806	Technical Seminar	PROJ	2	0	0	100	00	1
4	1802807	Project Stage - II	PROJ	0	0	10	50	50	5
			Total	08	0	10	210	190	12

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B. Tech., VII Semester

Course Title	Utilization of Electric Power				B. Tech. VII Semester		
Course Code	Category	Hours / Week		Credits	Maximum Marks		
1802702	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration : 3Hrs		
Course Objectives: The objective of the course is to learn the concepts of illumination, Electrical heating, Welding, Electrolytic Process and Electric Traction.							
On successful completion of this course, the students will be able to							
CO 1	Understand different types of electric drives, heating, welding and illumination.						
CO 2	Understand the basic principle of electric traction including speed– time curves of different traction services						
CO 3	Understand the method of calculation of various traction systems for braking, acceleration and other related parameters						
CO 4	Choose appropriate drive for the industrial purpose, proper illumination strategy for good lighting system, the traction system for better performance						

UNIT - I

Illumination: Introduction, terms used in illumination, laws of illumination, polar curves, photometry, integrating sphere, sources of light, discharge lamps, MV and SV lamps – Comparison between tungsten filament lamps and fluorescent tubes- Basic principles of light control- Types of lighting schemes -factory lighting, street lighting and flood lighting.

UNIT - II

Electric Heating & Welding: Advantages and methods of electric heating - types and applications of electric heating equipment- Resistance ovens-induction heating –dielectric heating-Electric welding –resistance welding and arc welding techniques - arc furnaces.

UNIT –III

Electric Drives: Types of Electric drives, Choice of motor, starting and running characteristics, Speed control, temperature rise, particular applications of electric drives, types of industrial loads, continuous, intermittent and variable loads, load equalization.

UNIT –IV

Systems of Electric Traction and Track Electrification: Review of existing electric traction systems in India. Special features of traction motors, methods of electric braking – plugging, rheostatic braking and regenerative braking.

UNIT –V

Mechanism of Train Movement: Speed-time curves for different services – Trapezoidal and quadrilateral speed time curves – Calculations of tractive effort, power, specific energy consumption for a given run, the effect of varying acceleration and braking retardation, adhesive weight and coefficient of adhesion.

Text Books:

1. Utilization of Electric energy by E. Openshaw Taylor and V. V. L. Rao, Universities Press, 2009.
2. Art & Science of Utilization of Electrical Energy by H. Partab, Dhanpat Rai & Co, 2004.
3. Electric Traction: A Treatise on the Application of Electric Power to Tramways and Railways by Alfred Thomas Dove, Franklin Classics Trade Press (11 November 2018)

Reference Books:

1. Generation, Distribution and Utilization of Electrical energy by C. L. Wadhwa, New Age International (P) Limited, 1997.
2. Utilization of Electrical Power including Electric Drives and Electric Traction by N. V. Suryanarayana, New Age International (P) Limited, 1996.

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Course Title	Flexible AC Transmission Systems (PE – III)					B. Tech. VII Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1802703	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	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.

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 Gyuygyi, 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.
3. Flexible AC Transmission Systems by Suman Bhowmick, CRC Press, 2015.

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	POWER QUALITY (PE – III)					B. Tech. VII-Semester		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1802704	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3Hrs		

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.

UNIT-III

Fundamentals of Harmonics & Applied 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. Applied Harmonics: Effects Of Harmonics, Harmonic Distortion Evaluations, Principles of Controlling Harmonics, Devices for Controlling Harmonic Distortion.

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	Digital Control Systems (PE – III)					B. Tech. VII-Semester		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1802705	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3Hrs		

Course Objectives: The student is able to learn basics of digital control systems, Z-plane analysis of discrete time control systems, Design of systems by conventional methods, state space analysis and design of pole placement and state observer.

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

CO 1	Understand the basic concepts of digital control systems, Z-transforms & inverse Z-transforms
CO 2	Analyze z-plane for various discrete time control systems, liapunov stability
CO 3	Design control systems by using conventional methods, pole placement and state observer
CO 4	Apply state space for solving discrete and continuous state space equations

UNIT- I

Introduction: Digital Control Systems, quantization and quantization error, Z-transform, Z-transforms of elementary functions, properties of Z-transform, Inverse Z-transform, Z-transform method for solving difference equations.

UNIT-II

Z-plane Analysis of Discrete time Control Systems: Introduction, Impulse sampling and data hold, pulse transfer function, realization of digital controllers and digital filters.

UNIT-III

Design of Digital control systems by Conventional methods: Introduction, Mapping between s-plane and z-plane, transient and steady-state response analysis, Design based on frequency response methods, Analytical Design method.

UNIT- IV

State Space Analysis: State space representation of digital systems, solving discrete state space equations, pulse transfer function matrix, discretization of continuous time state space equations, Liapunov stability analysis.

UNIT-V

Pole placement and State Observers design: Controllability, Observability, useful transformations of state space analysis and design, Design through pole placement, state observer.

