## (CHOICE BASED CREDIT SYSTEM)

(Applicable to the students admitted for the academic year 2023-2024 onwards)

			SEMESTER I				
S.No	Category	Course Code	Course Title	L	Т	P	C
Theor	у						
1	PC	PPS23101	Advanced Power System Analysis	3	1	0	4
2	PC	PPS23102	Power System Dynamics	3	- 1	0	4
3	PC	PPS23103	Power System Transients	3	0	0	3
4	PC	PPS23104	Power System Instrumentation	3	0	0	3
5	FC	PEN23101	Research Methodology and IPR	3	0	0	3
6	PE	PPS2315*	Professional Elective I	3	0	0	3
7	AC	PAC23101	English for Research Paper Writing (Audit Course I)	2	0	0	0
Pract	ical						
8	PC	PPS23105	Advanced Power System Simulation Laboratory I	0	0	4	2
			TOTAL	20	2	4	22
			SEMESTER II				
S.No	Category	Course Code	Course Title	L	Т	Р	C
Theory	y		4.				
1	PC	PPS23201	Restructured Power Systems	3	1	0	4
2	PC	PPS23202	Advanced Power System Protection	3	1	0	4
3	PC	PPS23203	Smart Grid	3	0	0	3
4	PC	PPS23204	Power System State Estimation and Security Assessment	3	0	0	3
5	PE	PPS2315*	Professional Elective II	3	0	0	3
6	PE	PPS2315*	Professional Elective III	3	. 0	0	3
7	AC	PAC23201	Pedagogy Studies (Audit Course II)	2	0	0	0
Pract	ical						
8	PC	PPS23205	Advanced Power System Simulation Laboratory II	0	0	4	2
			TOTAL	20	2	4	22



# (CHOICE BASED CREDIT SYSTEM)

(Applicable to the students admitted for the academic year 2023-2024 onwards)

			SEMESTER III					
S.No	Category	Course Code	Course Title		L	Т	P	С
Theo	ory							
1	PC	PPS23301	Electrical Power Distribution System		3	0	0	3
2	PE	PPS2315*	Professional Elective IV		3	0	0	3
3	OE	*****	Open Elective		3	0	0	3
Prac	tical						-	
4	EE	PPS23302	Project Work (Phase I)		0	0	12	6
			T	OTAL	9	0	12	15
			SEMESTER IV					
S.No	Category	Course Code	Course Title		L	Т	P	C
Prac	tical							
1	EE	PPS23401	Project Work (Phase II)		0	0	24	12
			T	OTAL	0	0	24	12

NG CO Approved BOARD OF STUDIES Electrical & Electronics Engineering

## (CHOICE BASED CREDIT SYSTEM)

(Applicable to the students admitted for the academic year 2023-2024 onwards)

S.No	Category	Course Code	Course Title	L	Т	P	C
1	PE	PPS23151	Analysis of Power Converters	3	0	0	3
2	PE	PPS23152	System Theory	3	0	0	3
3	PE	PPS23153	Power System Reliability	3	0	0	3
4	PE	PPS23154	Design of Substation	3	0	0	3
5	PE	PPS23155	Analysis of Electrical Machines	3	0	0	3
6	PE	PPS23156	IoT for Smart Systems	3	0	0	3
7	PE	PPS23157	Power Electronics Application to Wind and Solar Energy Systems	3	0	0	3
8	PE	PPS23158	Solar and Energy Storage Systems	3	0	0	3
9	PE	PPS23159	Python for Power Systems Engineering	3	0	0	3
10	PE	PPS23160	Electromagnetic Interference and Compatibility in System Design	3	0	0	3
11	PE	PPS23161	Power Quality	3	0	0	3
12	PE	PPS23162	Application of DSP to Power System Protection	3	0	0	3
13	PE	PPS23163	SCADA System and Application	3	0	0	3
14	PE	PPS23164	FACTS and Custom Power Devices	3	0	0	3
15	PE	PPS23165	Computer Relaying and Wide Area Measurement Systems	3	0	0	3
16	PE	PPS23166	Energy Management and Auditing	3	0	0	3
17	PE	PPS23167	Computational Intelligence Techniques to Power Systems	3	0	0	3
18	PE	PPS23168	Machine Learning and Deep Learning	3	0	0	3
19	PE	PPS23169	Cloud Computing	3	0	0	3
20	PE	PPS23170	High Voltage and Insulation Systems	3	0	0	3



## (CHOICE BASED CREDIT SYSTEM)

(Applicable to the students admitted for the academic year 2023-2024 onwards)

S.No	Category	Course Code	Course Title	L	T	P	C
5.110	Category	Course Coue	Course The	L	1	r	C
1	OE	PSE23901	Climate Change and Adaptation	3	0	0	3
2	OE	PED23901	Industrial Safety	3	0	0	3
3	OE	PCS23901	Design of Digital System	3	0	0	3
4	OE	PCE23901	Big Data Analytics	3	0	0	3
5	OE	PPS23901	Alternate Energy Sources	3	0	0	3



# SEMESTER I

PPS2310	1 ADVANCED POWER SYSTEM ANALYSIS	3	1	0	4
COURS	OBJECTIVES				
To enable	the students to				
1 kn	ow about solution techniques.				
2 un	lerstand load flow analysis.				
3 kn	ow the concept of optimal power flow analysis.	-	-		
4 rea	lize contingency analysis for short circuit studies.		1		-
5 con	nprehend transient stability analysis.	1111	Trees		
UNIT I	SOLUTION TECHNIQUE				12
Sparse n	atrix techniques for large-scale power systems; Optimally ordered trian	ngula	ar: T	riang	ula
	Sparsity and optimal ordering scheme.	8	1		
UNIT II	LOAD FLOW ANALYSIS pupled load flow method; Contingency analysis - Overview of security				12
	ow, optimization based method, ATC determination using linear sensiti- ation considering the effect of contingency analysis.	vity	facto	ors; A	ATC
UNIT II	OPTIMAL POWER FLOW (OPF) ANALYSIS		-	-	12
dispatch, programi	mulation- Economic load dispatch, optimal reactive power dispatch, economic version of the security constrained OPF; OPF solution technique- Lagrange multiplining OPF, interior point method; Unit commitment - Objective function, ent; unit commitment solution methods- Priority list method, dynamic program	ier n cons	netho train	d, li ts in	near uni
UNIT IV	SHORT CIRCUIT ANALYSIS				12
Thevenin	's theorem and Z bus; Z bus methods in contingency analysis- Addi	ing a	and	emo	
multiple	ines, piecewise solution of interconnected systems, analysis of single conti	inger	ncies	anal	ysi
of multip fault stud	le contingencies, contingency analysis by De-model, system reduction fo ies.	r coi	nting	ency	and
UNIT V	TRANSIENT STABILITY ANALYSIS		21		12
Assumpt	ons of transient stability analysis; Multimachine transient stability- Math	emat	ical	mode	

transient stability improvement; Mathematical representation for use in transient stability simulation-Mathematical definitions of stability, mathematical models for transient stability simulation; Simulation methods- Partitioned explicit, implicit integration.

		TOTAL PERIODS 60
COUR	SE OUTCOMES	
At the	end of this course, students will be able to	BT Mapped (Highest Level)
CO1	explain about solution techniques.	Understanding (K2)
CO2	describe the techniques in load flow analysis.	Understanding (K2
CO3	implement the concept of optimal power flow analysis in real time application.	Applying (K3
CO4	enumerate contingency analysis for short circuit studies.	Applying (K3
CO5	explain transient stability analysis.	Applying (K3
REFE	RENCES	
1.	P.Venkatesh, B.V.Manikandna, S.Charles Raja, A.Srinivasan, Analysis, Security and Deregulation", PHI Learning Private Lin Edition, 2017.	
2.	D P Kothari, I J Nagrath, "Modern Power System Analysis", Ta Private Limited., New Delhi, Fifth Edition, 2022.	ata McGraw Hill Education
3.	John J. Grainger, William D. Stevenson, Jr., "Power System Ar Education Private Limited., New Delhi, 27 <sup>th</sup> Edition, Reprint 201	
4.	M. A. Pai Dheeman Chatterjee, "Computer Techniques in Power S	System Analysis", McGraw

 M. A. Pai Dheeman Chatterjee, "Computer Techniques in Power System Analysis", McGraw-Hill Education India 2014.

# **CO-PO MAPPING**

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak
Programme Outcomes PO's

			riogramme Ou	itcomes i O s		
O's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
01	2	* 1	3	3		121
02	3	2	3	3		
03	3	2	3	3	-	
04	3	2	3	3		-
05	3	2	3	3	the instants for	-
05	3	2	3	3		



	23102	induction in the	PO	WER S	SYSTEM	M DYN	AMIC	s		3	1	0	4
COUF	RSE OF	BJECTIVES											
To ena	able the	students to											
1	impart	knowledge on d	dynan	nic mod	eling of	a synch	hronous	machin	e in deta	ail.			
2	descri	be the modeling	gofex	citation									
3	unders	stand and enhand	nce sma	all signa	ıl stabilit	ty probl	lem of p	ower sy	stems.				
4	unders	stand the fundam	mental	concep	ts of tra	insient s	stability	of dyna	mic sys	tems.			
5	model	the power syste	em con	nponen	ts in volt	tage sta	ability st	udies.					
UNIT	I	SYNCHRONO	OUS N	<b>IACHI</b>	NE ANI	D MOD	DELLI	NG					12
Physic	al desc	ription; Mathen	matica	1 descr	intion o	of a svr	nchrono	us mac	hine -	Basic e	quatio	ons o	
		presentation in s				LINC				-			
calcula	ation, re	presentation in s	system	n studie	s.								
UNIT	П	EXCITATION	N SYS	TEM N	<b>IODEL</b>	LING							12
Eleme	nto of o	a avaitation and										_	
Lienie	ms or a	n excitation syst	stem; 7	ypes of	excitati		tem; Dy	namic p	erforma	ance me	asure;	Cor	itro
		functions; Mod				ion syst	tem; Dy	namic p	erforma	ance me	asure;	; Cor	itro
and pr	otective		delling	of exci	tation sy	ion syst	tem; Dy	mamic p	erforma	ance me	asure;	; Cor	
and pr	otective	functions; Mod	delling	of exci	tation sy ITY	ion syst ystem.	10.03	210.421			PLAT		12
and pr <b>UNIT</b> Funda	otective III mental	functions; Mod	delling NAL S ility of	of exci FABIL dynam	tation sy ITY ic systen	ion syst ystem. m; Eige	en prope	rties of	the state	e matrix	; Sma	all si	12 gna
and pr UNIT Funda stabilit	III mental of a s	functions; Mod SMALL SIGN. concept of stabil	delling NAL S ility of infinit	of exci TABIL dynam e bus sy	tation sy ITY ic systen stem; Ef	ion syst ystem. m; Eige	en prope	rties of	the state	e matrix	; Sma	all si	12 gna
and pro UNIT Funda stabilit Small	otective III mental of ty of a s signal s	functions; Mod SMALL SIGN. concept of stabil	delling NAL S ility of infinit i mach	of exci TABIL dynam e bus sy ine syst	tation sy ITY ic systen stem; Ef	ion syst ystem. m; Eige	en prope	rties of	the state	e matrix	; Sma	all si	12 gnal zer.
and pro UNIT Funda stabilit Small UNIT	ty of a signal s	functions; Mod SMALL SIGN. concept of stabil single machine in tability of multi	delling NAL S ility of infinit i mach STAE	of exci TABIL dynam e bus sy ine syst	tation sy ITY ic systen stem; Ef em.	ion syst ystem. m; Eige ffects o	en prope	rties of t	the state tem; Po	e matrix wer sys	; Sma tem st	all si tabili	12 gna zer
and pro UNIT Funda stabilit Small UNIT Review	otective III mental of ty of a s signal s IV wof nu	functions; Mod SMALL SIGN. concept of stabil single machine in tability of multi TRANSIENT S	delling NAL S illity of infinit i mach STAE ttion m	of exci TABIL dynam e bus sy ine syst <b>ILITY</b> ethod;	tation sy ITY ic system stem; Ef em. Simulatio	ion syst ystem. m; Eige ffects o ion of p	en prope of excita	rties of t tion sys	the state tem; Po ynamic	e matrix wer sys respons	; Sma tem st	all si tabili alysi	12 gna zer 12 s o
and pro UNIT Funda stabilit Small UNIT Review unbala	otective III mental of ty of a s signal s IV wof nu	functions; Mod SMALL SIGN. concept of stabil single machine in tability of multi TRANSIENT S merical integration aults; Case stud	delling NAL S illity of infinit i mach STAE ttion m	of exci TABIL dynam e bus sy ine syst <b>ILITY</b> ethod;	tation sy ITY ic system stem; Ef em. Simulatio	ion syst ystem. m; Eige ffects o ion of p	en prope of excita	rties of t tion sys	the state tem; Po ynamic	e matrix wer sys respons	; Sma tem st	all si tabili alysi	12 gna zer 12 s of
and pro- UNIT Funda stabilit Small UNIT Review unbala	otective III mental of ty of a s signal s IV wof nu anced fa ty analy	functions; Mod SMALL SIGN. concept of stabil single machine in tability of multi TRANSIENT S merical integration aults; Case stud	delling NAL S ility of infinit i mach STAE tion m dy of	of exci TABIL dynam e bus sy ine syst EILITY ethod; transien	tation sy ITY ic system stem; Ef em. Simulation t stabili	ion syst ystem. m; Eiger ffects o ion of p lity of a	en prope of excita	rties of t tion sys	the state tem; Po ynamic	e matrix wer sys respons	; Sma tem st	all si tabili alysi	12 gnal zer: 12 s of
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and pro- UNIT Fundar stabilit Small UNIT Review unbalar stabilit UNIT Basic	otective III mental of ty of a s signal s IV w of nu anced fa ty analy V Concep	functions; Mod SMALL SIGN. concept of stabil single machine in tability of multi TRANSIENT S merical integration aults; Case stud sis. VOLTAGE ST t of voltage stab	delling NAL S ility of infinit i mach STAE ttion m dy of TABI	of exci TABIL dynam e bus sy ine syst TILITY ethod; transien	tation sy ITY ic system stem; Ef em. Simulation t stabili	ion syst ystem. m; Eiger affects o ion of p lity of a SIS	en prope of excita power sy a large	rties of t tion sys	the state tem; Po ynamic ; Direct	e matrix wer sys respons t metho	; Sma tem st re; An d of Preve	all sig tabili alysi trans	12 gnal zer. 12 s ol ient
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and pro- UNIT Fundaa stabilit Small UNIT Review unbalaa stabilit UNIT Basic voltag	otective III mental of ty of a s signal s ignal s ig	e functions; Mod SMALL SIGN. concept of stabil single machine in tability of multi TRANSIENT S merical integrati aults; Case stud sis. VOLTAGE ST t of voltage stab se.	delling NAL S ility of infinit i mach STAE ttion m dy of TABII bility;	of exci TABIL dynam e bus sy ine syst EILITY ethod; transien LITY A Voltage	tation sy ITY ic system stem; Ef em. Simulation t stabili NALYS collapse ble to	ion syst ystem. m; Eiger iffects o ion of p lity of a SIS e; Volta	en prope of excita power sy a large age stab	rties of t tion sys yştem dy system: illity ana	the state tem; Po ynamic ; Direct lysis mo	e matrix wer sys respons t metho odeling; <b>TAL P</b> BT N (Highe	; Sma tem st e; An d of Prevo ERIO	all sig tabili alysi trans entio DDS d vel)	12 gna zer 12 s o ien 12 n o 60

