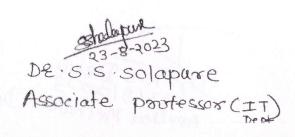
Semester- I Professional Core (Theory) Courses

·		Wal	chand College (Government Aide	of Engineerin	ng, Sangli				
	·····	······	AY	2023-24	*****	***************************************	***************************************		
Dwo	gram		Course	Information					
Cla	gram ss, Semester		M. Tech. All Bra	anches		***************************************	·		
Con	rse Code		First Year M. Te	ch., Semester I					
	rse Name		/IC501				and the second second		
	isc ivalile		Research Method	dology and IPR		***************************************			
······································	Teaching So	hemo				***************************************			
Lect		3 Hrs/week		Examination S	Scheme (Marks)	***************************************	***************************************		
Tuto	rial	2 1113/ WCCK	MSE	ISE	ÈSE		Total		
***************************************		***************************************	30	20	50		100		
000000000000000000000000000000000000000		***************************************		Cred	lits: 3				
	***************************************			A		-	***************************************		
1	To prepare	students for	Undergoing rossess	Objectives			***************************************		
	the hypothe	sis, design a r	undergoing research layout, set	n, identity and for	mulate the resea	rch pro	blems, st		
2	To enable s	tudent interr	ret the regular		and memodolog	у.			
	solve, and p	rove the solut	ion adapted—logica analyze critically	lly and analysis st	ggest possible/al	ternativ	e solutio		
3	10 impart l	chowledge to	analyze oriticalla	il iii	, conclude the re	esearch	findings.		
	journals and	to expose stu	analyze critically adents to research e	thice IPP and Date	d publish resear	ch in c	conferenc		
·····		Course Or	itcomes (CO):	al Di	ents				
t the	e end of the co								
01	Demonstra	te a research	Solution in rooms						
	appropriate	Engineering	solution in respect	ctive engineering	g domain using	Appl	У		
O2	Device feasi	ble solution	research process	and research me	thodology.				
	domain base	ed on econon	to a research prot	olem in respective	engineering	Anal	nalyze		
	research proc	edures and n	nic, social and legal aspects using appropriate Ana			•	-, 20		
O3	Write research	ch publication	n, Dissertation, IPR						
	***************************************	Paoneacioi	i, Dissertation, IPR	and patent docum	ent.	Create)		
odu	le		Madell			No. 1000000000000000000000000000000000000			
	Engineeri	ng Research	Module C	The second secon			Hours		
	Meaning	of research	problem Course	2 06		-	***************************************		
	Characteri	stics of a goo	d research problem	S of research pr	oblem, Criteria	and			
ı	Definition.	scope and o	Meaning of research problem, Sources of research problem, Criteria and Characteristics of a good research problem, Errors in selecting a research problem, Definition, scope and objectives of research problem.						
I	Definition, scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation,								
I	of solutio	ns for resea	arch problem da	h problem. Approx	aches of investig	ation	6		
I	Necessary	instrumentati	arch problem, da	th problem. Approxia collection, and	aches of investig	ation ition,	6		
I	Necessary Research	instrumentati Methodolog y	arch problem, da	ta collection, and	aches of investig	ation ition,	6		
······································	Research I Problem st	instrumentati Methodology atement form	arch problem, da	ta collection, and	aches of investig	ation tion,	6		
······································	Research I Problem stand Analy	instrumentati Methodology atement form tical modelli	arch problem, da ons. ulation, resources i	ta collection, and	aches of investig	ation ition,	and A proper		
······································	Research I Problem stand Analy	instrumentati Methodology atement form tical modelli	arch problem, da ons. ulation, resources i	ta collection, and	aches of investig	ation ition,	6		
······································	Research I Problem stand Analy engineering etc.,	instrumentati Methodology atement form tical modelli g research. I	arch problem, da	ta collection, and	aches of investig	ation ition,	wa ng phogas		
······································	Research I Problem stand Analy engineering etc., Research I	instrumentati Methodology atement form tical modelli g research. I	arch problem, da ions. ulation, resources i ing, Simulations, Hypothesis and its	ta collection, and dentification for so Numerical and St testing by differe	aches of investig alysis, interpreta plution, Experima atistical method at techniques: Z	ental s in -test	and A proper		
II	Research I Problem stand Analy engineering etc., Research M	instrumentati Methodology atement form tical modelli g research. I Methods Multivariate	arch problem, da dons. ulation, resources in the difference of the done of th	dentification for so Numerical and St testing by differe	aches of investig alysis, interpreta plution, Experima atistical method int techniques: Z	ental s in -test	and A proper		
······································	Research I Problem stand Analy engineering etc., Research I Uni and I Method, Re	instrumentati Methodology atement form tical modelli g research. I Methods Multivariate gression Ana	arch problem, da dons. ulation, resources in the sign of the sign	dentification for so Numerical and St testing by differe	aches of investigalysis, interpretable blution, Experimental method on techniques: Z	ental s in -test	6		
II	Research I Problem strand Analy engineering etc., Research I Uni and I Method, Re Processing	instrumentati Methodology atement form tical modelli g research. I Methods Multivariate gression Ana and Analysi	arch problem, da ions. ulation, resources i ing, Simulations, Hypothesis and its	dentification for so Numerical and St testing by differe	eches of investigalysis, interpretable of investigalysis, interpretable of investigation, Experimental method on techniques: Zexperiments/Tag	ation ation, ental s in test	es a ganga		

De. S.S. Solapure
Associate Protessor (IT)