Text Books

1. Katsuhiko Ogatta, "Discrete time Control Systems" Second Edition, Prentice Hall of India (2005)
2. I. J. Nagrath, "State Space methods and digital control systems", New Age International (2004).

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Course Title	Digital Signal Processing (PE – III)					B. Tech. VII-Semester		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1802706	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3Hrs		

Course Objectives: The objective of the course is to learn about Discrete Fourier Transform and its efficient computation, various IIR and FIR realization techniques, design of IIR and FIR filters.

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

CO 1	Interpret, represent and process discrete/digital signals and systems
CO 2	Understand discrete and fast Fourier transforms
CO 3	Apply Z-transforms in digital system design
CO 4	Design FIR and IIR Digital Filter for the desired characteristics

UNIT-I

Introduction: Definition and Classification of Signals, Elementary signals, Basic operations on signals.

Discrete-time signals: Sequences, Discrete-time systems, Linear-time invariant systems and its properties, linear constant coefficient difference equations, Frequency-domain representation of discrete-time signals and systems

UNIT-II

Discrete Fourier Transform: The Fourier Transform of periodic signals, sampling the Fourier transform, the discrete Fourier transform, properties of DFT, linear convolution of sequences using DFT.

Fast Fourier Transforms: Efficient computation of the DFT, Decimation in time and decimation in frequency FFT algorithms, Implementation of FFT algorithms and FFT algorithms for composite N.

UNIT-III

Z–Transforms: Introduction, The z-transform, properties of the Region of Convergence for the z-transform, The Inverse z-transform, z-transform properties, the inverse z-transform using contour integration.

Realization of Digital Filters: Block diagram representation of linear constant-coefficient difference equations, basic structures of IIR filters- direct form I, direct form II, transposed form, cascade form, parallel forms, basic structures of FIR filters-Direct form, Cascade form, Linear phase structure, Lattice structures.

UNIT-IV

IIR Digital Filters: General considerations-Causality and its implications, Characteristics of Practical Frequency-selective filters, IIR filter design by Impulse Invariance, Bilinear

transformation, Design of IIR filters from analog filters-Butterworth and chebyshev approximations, design examples: frequency transformations, Illustrative Problems.

UNIT-V

FIR Digital Filters: Symmetric and Anti-symmetric FIR filters, Design of Linear Phase FIR digital filters using windows, Frequency sampling technique, comparison of IIR and FIR filters, Illustrative Problems,

Applications of DSP (Dual Tone Multi frequency signal detection, Spectral analysis of sinusoidal and non stationary signals).

Text Books

1. A.V.Oppenheim and R.W. Schaffer, & J R Buck, "Discrete Time Signal Processing," 2nd ed., Pearson Education, 2012.
2. John G. Proakis, Dimitris G. Manolakis, "Digital signal processing, principles, Algorithms and Aapplications", Pearson Education/PHI, 4th Edition, 2007.
3. Sanjit K Mitra, "Digital signal processing", A computer base approach- Tata McGraw-Hill, 3rd Edition, 2009.

Reference Books

1. Andreas Antoniou, Digital signal processing: Tata McGraw-Hill, 2006.
2. Digital signal processing: M H Hayes, Schaum's Outlines, Tata McGraw-Hill, 2007.
3. A. Anand Kumar, "Digital Signal Processing," PHI Learning, 2011.

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Course Title	Smart Grid (PE – III)					B. Tech. VII-Semester		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1802707	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	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 - Phase Measurement Unit (PMU).

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

Reference Books

1. A.G. Phadke and J.S. Thorp, "Synchronized Phasor Measurements and their Applications", Springer Edition, 2e, 2017.
2. James Northcote, Green, Robert G. Wilson "Control and Automation of Electric Power Distribution Systems (Power Engineering)", CRC Press.
3. Andres Carvallo, John Cooper, "The Advanced Smart Grid: Edge Power Driving Sustainability", Artech House Publishers July 2011.
4. 4. Clark W Gellings, "The Smart Grid, Enabling Energy Efficiency and Demand Side Response"- CRC Press, 2009.

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Course Title	Labview Programming					B. Tech. VII Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1802708	Engineering Science Course (ESC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	3	1.5	50	50	100
						End Exam Duration : 3Hrs		

Course Objectives: The objective of the course is to learn, write, test and debug simple Labview Programs.