CO2	discuss the mo- function for stab	-	ation to control and	d protective	Unders	tanding (K2)
CO3	describe the sig with controllers.		t small signal stabil	lity analysis	A	pplying (K3)
CO4	analyze the stab modified Euler*		ystem by point-by po Kutta method.	oint method,	A	pplying (K3)
C05	carry out a vo voltage collapse		analysis and preve	enting from	A	nalyzing(K4)
REFER	ENCES					1
2.	2018. L.P.Singh, "Adva Publishers, Sixth I		System Analysis ar	nd Dynamic	s", New Age	Internationa
4. <b>CO-PO</b>	Edition Reprint, 2 Dr.B.R.Gupta, "F Reprint, 2015. MAPPING	018. Power System	Dynamics Stability a Analysis and Desig <b>D's) with Program</b>	gn", S.Chano ne Outcome	d Publication,	First Editior
4. <b>CO-PO</b>	Edition Reprint, 2 Dr.B.R.Gupta, "F Reprint, 2015. MAPPING Iapping of Cours	018. Power System	Analysis and Desig O's) with Programm Specific Outcomes	gn", S.Chano ne Outcome PSO's	d Publication, 1	First Edition
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4. <b>CO-PO</b>	Edition Reprint, 2 Dr.B.R.Gupta, "F Reprint, 2015. MAPPING Iapping of Cours	018. Power System	Analysis and Desig O's) with Programm Specific Outcomes h of correlation) 3-5	gn", S.Chand ne Outcome PSO's Strong, 2-Mo	d Publication, 1	First Edition
4. CO-PO M	Edition Reprint, 2 Dr.B.R.Gupta, "F Reprint, 2015. MAPPING Iapping of Cours (1/2/3 in	018. Power System te Outcome (Co dicates strengt	Analysis and Desig O's) with Programm Specific Outcomes h of correlation) 3-S Programme Outco	gn", S.Chand ne Outcome PSO's Strong, 2-Mo omes PO's	d Publication, s (PO's) and Pr edium, 1-Weak	First Edition
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cou	RSE O	BJECTIVES	and providing the restrict strong in		Re 1			
To ena	able the	e students to						
1	gain	knowledge in so	rces of transients like lightning, switching	and tempora	ry o	vervo	Itages	4
2	mode	el power system	omponents and estimate the overvoltages i	n power syst	tem.	100	11-1	
3	analy	ze travelling wa	e phenomena against different overvoltage	s.		huit		
4	comp	oute transient ov	voltages using electromagnetic transient p	rogram (EM	TP).			
5	coord	linate the insula	on of power system and protective devices	• • • • • • • • • •			6.1	
UNIT	I	LIGHTNING	OVERVOLTAGES					9
Classi	ficatio	n of over volt	es- Mechanism and parameters of ligh	tning flash,	prot	tective	e sha	dow,
UNIT		and the state states in the	AND TEMPORARY OVERVOLTAGE			n e	F	9
		and the state states in the	pt, phenomenon, system performance u		ing		E East	
	ining u	ansients - con			1112 .	Suigo	5, 10	ranu
	*****							
		orary overvoltag	, load rejection, line faults, ferro resonanc				vervo	
(VFT	0).	Buy West appell	, load rejection, line faults, ferro resonanc				vervo	
(VFT)	0). ` <b>III</b>	TRAVELLIN	, load rejection, line faults, ferro resonance WAVES ON TRANSMISSION LINE	e, very fast t	trans	ient o		ltage 9
(VFT) UNIT Circui	O). TIII its and	TRAVELLIN distributed co	Note:	e, very fast t action ; Beh	trans	ient o	trave	ltage 9 elling
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(VFTC UNIT Circui waves multiv UNIT insula insula arreste	O). TIII its and s at the velocity TIV ition co ition si ers, ins	TRAVELLIN distributed con line termination waves INSULATIO -ordination –Vo trength standar ulation co-ordin	Note:	e, very fast t action ; Beh tion; Multic and their sele vices, applic	navio ondu	ient o our of actor s n; Eva	' trave system aluatio	9 9 Illing n and 9 0 on of n of
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CO2	compute possib	le overvoltages i	in power systems.	CHARLEN DEL		Applying (K3
CO3	predict overvol theory.	tages in power	system using tra	avelling wave	Unde	erstanding (K2
CO4	compute overvo	oltages using EM	1TP with multiple	sources.		Applying (K3
CO5	coordinate the i	nsulation level o	of the power system	n.	Unde	erstanding (K2
REFER	ENCES				Physics of Lot 19	Participants -
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2.	Allan Greenwoo	d, "Electrical T	ransients in Powe	er System". Wi	lev & Sons Ir	nc. New York
	2012.			en anvia a ro	DEPTH DI	
			High Voltage AC		Buiering ,	Second Lantion
4. CO-PO	Naidu M S and Company Ltd., N MAPPING Mapping of Cour	Kamaraju V, ew Delhi, 2014. rse Outcome (C	ew Delhi, Reprint, "High Voltage E O's) with Progra Specific Outcon th of correlation) Programme Ou	Engineering", T mme Outcome nes PSO's 3-Strong, 2-Me	s (PO's) and F	Programme
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PPS	323104	POWER SYSTEM INSTRUMENTATION	3	0	0	3
co	URSE	OBJECTIVES				
Тое	enable ti	he students to				51.1
1		rstand the concept of temperature measurement and pressure measurement.	easu	reme	nt an	d its
2	prese	nt knowledge about various safety and miscellaneous sensors technolog wer system instrumentation.	gies 1	that c	an be	used
3	offer	an opportunity to innovate newer procedures and better methods for imentation systems for power networks.	r effe	ective	e desig	gn of
4	1.2	de knowledge about various possible of insulation measurements an pologies that can be used.	id sy	stem	prote	ction
5	analy	se the various metering, billing and collection.				
UNI	IT I	TEMPERATURE MEASUREMENT AND PRESSURE MEASUR	REM	IENT	r	9
Rad	iation a	and infrared pyrometers; Resistance temperature detectors; Temper	rature	e sw	itches	and
		; Manometers; Multiple pressure scanners; Pressure repeaters; Press itches; Vacuum sensors.	sure	and	differe	entia
· .	IT II	SAFETY AND MISCELLANEOUS SENSORS	_			_
UN						
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001						st Level)
C01	pressure measur		emperature meas	surement and	Unde	erstanding (K2)
CO2	describe the of miscellaneous set		d architecture o	of safety and	Unde	erstanding (K2)
CO3	analyze the fur system network.		tribution automat	tion in power	Unde	erstanding (K2)
CO4	implement the and system prot		ed in insulation	measurements	Unde	erstanding (K2)
CO5	analyse the meter	ering, billing and	l collection.			Applying (K3)
REFE	RENCES		TOP/ DIST			
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4. <b>CO-PC</b>	Sherry A, "Moo Pergamon Press, Murphy.W.R and MAPPING	dern Power Stat 1971. d Mc Kay G <u>"</u> Er	urth Edition, Repr tion Practice", Vol nergy Managemen O's) with Progra Specific Outcom	rint 2013. I.6 (Instrumenta nt" Butterworths	tion, Controls Publications,	and Testing), London, 1982.
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PEN2	3101	RESEARCH METHODOLOGY AND I	PR	3 0	0	3
COUI	RSE O	BJECTIVES	- de cinero de			
To en	able the	e students to	ind lines in the second	il spec	e a l	
1. u	ndersta	nd the formulation of research problem	and the self and			
2. b	e famil	ar with data collection and literature survey process				
3. ki	now the	e statistical concepts in experimentation	and a second second of	3,643		
4. a	cquire l	knowledge in writing research proposal				
5. le	earn abo	out patent rights and its importance	the stand from the			
UNIT	Ι	RESEARCH PROBLEM FORMULATION	Contraction of the second	PLAR	Ø4	-
Meani	ing of 1	research, Objectives of Research, Types of research, Signifi	cance of Research, R	esearcl	n pro	cess
Select	ing the	problem, Necessity of defining the problem, Meaning of Rese	earch design, Need for	resear	ch de	sign
feature	es of a	good design, Different research designs.				
UNIT	п	LITERATURE SURVEY	1			5
Quant	itative	and Qualitative data, Scaling, Scaling Techniques, Experiment	nts and Surveys, Colle	ection of	f pri	mary
and se	econdar	y data, Data preparation process. Research problems, Effectiv	e literature studies app	proache	es, Su	irvey
for exi	isting li	terature, Procedure for reviewing the literature, Analysis and a	assessment.			
UNIT	ш	DESIGN OF EXPERIMENTS		1		
Strateg	gy of E	xperimentation - Typical applications of experimental design,	Guidelines for design	ing exp	perim	ents
Basic	statistic	al concepts - Statistical concepts in experimentation, Regressi	on approach to analys	is of va	rianc	æ.
UNIT	IV	RESEARCH PROPOSAL AND WRITING				!
Conter	nts of a	research proposal, Writing a research report - Research writ	ting in general, Refere	ncing,	Writ	ing a
bibliog	graphy,	Presentation and assessment by a review committee, Plagiaris	sm, Research ethics.			
UNIT	V	INTELLECTUAL PROPERTY RIGHTS	A * 2 1			9
Intelle	ectual F	Property - Definition, WTO, Fundamentals of Patent, Gopy	right, Rights of the	owner,	Ter	m o
copyri	ight, Re	egister of trademark, Procedure for trade mark, Term of tra	ademark; New Develo	opment	s in	IPR
Admir	nistratio	on of patent system, IPR of Biological Systems, Computer Sof	tware.			
			TOTAL PERI	ODS:		45
COUI	RSE O	UTCOMES	BT M	IAPPE	D	
At the	end of	the course, the students will be able to	(High	est Lev	el)	
CO1	ident	fy research problems.	Under	rstandir	ng (K	2)
CO2	colle	t and prepare suitable data for research.	Apply	ing (K	3)	-
CO3	desig	n experiments for different statistical concepts.	Under	rstandir	ng (K	2)
	write	research proposals and reports.	Apply	ing (K	3)	
CO4						

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3. Do 201		tgomery, "Design	n and Analysis	of Experiments",	9th edition, W	/iley Publisher
A Ma	arai Danday and	Khushdeen Dharr	ni, "Intellectual Pro	perty Rights" Pre	entice Hall India I	earning 2014
4. Ne	eraj ranucy and	renashacep shar	in, interrectant i to	perty reights , ric	indee man mana E	cuming, 2014.
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	) MAPPING	Mapping of Co	ourse Outcomes wi gth of correlation	th Programme Out	tcomes:	curning, 2014.
CO - PO	) MAPPING	Mapping of Co	ourse Outcomes wi gth of correlation	th Programme Out	tcomes:	curning, 2014.
	) MAPPING	Mapping of Co	ourse Outcomes wi gth of correlation	th Programme Out ) 3-Strong, 2-Mee	tcomes:	P06
CO - PO	) MAPPING (1/2	Mapping of Co /3 indicates streng	ourse Outcomes wi gth of correlation Programme O	th Programme Out ) <b>3-Strong, 2-Med</b> putcomes(POs)	tcomes: lium , 1-Weak	
CO - PO	) MAPPING (1/2 PO1	Mapping of Co /3 indicates streng PO2	ourse Outcomes wi gth of correlation Programme O PO3	th Programme Out ) <b>3-Strong, 2-Med</b> putcomes(POs)	tcomes: lium , 1-Weak	
CO - PO COs CO1 CO2	D MAPPING (1/2 PO1 3	Mapping of Co /3 indicates streng PO2 3	ourse Outcomes wi gth of correlation Programme O PO3	th Programme Out ) <b>3-Strong, 2-Med</b> putcomes(POs)	tcomes: lium , 1-Weak PO5	
CO - PO	O MAPPING (1/2 PO1 3 3	Mapping of Co /3 indicates streng PO2 3 3 3	ourse Outcomes wi gth of correlation Programme O PO3 3 -	th Programme Out ) <b>3-Strong, 2-Mec</b> Putcomes(POs) PO4 1 1	tcomes: lium, 1-Weak PO5 - 2	

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### **COURSE OBJECTIVES**

PAC23101

To enable the students to

1. improve the writing skills and level of readability.

2. learn about what to write in each section and to understand the skills required to develop a title.

 choose a topic of interest and paraphrase, summarize, using correct attribution and following documentation guidelines.

4. craft a research paper in their discipline.

5. ensure the good quality of a research paper at first-time submission

UNIT I PLANNING AND PREPARATION

Precision of Words; Breaking up long sentences; Structuring Paragraphs and Sentences; Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness. Expressing independent thought with grace, clarity and force.

UNIT II LITERATURE REVIEWS AND CITATIONS

Key skills required - write a title, an abstract, write an introduction, write the review of the literature, conduct a literature review of all current research in their field; Review of the Literature; Methods; Results; Discussion and Conclusions; citing references correctly and avoiding plagiarism.

# UNIT III WRITING STANDARDS

Useful phrases - to ensure paper is as good as it could possibly be the first-time submission - first draft, second draft, final draft of research report; journal article; literature review; chapters, grant proposal; Avoid inadequate support of generalizations, slipshod or hurried style, poor attention to detail, straying from directions, mechanical errors, underwritten and/or marred by confused purpose, lack of organization, repetition of ideas, improper use of words, and frequent grammatical, spelling and punctuation errors.

## UNIT IV STRUCTURE OF A PAPER

Details of all the parts, Clarifying Who Did What; Highlighting the Findings; Hedging and Criticizing; Skills to identify something we really need to know, some ways to find a topic; to venture out across the swamp of research without losing our bearings; Paraphrasing; Sections of a Paper - Abstract, Introduction to Free writing.

## UNIT V EDITING AND ORGANISING SKILLS

Skills required - write the Methods, write the Discussion, write the Results, write Conclusions; write about what we've learned truthfully so the reader really gets it in thought and expression, demonstrating a clear understanding and execution of the research.

		TOTAL PERIODS:	30
COU	RSE OUTCOMES	BT MAPPED	
At the	end of the course, the students will be able to	(Highest Level)	
CO1	plan and write a research paper in their discipline	Understanding (	K2)

CO2	understand the basics of citations, avoiding plagiarism and literature reviews	Applying (K3)
CO3	write paraphrase, results and conclusions.	Understanding (K2)
CO4	culminate the actual crafting and revising of a research paper	Applying (K3)
CO5	use suitable vocabulary, grammar and punctuation to write flawless piece of writing	Applying (K3)

## REFERENCES

1. Goldbort R (2006) Writing for Science, Yale University Press.

2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press.

3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.

 Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

### **CO - PO MAPPING**

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)								
	PO1	PO2	PO3	PO4	PO5	PO6			
CO1	-	-		2	-	1			
CO2		3	-	2	2	2			
CO3		1	n of glanoon by	the loss as an an	The second second second second				
CO4				3		100 1001			
CO5	-	2	2	3	-	-			

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PPS23			OWER SYSTE		ON 0	0	4	2
COUR	SE OBJECTIV	ES						-
To enab	ole the students to	0						
1	impart knowledg	ge about load flow	analysis throug	h digital simula	tion.			
		nic mechanisms b			lity problems i	n elect	ric p	owe
		ng physical pheno	the second se	-				
-		nation of differen						
4	understand the p	erformance of rela	ay and generatio	on dispatching so	cheme.			-
LIST C	<b>OF EXPERIME</b>	NTS						
1.	Power flow ana	lysis by Newton-F	Raphson method	and fast decoup	oled method.			
2.	Transient stabili	ity analysis of sing	gle machine-infi	nite bus system	using classical	machin	ne mo	del.
3.	Contingency and	alysis: Generator	shift factors and	line outage dist	ribution factors	k.		
4.	Economic dispa	tch using Lambda	-iteration metho	od.				
5.	Unit commitme	nt: Priority-list scl	hemes and dyna	mic programmii	ng.			
6.	Analysis of swit	tching surge using	EMTP: Energis	sation of a long	distributed para	umeter	line.	
7.	Analysis of swit	tching surge using	EMTP: Compu	tation of transie	nt recovery vol	tage.		
8.	Simulation and	implementation o	f voltage source	inverter.				
9.	Digital over cur	rent relay setting a	and relay coordi	nation.				
					TOTAL PE	RIOD	s	60
COUR	SE OUTCOME	S .						
At the e	end of this course	e, students will be	able to			Mappe lest Le		
C01	investigate the	power flow studi	es.			Anal	yzing	(K4
CO2		electromagnetic a		anical		Anal	yzing	(K4)
CO3		the synchronous compensations so		in nower		Anal	yzing	(KA)
000	systems.	compensations se	nemes available	mpower		/ that	yzing	(IST)
	develop gener	ation dispatching	schemes in pow	er systems.		Anal	yzing	(K4)
CO4								
	MAPPING							
CO-PO	MAPPING	urse Outcome (C			ies (PO's) and	Progr	amm	e
CO-PO	MAPPING Mapping of Co		Specific Outc	omes PSO's			amm	e
CO-PO	MAPPING Mapping of Co	urse Outcome (C indicates streng	Specific Oute th of correlation	omes PSO's	Medium, 1-We		amm	e
CO-PO	MAPPING Mapping of Co		Specific Oute th of correlation	omes PSO's n) 3-Strong, 2-l	Medium, 1-We		amm PO 6	
CO-PO	MAPPING Mapping of Con (1/2/3	indicates streng	Specific Outc th of correlation Programme O	omes PSO's n) 3-Strong, 2-1 Dutcomes PO's	Medium, 1-We			
CO-PO CO's	MAPPING Mapping of Con (1/2/3 PO 1 3	PO 2 3	Specific Outc th of correlation Programme O PO 3	omes PSO's n) 3-Strong, 2-1 Dutcomes PO's PO 4	Medium, 1-We			
CO-PO CO's CO1	MAPPING Mapping of Con (1/2/3 PO 1	indicates streng PO 2	Specific Outc th of correlation Programme O PO 3 2	omes PSO's n) 3-Strong, 2-1 Dutcomes PO's PO 4 2	PO 5		<b>PO 6</b>	



# SEMESTER II

	23201	RESTRUCTURED POWER SYSTEMS		3	1	0	4
cou	RSE O	BJECTIVES					
To en	hable th	e students to	Sector 1		100	10	
1	fami	liarize the concept of restructuring in power industry and model	s.	1	lano		-
2	impa	rt knowledge on open access system and methodologies.					
3	provi	ide knowledge about electricity marketing.				1	-
4	clarit	fy the concept of various electricity pricing.				1.2	1
5	impa	rt knowledge on reliability and deregulation.	at last				
UNIT	ГІ	INTRODUCTION	-			1	12
Restr	ucturin	g model; Independent system operator; Power exchange; Marke	et operatio	on; N	Marke	et pov	ver
Stand	lard cos	sts; Transmission pricing; Congestion pricing.					
UNIT	ГП	OPEN ACCESS SAME TIME INFORMATION SYSTEM	I(OASIS)	)			12
Struc	ture of	OASIS; Implementation of OASIS phases; Posting of informa	tion; Trar	nsfer	capa	bility	
		ansmission services; Methodologies to calculate available					
Exam	nle wit	h QASIS in some restructuring models					1
	ipic with	h OASIS in some restructuring models.					
	-	ELECTRICAL ENERGY MARKETING		E	_		12
UNIT	ГШ		ative inst	rume	ents o	of ene	
UNIT Esser	F III nce of e	ELECTRICAL ENERGY MARKETING electric energy marketing; Energy marketing framework; Deriv					ergy
UNIT Essen marke	F III nce of e	ELECTRICAL ENERGY MARKETING electric energy marketing; Energy marketing framework; Deriv Risk management - Effect of positions on risk management; Energy					ergy
UNIT Esser marke powe	<b>FIII</b> nee of e eting; R er marke	ELECTRICAL ENERGY MARKETING electric energy marketing; Energy marketing framework; Deriv Risk management - Effect of positions on risk management; Energy					ergy
UNIT Esser marke powe UNIT	Γ III nce of e eting; R er marke Γ IV	ELECTRICAL ENERGY MARKETING electric energy marketing; Energy marketing framework; Deriv Risk management - Effect of positions on risk management; Energy eting.	ergy mark	ketin	g hut	os; Gi	ergy eer
UNIT Essen marke powe UNIT Electr	<b>F III</b> nce of e eting; R er marke <b>F IV</b> ricity p	ELECTRICAL ENERGY MARKETING electric energy marketing; Energy marketing framework; Deriv Risk management - Effect of positions on risk management; Energy eting. ELECTRICITY PRICING	ergy mark	pric	g hut	os; Gi	ergy reer 12 isk
UNIT Essen marke powe UNIT Electr	<b>F III</b> nce of e eting; R er marke <b>F IV</b> ricity p enges to	ELECTRICAL ENERGY MARKETING electric energy marketing; Energy marketing framework; Deriv Risk management - Effect of positions on risk management; Energy eting. ELECTRICITY PRICING price volatility; Electricity price indexes - Case study, vola	ergy mark	pric	g hut	os; Gi	reer 12 isk
UNIT Essen marke powe UNIT Electr Chall	FIII nce of e eting; R r marke FIV ricity p enges to FV	ELECTRICAL ENERGY MARKETING electric energy marketing; Energy marketing framework; Deriv Risk management - Effect of positions on risk management; Energy eting. ELECTRICITY PRICING price volatility; Electricity price indexes - Case study, vola o electricity pricing; Construction of forward price curves; Shor	ergy mark ttility of t term prio	pric ce fo	g hub e, ba	os; Gi asic i sting.	12 isk
UNIT Essen marke powe UNIT Electr Chall	FIII nce of e eting; R r marke FIV ricity p enges to FV	ELECTRICAL ENERGY MARKETING         electric energy marketing; Energy marketing framework; Deriv         Risk management - Effect of positions on risk management; Energy         eting.         ELECTRICITY PRICING         orice volatility; Electricity price indexes - Case study, vola         o electricity pricing; Construction of forward price curves; Shor         RELIABILITY AND DEREGULATION	ergy mark atility of t term prid eliability a	pric ce fo	g hub e, ba precas	os; Gi asic i sting. gulatic	reer 12 isk 12 on.
UNII Essen marke powe UNII Electr Chall UNII Relia	FIII nce of e eting; R r marke FIV ricity p enges te FV bility an	ELECTRICAL ENERGY MARKETING         electric energy marketing; Energy marketing framework; Deriv         Risk management - Effect of positions on risk management; Energy         eting.         ELECTRICITY PRICING         orice volatility; Electricity price indexes - Case study, vola         o electricity pricing; Construction of forward price curves; Shor         RELIABILITY AND DEREGULATION         nalysis; Network model; Reliability cost; Hierarchical levels; Reliability	ergy mark ttility of t term prio	pric ce fo	g hub e, ba precas	os; Gi asic i sting. gulatic	reer 12 isk
UNII Essen marke powe UNII Electri Chall UNII Relia	F III nce of e eting; R er marke F IV ricity p lenges to F V bility an	ELECTRICAL ENERGY MARKETING         electric energy marketing; Energy marketing framework; Deriv         Risk management - Effect of positions on risk management; Energy         eting.         ELECTRICITY PRICING         orice volatility; Electricity price indexes - Case study, vola         o electricity pricing; Construction of forward price curves; Shor         RELIABILITY AND DEREGULATION         nalysis; Network model; Reliability cost; Hierarchical levels; Re         OUTCOMES	ergy mark atility of t term prio eliability a TOTA	pric ce fo	g hub e, ba precas dereg	os; Gi asic i sting. gulatic DDS	reer 12 isk 12 on.
UNIT Essen marke powe UNIT Electr Chall UNIT Relia	FIII nce of e eting; R er marke FIV ricity p enges to FV bility an RSE O e end of	ELECTRICAL ENERGY MARKETING         electric energy marketing; Energy marketing framework; Deriv         Risk management - Effect of positions on risk management; Energy         eting.         ELECTRICITY PRICING         orice volatility; Electricity price indexes - Case study, vola         o electricity pricing; Construction of forward price curves; Shore         RELIABILITY AND DEREGULATION         nalysis; Network model; Reliability cost; Hierarchical levels; Relevence         OUTCOMES         f this course, students will be able to	ergy mark atility of t term prid eliability a TOTA B' (Hig	pric ce fo and o L PI T M ghes	g hub e, ba orecas dereg ERIC appe	ed vel)	reer 12 isk 12 on. 60
UNII Essen marke powe UNII Electr Chall UNII Relia	F III     nce of e     eting; R     er marke     F IV     ricity p     enges te     F V     bility an     IRSE O     e end of     1	ELECTRICAL ENERGY MARKETING         electric energy marketing; Energy marketing framework; Deriv         Risk management - Effect of positions on risk management; Energy         eting.         ELECTRICITY PRICING         orice volatility; Electricity price indexes - Case study, vola         o electricity pricing; Construction of forward price curves; Shore         RELIABILITY AND DEREGULATION         malysis; Network model; Reliability cost; Hierarchical levels; Reliability co	ergy mark atility of t term prid eliability a TOTA B' (Hig	pric ce fo and o L PI T M ghes	g hub e, ba orecas dereg ERIC appe	os; Gr asic r sting. gulatic DDS	ergy reer 12 isk 12 on. 60
UNIT Essen marke powe UNIT Electr Chall UNIT Relia	F III     nce of e     eting; R     er marke     F IV     ricity p     enges te     F V     bility an     IRSE O     e end of     1	ELECTRICAL ENERGY MARKETING         electric energy marketing; Energy marketing framework; Deriv         Risk management - Effect of positions on risk management; Energy         eting.         ELECTRICITY PRICING         orice volatility; Electricity price indexes - Case study, vola         o electricity pricing; Construction of forward price curves; Shore         RELIABILITY AND DEREGULATION         nalysis; Network model; Reliability cost; Hierarchical levels; Relevence         OUTCOMES         f this course, students will be able to	ergy mark atility of t term prid eliability a TOTA B' (Hig	pric ce fo and o L PI T M ghes	g hub e, ba orecas dereg ERIC appe	ed vel)	ergy reer 12 isk 12 on. 60
UNIT Essen marke powe UNIT Electr Chall UNIT Relia	<b>F III</b> nce of e         eting; R         er marke <b>F IV</b> ricity p         enges to <b>F V</b> bility and <b>RSE O</b> e end of <b>1</b> explain         dif	ELECTRICAL ENERGY MARKETING         electric energy marketing; Energy marketing framework; Deriv         Risk management - Effect of positions on risk management; Energy         eting.         ELECTRICITY PRICING         orice volatility; Electricity price indexes - Case study, vola         o electricity pricing; Construction of forward price curves; Shore         RELIABILITY AND DEREGULATION         malysis; Network model; Reliability cost; Hierarchical levels; Reliability co	ergy mark atility of t term prid eliability a TOTA B' (Hig	pric ce fo and o L PI T M ghes	g hub e, ba orecas dereg ERIC appe	ed vel)	reer 12 isk 12 on. 60
UNIT Essen marke powe UNIT Electr Chall UNIT Relia	<b>F III</b> nce of e         eting; R         er marke <b>F IV</b> ricity p         enges to <b>F V</b> bility and <b>RSE O</b> e end of         1         explant         dif         max	ELECTRICAL ENERGY MARKETING         electric energy marketing; Energy marketing framework; Deriv         Risk management - Effect of positions on risk management; Energy         eting.         ELECTRICITY PRICING         orice volatility; Electricity price indexes - Case study, vola         o electricity pricing; Construction of forward price curves; Shore         RELIABILITY AND DEREGULATION         nalysis; Network model; Reliability cost; Hierarchical levels; Reliability co	ergy mark atility of t term prid eliability a TOTA B' (Hig	pric ce fo and o L PI T M ghes nder	g hub e, ba orecas dereg ERIC appe it Lev stand	ed vel)	12 reer 12 risk 12 on. 60

	of financial tran	smission rights.				
CO4	explain the vola	tility, risk and fo	precasting of elec	tricity pricing.	Under	standing (K2
C05	outline the refor	m initiatives of	deregulation.		Under	standing (K2
REFER	ENCES		-		P I Y M AS	ALC: SHEET
1.	Mohammad Shah	idehpour and M	luwaffaq Almou	sh, "Restructure	d Electrical Po	ower System
	Operation, Tradin	g and Volatility	", CRC Press, Fir	st Edition, Repri	nt 2016.	
2.	Kankar Bhattacha	rya, Math H.J. E	Boolen, Jaap E. D	aadler, "Operatio	on of Restructu	ired
	Power Systems",	Springer, First E	dition, Reprint, 2	2012.		
3.	S.R.Paranjothi, "N	Modern Power S	ystems", New Ag	ge International,	First Edition, 2	.017.
4.	Sally Hunt," Ma	king Competitio	on Work in Ele	ctricity", John	Willey and Sc	ons Inc. Firs
11	Edition, Reprint 2	017.				
CO-PO	MAPPING		and the state	Se astron		
	MAPPING Iapping of Cours	se Outcome (CC	O's) with Progra	mme Outcomes	(PO's) and P	rogramme
	Iapping of Cours	OWNERS IN	Specific Outcor	nes PSO's	THEY MAY	A ATA
	Iapping of Cours	OWNERS IN	Specific Outcor h of correlation)	nes PSO's 3-Strong, 2-Me	THEY MAY	A ATA
	Iapping of Cours	OWNERS IN	Specific Outcor	nes PSO's 3-Strong, 2-Me	THEY MAY	A AT
N	Iapping of Cours (1/2/3 in	dicates strengtl	Specific Outcor h of correlation) Programme Ou	nes PSO's 3-Strong, 2-Me itcomes PO's	dium, 1-Weak	
N CO's	Iapping of Cours (1/2/3 in PO 1	dicates strengt	Specific Outcor h of correlation) Programme Ou PO 3	nes PSO's 3-Strong, 2-Me atcomes PO's PO 4	dium, 1-Weak	
N CO's CO1	Iapping of Cours (1/2/3 in PO 1 3	dicates strength	Specific Outcor h of correlation) Programme Ou PO 3 2	nes PSO's 3-Strong, 2-Me itcomes PO's PO 4 2	dium, 1-Weak PO 5 -	PO 6
N CO's CO1 CO2	Iapping of Cours (1/2/3 in PO 1 3 3	dicates strength	Specific Outcor h of correlation) Programme Ou PO 3 2 2 2	nes PSO's 3-Strong, 2-Me itcomes PO's PO 4 2 2	dium, 1-Weak PO 5 -	PO 6