Dr. R.S. Desai 23/8/2023 Applied Mechanics Dept

	Interpretation. Analyse your results and draw conclusions.	
IV	Research Practices Effective literature studies approaches, critical analysis, Plagiarism, Research ethics, Mendeley - Reference Management Software. Research communication- Effective Technical Writing, Writing a research article for Journal/conference paper, Technical report, Dissertation/ Thesis report writing, Software used for report writing such as WORD, Latex etc. Presentation techniques for paper/report/seminar. Publishing article in Scopus/SCI/Web of science indexed journal or conference.	7
V	Intellectual Property Rights (IPR) Nature of Intellectual Property: Patents, Designs, Trade and Copyright, Ownership of copyright, Term of copyright, Technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. New developments in IPR, Traditional knowledge ,Various Case Studies.	7
VI	Patents Patent Rights: Scope of Patent Rights. Various Patent databases. Geographical Indications. Procedure for grants of patents, Patenting under PCT. Licensing and transfer of technology. Administration of Patent System. Introduction to International Scenario: WIPO, TRIPs, Patenting under PCT	6
enervous	Totalest	····
1	Textbooks Votheri C. P. "Pagagrah Mathadalagy" and Edition New Aga International 2	1004
1 2	Kothari C. R, "Research Methodology", 2nd Edition, New Age International, 2 Melville Stuart and Goddard Wayne, "Research Methodology: An Introduction for S	
	Kothari C. R, "Research Methodology", 2nd Edition, New Age International, 2	Science
2	Kothari C. R, "Research Methodology", 2nd Edition, New Age International, 2 Melville Stuart and Goddard Wayne, "Research Methodology: An Introduction for S Engineering Students" Juta and Company Ltd, 2000. Kumar Ranjit, "Research Methodology: A Step-by-Step Guide for beginners' Publications, 4 th Ed2014.	Science
2	Kothari C. R, "Research Methodology", 2nd Edition, New Age International, 2 Melville Stuart and Goddard Wayne, "Research Methodology: An Introduction for S Engineering Students" Juta and Company Ltd, 2000. Kumar Ranjit, "Research Methodology: A Step-by-Step Guide for beginners' Publications, 4 th Ed2014. References Merges Robert, Menell Peter, Lemley Mark, "Intellectual Property in New Tech	Science ", SAG
2 3	Kothari C. R, "Research Methodology", 2nd Edition, New Age International, 2 Melville Stuart and Goddard Wayne, "Research Methodology: An Introduction for S Engineering Students" Juta and Company Ltd, 2000. Kumar Ranjit, "Research Methodology: A Step-by-Step Guide for beginners' Publications, 4 th Ed2014. References Merges Robert, Menell Peter, Lemley Mark, "Intellectual Property in New Tech Age", ASPEN Publishers, 2016.	Science ", SAG
3	Kothari C. R, "Research Methodology", 2nd Edition, New Age International, 2 Melville Stuart and Goddard Wayne, "Research Methodology: An Introduction for S Engineering Students" Juta and Company Ltd, 2000. Kumar Ranjit, "Research Methodology: A Step-by-Step Guide for beginners' Publications, 4 th Ed2014. References Merges Robert, Menell Peter, Lemley Mark, "Intellectual Property in New Tech	Science ", SAG
2 3 1 2	Kothari C. R, "Research Methodology", 2nd Edition, New Age International, 2 Melville Stuart and Goddard Wayne, "Research Methodology: An Introduction for S Engineering Students" Juta and Company Ltd, 2000. Kumar Ranjit, "Research Methodology: A Step-by-Step Guide for beginners' Publications, 4 th Ed2014. References Merges Robert, Menell Peter, Lemley Mark, "Intellectual Property in New Tech Age", ASPEN Publishers, 2016. Ramappa T., "Intellectual Property Rights Under WTO", S. Chand, 2008	Science ", SAG
2 3 1 2 3	Kothari C. R, "Research Methodology", 2nd Edition, New Age International, 2 Melville Stuart and Goddard Wayne, "Research Methodology: An Introduction for S Engineering Students" Juta and Company Ltd, 2000. Kumar Ranjit, "Research Methodology: A Step-by-Step Guide for beginners' Publications, 4 th Ed2014. References Merges Robert, Menell Peter, Lemley Mark, "Intellectual Property in New Tech Age", ASPEN Publishers, 2016. Ramappa T., "Intellectual Property Rights Under WTO", S. Chand, 2008 Mayall, "Industrial Design", McGraw Hill, 1992.	Science ', SAG
2 3 1 2 3 4	Kothari C. R, "Research Methodology", 2nd Edition, New Age International, 2 Melville Stuart and Goddard Wayne, "Research Methodology: An Introduction for S Engineering Students" Juta and Company Ltd, 2000. Kumar Ranjit, "Research Methodology: A Step-by-Step Guide for beginners' Publications, 4 th Ed2014. References Merges Robert, Menell Peter, Lemley Mark, "Intellectual Property in New Tech Age", ASPEN Publishers, 2016. Ramappa T., "Intellectual Property Rights Under WTO", S. Chand, 2008 Mayall, "Industrial Design", McGraw Hill, 1992. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007 Deepak Chopra and Neena Sondhi, Research Methodology: Concepts and case Publishing House, New Delhi	Science ', SAG
2 3 1 2 3 4 5	Kothari C. R, "Research Methodology", 2nd Edition, New Age International, 2 Melville Stuart and Goddard Wayne, "Research Methodology: An Introduction for S Engineering Students" Juta and Company Ltd, 2000. Kumar Ranjit, "Research Methodology: A Step-by-Step Guide for beginners' Publications, 4th Ed2014. References Merges Robert, Menell Peter, Lemley Mark, "Intellectual Property in New Tech Age", ASPEN Publishers, 2016. Ramappa T., "Intellectual Property Rights Under WTO", S. Chand, 2008 Mayall, "Industrial Design", McGraw Hill, 1992. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007 Deepak Chopra and Neena Sondhi, Research Methodology: Concepts and case Publishing House, New Delhi Useful Links	Science ', SAG