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

CO 1	Understand, test and debug simple Labview Programs
CO 2	Demonstrate operations on arrays and strings
CO 3	Apply conditional statements with Labview
CO 4	Make use of SubVI's for structuring Labview Programs
CO 5	Make use of Read and write data from/to files in Labview

LIST OF PROGRAMS

1. Basic arithmetic operations (Add, mul, div, compound arithmetic, expression node, express formula and formula node)
2. Boolean operations (truth table verification of logic gates, Half Adder and Full Adder, convert binary to decimal value, convert BCD to Gray and Vice-Versa)
3. String operations (Length, concatenation, insert string, sub-string, replace string, reverse string, rotate string, etc)
4. Sum of 'N' numbers using feedback loop (use 'for ' loop and 'while' loop)
5. Factorial of a give number using shift register (use 'for' loop and 'while' loop)
6. Generate Fibonacci series for N iteration (use 'for' loop)
7. Create a VI to increase the tank level from 0 to 100 & decrease the value from 100 to 0 using while loop in a single process.
8. Create a VI to implement and, or & not gates(or arithmetic operations) using case structure
9. Build a VI that generates a 1D array of random numbers and sort the array in descending and ascending order and find the following:
   a) Maximum and min value of array elements
   b) Size of the array
   c) Sum and product of array elements
   d) Rotate array by 1 position
   e) Split the array after 2 elements
10. Build an array of cluster controls in which each cluster consists of a numeric control and 1D numeric array. This forms the database of students. The numeric control indicates the

roll no and array indicates the test marks of 4 subjects. Build the logic to modify the mark in a particular subject of a particular student. Input the roll number, subject in which mark is to be changed and new mark. Display the database on a separate array indicator.

11. Create a VI to implement Full Adder circuit using SubVI.

12. Any application using Flat and stacked sequence

Software Used: LABVIEW Software for Windows/Linux

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Course Title	Power Systems – II Lab				B. Tech. VII Semester		
Course Code	Category	Hours / Week		Credits	Maximum Marks		
1802709	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	3	1.5	50	50	100
						End Exam Duration : 3Hrs		

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

- To present a problem oriented knowledge of power system analysis methods.
- To address the underlying concepts & approaches behind analysis of power system network using software tools.
- To identify & formulate solutions to problems relevant to power system using software tools.

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

CO 1	Understand the concept of MATLAB programming and ETAP in solving power systems problems.
CO 2	Acquire knowledge on formation of Bus Admittance matrix.
CO 3	Analyze the power flow using GS, NR method and DC load flow method.
CO 4	Analyze various fault studies on power system.
CO 5	Understand power system planning and operational studies.

List of Experiments (Any Eight)

1. Modelling of a Transmission Line with Lumped parameters.
2. Formation of Y-bus for a given power system network.
3. AC Load flow analysis of a simple 3-bus system using Gauss Seidel method.
4. AC Load flow analysis of a simple 3-bus system using Newton Raphson method.
5. Study on D C Load Flow
6. Study on Economic Load Dispatch.
7. Short circuit analysis.
8. Simulation of single area load frequency control system.
9. Simulation of Automatic Voltage Regulator.
10. Tripping characteristics of Fuse & MCB.
11. Tripping sequence of protective devices.
12. Characteristics of over current relay.

Note: All the above experiments are simulated using MATLAB/ETAP Software/Power World Simulator

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Course Title	Project Stage - I				B. Tech. VII Semester		
Course Code	Category	Hours / Week		Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	Total
1802711	PROJ	--	--	6	3	100	--	100

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 utilising a systems approach.
CO 4	Communicate with engineers and the community at large in written an oral form
CO 5	Demonstrate the knowledge, skills and attitudes of a professional engineer

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B. Tech., VIII Semester

Course Title	Electrical Distribution Systems (PE – IV)					B. Tech. VIII Semester		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1802801	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3Hrs		

Course Objectives: The student is able to learn load modelling 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.

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.
3. Electric Distribution Systems by Abdelhay A. Sallam, Om P. Malik, IEEE Press, Wiley Publishers, 2nd Edition, 2018.
4. Control and Automation of Electrical Power Distribution Systems by James Northcote-Green, Robert G. Wilson, CRC Press (Taylor & Francis), 1st Edition, 2006.

Reference Books

1. Electric Power Distribution Automation by Dr. M. K. Khedkar and Dr. G. M. Dhole, University Science Press, 2010.
2. Electrical Power Distribution Systems by V. Kamaraju, Jain Book Depot. 2012.
3. Electrical Power Systems for Industrial Plants by Kamalesh Das, JAICO Publishing House, 2008.
4. Hand Book of Electric Power Distribution by G. Ramamurthy, 2nd Edition, Universities Press, 2009.

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Course Title	Power System Reliability (PE – IV)				B. Tech. VIII Semester		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1802802	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	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 modelling 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

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.
3. Reliability Engineering-Methods and Applications by Mange Ram,CRC publications.
4. Reliability of Power Systems by G.F.Kovaley,L.M.Lebedeva,Sringer Publications

Reference Books

1. System Reliability Concepts by V. Sankar, Himalaya Publishing House, 2015.
2. Stochastic Models in Reliability Engineering by Lirong Cui,Ilia Frenkel,Antoly Lisnianski, CRC Publications.
3. Fundamentals of Reliability Engineering by Indra Gunawan,Wiley publications.
4. An Introduction to Reliability and Maintainability Engineering by Charles E. Ebeling, 3rd Edition, Kindle Edition.

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Course Title	Industrial Automation & Control (PE – IV)					B. Tech. VIII Semester		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1802803	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	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 basic of automation, how system works and importance of PLC, SCADA and robots in automation. This course will provide 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). Industrial bus systems: modbus & profibus

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.