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	3202	ADVA	NCEDI	POWER SY	YSTEM PR	OTECTIC	DN	3	1	0	4
COUL	RSE O	BJECTIVES									
To ena	able the	e students to				and the second second		100			2.7
1	know	the numerical pr	otection.		11-11-11-1		12.5		in the second		1
2	unde	rstand the concep	of digita	l protection	n in transmis	sion line.	THE REAL	THE O			
3	unde	rstand the perform	nance of s	ynchronou	s generator a	and power t	ransform	er.	1.8-		
4	comp	prehend about diff	erent rela	y settings.	201	Se paintai	-100				
5	know	the PC application	ons in sho	ort circuit st	tudies.	er a set	و و زرانه	a de			Ţ
UNIT	I	NUMERICAL	PROTE	CTION					12	1.11	1
		block diagram o uared (LES) tech							feren	ce wa	ive
UNIT	п	DIGITAL PRO	TECTIO	ON OF TR	ANSMISSI	ON LINE					1
of EH	IV/UH	heme based upor V transmission li									
of EH amplit	IV/UH	and the second se	ne based	upon trave	ling wave p	henomenor	n, new rel	laying	scher		sin
of EH amplit UNIT Introd	IV/UH tude co III fuction,	V transmission li omparison. DIGITAL PRO	TECTIONSFORM ONOUS generator. F	upon trave ON OF SYI IER nerator, pro	ling wave p NCHRONC	henomenor DUS GENE emes for s	n, new ref	AND us ger	scher	ne us r, dig	in; 1:
of EH amplit UNIT Introd protec digital	IV/UH tude co III luction, ction of l protec	V transmission li imparison. DIGITAL PRO POWER TRA faults in synchr synchronous ger	TECTIONSFORM ONOUS generator. F	upon trave ON OF SYI IER nerator, pro aults in a tr	ling wave p NCHRONC	henomenor DUS GENE emes for s	n, new ref	AND us ger	scher	ne us r, dig	sin; 1: gita
of EH amplit UNIT Introdu protec digital UNIT Direct setting man-n compu	IV/UH tude co TII luction, ction of l protec TIV tional i g, co-or nachine uter gra	V transmission li imparison. DIGITAL PRO POWER TRAN faults in synchr synchronous gen ction of transform OVERCURRE Instantaneous IDM redination of distant e interface subsynchics.	ne based TECTIONSFORM DONOUS generator. F er. NT REL TT overcomposition ice relays stem, in	upon trave <b>DN OF SYI</b> <b>IER</b> nerator, pro aults in a tr <b>AY</b> urrent relay , co-ordinat tegrated op	NCHRONC otection sch cansformer, , directional tion of overco peration of	benomenor DUS GENE emes for s schemes us chemes us current relay national p	n, new rel CRATOR ynchrono ed for tra distance ys, compu ower sys	AND us ger nsform relay, iter gra	scher nerato ner pr distar aphics applic	r, dig rotect	ion 12 gita ion 12 elay lay
of EH amplit UNIT Introduprotec digital UNIT Direct setting man-n compu	IV/UH tude co TII luction, ction of l protec TIV tional i g, co-or nachine uter gra	V transmission li imparison. DIGITAL PRO POWER TRAN faults in synchr synchronous gen ction of transform OVERCURRE Instantaneous IDM redination of distan-	ne based <b>TECTIONS IN</b> <b>NTECTIONS IN</b> <b>NTECTIONS IN</b>	upon trave <b>DN OF SYI</b> <b>IER</b> nerator, pro aults in a tr <b>AY</b> urrent relay , co-ordinat tegrated op	NCHRONC otection sch cansformer, , directional tion of overco peration of	benomenor DUS GENE emes for s schemes us chemes us current relay national p	n, new rel CRATOR ynchrono ed for tra distance ys, compu ower sys	AND us ger nsform relay, iter gra	scher nerato ner pr distar aphics applic	r, dig rotect	ion 12 ion 12 elay lay
of EH amplit UNIT Introd protec digital UNIT Direct setting man-n compu UNIT Types for S.C	IV/UH tude co TII fuction, ction of l protec TV tional i g, co-on nachine uter gra V	V transmission li imparison. DIGITAL PRO POWER TRAN faults in synchr synchronous gen ction of transform OVERCURRE Instantaneous IDM redination of distance interface subsynchics. PC APPLICAT	ne based <b>DTECTIONS INTECTIONS INTECTIONS INTECTIONS INTECTIONS INTECTIONS INTECTIONS INTECHEMEE</b> development of comparison of the compa	upon trave DN OF SYI IER nerator, pro aults in a tr AY urrent relay , co-ordinat tegrated op N SHORT O nent of algo ponent quar	NCHRONC otection sch cansformer, , directional tion of overo peration of CIRCUIT S orithm for S. ntities, S.C.	benomenor DUS GENE emes for s schemes us chemes us chemes us runtizone current relay national p STUDIES I C. studies, studies of n	n, new rel CRATOR ynchrono ed for tra distance ys, compu ower sys FOR DES PC based	AND us ger nsform relay, iter gra item, a SIGNI	scher nerato ner pr distar aphics applic <b>NG</b> rated	r, dig rotect nce ro a disp cation	12 gita ion 12 elay lay 1 o 12 vare

At the e	nd of this course,	students will be	able to		BT Ma (Highes	
C01	explain about nu	umerical protecti	on.			standing (K2)
CO2	enumerate the co	oncept of digital	protection in tra	nsmission line.	A	pplying (K3
CO3	analyse the per-	formance of syr	chronous genera	ator and power	А	nalyzing(K4
	transformer.					
CO4	describe about d	lifferent relay se	ttings.	dial ain ha n	Under	standing (K2
CO5	implement PC a	pplications in sh	ort circuit studie	s.	A	pplying (K3
REFER	ENCES			ANT STORT.	U DU BAD	
3. 4. <b>CO-PO</b>	2014. Paithankar and Bl Ltd., New Delhi, S T. S. M. Rao, "Di <b>MAPPING</b> Iapping of Cours	hide, "Fundamer Second Edition, gital / Numerica se Outcome (CC	ntals of Power Sy Reprint 2017. I relays", Tata M D's) with Progra Specific Outcom	Prentice Hall of I ystem Protection", fcGraw Hill, New mme Outcomes ( mes PSO's 3-Strong, 2-Med	Prentice Hall Delhi, 2015. (PO's) and P	of India Pvt
	(1/2/5 11	dicates strengti		atcomes PO's	ium, 1-weak	
110			i rogramme Or			
CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO's CO1	PO 1 2	<b>PO 2</b>	~		<b>PO 5</b> 3	<b>PO 6</b>
			PO 3	PO 4		
C01	2	2	<b>PO 3</b> 3	PO 4 3	3	2
CO1 CO2	2	2 2	PO 3 3 2	PO 4 3 2'	3	2



PPS	\$23203			SMART	GRID			3	0	0	3
cou	RSE OF	JECTIVES									
To en	hable the	students to									
1	know	the overview of	smart grid	and its fur	nctions.						-
2	under	stand the data co	mmunicat	ion and its	technologie	s.					
3	update	e the knowledge	in smart n	netering an	d demand-si	de integra	tion.				
4	relate	the distribution	automation	n and man	agement sys	tems.					
5	identi	fy the case studi	es and test	beds for th	ne smart grid						1
UNI	ті	INTRODUCT	ION TO S	SMART G	RID						9
		versus the smar									
of the	e technol	ogies required fo	or the smal	t grid; Fun	ctions of sm	art grid co	omponents	and s	takeh	older	roles.
		NEODMAN		COMMU	UCATION	TECUN	OL OCIES				9
UNI	ТП	INFORMATI	ing technic	COMINIUI	nunication c	hannels la	vered arch	itectu	ire an	d pro	
exch signa	ange; In	on technologies formation secur ber security star SENSING, M	for the sm ity for the idards.	art grid - C smart gri	Communicat d - Encrypt	ion and d	ecryption,	authe			digita
exchasigna	ange; In atures, cy T III rt meter	on technologies formation secur ber security star SENSING, M TECHNOLO ing; Smart met	for the sm ity for the idards. EASURE GIES ers - An	MENT, CO	Communicat d - Encrypt ONTROL A of the hard	ND AUT	ecryption, OMATIO	autho N	nfrast	tion,	digital 9 re and
excha signa UNI Smaa proto	ange; In atures, cy T III rt meteriocols for	on technologies formation secur ber security star SENSING, M	for the smither th	MENT, CO overview -side integ	Communicat d - Encrypt ONTROL A of the hard ration; Tran	ND AUT	OMATIO mmunicatio	autho N	nfrast	tion,	digital 9 re and
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exchasigna uNI Sman proto energy UNI Distri regu	ange; In atures, cy T III rt meterio cools for gy manage T IV ribution ilation; I	on technologies formation secur ber security star SENSING, M TECHNOLO ing; Smart met smart metering gement systems,	for the smither th	MENT, CO overview -side integ application	Communicat d - Encrypt ONTROL A of the hard ration; Tran ns, visualiza N AND MA equipment.	ND AUT ware, consmission stion technic NAGEM faults in	OMATIO mmunicatio system ope ques. ENT SYS the distrib	autho N ons in cration	nfrast n - D <u>S</u> n syst	ructu ata so	9 re and ources, voltage
exchasigna uNI Smar proto enery UNI Distr regu anal	ange; In: atures, cy T III rt meteri ocols for gy manau ribution lation; I ysis tools	on technologies formation secur ber security star SENSING, M TECHNOLO ing; Smart met smart metering gement systems, DISTRIBUTI automation - Su Distribution mar s, applications.	for the smither the smithert the smither the smithert the	MENT, CO overview -side integ application OMATION automation - Data sou	Communicat d - Encrypt ONTROL A of the hard ration; Tran ns, visualiza N AND MA equipment, arces and as DS FOR TH	IND AUT Iware, conservation technic Intechnic INAGEM faults in ssociated	ecryption, OMATIO mmunicatio system ope ques. ENT SYS the distrib external sy	authe N ons in cration <u>FEM</u> oution	nfrast n - D <u>S</u> n syst s, mo	ructu ata so eem, v	digital gre and ources voltageng and
exchasigna signa UNI Sman proto enery UNI Distri regu analy Micr prog rene	ange; In atures, cy T III rt meterio ocols for gy manage (T IV ribution dation; I ysis tools (T V rogrid w gramming ewable er	on technologies formation secur ber security star SENSING, M TECHNOLO ing; Smart met smart metering gement systems, DISTRIBUTI automation - Su Distribution mar s, applications.	for the smither the smithert t	MENT, CO overview -side integ application - Data sou TEST BEI wer system work recon- gration- de	Communicat d - Encrypt ONTROL A of the hard ration; Tran ns, visualiza N AND MA equipment, arces and as DS FOR TH n unit communifiguration escription of	IND AUT Iware, constrained smission stion technic in technic Sociated IE SMAR nitment (U in distribution issuert grid	ecryption, OMATIO mmunicatio system ope ques. ENT SYS the distrib external sy CT GRID UC) proble ution autor d activity, a	authe N ons in eration FEM oution vstem em; A nation appro	nfrast n - D S n syst s, mo Adapt n; Ca ach fo	tion, ructu ata so dem, v odellin ive d ase st or sm	digital 9 re and ources, voltage ng and ynamic udy o

At the e	nd of this course, s	tudents will be	able to	Contraction of the local distance of the loc	BT M	lapped
At the e	nu or uns course, s	dudents will be				st Level)
C01	categorize the o	verview of smar	t grid and its fun	octions.	Unde	erstanding (K2
CO2	illustrate the dat	a communicatio	on and its technol	logies.		Applying (K3
CO3	describe the sma	art metering and	demand-side int	tegration.	Unde	erstanding (K2
CO4	analyze the distr	ibution automat	tion and manage	ement systems.		Analyzing(K4
C05	paraphrase the c	ase studies and	testbeds for the s	smart grid.		Applying (K3
REFER	RENCES					
	press 2012.					
3. 4. <b>CO-PO</b>	Fereidoon P. Sios Academic Press, 2 Krzysztof Iniewsk MAPPING Mapping of Cour	2012. i, "Smart Grid I rse Outcome (C	nfrastructure & T O's) with Progr Specific Outco	Networking", Tat	a McGraw-Hill es (PO's) and P	Edition, 2012 Programme
3. 4. <b>CO-PO</b>	Fereidoon P. Sios Academic Press, 2 Krzysztof Iniewsk MAPPING Mapping of Cour	2012. i, "Smart Grid I rse Outcome (C	nfrastructure & T O's) with Progr Specific Outco	Networking", Tat ramme Outcome omes PSO's n) 3-Strong, 2-M	a McGraw-Hill es (PO's) and P	Edition, 2012. Programme
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3. 4. <b>CO-PO</b>	Fereidoon P. Sios Academic Press, 2 Krzysztof Iniewsk MAPPING Mapping of Cour (1/2/3 in	2012. i, "Smart Grid I rse Outcome (C ndicates streng	nfrastructure & T O's) with Programs Specific Outco th of correlation Programme O	Networking", Tat ramme Outcome omes PSO's n) 3-Strong, 2-M Dutcomes PO's	a McGraw-Hill es (PO's) and P edium, 1-Weal	Edition, 2012. Programme
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3. 4. CO-PO CO's CO1	Fereidoon P. Sios Academic Press, 2 Krzysztof Iniewsk MAPPING Mapping of Cour (1/2/3 in PO 1 3	2012. i, "Smart Grid I rse Outcome (C ndicates streng PO 2 3	nfrastructure & T O's) with Programs Specific Outco th of correlation Programme ( PO 3 2	Networking", Tat ramme Outcome omes PSO's n) 3-Strong, 2-M Dutcomes PO's PO 4 2	a McGraw-Hill es (PO's) and P edium, 1-Weal	Edition, 2012. Programme
3. 4. CO-PO CO's CO1 CO2	Fereidoon P. Sios Academic Press, 2 Krzysztof Iniewsk MAPPING Mapping of Cour (1/2/3 in PO 1 3 3	2012. i, "Smart Grid I rse Outcome (C ndicates streng PO 2 3 3	nfrastructure & T O's) with Programme O Specific Outco th of correlation Programme O PO 3 2 2 2	Networking", Tat ramme Outcome omes PSO's n) 3-Strong, 2-M Dutcomes PO's PO 4 2 2 2	a McGraw-Hill es (PO's) and P edium, 1-Weal	Edition, 2012. Programme



				ASSE	SSMENT							
COU	RSE O	BJECTIVES										
To en	able th	e students to										
1	intro	luce the state esti	imation	on DC net	work.				-		-	
2	impa	rt in-depth knowl	edge on	power sys	stem state	estimatio	on.			-		ten h
3	study	alternative form	ulations	of WLS s	tate estim	ation.	N. C.					1111
4	get in	sight of network	observa	bility and	bad data i	identifica	tion.	1.41.61				ab
5	gain	knowledge on po	wer syst	em securit	y assessn	nent.			164	793		
UNIT	I I	INTRODUCTI	ION TO	STATE	ESTIMA	TION						9
weigh	nts - gai	ate estimation – n matrix; State es roblems; Energy r	stimation	as applie	ed to DC 1	-						
UNIT	II	WEIGHTED I	EAST	QUARE	ESTIM	ATION						9
		t Jacobian matri bstitutions; Deco	ix, gain		Cholesky	decomp	osition a	ind perfo	ormin	ig for	ward	and
backw Role o	vard su of phas	t Jacobian matri	ix, gain oupled fo units (PM VE FOR	matrix; ( ormulation IU) in stat	Cholesky n of WLS te estimat	decomp 5 state es ion. WLS ST.	osition a timation,	nd perfo DC sta	te est	ig for	ward	and odel:
backw Role o UNIT Weak and V	vard su of phas T III ness of Wilkins	t Jacobian matri bstitutions; Deco or measurement u ALTERNATIV normal equation ons, equality co	ix, gain oupled for units (PM VE FOR n formul onstraints	matrix; ( ormulation (U) in stat MULAT ation, orth s WLS s	Cholesky n of WLS te estimat	decomp 5 state es ion. WLS ST. factorizati	osition a timation, ATE ES ton, hybr	nd perfo DC sta TIMAT id metho	te est	ng for imation	ward on m	and odel; 9 Peters
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backw Role of UNIT Weak and W formu UNIT Netwo metho analys measu Chi-so	vard su of phas T III ness of Wilkins alation a ork and ork and od base sis, det uremen quares	t Jacobian matri bstitutions; Deco or measurement u ALTERNATIV normal equation ons, equality co and comparison o NETWORK O	ix, gain oupled for units (PM VE FOR n formul onstraint: of technic DBSERV FION rk matri ole formul tical me ssification	matrix; ( ormulation IU) in stat MULAT ation, orth s WLS s ques. ABILITY ces, loop alation and asurement on of mea ed residua	Cholesky n of WLS te estimat ION OF 1 hogonal f tate estim d branch s; Role o surement ils; Bad d	decomposition. S state estion. WLS ST. Pactorization, a AD DAT as; Methonic variable f of PMU in s; Bad d lata idention	ATE ES fon, hybr ugmented ADETE ods obser formulation n network ata detec ification	nd perfo DC star TIMAT id method d matrix CCTION rvability on; Topo k observ- tion and	ION anal ologic abilit	ethod oroach ysis, al obs y; Pro	on m of P o, blo nume serval	and odel; 9 9 eters ocked 9 9 erical bility es of using
backw Role of UNIT Weak and W formu UNIT Netwo metho analys measu Chi-so	vard su of phas f III ness of Wilkins ilation a ork and ork an	t Jacobian matri bstitutions; Deco or measurement u ALTERNATIV normal equation ons, equality co and comparison o NETWORK O IDENTIFICAT d graphs, netword d on nodal variab ermination of criti- t residuals - Class distribution and r	ix, gain oupled for units (PM VE FOR n formul onstraints of technic DBSERV FION rk matri ole formul tical me ssification normaliz	matrix; ( ormulation (U) in stat <b>MULAT</b> ation, orth s WLS s pues. <b>ABILITY</b> ces, loop ulation and asurement on of mea ed residua on; Bad da	Cholesky n of WLS te estimat ION OF 1 hogonal f tate estim ( AND B. equation d branch 1 s; Role o surement ds; Bad d tta detecti	decomposition. S state estion. WLS ST. Cactorization nation, a AD DAT us; Methon variable for variable for s; Bad do ata identi- con using	ATE ES fon, hybr ugmented ADETE ods obser formulation n network ata detec ification	nd perfo DC star TIMAT id method d matrix CCTION rvability on; Topo k observ- tion and	ION anal ologic abilit	ethod oroach ysis, al obs y; Pro	on m of P o, blo nume serval	and odel; 9 9 eters ocked 9 9 erical bility es of using

security-Dynamic security assessment; Future trends to assessing dynamic security-Issues related to integration of renewable energies, security enhancement, issues and methods to solve SCOPF problem; Deal with the challenges for enhancing dynamic security.