2 3 1 2 3 4	Kothari C. R, "Research Methodology", 2nd Edition, New Age International, 2 Melville Stuart and Goddard Wayne, "Research Methodology: An Introduction for S Engineering Students" Juta and Company Ltd, 2000. Kumar Ranjit, "Research Methodology: A Step-by-Step Guide for beginners' Publications, 4 th Ed2014. References Merges Robert, Menell Peter, Lemley Mark, "Intellectual Property in New Tech Age", ASPEN Publishers, 2016. Ramappa T., "Intellectual Property Rights Under WTO", S. Chand, 2008 Mayall, "Industrial Design", McGraw Hill, 1992. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007 Deepak Chopra and Neena Sondhi, Research Methodology: Concepts and case Publishing House, New Delhi	Science ', SAG
2 3 1 2 3 4 5	Kothari C. R, "Research Methodology", 2nd Edition, New Age International, 2 Melville Stuart and Goddard Wayne, "Research Methodology: An Introduction for S Engineering Students" Juta and Company Ltd, 2000. Kumar Ranjit, "Research Methodology: A Step-by-Step Guide for beginners' Publications, 4th Ed2014. References Merges Robert, Menell Peter, Lemley Mark, "Intellectual Property in New Tech Age", ASPEN Publishers, 2016. Ramappa T., "Intellectual Property Rights Under WTO", S. Chand, 2008 Mayall, "Industrial Design", McGraw Hill, 1992. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007 Deepak Chopra and Neena Sondhi, Research Methodology: Concepts and case Publishing House, New Delhi Useful Links NPTEL:: General - NOC:Introduction to Research	Science ', SAG
2 3 1 2 3 4 5	Kothari C. R, "Research Methodology", 2nd Edition, New Age International, 2 Melville Stuart and Goddard Wayne, "Research Methodology: An Introduction for S Engineering Students" Juta and Company Ltd, 2000. Kumar Ranjit, "Research Methodology: A Step-by-Step Guide for beginners' Publications, 4th Ed2014. References Merges Robert, Menell Peter, Lemley Mark, "Intellectual Property in New Tech Age", ASPEN Publishers, 2016. Ramappa T., "Intellectual Property Rights Under WTO", S. Chand, 2008 Mayall, "Industrial Design", McGraw Hill, 1992. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007 Deepak Chopra and Neena Sondhi, Research Methodology: Concepts and case Publishing House, New Delhi Useful Links NPTEL:: General - NOC:Introduction to Research Introduction to Research - Course (nptel.ac.in) Qualitative Research Methods And Research Writing - Course (nptel.ac.in) https://onlinecourses.swayam2.ac.in/ntr21_ed23/preview - Academic Research & Report Writing	Science ', SAG
2 3 1 2 3 4 5	Kothari C. R, "Research Methodology", 2nd Edition, New Age International, 2 Melville Stuart and Goddard Wayne, "Research Methodology: An Introduction for S Engineering Students" Juta and Company Ltd, 2000. Kumar Ranjit, "Research Methodology: A Step-by-Step Guide for beginners' Publications, 4 th Ed2014. References Merges Robert, Menell Peter, Lemley Mark, "Intellectual Property in New Tech Age", ASPEN Publishers, 2016. Ramappa T., "Intellectual Property Rights Under WTO", S. Chand, 2008 Mayall, "Industrial Design", McGraw Hill, 1992. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007 Deepak Chopra and Neena Sondhi, Research Methodology: Concepts and case Publishing House, New Delhi Useful Links NPTEL:: General - NOC:Introduction to Research Introduction to Research - Course (nptel.ac.in) Qualitative Research Methods And Research Writing - Course (nptel.ac.in) https://onlinecourses.swayam2.ac.in/ntr21_ed23/preview - Academic Research & Report	Science ', SAG
2 3 1 2 3 4 5	Kothari C. R, "Research Methodology", 2nd Edition, New Age International, 2 Melville Stuart and Goddard Wayne, "Research Methodology: An Introduction for S Engineering Students" Juta and Company Ltd, 2000. Kumar Ranjit, "Research Methodology: A Step-by-Step Guide for beginners' Publications, 4th Ed2014. References Merges Robert, Menell Peter, Lemley Mark, "Intellectual Property in New Tech Age", ASPEN Publishers, 2016. Ramappa T., "Intellectual Property Rights Under WTO", S. Chand, 2008 Mayall, "Industrial Design", McGraw Hill, 1992. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007 Deepak Chopra and Neena Sondhi, Research Methodology: Concepts and case Publishing House, New Delhi Useful Links NPTEL:: General - NOC:Introduction to Research Introduction to Research Methods And Research Writing - Course (nptel.ac.in) Qualitative Research Methods And Research Writing - Course (nptel.ac.in) https://onlinecourses.swayam2.ac.in/ntr21_ed23/preview - Academic Research & Report Writing https://www.scopus.com/search/form.uri?display=basic#basic https://onlinecourses.nptel.ac.in/noc21_ge12/preview - Qualitative Research Methods And Research Writing	Science ', SAG
2 3 1 2 3 4 5	Kothari C. R, "Research Methodology", 2nd Edition, New Age International, 2 Melville Stuart and Goddard Wayne, "Research Methodology: An Introduction for S Engineering Students" Juta and Company Ltd, 2000. Kumar Ranjit, "Research Methodology: A Step-by-Step Guide for beginners' Publications, 4th Ed2014. References Merges Robert, Menell Peter, Lemley Mark, "Intellectual Property in New Tech Age", ASPEN Publishers, 2016. Ramappa T., "Intellectual Property Rights Under WTO", S. Chand, 2008 Mayall, "Industrial Design", McGraw Hill, 1992. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007 Deepak Chopra and Neena Sondhi, Research Methodology: Concepts and case Publishing House, New Delhi Useful Links NPTEL:: General - NOC:Introduction to Research Introduction to Research - Course (nptel.ac.in) Qualitative Research Methods And Research Writing - Course (nptel.ac.in) https://onlinecourses.swayam2.ac.in/ntr21_ed23/preview - Academic Research & Report Writing https://www.scopus.com/search/form.uri?display=basic#basic https://onlinecourses.nptcl.ac.in/noc21_ge12/preview - Qualitative Research Methods	Science ', SAG