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
3. Industrial Instrumentation, Control and Automation, S. Mukhopadhyay, S. Sen and A.K. Deb, Jaico Publishing House, 2013
4. Programmable logic controller, Dunning, Delmar

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

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Course Title	SCADA & Its Applications (PE – IV)				B. Tech. VIII Semester		
Course Code	Category	Hours/ Week		Credits	Maximum Marks		
1802804	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	100
Mid Exam Duration: 2 Hrs					End Exam Duration : 3Hrs		

Course Objectives: The student is able to learn

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

CO 1	Describe the basic tasks of Supervisory Control Systems (SCADA) as well as their typical applications.
CO 2	Acquire knowledge about SCADA architecture, various advantages and disadvantages of each system
CO 3	Acquire knowledge about single unified standard architecture IEC 61850
CO 4	Acquire knowledge about SCADA system components: remote terminal units, PLCs, intelligent electronic devices, HMI systems, SCADA server
CO 5	Acquire knowledge about SCADA communication, various industrial communication technologies, open standard communication protocols
CO 6	Learn and understand about SCADA applications in transmission and distribution sector, industries etc
CO 7	Gain knowledge and understanding for the design and implementation of a SCADA system

UNIT - I

Introduction to SCADA: Data acquisition systems, Evolution of SCADA, Communication technologies, Monitoring and supervisory functions, SCADA applications in Utility Automation, Industries

UNIT - II

SCADA System Components: Schemes- Remote Terminal Unit (RTU), Intelligent Electronic Devices (IED), Programmable Logic Controller (PLC), Communication Network, SCADA Server, SCADA/HMI Systems

UNIT - III

SCADA Architecture: Various SCADA architectures, advantages and disadvantages of each system - single unified standard architecture -IEC 61850

UNIT - IV

SCADA Communication: various industrial communication technologies -wired and wireless methods and fiber optics. Open standard communication protocols

UNIT - V

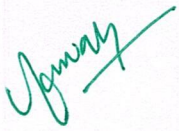
SCADA Applications: Utility applications- Transmission and Distribution sector - operations, monitoring, analysis and improvement. Industries - oil, gas and water.

Text Books

1. Stuart A. Boyer: SCADA-Supervisory Control and Data Acquisition, Instrument Society of America Publications, USA,2004.
2. Gordon Clarke, Deon Reynders: Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems, Newnes Publications, Oxford, UK,2004.

Reference Books

1. William T. Shaw, Cyber security for SCADA systems, PennWell Books, 2006.
2. David Bailey, Edwin Wright, Practical SCADA for industry, Newnes, 2003.
3. Michael Wiebe, A guide to utility automation: AMR, SCADA, and IT systems for electric power, Penn Well 1999



Course Title	Distributed Generation & Micro Grid (PE – IV)				B. Tech. VIII Semester		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1802805	Professional Elective (PEC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	30	70	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 system 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 micro grid 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.

UNIT - IV

Introduction to Micro grid: Micro grid Configurations – CERTS Micro grid 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 Micro grid - Grid Connected Mode – Islanded mode – Battery Charging mode – design of parallel inverters – Micro grid application - Brick Busses Software Frame work.

UNIT - V

Control in Micro grid: Impact of load characteristics – Local control – Centralized Control-Decentralized Control Micro grid control for islanded 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 Micro grid" , Wiley-IEEE Press, 2014.
2. S. Chowhury, S. P. Chowdury and Peter Crossley," Micro grids and Active Distribution Networks" ISBN978-1-84919-014-5, IET renewable Energy series, 2009.

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Course Title	Technical Seminar				B. Tech. VIII Semester		
Course Code	Category	Hours / Week		Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	Total
1802806	PROJ	2	-	-	1	100	--	100

Course Objectives: The main objective of the seminar helps to develop in an emerging field at the intersection of multidisciplinary understandings of culture and education. The students also explore and develop in new perspectives.

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

CO 1	Understand the theme of the seminar.
CO 2	Identify and discuss current real-world issues.
CO 3	Distinguish and integrate differing forms of knowledge and academic disciplinary approaches with that of the student's own academic discipline and apply a multidisciplinary strategy to address current, real-world issues.
CO 4	Improve oral and written communication skills
CO 5	Explore an appreciation of the self in relation to its larger diverse social and academic contexts.
CO 6	Apply principles of ethics and respect in interaction with others.

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Course Title	Project Stage - II				B. Tech. VIII Semester		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
1802807	PROJ	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		--	--	10	5	50	50	100

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 systems approach.
CO 4	Communicate with engineers and the community at large in written an oral form
CO 5	Demonstrate the knowledge, skills and attitudes of a professional engineer

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Course Title	Skill Oriented Course (Fundamentals of MATLAB Programming)				B. Tech. III Semester (EEE)		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2002309	Skill Oriented Course (SS)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		1	--	2	2	40	60	100
						End Exam Duration : 3Hrs		

Course Objectives: The objective of the course is to learn basic knowledge in MATLAB Programming to solve Electrical Engineering Problems.