	TOTA	L PE	RIOI	DS	45
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DT Manual

COURSE OUTCOMES
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At the en	nd of this course, students will be able to	(Highest Level)
C01	define various concepts implied in state estimation and its need in DC networks.	Understanding (K2)
CO2	apply State estimation algorithms in modelling of transmission lines.	Applying (K3)
CO3	compare the different types of formulation techniques of state estimation.	Analyzing(K4)
CO4	analyse network observability and identify the bad data detection using different methods.	Analyzing(K4)
C05	list the different types of assessing power system security and solve the issues.	Understanding (K2)

### REFERENCES

- Ali Abur and Antonio Gomez Exposito, "Power System State Estimation Theory and Implementation", Marcel Dekker, Inc., New York. Basel, Third Edition, Reprint, 2014.
- J J Grainger and W D Stevension, "Power System Analysis", McGraw-Hill, Inc., Fourth Edition, 2016.
- A Monticelli, "State Estimation in Electric Power Systems", Kluwer Academic Publishers, Seventh Edition, 2016.
- 4. Mukhtar Ahmad, "Power System State Estimation", Lap Lambert Acad Publishers, 2013.

### **CO-PO MAPPING**

Maj		se Outcome (CO adicates strengt	Specific Outco	mes PSO's ) 3-Strong, 2-M		
CO's	PO 1	PO 2	Programme O PO 3	PO 4	PO 5	PO 6
CO1	3	3	2	2	-	-
CO2	3	3	2	2	ent i s piché re	-
CO3	3	3	2	2		-
CO4	3	3	3	1		-
CO5	3	3	2	1	3	-



PAC23201

#### PEDAGOGY STUDIES

0 0 2

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COURSE OBJECTIVES

To enable the students to

1. understand the aims, objectives and educational philosophies of education.

2. acquire the knowledge of Instructional objectives of teaching and teaching skills.

3. apply the knowledge of methods and strategies of teaching in real classroom situation.

4. utilize the instructional aids and tools for effective classroom teaching.

5. acquaint with the knowledge of professional development of teachers.

#### UNIT I EDUCATION AND ITS PHILOSOPHY

Education- Definition, Aims, Objectives, Scope, Educational philosophy of Swami Vivekananda, Mahatma Gandhi, Rabindranath Tagore, Sri Aurobindo and J.Krishnamoorthy, Montessori, Jean - Jacques Rousseau, Friedrich Froebel and John Dewey. Current trends and issues in Education - Educational reforms and National policy on Education - 1968 and 1986 - its objectives and features.

#### UNIT II INSTRUCTIONAL OBJECTIVES AND DESIGN

Instructional Objectives: Taxonomy of Educational objectives - Writing of general and specific objectives. Instructional design: Planning and designing the lesson, Writing of lesson plan: meaning, its need and importance, format of lesson plan. Types of lesson plan Skills of teaching: various ways of introducing lessons, explaining skills, problem solving skills, illustrative skills, scaffolding skills, integrating ICT skills, questioning skills, Reinforcement skills, skill of probing questions, skill of Stimulus variation and computation skills.

#### UNIT III INSTRUCTIONAL METHODS AND STRATEGIES

Instructional strategies Lecture, demonstration, laboratory, Inductive method, Deductive method, Inquiry method, seminar, panel discussion, symposium, problem solving, project based learning (PBL), Learning by doing, workshop, role - play (socio-drama), Recent trends: Constructivist learning - Problem - based learning - Brain based learning - Collaborative learning - Flipped learning - Blended learning - e-Learning trends - Video conferencing.

#### UNIT IV INSTRUCTIONAL MEDIA

Key concepts in the selection and use of media in education, Developing learning resource material using different media, Instructional aids - types, uses, selection, preparation, utilization. Dale cone of Experience, Teacher's role in procuring and managing instructional Aids - Projected and non-projected aids, multimedia, video - teleconferencing etc.

#### UNIT V **TEACHER PREPARATION**

Teacher - roles and responsibilities, functions, characteristics, competencies, qualities, Preparation of Professional teacher, Organizing professional aspects of teacher preparation programs, Professional Development of teachers -In-service training, Refresher programmes, workshop and higher studies.

> TOTAL PERIODS: 30

6

6

6

6

6

	CTICUM					
•	Writing of three	lesson plans				
•	Practice teaching	g for 15 days				
•	Preparation of o	ne teaching aid				
•	A seminar on on	e educational phil	losophy	and the second se		
•	Assignment on a	any of these five u	nits	Internet Gentle	a star for star	
COUI	RSE OUTCOME	s	the second second	A local local	BT M	IAPPED
At the	end of the course,	the students will	be able to		(High	est Level)
CO1	explain the educ	ational philosophi	es of education.	Lance Children	Unde	rstanding (K2)
CO2	write instruction	al and specific obj	jectives in lesson pl	an.	Apply	ying (K3)
CO3	utilize the teachi	ng skills and meth	nods effectively.	- Reality of stands of	Unde	rstanding (K2)
CO4	use instructional	media efficiently.	and the second second second	in it will be	Apply	ying (K3)
CO5	update themselv	es in the area of p	rofessional develop	ment.	Apply	ying (K3)
1. 1	Action1992.	atom for age	68 and 1986- Nation		div sort and	5-Programme c
1. 1 2. 1 3. 5 4. 1 5. 1	National Policy of Action1992. Benjamin S.Bloom Siddiqui, Mujibul I Jeffrey Bennett (20 Big Kid Science: E	netal. (1987). Taxo Hasan(2005). Tecl 014).On Teaching Boulder, CO pal,B.M.(2010).De	ono my of education hniques of classroo Science: Principle eveloping teaching	nal objectives. Lon, m teaching A.P.H. s and Strategies Tl competencies. New	gman Group. hat Every Educato v Delhi: Viva Boo	or Should Know
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1. 1 2. 1 3. 5 4. 1 5. 1 CO - 1	National Policy of Action1992. Benjamin S.Bloom Siddiqui, Mujibul I Jeffrey Bennett (20 Big Kid Science: E Bawa,M.S.& Nagp PO MAPPING	etal. (1987). Taxo Hasan(2005). Tech D14).On Teaching Boulder, CO Dal,B.M.(2010).De Mapping of Co /3 indicates stren	ono my of education hniques of classroo Science: Principle eveloping teaching ourse Outcomes wi <b>agth of correlation</b>	nal objectives. Lon m teaching A.P.H. s and Strategies Th competencies. New th Programme Out ) <b>3-Strong, 2-Med</b> outcomes(POs) PO4	gman Group. hat Every Educato v Delhi: Viva Boo comes:	or Should Know
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PPS23	205	ADVA			M SIMULATION	N 0	0	4	2
COUR	SE OBJEC	TIVES	L	ABORATORY	11	_	-		
	ble the stude					_	-	_	-
			COMD.	des alles des la se			_	_	
1	Shou should be		and the second	sing classical ma					
2	-			with STATCO	М.			_	
3	know the de								
4	study about	DFIG, PMS	G in wind	energy conversi	on system.				
LIST (	OF EXPERI	MENTS		-					
1.	Small-signa model.	l stability ar	alysis of s	ingle machine-in	nfinite bus system	using classic	al ma	chine	
2.	Small-signa	l stability ar	nalysis of r	nulti-machine co	onfiguration with	classical mac	hine n	nodel.	
3.	Induction m	Contract of Contractor (Contractor					1		
4.				tem with STAT					
5.				em with STATC					
6.					existing load flow	program.			
7.				gy conversion sy			_		
8.				gy conversion sy					
9.	a contract of the second s			Water and the second second second	ectifier feeding a			_	
10.	Co-ordinati	on of over-c	urrent and	distance relays	for radial line prot	ection.			
					1.1	TOTAL P	ERIO	DS	60
COUR	SE OUTCO	MES							-
At the	end of this co	ourse, studer	ts will be	able to		BT N	Mapp	ed	-
						(High			
C01	implement through si		pt SMIB	using classical	machine model		Appl	ying (	(K3)
CO2	analyze tv	vo-bus syste	m with ST	ATCOM.			Anal	yzing(	(K4)
CO3	execute th	e relay prot	ection circ	uit in simulation			Anal	yzing(	(K4)
CO4	describe	the concep	ot of DF	IG, PMSG in	wind energy	Und	erstan	ding (	K2
	conversio	n system.							
CO-PC	) MAPPINO	3							
	Mapping of	Course Ou	tcome (Co	O's) with Progr	amme Outcomes	(PO's) and	Progr	amm	e
				Specific Outco					
	(1	/2/3 indicat	es strengt	h of correlation Programme O	) 3-Strong, 2-Me	dium, 1-Wea	ik		-
CO's	DO.		PO 2	Programme O PO 3	PO 4	PO 5		DO (	
	PO	1						PO	<b>)</b>
C01			3	2	2	1		1	
CO2	3		3	2	2	1		1	
			3	2	2	1		1	
CO3	3		3	~	-				

Approved BOARD BOARD OF STUDIES Electrical & Electronics Engineering ANA: MAK AUTONOMOUS

# PROFESSIONAL ELECTIVES

PPS23	3151	A	NALYSIS OF POWER CONVERTERS		3	0	0	3
COUI	RSE OB	JECTIVES		a sé dés				10
To ena	able the s	students to	the manufacture of the second s					
1	analyze convert		end the various operating modes of different	ent config	gurati	ons o	of po	wer
2	know t	he operation of	various inverter and their PWM controlling t	echniques	s.	i din		an
3	design	different powe	r converters DC to DC converters.					
4	learn th	ne types of AC	voltage controllers and basics of matrix conve	erters.	, i i i			
5	impart	knowledge on	different types of multilevel inverter and PW!	M techniq	ues.	The		
UNIT	I	CONVERTER	*					9
diodes imped	, contin	uous and dis l overlap; Thre	and fully controlled converters – R Load, continuous modes of operation, inverter of the phase Semi and fully controlled converter	operation;	Effe	ect o	of sou	urce
UNIT	п	NVERTERS						9
Princip	ple of op	eration of half	and full bridge inverters; Voltage control of	single ph	nase i	nvert	ers us	sing
PWM	techniq	ues; Harmonic	elimination techniques; 180 degree and 12	20 degree	e con	ducti	on m	ode
inverte	ers with s	star and delta c	onnected loads.					
UNIT	Ш	DC-DC CONV	VERTERS					9
			d step-up converters; Analysis of buck, urrent limit control; Full bridge converter; I					
conver		ne funo uno e		cesonan	und	quasi	10301	in the second se
UNIT	IV I	AC VOLTAG	E CONTROLLERS					9
Princip	ple of ph	ase control; Si	ngle phase and three phase controllers - Ana	alysis with	h R a	nd R	-L lo	ads;
Princip	ple of o	peration single	phase and three phase cyclo-converters; P	ower fac	tor co	ontro	l; Ma	trix
conver	rters.							
UNIT	V I	MULTILEVE	L AND BOOST INVERTERS		-10			9
Multil	evel con	cept – Diode c	lamped, flying capacitor, cascade type multile	evel inver	ters,	comp	ariso	n of
multile	evel i	nverters; A	oplication of multilevel inverters;	PWM	tech	hniqu	ies	for
multile	evel inve	rters; Single pl	hase and three phase impedance source inverte	ers.				
				TOTA	L PF	RIO	DS	45
COUL	RSE OU	TCOMES						
At the	end of the	his course, stud	lents will be able to		BT M lighes			

	apply the differe	nt converter con	ifiguration based on	the	A	pplying (K3)
	application.			10.2673		
CO2	describe the sing	gle and three pha	ise inverter.		Unders	standing (K2)
CO3	design a suitable	DC-DC conver	ter for given load sp	pecification.	A	nalyzing(K4)
CO4	apply different t application.	ypes AC voltage	e controller based or	n the	А	applying (K3)
C05	analyze the mult	ilevel inverter fo	or power system app	olication.	А	nalyzing(K4)
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At the e	nd of this course, s	students will be	able to			apped t Level)
C01	understand the c systems.		Applying (K3)			
CO2	explain the solut	Under	standing (K2			
CO3	realize the prope	Analyzing(F				
CO4	identify non-linearities and evaluate the stability of the system using lyapnov notion.					nalyzing(K4
CO5	perform modal	analysis and de	sign controller	and observer in	A	nalyzing(K4
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	23153	POWER SYSTEM RELIABILITY	3	0	0	3
COU	IRSE O	BJECTIVES				
To er	hable the	e students to	ESCI U			
1	know	the basic concepts of reliability engineering.				
2	under	rstand about the probability methods in generating capacity.		-	-	-
3	know	the concept of frequency and duration methods in generating capacity.				-
4	study	the formation of system model.				
5	learn	the importance of reliability indices in power system planning, expansi ol.	ion, o	pera	tion	and
UNI	ГІ	INTRODUCTION		-		9
funct	ions of	cess, recursive technique; Security levels of system – Reliability cost, system security; Contingency analysis; Linear sensitivity factors, hier n reliability assessment.				
UNI	гп	GENERATING CAPACITY: BASIC PROBABILITY METHOD	s			9
		ystem models - capacity outage probability tables, loss of load indices,	equiv	valer	nt for	ced
	ge rate, o ergy inc	capacity expansion analysis, scheduled outages, evaluation methods on				
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601		1.1. C				t Level)	
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CO2	understand the importance of customer oriented and system         Understanding (K)           oriented indices.						
CO3	illustrate the co generating capac	Unders	tanding (K2)				
CO4	familiarize with	reliability evalu	ation methodolo	ogies.	Unders	tanding (K2)	
C05	analyse the systematic strategies.	ystem perforn	nance with pr	roper remedial	Aı	nalyzing(K4)	
REFER	ENCES	within the bar		2010 0			
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3.		ssessment of Po	, 2019. ower System Rel	iability", Springer	r, 2017.		
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COL	RSE	OBJECTIVES	and the state of a state of the	1.5
To er	nable t	the students to	printing reaction surgering and the second statements	27,10
1	gat	her knowledge abo	out air insulated (AI) and gas insulated (GI) substations.	
2	awa	are of substation ed	quipment and their arrangements.	1.1.1
3	und	lerstand the concep	pts of insulation coordination and standards of substation.	0.0
4			on grounding system and shielding.	14 F
5	kno	ow about the source	e and effect of fast transients in air insulated, gas insulated substa	ations.
UNIT	I T	INTRODUCTIO	ON *	
Introd	luctio	n - characteristics.	, comparison of air insulated substation (AIS) and gas insulated	
insula	ated lin	ne (GIL),gas insula	bstations; Environmental considerations, planning and install ated busducts (GIB).	
UNIT	п	MATOD FOUT		
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C01	express the fundamentals of air insulated (AI) and gas insulated (GI) substations.	Understanding (K2)
CO2	describe the assembly of substation equipment's.	Understanding (K2)
CO3	deliver standards of insulation coordination.	Understanding (K2)
CO4	design the substation grounding system and shielding.	Analyzing(K4)
CO5	implement the effects of fast transients in AIS and GIS.	Analyzing(K4)

### REFERENCES

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- M.S. Naidu, "Gas Insulation Substations", I.K. International Publishing House Private Limited, 2018.
- 3. Klaus Ragallar, "Surges in High Voltage Networks" Plenum Press, New York, 2016.
- Pritindra Chowdhuri, "Electromagnetic Transients in Power Systems", PHI Learning Private Limited, New Delhi, Second edition, 2014.