۵	https://onlinecourses.swayam2.ac.in/ntr21_ed23/preview - Academic Research & Report
,	Writing
10	https://nptel.ac.in/courses/121/106/121106007/
11	https://www.wipo.int/about-wipo/en/

		•••••	CO-PO M	lapping				
	Programme Outcomes (PO)							
	1	2	3	4	5	6		
CO1	3		1					
CO2			2	3	2	-		
CO3		3	***************************************	2		7		

Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

DE.S.S. Solapure Associate Protessor (IT) Dept.

		Wal	chand College (Government Aide	of Engineering, Sa	ıngli	
				2023-24		
			Course	Information		
	gramme			System Engineering)		
	s, Semester		First Year M. Te	ch., Sem I		
***************************************	rse Code		7PS501			
	rse Name		Digital Protection	n of Power System		
Desi	red Requisi	tes:	Power System Pr	otection		

т .	Teaching	· · · · · · · · · · · · · · · · · · ·		Examination Scheme	e (Marks)	
	Lecture 3 Hrs/week		MSE	ISE	ESE	Total
Tuto	rial	-	30	20	50	100
***************************************				Credits: 3		100

······································			Course	Objectives		
1 2	To make	students underst	and digital techniq	ues for realizing various	needs of protec	ction
3						
3	10 develo	p the skills nece	essary to analyze, d	esign and implement dia	ital protective	relavs.
At the	end of the	Course (Outcomes (CO) wients will be able to,	th Bloom's Taxonomy	Level	
	ond of the t	course, the stude	ents will be able to,			
CO		Course Outcome Statement/s			Bloom's Taxonomy Level	Bloom's Taxonom
CO1	angitui più	rection of Lowe	r Systems	, PT and relays used in	III	Descriptio Applying
CO2	power syst	CIII.	systems for protection of different parts of		IV	Analyzing
C O3	parts of po	wei system.	ings of relays for protection of different		V	Evaluating
CO4	systems.	nalog/digital pr	otection scheme	for simple electrical	VI	Creating
/lodu	le		Modula Ca			
***************************************	Review	of Relaying So	Module Co	ntents		Hours
Protection schemes for Transmission line prote graded schemes, drawba Electromagnetic CT and			alternator, transfo tection using over acks of these scher	Current- time graded	and	6
	Compa					
II		sine type phase	n amplitude and percomparators, coinc	tude comparator, phase ohase comparators, cosii idence type phase compa	ne-type and	7
***************************************	ν.	Aram Tubat Co	imparator: Amplit	ude comparator, phase co	omparator.	
III	Differen Micropro	t time-currer ocessor/microco	nt characteristics		nt relay,	7

Yah.

IV	Differential Relays Circulating current differential protection, percentage differential protection of power transformers, effect of magnetizing inrush, effect of over voltage inrush, hardware and software used for digital protection of transformer.	7
V	Distance Protection Relays Microprocessor/microcontroller-based impedance, reactance and admittance relays, and measurement of R and X. Quadrilateral characteristics. Digital protection scheme based upon fundamental frequency signals, hardware and software design.	6
VI	Recent Developments in Digital Protection Digital Relaying techniques based on modern tools of digital signal processing like DFT, Haar Transform, WT etc.	6
	Textbooks	
1	Badri Ram, D.N. Vishwakarma, "Power System Protection and Switchgear", TM	H, 2004.
2	Y.G. Paithankar, S.R. Bhide, "Fundamentals of Power System Protection", PHI,	
	References	
1	L.P. Singh, "Digital Protection", New Age, Second Edition, 2004.	
2	A.G. Phadke, J.S. Thorp, "Computer Relaying for Power Systems", Wiley India,	II Edi., 2012
	Useful Links	
1	https://nptel.ac.in/courses/108/107/108107167/	
2	https://nptel.ac.in/courses/108/105/108105167/	

		CO-PO	O Mapping					
Programme Outcomes (PO)								
	1	2	3	4	5	6		
CO1	2							
CO2				3				
CO3			2					
CO4		2				1		

Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Yals.

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute) AY 2023-24 **Course Information** Programme M. Tech. (Power System Engineering) Class, Semester First Year M. Tech., Sem I Course Code 7PS502 Course Name Power Apparatus Modelling Power System Engineering, A.C. Machines, Power System Analysis and **Desired Requisites:** Stability **Teaching Scheme Examination Scheme (Marks)** Lecture 3 Hrs/week **MSE** ISE **ESE Total Tutorial** 30 20 50 100 Credits: 3 **Course Objectives** To provide the students the ability to understand the problem of stability of single machine 1 connected to infinite bur and multi machine system. To give the students a sound mathematical approach towards modelling of various approach used 2 in power system. Course Outcomes (CO) with Bloom's Taxonomy Level At the end of the course, the students will be able to, Bloom's Bloom's \mathbf{CO} **Course Outcome Statement/s Taxonomy Taxonomy** Level Description Construct models of apparatus in power system. CO₁ III Applying CO₂ Analyze models for stability of power systems. IV Analyzing Recommend solutions to the problem of power system stability and CO₃ **Evaluating** V control. Module **Module Contents** Hours Introduction to Power System Stability Problem Classification of stability, resolution of stability problem by classical method, I 6 transient stability of multi-machine system. Modeling of Synchronous machine Physical description, mathematical description of synchronous machine, dq0 II transformation, per unit representation, equivalent circuits for direct and 7 quadrature axis. **Excitation System** Elements of excitation system, types of excitation system, necessity of III 6 stabilizing circuits IEEE excitation systems. Prime Movers and Energy supply Systems Turbines and governing systems, modeling of steam turbines, steam turbine IV 7 controls, steam turbine off-frequency capability. Dynamic modeling of hydro turbine and governors Hydraulic turbine transfer function, governors for hydraulic turbines, detailed V 7 hydraulic system model, guidelines for modeling hydraulic turbines Load modeling for stability studies Basic load modeling concepts, static load models, dynamic load models, VI modeling of induction motor, per unit representation, representation in stability 6 studies Shall

Textbooks P. Kundur, Power System, Stability and Control, Tata McGraw Hill, New Delhi, 1994.