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

CO 1	Understand the basic features of MATLAB Programming,Array construction methods, operations, Relational & Logical Operators.
CO 2	Illustrate the Polynomial operations
CO 3	Analyze the Control flow structures IF-ELSE, FOR and WHILE
CO 4	Solve electrical engineering problems using MATLAB Programs

Module-1: 10hrs

Basic features: Introduction –Simple math – MATLAB Workspace – About variables – comments, punctuation and aborting execution – Script M-files.

Arrays and Array Operations: Simple arrays – Array addressing – Array construction – Scalar Array Mathematics - Array Array Mathematics –Array size.

Module-2: 10hrs

Control Flow: Relational & Logical operators – For, While Loops, If-Else-End Construction.

Polynomials: Roots, multiplication, addition, division, derivatives and Integrals

Module-3: 10hrs

Electrical Engineering Applications: Solving simple problems in Electrical Circuits, Electrical Machines, Control Systems and Power Systems.

Text books

1. Mastering MATLAB by Hanselman, Littlefield– Pearson Publications, 1st Edition, 2012.
2. MATLAB Programming by David C. Kuncicky -Prentice Hall, 2004.
3. MATLAB Programming for Engineers by Stephen J. Chapman, Cengage Learning India Pvt. Ltd., 6th Edition, 2019.
4. MATLAB and its Applications in Engineering by Raj Kumar Bansal, Ashok Kumar Goel and Manoj Kumar Sharma, Pearson Education, 2nd Edition 2016.

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Course Title	Human Values & Professional Ethics				B. Tech. III Semester (EEE)		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
20MC310	Mandatory Course (MC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		2	-	--	--	40	--	40
Mid Exam Duration: 2Hrs					End Exam Duration : 3Hrs		

Course Objectives: The objective of the course is to understand the moral values that ought to guide the management profession and resolve the moral issues in the profession, justify the moral judgment concerning the profession, develop a set of beliefs, attitudes, and habits that engineers should display concerning morality, create an awareness on Management Ethics and Human Values, inspire Moral and Social Values and Loyalty and appreciate the rights of others.

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

CO 1	Develop appropriate technologies and management patterns to create harmony in professional and personal life.
CO 2	Ensure students sustained happiness through identifying the essentials of human values and skills.
CO 3	Get awareness of types of ethical challenges and dilemmas confronting members of a range of professions (business, media, police, law, medicine, research)
CO 4	Bring to bear ethical analysis and reasoning in the light of normative ethics frameworks on a selection of ethical challenges and dilemmas across the chosen range of professions
CO 5	relate ethical concepts and materials to ethical problems in specific professions and professionalism

UNIT - I

Human Values: Morals, Values and Ethics - Integrity - Trustworthiness - Work Ethics - Service Learning - Civic Virtue - Respect for others - Living Peacefully - Caring - Sharing - Courage - Value Time - Cooperation - Commitment - Empathy - Self-confidence - Spirituality - Character.

UNIT - II

Engineering Ethics: Senses of Engineering Ethics – Variety of Moral issues – Types of inquiry – Moral Dilemmas – Moral Autonomy – Kohlberg's Theory – Consensus and Controversy – Professions and Professionalism – professional ideals and virtues.

UNIT - III

Engineer's Responsibility for Safety: Safety and Risk – Assessment of Safety and Risk – Risk benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk – Chernobyl Case and Bhopal Case studies.

UNIT - IV

Value Education: Self- exploration- its content and process- natural acceptance- Happiness and Prosperity- Understanding Human relations.

UNIT - V

Holistic Perception of Harmony: Understanding the Harmony in the society- -Universal order- critical appreciation of Human values- Justice, Trust.

Text Books

1. Mike Martin and Roland Schinzinger.“ Ethics in Engineering ’’, McGrow Hill, New York 2005.
2. Charles E Harris. Michael S Pritchard and Michael J Rabins.“ Engineering Ethics – Concepts and Cases ”, Thomson Learning 2000.
3. R R Gaur, R Asthana, G P Bagaria, “A Foundation Course in Human Values and Professional Ethics”, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1.

Reference Books

1. Charles D Fleddermann, “ Engineering Ethics”, Prentice Hall, New Mexico, 1999.
2. John R Baatright. “Ethics and the Conduct of Business”, Pearson Education 2003.
3. Edmund G Seeabauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University press 2001.