# **CO-PO MAPPING**

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

	Programme Outcomes PO's							
CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6		
CO1	3	3	2	2	a find two pains	dian-		
CO2	3	3	2	2				
CO3	3	3	2	2	3	3		
CO4	3	3	3	1	3	3		
CO5	3	3	2	1	3	3		


To ena	SE OBJECTIVES			_	
	hie the students to				_
1		bout the fundamentals of magnetic circuits.			nı
2		state and dynamic state operation of DC machine.			ī
3		theory of transformation of three phase variables to two phase			
4	analyze the steady s theory based mathem	state operation of three-phase induction machines using tr atical modeling.	ansfo	ormat	ior
5		state and dynamic state operation of three-phase synchrono theory based mathematical modeling.	ous n	nachi	nes
UNIT	I ELECTROM	AGNETIC ENERGY CONVERSION			9
Magne	tically coupled circuits	s - Linear magnetic system, nonlinear magnetic system; Elect	rome	chan	ca
energy	conversion - Energy	relationships, energy in coupling fields; Machine winding ing inductance and voltage equations.			
UNIT		RRENT MACHINES	-		9
		C) machine - Voltage and torque equations, Basic types of	-	1	
UNIT	III REFERENCE	FRAME THEORY			9
Equatio	ons of transformation	- Changes of variables; Stationary circuit variables transfer	orme	d to	the
arbitrar	y reference frame;	Commonly used reference frames; Transformation betwee	en r	efere	nce
frames;	Transformation of a	balanced set; Balanced steady state phasor relationships; Bal	ance	d stea	ady
state vo	oltage equations.				
UNIT	IV SYMMETRIC	CAL INDUCTION MACHINES			9
Voltage	e equations in mach	nine variables; Torque equation in machine variables; 1	Equa	tions	0
ransfo	rmation for rotor circ	cuits; Voltage equations in arbitrary reference frame varia	bles;	Tor	que
equatio	n in arbitrary referen	ce frame variables; Analysis of steady-state operation; Free	acc	elerat	ior
charact	eristics - Free accele	eration characteristics viewed from various reference fram	es; I	Dynai	nic
perform	nance during sudden c	hanges in load torque.			
UNIT	V SYNCHRONO	DUS MACHINES			9
Voltage	e equations in mach	ine variables; Torque equation in machine variables; S	tator	volt	age
equatio	ons in arbitrary referen	ce frame variables; Voltage equations in rotor reference fran	ne va	riable	es -
					8

Park's equations; Rotor angle and angle between rotors; Analysis of steady state operation; Dynamic performance during a sudden change in input torque; Dynamic performance during three phase fault at the machine terminals.

					TOTAL PE	RIODS	45
COUR	SE OUTCOMES						
At the e	nd of this course,	students will be	able to	na ostin pro-	BT Ma (Highest		
C01	understand the f	undamentals of	magnetic circuit	S.		tanding (	K2
CO2	learn the stead machine.	ly state and d	ynamic state o	peration of dc	Underst	tanding (	K2)
CO3	known the theo two phase varial	•	ation of three ph	ase variables to	Underst	tanding (	K2)
CO4				phase induction 1 mathematical	Underst	tanding (	K2)
C05	the second se	ous machines us		ration of three- on theory based	Underst	tanding (	K2)
REFEF	RENCES			at see to be	Contra Statistic		-
1.	Paul C.Krause, O	leg Wasyzczuk,	Scott S, Sudhof	f, "Analysis of El	ectric Machine	ry and D	rive
	Systems", John W	iley, Second Ed	lition, reprint 20	18.			
2.							
		energlized i neor	v of Electrical N	lachines" Khanns	Publishers 20	21	
				Aachines", Khanna	Company of the local state		Toto
	A.E, Fitzgerald,	Charles Kingsle	y, Jr, and Stepl		Company of the local state		Tata
3.	A.E, Fitzgerald, McGraw Hill, 6th	Charles Kingsle Edition, reprint	ey, Jr, and Stepl 2015.	nan D, Umanx, "	Electric Mach	iinery", 1	
3.	A.E, Fitzgerald, McGraw Hill, 6th Hamid A. Toliy	Charles Kingsle Edition, reprint vat, Subhasis N	ey, Jr, and Stepl 2015. andi,Seungdeog	han D, Umanx, " Choi,Homayoun	Electric Mach Meshgin-Kel	iinery", 1 k, "Elec	
3.	A.E, Fitzgerald, McGraw Hill, 6th Hamid A. Toliy Machines: Model	Charles Kingsle Edition, reprint vat, Subhasis N	ey, Jr, and Stepl 2015. andi,Seungdeog	han D, Umanx, " Choi,Homayoun	Electric Mach Meshgin-Kel	iinery", 1 k, "Elec	
3. 4. CO-PO	A.E, Fitzgerald, McGraw Hill, 6th Hamid A. Toliy Machines: Model MAPPING	Charles Kingsle Edition, reprint vat, Subhasis N ing, Condition N	ey, Jr, and Stepl 2015. andi,Seungdeog Monitoring, and I	han D, Umanx, " Choi,Homayoun Fault Diagnosis",	Electric Mach Meshgin-Kel CRC Press, 201	iinery", 7 k, "Elec 3.	ctric
3. 4. CO-PO	A.E, Fitzgerald, McGraw Hill, 6th Hamid A. Toliy Machines: Model	Charles Kingsle Edition, reprint vat, Subhasis N ing, Condition N	y, Jr, and Stepl 2015. andi,Seungdeog Monitoring, and I <b>D's) with Progr</b>	han D, Umanx, " Choi,Homayoun Fault Diagnosis", ( amme Outcomes	Electric Mach Meshgin-Kel CRC Press, 201	iinery", 7 k, "Elec 3.	ctric
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1		about internet of	f thing	s(IoT) te	chnologies	and its bas	sics.		-			10
2	and the second se	ice the network										
3	familia	arize the principl	oles be	hind the i	nternet cor	nnectivity p	principles	for IoT.	il ling ret			
4	provid	e insight about t	the dat	ta acquiri	ng, process	sing, organ	nizing and	l analytics				
5		s the application										
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in the ch	ia or and course, s	adents will be				t Level)
C01	analyze the basic	concepts of IoT	and its present dev	elopments.	1	Analyzing(K4
CO2	compare and cont	rast about differ	ent architecture of	loT.	1	Analyzing(K4
CO3	explain different i	nternet connecti	vity principles.		Unde	rstanding (K2
CO4	analyze the data a processing of IoT.		acquiring, organis	ing,	1	Analyzing(K4
C05	implement IoT so	lutions for smart	t applications.	a single and		Analyzing(K4
REFER	ENCES		10.00	n dia mandri San di		
1.	David Hanes, Go	nzalo Salgueiro	o, Patrick Grosse	etete, Rob Bar	ton and Jerome	e Henry, "IoT
	Fundamentals: Ne	tworking Tech	nologies, Protoco	ols and Use C	ases for Interne	et of Things"
	Cisco Press, First I	Edition, 2017.				
2.	Rajkamal, "Interne	t of Things: Ar	chitecture, Desig	n Principles an	d Applications".	McGraw Hil
	Higher Education,					
	Olivier Hersent, D			i "The Intern	at of Things: Ke	w application
			A second s	n, The Internet	et of Things. Ke	y application
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ERING COLLEGE BOARD OF STUDIES Electrical & Electronics Engineering ろンスン 1 AUTONOMOUS

PPS23157	POWER E	LECTRONICS APPLICATION TO WIND AND SOLAR ENERGY SYSTEMS	3	0	0	3
COURSE OF	BJECTIVES					
o enable the	students to					
1 impart	knowledge on	wind energy conversion.				
2 familia	arize on differen	nt types of power converters used in wind energy conve	ersion	syste	ems.	
3 unders	stand the proces	s of solar energy conversion using photovoltaic (PV) s	ystem	l.		
impar	t detailed know	ledge on grid connected PV system and MPPT (ma	aximu	im po	ower	point
	ng) algorithms.		1	-	_	
5 recogn		nt configuration of hybrid energy system and their conti	rol.			-
UNIT I		GY CONVERSION SYSTEMS				9
Power in the	Wind; Wind t	turbine design considerations; Grid connected wind t	farms	; Hyl	orid I	power
systems; Cla	ssification of v	vind turbine rotors; Common generator types in win	d tur	bines	; Dif	ferent
configuration	s for connecting	g wind turbines to the grid - Economic analysis of wind	d syste	ems.		
UNIT II Developmen Two level po wind power	POWER ELF t of wind powe ower converter, converter; Cont	g wind turbines to the grid - Economic analysis of wind ECTRONICS FOR WIND TURBINES r generation; Wind power conversion; Power converter multilevel power converter, multi cell converter; Power rols and grid requirements for modern wind turbines - Total harmonic distortion - Fault ride through capability	ers fo er sen Activ	or win nicon we po	iducto wer c	ors for control
UNIT II Developmen Two level po wind power - Reactive po	POWER ELF t of wind powe ower converter, converter; Cont ower control - T nd power system	ECTRONICS FOR WIND TURBINES r generation; Wind power conversion; Power converte multilevel power converter, multi cell converter; Power rols and grid requirements for modern wind turbines - Total harmonic distortion - Fault ride through capability m.	ers fo er sen Activ	or win nicon we po	iducto wer c	bine - ors for control ability
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HES; DC-bus connected HES; DC-side integration of HES; Three port converters; DC-DC converter; High-frequency link; Neutral-point-clamped multilevel converters with multiple energy sources; Cascaded and modular multilevel converters; Solid state transformers.

					TOTAL PE	RIODS	45
COUR	SE OUTCOMES				-		
At the e	nd of this course,	students will be	able to	and we have	BT M: (Highest		
C01	explain the basic	cs of wind energ	y conversion sys	tem.	Under	standing	(K2)
CO2	elucidate power	conversion in w	ind energy conve	ersion system.	Under	standing	(K2)
CO3	describe the pro-	cess of solar ene	rgy conversion s	ystem.	Under	standing	(K2)
CO4	use the converte	rs for solar energ	gy conversion.		Under	standing	(K2)
CO5	implement the c using power con		d renewable ene	rgy conversion	A	Analyzing	(K4)
REFER	ENCES						
	Ahmed F Zobaa Scientific Publish						
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clustering algorithm; Introduction to python visualization using Matplotlib - Plotting 2- dimensional, 3dimensional graphs, formatting axis values, plotting multiple rows of data in same graph.

UNIT V INTRODUCTION TO NEURAL NETWORKS AND EMBEDDED MACHINE LEARNING

Introduction to neural networks and significance – Neural network architecture, single layer perceptron and multi-layer perceptron (MLP), commonly used activation functions; Forward propagation, back propagation, and epochs, gradient descent; Introduction to convolution neural networks; Implementation of digit classification using MNIST dataset ML for embedded systems

## TOTAL PERIODS 45

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At the e	nd of this course, students will be able to	BT Mapped (Highest Level)
C01	implement skill in system administration and network programming by learning python.	Applying(K3)
CO2	demonstrate the concepts of machine learning and implement using python.	Understanding (K2)
CO3	relate Pythons highly powerful processing capabilities for primitives, modelling etc.,	Applying(K3)
CO4	improve the employability and entrepreneurship capacity due to knowledge upgradation on recent trends in embedded systems design.	Understanding (K2)
C05	apply the concepts acquired over the advanced research/employability skills.	Applying(K3)

1. Mark Lutz, "Learning Python, Powerful OOPs", O'reilly, 2017.

- Zelle, John "M. "Python Programming: An Introduction to Computer Science.", Franklin Beedle & Associates, 2013.
- Andreas C. Müller, Sarah Guido, "Introduction to Machine Learning with Python", O'Reilly, 2016.
- Sebastian Raschka, Vahid Mirjalili, "Python Machine Learning Third Edition", Packt, December 2019.

### **CO-PO MAPPING**

Ma			D's) with Progra Specific Outcor h of correlation)	nes PSO's 3-Strong, 2-Me		ogramme
CO's	PO 1	PO 2	Programme Ou PO 3	PO 4	PO 5	PO 6
CO1	3	3	2	2	105	100
	3	2	2	2	-	-
CO2	3	3	2	~	-	
CO3	3	3	2	2	Sector and the	ni pad- na
CO4	3	3	3	1	d live - ambies	di grino
CO5	3	3	2	1 ·		-



	23160		TROMAGNETIC INTERFERENCE AND OMPATIBILITY IN SYSTEM DESIGN	3	0	0	3
cou	RSE O	BJECTIVES				_	_
To en	able the	e students to					
1	recog	nize the basic of	electromagnetic compatibility and its application.				
2			cabling and grounding fundamentals.	919 H.	10202		
3	know	about the impor	tance of balancing and filters.				
4			electromagnetic interface (EMI) from apparatus an	d circui	ts.	-	
5	T-1		s of electrostatic discharge (ESD).		72012	1	
UNIT			AGNETIC COMPATIBILITY AND APPLICAT	IONS			9
UNI	гп	CABLING A	nts; Decoupling capacitors; Effective decoupling str <b>ND GROUNDING</b> on shield on capacitive coupling; Inductive coupli			-	9
	ceptor a	and the second se	on magnetic coupling; Shielding to prevent magne	nower	distrib	oution	and
safet	y groun	ds; Signal groun	fields; common impedance shield coupling; AC ds; Equipment grounding; Ground loops.	power	distrib	oution	n and
UNI	тш	ds; Signal groun	fields; common impedance shield coupling; AC ds; Equipment grounding; Ground loops.	power	distrib	oution	n and
UNI Bala Com circu	T III ncing – imon m iit deco	BALANCING Common mode	fields; common impedance shield coupling; AC ds; Equipment grounding; Ground loops.	nced lo Low fr	distrib pads; reque	Filter	n and 9 ing – nalog
UNI Bala Com circu andi	T III ncing – imon m iit decc ng.	BALANCING Common mode ode filters, para pupling, amplifie	fields; common impedance shield coupling; AC ds; Equipment grounding; Ground loops. <b>3 AND FILTERING</b> rejection ratio, cable balance, system balance, bala sitic effects in filters; Power supply decoupling – er decoupling; Driving capacitive loads; System l APPARATUS AND CIRCUITS	anced le Low fr	distrib oads; equer dth; M	Filter ncy a Modu	n and 9 ing – nalog lation
UNI Bala Com circu andi UNI Elec Nois mod lines indu	T III ncing – amon m ait decc ng. IT IV ctromag se char dulation s – Mu aced vo	Ads; Signal groun BALANCING Common mode tode filters, para oupling, amplifie EMI FROM netic emissions racteristics, effe , intermodulatio liticonductor line litages and curre	fields; common impedance shield coupling; AC ds; Equipment grounding; Ground loops. <b>GAND FILTERING</b> rejection ratio, cable balance, system balance, bala sitic effects in filters; Power supply decoupling – er decoupling; Driving capacitive loads; System balance, <b>APPARATUS AND CIRCUITS</b> – Systems, appliances; Noise from relays and sw cts of interfaces; Nonlinearities in circuits – n, cross modulation; Passive intermodulation; Cross to three conductor line; Transients in power supply nts, surges on main power supply; Electromagnet	anced le Low fi bandwid itches - Amplifi oss talk / lines	distrib bads; requend dth; M - Circ ier no in tr - Cal	Filter ncy a Modu cuit n online ansm culat	9 ing – nalog lation 9 nodel earity ission ion o
UNI Bala Com circu andi UNI Elec Nois mod lines indu cour	T III ncing – amon m ait decc ng. IT IV ctromag se char dulation s – Mu aced vo	Ads; Signal groun BALANCING Common mode tode filters, para oupling, amplifie EMI FROM netic emissions racteristics, effe , intermodulatio liticonductor line litages and curre Conduction coupl	fields; common impedance shield coupling; AC ds; Equipment grounding; Ground loops. <b>GAND FILTERING</b> rejection ratio, cable balance, system balance, bala sitic effects in filters; Power supply decoupling – er decoupling; Driving capacitive loads; System balance, <b>APPARATUS AND CIRCUITS</b> – Systems, appliances; Noise from relays and sw cts of interfaces; Nonlinearities in circuits – n, cross modulation; Passive intermodulation; Cro e, three conductor line; Transients in power supply	anced le Low fi bandwid itches - Amplifi oss talk / lines	distrib bads; requend dth; M - Circ ier no in tr - Cal	Filter ncy a Modu cuit n online ansm culat	9 ing – nalog lation 9 nodel earity ission ion o

grounding; Non grounded products; Field induced upset; Transient hardened software design; Time windows.