1

	References
1	K. R. Padiyar, "Power System Dynamic, Stability & Control", B.S. Publication, 2008.
2	Peter W.Sauer, M.A. Pai, "Power System Dynamics and Stability", Person Education Asia, 1998.
	Useful Links
1	https://nptel.ac.in/courses/108104051

		CO-	PO Mapping					
	Programme Outcomes (PO)							
	1	2	3	4	5	6		
CO1			3					
CO2	Tara and the same of the same			3				
CO3						2		

Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)



		Wal	chand College (Government Aid	e of Engineering, S led Autonomous Institute)	angli		
				7 2023-24			
				e Information			
	ramme		M. Tech. (Powe	er System Engineering)			
	s, Semester		First Year M. T	ech., Sem I			
	se Code		7PS503				
	se Name		Computer Aideo	d Power System Analysi	S		
Desir	ed Requisi	ites:	Power System				
	Teaching	Scheme		Examination Schei	ne (Marks)		
······································	Lecture 3 Hrs/week		MSE	ISE	ESE	Total	
Tutor	rial	_	30	20	50	100	
				Credits:		100	
			Conve	e Objectives		*	
1	To makes	s the students co	nversant with diff	e Objectives Ferent power system anal			
2	To provid	de basic knowle	dge of formation of	of Vhus methods	ysis methods.		
3	To provio	le different pow	er system compute	er analysis methods usin	g computer		
		Course	Outcomes (CO) v	vith Bloom's Taxonomy	g computer.		
At the	end of the	course, the stud	ents will be able to	0,	LEVEL		
		Bloom's					
CO		Course Outcome Statement/s				Bloom's Taxonomy	
CO1	Evoleia				Taxonomy Level	Description	
*****************	Applain v	arious methods	of analyzing shun	t and series faults.	II	Understanding	
CO2	analysis.	e Network 10	opology knowled	ge for power system	III	Applying	
CO3	Study Pov	ver flow analysi	is and economic dispatch of generation.		IV	Analyzing	
	***************************************					Analyzing	
Modu			Module C	Contents		Hours	
		tical Simplifica					
Ţ	Inree	Component m	ethod, Two-Con	nponent method, seque	nce network		
I	connec	ctions for differ	ent faults, Analys	is of unsymmetrical shu	int and series	6	
	Taults	using three-coi	mponent (symmet	trical component method	od) and two-		
	Compo	onent method.		ed Lancelle			
		rk Topology					
	Introdu	ction, Elementa	ary graph theory,	Connected graph, tree,	co-tree, basic		
II	cutsets,	basic loops, Ir	cidence matrices,	Element-node, Bus inc	idence Tree-	7	
	branch	path, Basic cu	itset, augmented	cut-set, Basic loop and	Augmented	-	
	100p, P	rimitive network	k, Impedance forn	and Admittance form.			
		rk Matrices	v grades at les entre				
777	Introdu	ction, formation	of Ybus by meth	od of Inspection, metho	d of Singular		
III	Transfo	ormation, Step	by Step building	algorithm for formation	on of Ybus	7	
	Format	ion of Bus Impe	edance Matrix, M	odification of Zbus for	addition of a	,	
	branch,	addition of link	, removal of an el	ement.			
	Networ	k Fault and Co	ontingency Calcu	lations			
	Fault ca	alculations usir	g Zbus, fault ca	lculations using the Yl	ous table of		
IV	factors,	Contingency a	nalysis for Power	r systems. Using the Y	bus table of	7	
	Tactors	for contingend	ies. Analysis of	Unsymmetrical faults	using Rus	/	
	Impedar	nce Matrix.	,		Dus		