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B. Tech., IV Semester

<table>
<tr><td>Course Title</td><td colspan="5">Special Functions & Complex Analysis</td><td colspan="3">B. Tech. EEE IV Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2021401</td><td rowspan="2">Basic Sciences (BSC)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration : 2Hrs</td><td colspan="3">End Exam Duration : 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives: The objective of this course is to familiarize the students Bessel functions, Legendre's equations and the concepts of complex variables to equip the students to solve application problems in their disciplines</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to,</td></tr>
<tr><td>CO 1</td><td colspan="8">Solve Bessel and Legendre equations in terms of polynomials</td></tr>
<tr><td>CO 2</td><td colspan="8">Define analytic function, singularities, poles and residues</td></tr>
<tr><td>CO 3</td><td colspan="8">Determine the differentiation of complex functions used in engineering problems and analyze images from z-plane to w-plane</td></tr>
<tr><td>CO 4</td><td colspan="8">Discuss the various special transformations</td></tr>
<tr><td>CO 5</td><td colspan="8">Analyze real definite integrals in definite regions</td></tr>
</table>

UNIT - I

Bessel functions: Introduction – Recurrence formulae for $J_n(x)$ – Generating function for $J_n(x)$ – Jacobi series – Orthogonality of Bessel functions – Legendre's equation – Rodrigue's formula, Legendre Polynomials – Generating function for $P_n(x)$ - Recurrence formulae for $P_n(x)$ – Orthogonality of Legendre polynomials.

UNIT - II

Functions of a complex variable: Limit – Continuity -Differentiability – Analytic function – Properties – Cauchy – Riemann equations in cartesian and polar coordinates – Harmonic and Conjugate harmonic functions. Construction of analytic function using Milne's Thomson method.

UNIT - III

Conformal Mapping: Some standard transforms – translation, rotation, magnification, inversion and reflection. Bilinear transformation – invariant points. Special conformal transformations: $w = e^z$, z^2, sinz and cosz.

UNIT - IV

Complex integration: Line integral - Evaluation along a path – Cauchy's theorem – Cauchy's integral formula – Generalized integral formula. Singular point – Isolated singular point – Simple pole, Pole of order m – Essential singularity.

UNIT - V

Residues: Evaluation of residues by formula. Cauchy's residue theorem – Evaluation of the real definite integrals of the type (i) Integration around the unit circle (ii) integration around a small semi circle

Text Books:

1. Higher Engineering Mathematics, Dr. B.S Grewal, Khanna Publishers.
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Publications, 9th edition.

Reference Books:

1. Higher Engineering Mathematics, B.V.Ramana, Mcgraw Hill Education(India) Private Limited.
2. Engineering Mathematics, Volume – III , E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher.

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Course Title	Fundamentals of Management for Engineers				B. Tech. EEE IV Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2025402	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	--	--	3	40	60	100
Mid Exam Duration : 2Hrs						End Exam Duration : 3Hrs		

Course Objectives: The objective of the course is to understand the functions and responsibilities of managers, provide them tools and techniques to be used in the performance of the managerial job, enable them to analyze and understand the environment of the organization and to develop cognizance of the importance of management principles.

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

CO 1	Know and understand principles, functions, approaches and theories of Management.
CO 2	Use problem solving strategies and critical thinking skills in real life situations.
CO 3	Design organization structures and understand the concept of Human Resource Management in present Competitive Organizations.
CO 4	Recognize and Describe the role of leaders in business and other types of Organizations.
CO 5	Explain the basic control process, monitoring points and describes the different levels and types of controls

UNIT – I

Introduction to Management: Definition, Nature and Scope, Functions, Managerial Roles, Levels of Management, Managerial Skills, Challenges of Management; Evolution of Management- Classical Approach- Scientific and Administrative Management; The Behavioral approach; The Quantitative approach; The Systems Approach; Contingency Approach, IT Approach.

UNIT – II

Planning and Decision Making: General Framework for Planning: Planning Process, Types of Plans, Management by Objectives, Development of Business Strategy. Decision making and Problem solving: Programmed and Non Programmed Decisions, Steps in Problem Solving and Decision Making; Bounded Rationality and Influences on Decision Making.

UNIT – III

Organization Structures and HRM: Principles of Organization: Organizational Design & Organizational Structures. Organizational ulture; Organizational Climate and Organizational Change.

Human Resource Management & Business Strategy: Talent Management, Talent Management Models and Strategic Human Resource Planning; Recruitment and Selection; Training and Development; Performance Appraisal.

UNIT – IV

Leading and Motivation: Leadership, Power and Authority, Leadership Styles; Behavioral Leadership, Situational Leadership, Leadership Skills, Leader as Mentor and Coach, Leadership during adversity and Crisis; Handling Employee and Customer Complaints, Team Motivation - Types of Motivation; Relationship between Motivation, Performance and Engagement, Content Motivational Theories.

UNIT – V

Controlling: Control, Types and Strategies for Control, Steps in Control Process, Budgetary and Non- Budgetary Controls. Characteristics of Effective Controls, Establishing control systems, Control frequency, and Methods.

Text Books:

1. Management Fundamentals, Robert N Lussier, 5e, Cengage Learning, 2013.
2. Fundamentals of Management, Stephen P. Robbins, Pearson Education, 2009.

Reference Books:

1. Essentials of Management, Koontz Kleihrich, Tata McGraw Hill.
2. Management Essentials, Andrew DuBrin, 9e, Cengage Learning, 2012

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Course Title	Induction Motors & Synchronous Machines					B. Tech. EEE IV Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2002403	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	--	--	3	40	60	100
Mid Exam Duration : 2Hrs						End Exam Duration : 3Hrs		

Course Objectives: The objective of the course is to learn principles, operation, construction, characteristics and starting methods of induction motor and synchronous machines.