					TOTAL PH	RIODS	45
COURS	SE OUTCOMES						
At the en	nd of this course,	students will be	able to	والرجاء أبراج والرج	BT M (Highes	apped t Level)	
C01	explain the base application.	sics of electron	nagnetic compa	tibility and its	Under	standing (	(K2
CO2	describe the pro	cess of on cablir	ng and grounding	g fundamentals.	Under	standing	(K2
CO3	elucidate the im	portance of bala	ncing and filters		Under	standing	(K2
CO4	examine the ef apparatus and ci	fect of electron ircuits.	nagnetic interfa	ce=(EMI) from	Under	standing	(K2
C05	implement the applications.	concept elect	rostatic dischar	rge in various		Applying	(K3
REFER	ENCES			a local day of	a land the last		
2.	V.Prasad Kodali,		ectromagnetic C	Compatibility", I	EEE Press and .	John Wile	ey 8
2. 3. 4. <b>CO-PO</b>	V.Prasad Kodali, Sons Ltd, First Ec David A. West Measurement", C Clayton Paul, "In Edition, 2022. MAPPING Iapping of Cours	"Engineering El lition, Reprint 20 on, "Electroma RC Press, Third troduction to Ele	ectromagnetic C 017. agnetic Compar Edition, 2016. ectromagnetic Co O's) with Progra Specific Outco	tibility: Method ompatibility", Jo amme Outcome mes PSO's	ds, Analysis, ohn Wiley & Sou es (PO's) and P	Circuits ns, Inc., T rogramn	and
2. 3. 4. <b>CO-PO</b>	V.Prasad Kodali, Sons Ltd, First Ec David A. West Measurement", C Clayton Paul, "In Edition, 2022. MAPPING Iapping of Cours	"Engineering El lition, Reprint 20 ron, "Electroma RC Press, Third troduction to Ele	ectromagnetic C 017. agnetic Compar Edition, 2016. ectromagnetic Co O's) with Progra Specific Outco	tibility: Method ompatibility", Jo amme Outcome mes PSO's ) 3-Strong, 2-M	ds, Analysis, ohn Wiley & Sou es (PO's) and P	Circuits ns, Inc., T rogramn	and
2. 3. 4. <b>CO-PO</b>	V.Prasad Kodali, Sons Ltd, First Ec David A. West Measurement", C Clayton Paul, "In Edition, 2022. MAPPING Iapping of Cours	"Engineering El lition, Reprint 20 ron, "Electroma RC Press, Third troduction to Ele	ectromagnetic C 017. agnetic Compar Edition, 2016. ectromagnetic Co D's) with Progra Specific Outco h of correlation	tibility: Method ompatibility", Jo amme Outcome mes PSO's ) 3-Strong, 2-M	ds, Analysis, ohn Wiley & Sou es (PO's) and P	Circuits ns, Inc., T rogramn	and
2. 3. 4. CO-PO	V.Prasad Kodali, Sons Ltd, First Ec David A. West Measurement", C Clayton Paul, "In Edition, 2022. MAPPING Iapping of Cours (1/2/3 in	"Engineering El lition, Reprint 20 on, "Electroma RC Press, Third troduction to Ele se Outcome (CC dicates strength	ectromagnetic C 017. agnetic Compar Edition, 2016. ectromagnetic Co D's) with Progra Specific Outco h of correlation Programme O	tibility: Method ompatibility", Jo amme Outcome mes PSO's ) 3-Strong, 2-M utcomes PO's	ds, Analysis, ohn Wiley & Sor es (PO's) and P edium, 1-Weal	Circuits ns, Inc., T rogramm	and
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PPS23	3161			POWER	QUALI	TY	-			3	0	0	3
COUF	RSE OB	JECTIVES							_			_	
Fo ena	able the	students to											
1	provid	e knowledge abo											
2	supply	tand the concepting nonlinear lo	ads.										
3		with required s tion and load vo			onvention	al comp	ensatio	on tech	nnique	s for	pow	er fa	cto
4		uce the control t						l milin					di la
5	unders and U	stand the mitigate PQC.	tion tech	niques us	sing custo	om powe	er devi	ces suc	h as I	DSTA	TCO	M, E	VR
UNIT	I I	INTRODUCT	ION			ITT Las	man.	-	100	6			
unbal	anced lo	ads, DC offset	in loads	quality notching	problems in load v	voltage;	Distur	bance i	n supp	oly vo	oltage	- Pe	owe
qualit UNIT Single linear	ty standa <b>F II</b> e phase r and no	oads, DC offset	in loads <b>OF SINC</b> -linear l Three p	, notching <b>LE PHA</b> pads — sir nase balar	se AND se and which a system	THREI e sinuso em, three	Distur E <b>PHA</b> vidal, n e phase	SE SY on-sin e unbal	n supp STEM usoida anced	M 1 sou syste	oltage irce; ! em, th	e – Po Suppl	lyin
qualit UNIT Single linear unbal three	ty standa <b>F II</b> e phase r and no lanced a wire, th	ards, DC offset ards. ANALYSIS O linear and non- onlinear loads – and distorted so aree phase - four	oF SINC -linear l Three p urce su wire sy	, notching <b>CLE PHA</b> pads – sir hase balar oplying no stem.	SE AND ngle phase need syste	voltage; THREI e sinuso em, three loads; C	Distur E PHA iidal, n e phase Concep	SE SY ton-sint e unbal of of po	n supp STEM usoida anced ower f	M 1 sou syste	oltage irce; ! em, th	e – Po Suppl	lyin
qualit UNIT Single linear unbal three	ty standa <b>F II</b> e phase r and no lanced a wire, th <b>T III</b>	ards, DC offset ards. ANALYSIS O linear and non- onlinear loads – and distorted so aree phase - four CONVENTIO	in loads <b>OF SINC</b> -linear l Three p urce su wire sy <b>DNAL I</b>	LE PHA bads – sir hase balan oplying no stem.	SE AND ngle phase need syste on-linear	THREI THREI e sinuso em, three loads; C	Distur E PHA idal, n e phase Concep	SE SY toon-sime unbal of of po HODS	n supp STEM usoida anced ower f	M I sou syste actor	oltage irce; ! em, th r; Thr	suppl suppl ree pl	lyin hase
qualit UNIT Single linear unbal three UNIT Princ balar Anal	ty standa <b>F II</b> e phase r and no lanced a wire, th <b>T III</b> ciple of ncing, c lysis of t	ards, DC offset ards. ANALYSIS O linear and non- onlinear loads – and distorted so aree phase - four	oF SINC -linear l Three p urce su wire sy <b>DNAL I</b> ion and ncing, o	LE PHA oads – sir nase balan oplying no stem. OAD CO voltage re urrent bal	se AND ngle phase need syste on-linear OMPENS egulation; lancing, T	THREI e sinuso em, three loads; C SATION ; Classic harmonic	Distur E PHA iidal, n e phase Concep MET al load c reduc	bance i SE SY ion-sinue unbal ot of po HODS I balan ction a	n supp STEM usoida anced ower f cing p and vo	vi M I sou syste actor	errce; sag	Suppl suppl ree pl Open reduc	lyin hase loo
qualit UNIT Single linear unbal three UNIT Princ balar Anal comp	ty standa <b>F II</b> e phase r and no lanced a wire, th <b>T III</b> ciple of ncing, c lysis of the ponent for <b>T IV</b>	ANALYSIS O Inear and non- onlinear and non- onlinear loads – and distorted so aree phase - four CONVENTIC load compensat losed loop bala unbalance – Inst rom measured.	oF SINC -linear l Three p urce su wire sy <b>DNAL I</b> ion and ncing, c antaneo <b>PENSA</b>	LE PHA oads – sir nase balan oplying no stem. OAD CO voltage re urrent bal us of real	se AND ngle phase need syste on-linear OMPENS egulation; lancing, l and reaction	THREI e sinuso em, three loads; C ATION ; Classic harmonic ive powe	Distur E PHA iidal, n e phase Concep MET al load c reducers; Ex	bance i SE SY non-sime unbal of of po HODS d balan ction a stractio	n supp STEM usoida anced ower f cing p and vo n of fu	M 1 sou syste factor	oltage irce; ! em, th r; Thr em - 0 sag nenta	Suppl Suppl ree pl Open reduc	lyin bhas hase loo ction
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qualit UNIT Single linear unbal three UNIT Prince balar Anal comp UNIT Com curre refer DST UNI	ty standa <b>F II</b> e phase r and no lanced a wire, th <b>T III</b> ciple of ncing, c lysis of the ponent f <b>T IV</b> mpensating ents using rence control of the <b>T IV</b> mpensating <b>T IV</b> <b>T IV</b>	ANALYSIS O Inear and non- onlinear loads – and distorted so aree phase - four CONVENTIC load compensat losed loop balar unbalance – Inst rom measured. LOAD COM ng single-phase ng instantaneou urrents when t	in loads <b>OF SINC</b> -linear l Three p urce su wire sy <b>DNAL I</b> ion and ncing, c antaneo <b>PENSA</b> loads; I is PQ th he sound trol mo <b>MPENS</b>	LE PHA oads – sin nase balan oplying no stem. OAD CO voltage re urrent bal us of real so f real three eory; Inst ce is unl de.	sin load v SE AND ngle phase on-linear OMPENS egulation; lancing, T and reaction FING DS' phase shu tantaneou balanced;	THREI e sinuso em, three loads; C ATION ; Classic harmonic ive powe TATCO unt comp is symm ; Realize	Distur E PHA iidal, n e phase Concep MET al load c reducers; Ex OM pensato netrical ation	bance i SE SY ion-similation e unbalant ot of por HODS d balant ction a ction a ctraction or struct l comp and comp UTIO!	n supp STEM usoida anced ower f cing p ind vo n of fu cture; ( onents ontrol	VI I sou syste factor factor datage indan Gene s theo of I	oltage irce; em, th ; Thr em - ( sag nenta ory; ( DSTA	Suppl aree p ree p Open reduc I sequ g refe Gener	lyin bhas hase loc ction uend rrene ratin

					TOTAL PE	RIODS	45
COURS	SE OUTCOMES						1.00
At the e	nd of this course, st	udents will be	able to		BT Ma (Highes		
CO1	comprehend the c	onsequences o	of power quality i	issues.	and the second sec	standing (	K2
CO2	conduct harmoni systems supplying			nd three phase	Unders	standing (	K2
CO3	design passive filt	ter for load cor	npensation.		A	nalyzing(	K4
CO4	design active filte	rs for load con	npensation.		А	nalyzing(	K4
CO5	understand the devices such as a dynamic voltage r	distribution sta	atic compensator		Unders	standing (	K2)
REFER	ENCES	e filinte s	IN PLATIN T	Think the second	CONTRACTOR IN TH	-	-
2.	Devices",Kluwer A G.T.Heydt, "Electr 2016.	cademic Publi		on, Reprint 2019		ition, Rep	
2. 3. 4. <b>CO-PO</b>	G.T.Heydt, "Electr 2016. R.C.Duggan "Elect Reprint, 2019. Derek A.Paice "Pow MAPPING Mapping of Course	cademic Publi ic Power Qual ric Power Sys wer Electronic Outcome (CC	shers, First Editi lity", Stars in a tems Quality", T Converter Harm D's) with Progra Specific Outcon	on, Reprint 2019 Circle Publicatio Fata MC Graw H nonics" IEEE Pres meme Outcomes mes PSO's	ns, Second Edi ill Publishers, ss, 2014. (PO's) and Pr	Third Edi	tior
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1134	23162	APP	CATION OF DSP TO POWER SYSTEM PROTECTION	3		0	0	3
cou	RSE O	BJECTIVES		der 10				
To er	nable the	e students to	and an entry of a state to a state of	(inde				
1	expos	se the students to	arn about DFT and wavelet transforms.	and spin	ni p			
2	provie		nowledge on the components used for the	implemen	itatio	n	of di	igita
3	impar	t knowledge on	ferent algorithms for digital protection of power	er system	com	pon	ents.	
4	imple	ment digital prot	tion for transformer.					2
5	under	stand different d	ision making methodologies in protective relay	ys.				
UNI	ГІ	DIGITAL SIG	AL PROCESSING TECHNIQUES			1		9
Samp	oling-Pri	nciple of scaling	liasing, decimation, interpolation; Fourier and	discrete fo	ourie	r tra	ansfo	orms
Fast	fourier to	ransforms; Wave	t transform; Numerical algorithms.					
UNI	ГП	DIGITAL PR	TECTION		-	-		(
Digit	al prote	ction - Performa	e and operational characteristics of digital pro	otection; E	asic	co	mpor	
10			oning systems, conversion subsystem, digital re-				1	
relav	TOF gene	erator, transform	feeder, busbar protection.					
-	_		feeder, busbar protection.					
UNI	ГШ	ALGORITHM	C TECHNIQUES	ve fitting	and	or	nooti	
UNI Finite	r III e differe	ALGORITHM ence techniques	C TECHNIQUES Interpolation, numerical differentiation, curv	-				hing
UNI Finite Sinus	r III e differe soidal w	ALGORITHM ence techniques ave based algori	C TECHNIQUES Interpolation, numerical differentiation, curv ns -First and second derivative method, two an	ind three s	amp	le te	echni	hing
UNI Finite Sinus Wals	<b>F III</b> e differe soidal wa h functio	ALGORITHM ence techniques ave based algori on analysis- Leas	C TECHNIQUES Interpolation, numerical differentiation, curv ms -First and second derivative method, two an squares based methods, differential equation ba	and three s ased techn	amp	le te	echni	hing
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UNI Finite Sinus Wals wave	r III e differe soidal wa h function protecti <b>Γ IV</b>	ALGORITHN ence techniques ave based algori on analysis- Leas ive schemes; FIR DIGITAL PRO	C TECHNIQUES Interpolation, numerical differentiation, curv ns -First and second derivative method, two an squares based methods, differential equation ba ased algorithms; Least square curve fitting algo TECTION TECHNIQUES	and three s ased techn orithm.	ampl ique	le to	echni Frave	hing ique Iling
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At the e	nd of this course, s	tudents will be a	able to	9	BT M: (Highes	
CO1	apply DSP techn	iques for digital	protection.			Applying(K3)
CO2	make decision relaying applicat		suitable algorithm	for digital	Under	rstanding (K2
CO3	employ FIR base	d algorithms for	r digital relaying.	a substances	the state of the state	Applying(K3
CO4	do transformer p	rotection using	digital techniques.		Under	rstanding (K2
C05	perform coordina	ated operation o	f relays for specific	purposes.		Applying(K3
REFER	RENCES					
3.	York, Reprint 201			Non and		
4. CO-PO	Y.G. Paithankar a Second Edition Re MAPPING Mapping of Cour	and S.R Bhide, eprint 2018. se Outcome (Co	"Digital Signal Proc "Fundamentals of O's) with Program Specific Outcome th of correlation) 3-	Power System me Outcomes es PSO's	Protection", (PO's) and P	PHI Learning
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COU	RSE O	BJECTIVES					
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1	know	about the funct	ional requirements of SCADA.	- C. N. 191 - 1911 -			-5
2	infer	the system com	ponents of SCADA.		Re te	-	
3	under	rstand the comm	unication protocols used in SCADA.	197	3.10	12	1
4	interp	oret the monitori	ng and control process of SCADA.	ant - 1 St			-
5	ident	ify the SCADA	application in power system.	int shall	initia in		7
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CO3	analyze the SCA	ADA communica	ation protocols.		A	nalyzing(K4)
CO4	investigate the c	ontrol and moni	toring functions	of SCADA.		Applying(K3)
CO5	describe the SC.	ADA application	n in power system	n.	Under	standing (K2)
REFER	ENCES			10.000	IN THE REAL	
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	America Publicati			1		
				SCADA Det	I. DUDI	(0070 5
				ern SCADA Prot	ocols: DNP3,	60870.5 and
	Related Systems"	, Newnes Public	ations, Oxford,	UK, 2014.		
3.	William T. Shaw,	"Cyber Security	y for SCADA sy	stems", Penn Wel	Books, 2016	20000
4.	David Bailey, Edv	win Wright, "Pra	actical SCADA	for Industry", New	nes, 2018.	
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CO3	describe the op compensators.	peration and co	ontrol of variou	s static series	Unde	erstanding (K2
CO4	explain the op controller.	peration and co	ontrol of unified	d power flow	Unde	erstanding (K2
C05	distinguish vari mitigated by var		lity issues and vices.	how are they	Unde	erstanding (K2
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Filtering – Linear system and estimation; System noise smoothing and prediction; Gauss Markov discrete time model – Estimation criteria; Minimum variance estimation; Least square estimation – Recursive estimation.