V	Power flow analysis Formulation of the problem and power flow equations. Application of numerical techniques to solve load flow problems using bus admittance matrix and bus impedance matrix in the bus – frame of reference such as Gauss, Gauss – Seidel, Newton – Raphson methods, Decoupled load flow methods etc.	6
VI	Optimal Dispatch of generation Performance Curves, economic dispatch of generation without and with transmission-line losses, Iterative technique, approximate penalty factor, Derivation of transmission loss formula, Calculation of loss- coefficient using Ybus and sparse matrix techniques.	6
	Toythooka	
1	Textbooks Pual M. Anderson "Analysis of faulted system". The Iowa state university press	s/ AMES 1973
2	Pual M. Anderson, "Analysis of faulted system", The Iowa state university press K. Uma Rao, "Computer Techniques and Models in Power systems", I. Publishing house Pvt. Ltd. New Delhi, 2007.	
	Pual M. Anderson, "Analysis of faulted system", The Iowa state university press. K. Uma Rao, "Computer Techniques and Models in Power systems", I. Publishing house Pvt. Ltd. New Delhi, 2007.	
	Pual M. Anderson, "Analysis of faulted system", The Iowa state university press K. Uma Rao, "Computer Techniques and Models in Power systems", I. Publishing house Pvt. Ltd. New Delhi, 2007. References	K. International
	Pual M. Anderson, "Analysis of faulted system", The Iowa state university press. K. Uma Rao, "Computer Techniques and Models in Power systems", I. Publishing house Pvt. Ltd. New Delhi, 2007.	K. International
2	Pual M. Anderson, "Analysis of faulted system", The Iowa state university press. K. Uma Rao, "Computer Techniques and Models in Power systems", I. Publishing house Pvt. Ltd. New Delhi, 2007. References I. J. Nagrath and D. P. Kothari, "Power System Engineering", Tata Mc-Graw	K. International
1	Pual M. Anderson, "Analysis of faulted system", The Iowa state university press. K. Uma Rao, "Computer Techniques and Models in Power systems", I. Publishing house Pvt. Ltd. New Delhi, 2007. References I. J. Nagrath and D. P. Kothari, "Power System Engineering", Tata Mc-Graw Co., 1994. Hadi Sadat, "Power system analysis", 1st edition, Tata Mc-Graw Hill publishing	K. International
1 2	Pual M. Anderson, "Analysis of faulted system", The Iowa state university press. K. Uma Rao, "Computer Techniques and Models in Power systems", I. Publishing house Pvt. Ltd. New Delhi, 2007. References I. J. Nagrath and D. P. Kothari, "Power System Engineering", Tata Mc-Graw Co., 1994. Hadi Sadat, "Power system analysis", 1st edition, Tata Mc-Graw Hill publishin 2002.	K. International
1 2 3	Pual M. Anderson, "Analysis of faulted system", The Iowa state university press. K. Uma Rao, "Computer Techniques and Models in Power systems", I. Publishing house Pvt. Ltd. New Delhi, 2007. References I. J. Nagrath and D. P. Kothari, "Power System Engineering", Tata Mc-Graw Co., 1994. Hadi Sadat, "Power system analysis", 1st edition, Tata Mc-Graw Hill publishin 2002. George L. Kusic, "Computer Aided Power System Analysis", PHI, 2003.	K. Internationa Hill Publishing

		CO-	PO Mapping					
Programme Outcomes (PO)								
	1	2	3	4	5	6		
CO1				2				
CO2						3		
CO3	- 23 - 1 3 1 1 1 1 1 1 1 1			1				

Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)



Professional Core (Lab) Courses

		Wal	Covernment Aid	e of Engineer. led Autonomous Ins		gli	
				ea Autonomous Ins 7 2023-24	iiiuie)		
				e Information			
Progr	amme		M. Tech. (Power		ing)		
	, Semeste	r	First Year M. Ted				
Cours	se Code		7PS551				
Cour	se Name		Digital Protection	of Power System	n Laborator	Y	
Desir	ed Requis	sites:	Digital Protection				***************************************
		-				1	
	Teaching	Scheme		Examination	n Scheme ((Marks)	
Pract	ical	2 Hrs/ Week	LA1	LA2	Lab	ESE	Total
Intera	action		30	30	40	0	100
***************************************				Cı	redits: 1		
1	TD 1			se Objectives			
1	To deve	lop analytical sk	ills of the student a	and help to evalua	te modern	relaying praction	ces.
2	designir	ng relaying hardy	develop protective vare and software.	a Ladad		1 1/1/4	portunity for
		Cours	e Outcomes (CO)	with Bloom's Ta	xonomy L	evel	\$2.5 EE 6
At the	end of the	e course, the stud	lents will be able to),			
СО		Cou	rse Outcome State	ement/s		Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Demons	trate the operation	on of electromagne	tic & digital relay	rs.	III	Applying
CO2	Test dig	ital relays to ver	ify the operating ch	naracteristics.		IV	Analyzing
CO3	Design group ta		mpile programs for	r simple digital re	elays, as a	V	Evaluating
			ist of Evnovimon	to / T ob A otherwise	-/m:		
ah ac	rtivities/ne		List of Experimen				E-9 554
visit, l	ab experin	ment, tutorials, as	include mini projectsignments, group of course.	discussion, progra	arawings, c	d other suitabl	e activities as
or ma				extbooks	a company		
			l1	System Protection	on and Swit	tchgear", TMH	, 2004.
1	Badr	i Ram, D.N. Vis	nwakarma, "Power	Dystelli i foteette			
	Badr	i Ram, D.N. Vis					
		i Ram, D.N. Vis C Relay user ma	Re	eferences			
1	PRD Mi-P	C Relay user ma	Re	eferences			

Yan

Useful Links

https://nptel.ac.in/courses/108/107/108107167/ https://nptel.ac.in/courses/108/105/108105167/

		CO-	PO Mapping			
	·		ne Outcomes			
	1	2	3	4	5	6
CO1			3		3	U
CO2				2		
CO3		2		<u>L</u>	2	
a attached a		2				

		Assessment		
There are three IMP: Lab ESE	e components of la is a separate head	ab assessment, LA1, LA2 a d of passing.(min 40 %), LA	nd Lab ESE. A1+LA2 should be min 40%	
Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.