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

CO 1	Understand Constructional details, working, characteristics, starting methods of synchronous machines and induction motors.
CO 2	Distinguish torque-speed curves and Speed control methods of induction motors.
CO 3	Analyze the regulation, synchronization, hunting of synchronous machines and power factor improvement.
CO 4	Evaluate the performance of three phase induction machines and synchronous machines by direct and indirect tests.

UNIT - I

3-Φ Induction Motors: Production of rotating magnetic field - construction, types (squirrel cage and slip-ring), torque slip characteristics, starting and maximum torque, equivalent circuit. phasor diagram, losses and efficiency, circle diagram construction.

UNIT - II

Starting methods: Methods of starting for induction motors.

1-ø Induction Motor: Introduction - double field revolving theory– equivalent circuit – determination of equivalent parameters- problems - starting methods – resistance & capacitance split phase and shaded pole motors.

UNIT - III

Synchronous Generators: Constructional details of synchronous machines, armature windings, distribution, pitch and winding factors - emf equation; armature reaction, concept of leakage flux, synchronous reactance, equivalent circuit, phasor diagram, voltage regulation, determination of regulation by synchronous impedance method, MMF and ZPF method.

UNIT - IV

Salient Pole Machines: Theory of salient pole machines, phasor diagrams, and determination of X_d and X_q from slip test, expression for power output of salient pole and cylindrical pole synchronous generators, power angle characteristics, Synchronizing power and torque.

Parallel Operation: Conditions for parallel operations, synchronizing and load sharing of synchronous generators

UNIT - V

Synchronous Motors: Principle of operation, methods of starting, phasor diagram of synchronous motor, variation of current and power factor with excitation, hunting and use of damper bars, synchronous condenser and power factor correction.

Text Books

1. Electrical Machines, P. S. Bimbra, Khanna Publishers
2. Electrical Machines, I.J. Nagarath & D.P. Kothari, TMH, 7th Edition 2005
3. Electrical Machines, J.B. Gupta, Kataria Publications.
4. Electrical Machines-Fundamentals of Electromechnical convertion, Jacek F.Gieras,

Reference Books

1. Electrical Machinery, A. E. Fitzgerland, C. Kingsley and S. Umlauts, TMH,5th Edition
2. Performance and Design of DC machines, Clayton and Hancock, BPB Publishers, 2004
3. DC Machines & Transformers, R.K. Rajput, Laxmi Publications.
4. A text Book of Electric Machinery,Haris J Ryan,Vol 1.

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Course Title	Linear Control Systems					B. Tech. EEE IV Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2002404	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	--	--	3	40	60	100
Mid Exam Duration : 2Hrs						End Exam Duration : 3Hrs		

Course Objectives: The objective of the course is to learn mathematical modeling of physical systems, electrical systems, time response of first order and second order Systems, stability analysis using time domain and frequency domain and design compensator in frequency domain to improve the performance.

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

CO 1	Understand modeling of physical systems, time and frequency domain specifications and stability of the system.
CO 2	Analyze the stability of the system in time and frequency domains.
CO 3	Evaluate the transfer function using block diagram reduction technique and signal flow graph, steady state error and static error constants.
CO 4	Design lag, lead, lag-lead compensators in frequency domain.

UNIT - I

Control System Concepts: Introduction to control systems, classification, transfer function, effect of feedback, mathematical modeling of physical systems, block diagram, reduction techniques, signal flow graphs and mason's gain formula, transfer function of simple electrical systems.

UNIT - II

Time Domain Analysis: Standard test signals, time response of first and second order systems- time response specifications, steady state error and error constants, response of P, PI, and PID controllers.

UNIT - III

Concept of Stability and Root Locus: The concept of stability, necessary conditions for stability – Routh Hurwitz's criterion – limitations of Routh's stability – Root locus concept – construction of Root loci, effect of poles & zeros on stability.

UNIT - IV

Frequency Domain Analysis: Introduction, correlation between time and frequency response, frequency domain specifications, bode plots, Polar plots - gain and phase margin.

UNIT - V

Compensation Techniques: System design and compensation – realization of basic lead, lag and lead – lag cascade compensations in frequency domain.

Text Books

1. "Control Systems Engineering" by I. J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers, 5th edition, 2007.
2. "Automatic Control Systems" by B. C. Kuo and Farid Goinaraghi – John Wiley and Son's, 8th edition, 2003.
3. Control Systems" by A. Anand Kumar, Prentice Hall of India Pvt. Ltd.
4. "Control System Engineering", Norman S.Nise,7th Edition.

Reference Books

1. "Modern Control Engineering" by Katsuhiko Ogata, Prentice Hall of India Pvt. Ltd., 5th edition, 2010.
2. "Control Systems Engineering" by NISE, 5th edition, John Wiley.
3. "Modern Control Systems" by C. Dorf, Robert H.Bishop, 12th edition, Pearson New International Edition.
4. "Advanced Control Engineering", Roland S.Burns.