#### UNIT V KALMAN FILTER

Filter problem and properties – Linear estimator property of Kalman filter, time invariance and asymptotic stability of filters, time filtered estimates and signal to noise ratio improvement; Extended Kalman filter; Kalman filter for power system protection applications

TOTAL PERIODS 45

9

At the e	nd of this course,	students will be	able to	1	BT Mapped (Highest Level)	T			
CO1	describe the con systems.	cept of optimiza	tion techniques for power		Understanding	(K2)			
CO2	identify, formula controllers for p		the performance of optima		Applying	(K3)			
CO3			king problems and impleme on for discrete and continu		Understanding	(K2			
CO4	apply filtering and estimation techniques for power systems applications. Applying (K3)								
CO5	describe Kalman	n filter for power	r system protection applica	tion.	Understanding	(K2			
REFER	RENCES				1.				
			ourth Edition Reprint 2020 anda, "Computational Tech		wer Systems Analy	sis"			
3.	Dipu Sarkar, Char BS Publications / Nagendra Singh Intelligence Tech 2023.	ndan Kumar Cha BSP Books 202 , Sitendra Tam	anda, "Computational Tech	niques for Po anjeev Kum	ar Gupta, "Artif	ficia			
3. 4. CO-PO	Dipu Sarkar, Char BS Publications / Nagendra Singh Intelligence Tech 2023. MAPPING ing of Course Ou	ndan Kumar Cha BSP Books 2020 , Sitendra Tam niques in Powe tcome (CO's) w	anda, "Computational Tech 0. rakar, Arvind Mewada, S	niques for Por anjeev Kum d Analysis", s (PO's) and	ar Gupta, "Artif Auerbach Publicat Programme Speci	ficia			
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2	provi	de insight about	eural networks.	ALL SALES	a Paris	1.2.21	18		
3	know	about the mach	e learning fundamen	tals and significance.		185	1/1	i an	19
4	acqui	re knowledge at	ut pattern recognition	n.	1.0 0	ai a			
5	apply	deep learning a	orithms for solving r	real life problems.	here and	t d'ana	100		
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UNIT			ARNING – FUNDA	MENTALS, FEAT	URE SEL	ECTIO	ONS		9
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CO5	construct diff	erent feature	selection and classi	fication	of Gilpholis of	
		advanced neura	l network architectures	such as	Under	standing (K2)
REFER	ENCES		the state without your	ort sample	a internation of	1010 1 10
1.	J. S. R. Jang, C.	T. Sun, E. Mize	utani, "Neuro Fuzzy and	Soft Com	puting - A C	Computational
	Approach to Lean	ming and Machin	ne Intelligence", 2019, P	HI learning		
2.	Ian Good fellow	, YoshuaBengio	and Aaron Courville,	"Deep Lea	rning", MIT	Press, ISBN:
	9780262035613,	2016.		and paint	al to set a la	
3.	Trevor Hastie, Ro	obert Tibshirani	and Jerome Friedman, "	The Elemen	nts of Statisti	cal Learning"
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	Second Edition R Shai Shalev-Shw		* Ben-David. "Understand	ling Machi	ne Learning	". Cambridge
4. СО-РО	Shai Shalev-Shw University Press. MAPPING	vartz and Shai I 2020.	* Ben-David. "Understand ith Programme Outcon Outcomes PSO's	ed multiple agent the A		
4. СО-РО	Shai Shalev-Shw University Press. MAPPING ng of Course Out	artz and Shai I 2020. tcome (CO's) wi	ith Programme Outcom Outcomes PSO's h of correlation) 3-Stro	nes (PO's) ng, 2-Medi	and Program	nme Specific
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PPS23169 CLOUD COMPUTING	3	0	)	3
COURSE OBJECTIVES	e hard			
To enable the students to	Car with the		900	
1 know the principles of cloud computing.	es in les	and a		
2 study the various cloud service models.	at france			
3 understand the basics of virtualization.		PRA H		
4 familiarize with the programming models available in cloud.	ni-drini <sup>1</sup> ed	1201	1	
5 get an insight on some applications and prospects of cloud computin	g.	<b>H</b>	1	
UNIT I AN OVERVIEW	and the second	Lord		9
Cloud Computing - Definition, motivation, characteristics; Past, present,	and future	cloud	com	outing
methodologies; The cloud architecture; Cloud deployment techniques; Cloud	d services; C	loud ap	plica	tions;
Issues with cloud computing, comparison between cloud computing a	nd grid co	mputing	, be	nefits,
limitations, and concerns associated with cloud computing, prospects and in	plications.			
UNIT II CLOUD SERVICES	Pagen			9
Cloud services, classification, software as a service (SaaS), platform	as a ser	vice (P	aaS)	, and
infrastructure as a service (IaaS), data storage as a service, other services-	security as	a servic	e (S	eaaS),
knowledge as a service, and analytics as a service (AaaS), service provide	rs, cloud de	ployme	nt m	odels,
private cloud, public cloud, community cloud, hybrid cloud.				
UNIT III VIRTUALIZATION				9
Introduction- Virtualization opportunities; Processor virtualization, me	mory virtu	alization	1, S	torage
virtualization, network virtualization, data virtualization, application	virtualization	n, appr	oach	es to
virtualization, full virtualization, para virtualization, hardware-assisted	ed virtualiz	ation;	Тур	es of
hypervisors; From virtualization to cloud computing - IaaS, PaaS, SaaS.				
UNIT IV PROGRAMMING MODELS FOR CLOUD COMPUTIN	G			9
Existing and extended programming models for cloud - BSP model, map	reduce mod	el, clou	d Ha	skell;
Multi MLton, Erlang; SORCER - Object oriented programming; Program	ming mode	ls in Ar	eka;	New
programming models proposed for cloud; Orleans; BOOM and bloom; Gri	d batch - Si	mple A	PI fo	r grid
amplications				
applications.				
UNIT V APPLICATIONS AND PROSPECTS	-	-		9
	personal ar	plicatio	_	
UNIT V APPLICATIONS AND PROSPECTS			ns;	Cloud
UNIT V         APPLICATIONS AND PROSPECTS           Cloud applications - Engineering applications, educational applications,	T industry;		ns;	Cloud
UNIT V         APPLICATIONS AND PROSPECTS           Cloud applications - Engineering applications, educational applications, gaming; Cloud prospects; Impact of the cloud on IT professionals and the I	T industry;	Cloud	ns; comj	Cloud
UNIT V         APPLICATIONS AND PROSPECTS           Cloud applications - Engineering applications, educational applications, gaming; Cloud prospects; Impact of the cloud on IT professionals and the I	T industry; clouds.	Cloud	ns; comj	Cloud outing
UNIT V         APPLICATIONS AND PROSPECTS           Cloud applications - Engineering applications, educational applications, gaming; Cloud prospects; Impact of the cloud on IT professionals and the I in emerging markets; Research topics in cloud computing; The future of the	T industry; clouds. TOTAL P BT	Cloud	ns; comp os	Cloud outing

	computing.	
CO2	describe the cloud services offered by the companies.	Understanding (K2
CO3	explain the concept of virtualization.	Understanding (K2
CO4	discuss the suitability of each programming model to different kinds of application.	Understanding (K2
CO5	identify the areas of application and explore future prospects.	Understanding (K2
2.	K. Chandrasekaran, "Essentials of Cloud Computing", CRC press, 2020 RajkumarBuyya, James Broberg, Andrzej M. Goscinski, "Cloud C Paradigms", Wiley, 2019.	
3.	Dan C. Marinescu, "Cloud Computing: Theory and Practice, Morgan K	aufmann,2019.
4.	San Murugesan, Irena Bojanova, "Encyclopedia of Cloud Computing",	Wiley-IEEE press, 2016.
CO-PO	MAPPING	os hunda thine minual l.
Mapp	ing of Course Outcome (CO's) with Programme Outcomes (PO's) a Outcomes PSO's	nd Programme Specific

	(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak
-	Programme Outcomes PO's

	Programme Outcomes PO's							
CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6		
C01	1	2	1		-	-		
CO2	1	1	2		-			
CO3	2	-	1	-	-	-		
CO4	1	2	1	-	-	-		
CO5	3	3	1		-	-		
						A REAL PROPERTY OF A REAL PROPER		

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- Andre Carri		BJECTIVES		11.4		19	
1	able the	students to	1	-	1	P.C.	2
	know	the various insulating materials used in power system.		11	1.15		1
2	infer l	preakdown mechanism of solid, liquid and gaseous dielectrics.	-Ind		24		
3	interp	ret the high voltage generation methods and measurements		10.34	-		
4	constr	ue insulation testing of electrical equipments.	100				
5	under	stand the various Non-destructive testing in high voltage.	all an	in the	1		
UNIT	I	INSULATING MATERIALS IN POWER SYSTEM	1.57	H			9
Review	w of i	nsulating materials gases, vacuum, liquids and solids; Cha	aracteriz	zation	of i	nsula	ation
condit	ion – p	ermittivity, capacitance, resistivity and insulation resistance, d	ielectric	dissip	ation	n fac	tors
Partial	l discha	arges sources, forms and effects, ageing effects, electrical	breakd	own a	nd o	opera	ating
stresse	es, stand	lards relating to insulating materials.					
		BREAKDOWN MECHANISMS OF SOLID, LIQUID AN	DGAS	EOUS			
UNIT		DIELECTRICS					9
		to insulation systems used in high voltage power apparatus -	Breakd	own m	echa	nisn	ns of
		gas and vacuum insulation.	341				
UNIT	ш	BASIC METHODS OF GENERATION AND MEASURE HIGH VOLTAGES	MENT	OF TH	EST	104	9
Genera	ation of	high alternating voltages - Cascaded transformers and series	resonan	t circui	t; G	enera	ation
of hig	h de vo	oltages - Rectifier circuit and voltage multiplier circuit; Gene	ration o	f impu	lea	volta	
				n more	IISC		1205-
viuns	INVE III	unules concreter aircuit: Concretion of impulse currents: Mas					~
		pulse generator circuit; Generation of impulse currents; Meas	uremen	t of hi	gh a	c, dc	and
impuls		apulse generator circuit; Generation of impulse currents; Meas ges - Voltage divider circuits; Digital storage oscilloscope for	uremen	t of hi	gh a	c, dc	and
		ges - Voltage divider circuits; Digital storage oscilloscope for	uremen	t of hi	gh a	c, dc	and
	se volta rement	ges - Voltage divider circuits; Digital storage oscilloscope for	suremen impulse	t of hi	gh a	c, dc	and
measu UNIT	se volta irement: <b>IV</b>	ges - Voltage divider circuits; Digital storage oscilloscope for 5.	suremen impulse NTS	t of hig voltag	gh ao	c, dc d cu	and rren
measu UNIT Necess	se volta rement: <b>IV</b> sity for	ges - Voltage divider circuits; Digital storage oscilloscope for s. INSULATION TESTING OF ELECTRICAL EQUIPMEN	suremen impulse NTS er trans	t of hig voltag	gh ao ge an rs ;	c, dc d cu Vo	e and rrent 9 Itage
measu UNIT Necess transfo	se volta rement: <b>IV</b> sity for ormers;	ges - Voltage divider circuits; Digital storage oscilloscope for s. INSULATION TESTING OF ELECTRICAL EQUIPMENT r high voltage testing - Testing of distribution and pow	suremen impulse NTS er trans	t of hig voltag	gh ao ge an rs ;	c, dc d cu Vo	and rrent 9 ltage
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measu UNIT Necess transfo High v UNIT Insulat objects	se volta rement: <b>IV</b> sity for ormers; voltage <b>V</b> tion res s like	ges - Voltage divider circuits; Digital storage oscilloscope for s. INSULATION TESTING OF ELECTRICAL EQUIPMEN r high voltage testing - Testing of distribution and pow Current transformers; Bushings; Overhead line and substation cables; Circuit breakers and isolators; IEC and Indian standard NON-DESTRUCTIVE TESTING istance measurement- Measurement of tan delta and capacitar transformers and alternators; Measurement of PARTIAL	wTS er trans insulat s. ince of d dischar	t of hig voltag sforme ors; Su ielectric rges; I	gh ao te an rs ; trge cs; (	c, dc d cu Vol arres	e and rrent 9 9 1ltage sters 9 ndec
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CO5	describe the various Non-destructive testing in high voltage.	Understanding (K2)
CO4	evaluate insulation testing of electrical equipments.	Understanding (K2)
CO3	explain the high voltage generation methods and measurements.	Understanding (K2)

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- Gallagher, T.J., and Permain, A., "High Voltage Measurement, Testing and Design", John Wiley Sons, New York, 2020.

# **CO-PO MAPPING**

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

	Programme Outcomes PO's								
CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6			
C01	2	1	3	3	2	2			
CO2	3	2	3	3	2				
CO3	3	2	3	3	1.107 - CONT	2			
CO4	3	2	3	3	2	2			
CO5	3	2	3	3	2	2			

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