		Wa	chand Colleg	ge of Engineer	ing, Sai	ngli	
				Y 2023-24	iiiie)		
			Cour	rse Information			
Progr	ramme		M. Tech. (Powe	er System Engineeri	ng)		
	, Semester		First Year M. T		<u> </u>		
	se Code		7PS552				
	se Name		Computer Aided	d Power System An	alysis Lal	boratory	
Desir	ed Requis	ites:	Power System				
	Teaching	Scheme		Examination	Scheme	(Marks)	
Pract	ical	2 Hrs/ Week	LA1	LA2	Lab		Total
Intera	action		30	30	4		100
					edits: 1		TOU
			Com	mgo Obi ootivaa			
1	To make	the students cor	versant with diff	rse Objectives Ferent recent techniq	C		
2	To provi	de basic knowle	dge of formation	of Ybus methods us	ues for po	ower system a	nalysis methods.
3	To provi	de different com	puter solution for	r large interconnecte	ed power	ramming langu	lages
		Course	Outcomes (CO) with Bloom's Tax	onomy I	system networ	KS.
At the	end of the	course, the stud	ents will be able	to,	conomy 1		
СО		Cour	se Outcome Stat	ement/s		Bloom's Taxonomy Level	Bloom's Taxonomy
CO1	Explain faults.	the different co	mputer analysis	methods of power	system	II	Understanding
CO ₂	Apply the	e Network Topo	logy knowledge f	for power system an	alvsis	III	
CO3	Study N	MATLAB programmer dispatch of gen	ramming for P	ower flow analys	sis and	IV	Applying Analyzing
		T.	ist of Even				
Lab act	tivities/ner	formance shall i	noludo mini music	nts / Lab Activities	Topics		
, 191t, 10	to experim	ent, tutorials, ass quirement of lab	signments, group	ect, presentations, di discussion, progran	rawings, on ming, an	case study, repaid other suitab	ort writing, site le activities as
1	D 13		Т	extbooks			
1	Pual N	A. Anderson, "A	nalysis of faulted	system", The Iowa	state univ	ersity press/ A	MES, 1973.
2	ix. Of	na Rao, Com	puter Technique Ltd. New Delhi, 2	s and Models in	Power s	systems", I. k	K. International
1	23 A44 C		R	eferences			
1			Kothari, "Power	System Engineering			
2				1st edition, Tata M			g company ltd.,
3	George	e L. Kusic, "Con	iputer Aided Pow	ver System Analysis	", PHI, 20	003.	
			Uos	eful Links			



https://archive.nptel.ac.in/courses/108/107/108107127/

The state of the s		CO	-PO Mapping			
		Program	me Outcomes	(PO)		
	1	2	3	4	5	6
CO1				2	3	U
CO2						
CO3						3

		Assessment		
There are three IMP: Lab ESE	e components of la is a separate head	ab assessment, LA1, LA2 at d of passing.(min 40 %), LA	nd Lab ESE. A1+LA2 should be min 40%	STORY OF THE STORY
Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.



Course Information Programme			Wa	lchand Colleg (Government A	ge of Enginee ided Autonomous I	ring, Sa	ngli	
M. Tech. (Power System Engineering)								
Class, Semester Course Code Course Name Advanced Power System Laboratory Desired Requisites: Power System Fraching Scheme Teaching Scheme Teaching Scheme Teaching Scheme Teaching Scheme Course Objectives To provide extensive knowledge of power system protection measurements, control and relay log To impart knowledge of designing schemes of protection, relay coordination and numerical relays practically as implemented in industry. Course Objectives To provide basic knowledge of various aspects of power system protection both theoretical practically as implemented in industry. Course Outcomes (CO) with Bloom's Taxonomy Level the end of the course, the students will be able to, Course Outcome Statement/s Course Outcome Statement/s Bloom's Taxonomy Level the end of the course, the students will be able to, Course Outcome Statement/s Taxonomy Level Level Applying Applyin		•••••		Cour	se Information			
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Desired Requisites: Power System Laboratory			r	First Year M. Te	ech., Sem I			
Power System Power System Power System Power System Power System								
Teaching Scheme Practical 2 Hrs/ Week LA1 LA2 Lab ESE Total Interaction - 30 30 40 100 Credits: 1 Course Objectives 1 To provide extensive knowledge of power system protection measurements, control and relay log 2 To impart knowledge of designing schemes of protection, relay coordination and numerical relays practically as implemented in industry. Course Outcomes (CO) with Bloom's Taxonomy Level t the end of the course, the students will be able to, CO Course Outcomes (CO) with Bloom's Taxonomy Level t the end of the course, the students will be able to, CO Course Outcome Statement/s Bloom's Taxonomy Level t the end of the course, the students will be able to, CO Course Outcome Statement/s III Applying Analyze the stability of Power System. O2 Analyze the stability of Power System. O3 Evaluate the performance of Power System Network. V Evaluation List of Experiments / Lab Activities/Topics be activities/performance shall include mini project, presentations, drawings, case study, report writing, s it, lab experiment, tutorials, assignments, group discussion, programming, and other suitable activities a r nature and requirement of lab course Textbooks Pual M. Anderson, "Analysis of faulted system", The Iowa state university press/ AMES, 1973. K. Uma Rao, "Computer Techniques and Models in Power systems", I. K. Internation Publishing house Pvt. Ltd. New Delhi, 2007. References 1 J. Nagrath and D. P. Kothari, "Power System Engineering", Tata Mc-Graw Hill Publishing Co. 1994. Hadi Sadat, "Power system analysis". Ist edition. Tata Mc-Graw Hill Publishing Co. 1994.				Advanced Power	r System Laborat	ory		
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Pual M. Anderson, "Analysis of faulted system", The Iowa state university press/ AMES, 1973. K. Uma Rao, "Computer Techniques and Models in Power systems", I. K. Internation Publishing house Pvt. Ltd. New Delhi, 2007. References I. J. Nagrath and D. P. Kothari, "Power System Engineering", Tata Mc-Graw Hill Publishing Co. 1994. Hadi Sadat, "Power system analysis", 1st edition. Tata Mc-Gray Hill publishing the system analysis.		1	tatoriais, ass	nginnents, group a	liscussion, progra	drawings, c mming, an	ase study, repo	ort writing, si
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Publishing house Pvt. Ltd. New Delhi, 2007. References I. J. Nagrath and D. P. Kothari, "Power System Engineering", Tata Mc-Graw Hill Publishing Co. Hadi Sadat, "Power system analysis", 1st edition. Tata Mc-Graw Hill publishing to the system analysis."	1	Pual N	A. Anderson, "Ar	nalvsis of faulted s	vstem" The Iowa	state univ	ersity press/ A	MFS 1072
1. J. Nagrath and D. P. Kothari, "Power System Engineering", Tata Mc-Graw Hill Publishing Co. 1994. Hadi Sadat, "Power system analysis", 1st edition. Tata Mc-Graw Hill publishing to the system analysis."	2		Tuo, Comp	ruler recriffications	and Models in	Power s	ystems", I. K	. Internation
1. J. Nagrath and D. P. Kothari, "Power System Engineering", Tata Mc-Graw Hill Publishing Co. 1994. Hadi Sadat, "Power system analysis", 1st edition. Tata Mc-Graw Hill publishing to the system analysis."				Ref	erences			
Hadi Sadat, "Power system analysis", 1st edition, Tata Mc-Graw Hill publishing company ltd 2002.	1			Kothari, "Power S	System Engineerii			
	2	Hadi S 2002.	Sadat, "Power sy	estem analysis", 1	st edition, Tata N	Ac-Graw H	lill publishing	company lto