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<table>
<tr><td>Course Title</td><td colspan="4">Power Systems - I</td><td colspan="3">B. Tech. EEE IV Sem</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2002405</td><td rowspan="2">Professional Core (PCC)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>--</td><td>--</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration : 2Hrs</td><td colspan="3">End Exam Duration : 3Hrs</td></tr>
<tr><td colspan="8">Course Objectives: The objective of the course is to learn conventional & non conventional energy sources, economic aspects mechanical and electrical design of transmission lines, and underground cables.</td></tr>
<tr><td colspan="8">Course Outcomes: On successful completion of this course, the students will be able to,</td></tr>
<tr><td>CO 1</td><td colspan="7">Understand the basic concepts of various generating systems and its load characteristics</td></tr>
<tr><td>CO 2</td><td colspan="7">Understand the construction and types of cables used for underground</td></tr>
<tr><td>CO 3</td><td colspan="7">Analyze the mechanical aspects of transmission lines and corona phenomenon</td></tr>
<tr><td>CO 4</td><td colspan="7">Evaluate inductance and capacitance of transmission lines and grading of underground cables</td></tr>
<tr><td>CO 5</td><td colspan="7">Determine the cost of electrical energy, tariff charges on consumers</td></tr>
</table>

UNIT - I

Thermal, Hydro & Nuclear Power Stations: Line diagram & its explanation for thermal, hydro & nuclear power stations, and principle of operation of nuclear reactor.

UNIT - II

Economic Aspects of Power Generation: Load curve, load duration curve, integral load duration curves, load factor, demand factor, diversity factor, capacity factor, utilization factor and plant use factors-numerical problems.

Choice of size and number of generating units, cost of electrical energy, problems, types of tariff charges on consumers – numerical problems.

UNIT - III

Mechanical Design of Transmission Lines: Insulators, types of insulators, string efficiency, methods of improving string efficiency, numerical problems.

Sag and tension calculations for equal and unequal heights of towers, effect of wind and ice on weight of conductors, numerical problems.

UNIT - IV

Electrical Design of Transmission Lines: Types of conductors, calculation of resistance for solid conductor, concept of GMR & GMD, calculation of inductance and capacitance for 1Φ and 3Φ single and double circuit lines, symmetrical and asymmetrical conductor configuration with and without transportation, effect of earth on capacitance - numerical problems.

UNIT - V

Underground Cables: Construction, types of cables, insulation in cables, calculation of insulation resistance and stress in insulation. capacitance of single and 3 core belted cables. grading of cables, capacitance grading, description of intersheath grading, numeric problems.

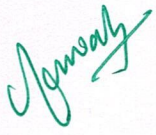
Corona: Description of corona phenomenon, factors affecting corona, critical disruptive voltage, visual disruptive voltage and power loss, radio interference, numeric problems.

Text Books

1. Elements of power system analysis, William. D. Stevenson, 4th Edition Jr., MGH
2. Modern Power System Analysis by I. J. Nagarath & D. P. Kothari, TMH, 2nd Edition.
3. A Text Book on Power System Engineering by M. L. Soni, P. V. Gupta, U. S. Bhatnagar, Chakrabarti, Dhanpat Rai & Co Pvt. Ltd., 2003.
4. Power Systems Engineering, Yoshihide Hase, Wiley Publications.

Reference Books

1. Electrical power systems by C. L. Wadhwa, New Age International publications.
2. A course in Power Systems by J. B. Gupta, S. K. Kataria & Sons, 11th Edition, 2013.
3. Power System analysis and Design, J.Duncan Glover, Thomas J Overbye,4th Edition.
4. Electrical Power system Technology, Dale R.Patrick, Stephen W.Fardo, 3rd Edition.



Course Title	Induction Motors & Synchronous Machines Lab					B. Tech. EEE IV Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2002406	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		--	--	3	1.5	40	60	100
						End Exam Duration : 3Hrs		

Course Objectives: The objective of the course is to analyze the performance of various AC machines like induction motors and synchronous machines.

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

CO 1	Identify parts of transformers and AC machines
CO 2	Determine the performance of AC machines
CO 3	Choose the apparatus in experimental circuit based on loading and rating of the AC machines

List of experiments (Any Eight)

1. Brake test on Three Phase Induction Motor
2. No-load & Blocked rotor Tests on Three Phase Induction Motor
3. Speed Control of three phase Induction Motor
4. Equivalent Circuit of a Single Phase Induction Motor
5. Determination of X_d and X_q of a Salient Pole Synchronous Machine
6. Load test of a three phase alternator by Resistive, Inductive and Capacitive Loading
7. Regulation of a Three –Phase Alternator by Synchronous Impedance Method
8. Regulation of Three Phase Alternator by Z.P.F. Method.
9. V and Inverted V Curves of a 3 Phase Synchronous Motor.
10. Determination of transient, sub-transient and steady state reactance of an alternator.

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