		CO-Po	O Mapping			
		Programme	Outcomes	(PO)		
	1	2	3	4	5	6
CO1				3	***************************************	
CO2			3			
CO3	3					

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.

IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.



Professional Elective 1

		Wald	chand College (Government Aid	e of Engineering, S	angli		
				2023-24			
				Information			
	ramme		M. Tech. (Power System Engineering)				
	s, Semester	r	First Year M. Te	ech., Sem I			
	rse Code		7PS511				
	se Name	-	Professional Ele	ective 1: Smart Grid			
Desir	red Requis	ites:		Engineering, Power Elect	ronics		
***************************************	Teaching	Scheme		Examination Scher			
Lectu	ıre	3 Hrs/week	MSE	ISE			
Tutor	rial	-	30	20	ESE	Total	
				Credits:	50	100	
				Credits:)		
1	To massi	1 (1 1	Course	Objectives			
2	To provid	the advance k	nowledge in the fi	eld of smart – grid techr	ology		
3	10 make	the students awa	re of research ave	nues in the field of amount	4 - 1 4 1 1	gy	
	10 deven	op the skills of si	mulation and anal	VSIS of smart orid system	16		
At the	end of the	course, the stude	ents will be able to	ith Bloom's Taxonomy	Level		
СО			Outcome Statem		Bloom's Taxonomy	Bloom's	
004					Level	Taxonomy Description	
CO1	Explain v	arious concepts	associated with sm	nart grid.	II	Understanding	
CO2			cept to power	system monitoring,		Applying	
	Analyza	cation and protec	tion.		III	11 78	
CO3	computati	tools for sma	rt grid's perfor	mance, stability and	IV	Analyzing	
Modul	le		Module Co				
	Smart	grid architectu	re	untents		Hours	
I	Introdu power	system enhance	id verses today'	s grid, computational market drivers, architect	intelligence, ure of smart	7	
	Smart	grid technologi	es				
	Introdu	ection to Smart	Meters, Automat	tic Meter Reading (AM	IR). Outage		
II	Manage	ement System (OMS), Plug in H	lybrid Electric Vehicles	(DLIEVI) 0-		
	more,	Substation Autor	nation, Feeder A	utomation Geographic	Information	6	
	System	(OIS), intellige	nt Electronic Dev	vices (IED) & their app	olication for		
*****************************	monitoi	ing & protection	i ingla is		meation for		
	Transn	nission aspects					
III	Wide an	placement,	Hada HefA				
	inical	state estimation,	System security	V under smart grid a	nvironmant	7	
***************************************	Concept	t of Resilient & S	self-Healing Grid,	adaptive relaying using	PMUs.	Marie Commission and	
	Commit	unication aspect	S				
	Element	ts of communic	ation and networ	rking: architectures, sta	ndards and	E ZBILBOIN	
IV	adaptati	on or power fine	e communication	(PLCC) zighee GSM	and mana.		
	network	to machine coi	nmunication mod neighbourhood a	lels for the smart grid; area networks (NAN);	Uoma area	6	

Performance analysis tool for smart grid design Load flow in smart grid, load flow methods, congestion management flow effect, load flow for smart grid design, dynamic stochastic optimal power flow (DSOPF), DSOPF application to smart grid. Static security assessment and contingencies study for the smart grid. Stability analysis tools and computational tools for smart grid Voltage stability assessment and its techniques, angle stability assessment and state estimation, optimization techniques, classical optimization methods, Heuristic optimization, evolutionary computational Techniques, Hybrid optimization techniques and application to smart grid. Textbooks 1 Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Y. "Smart Grid: Technology and Applications". 2 G. M. Masters, "Renewable and Efficient Electric Power Systems", John Wiley & 2004. References 1 Gilbert N. Sorebo, Michael C. Echols, "Smart grid security: An end to end view of new Electrical grid" CRC press, Taylor & Fancis group, 2011. 2 S. P. Chowdhary, P. Crosley and S. Chowdhary, "Micro-grids and active of networks", The institution of engineering and technology, London, 2009. 3 J. S. Thorp, A.G. Phadke, "Synchronized Phasor Measurement and Their App Springer 2008. Useful Links 1 http://nptel.ac.in/downloads/117105077 2 http://www.nptelvideos.in/2012/12/digital-communication.html			
Voltage stability assessment and its techniques, angle stability assessment and state estimation, optimization techniques, classical optimization methods, Heuristic optimization, evolutionary computational Techniques, Hybrid optimization techniques and application to smart grid. Textbooks Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Y. "Smart Grid: Technology and Applications". G. M. Masters, "Renewable and Efficient Electric Power Systems", John Wiley & 2004. References Gilbert N. Sorebo, Michael C. Echols, "Smart grid security: An end to end view of new Electrical grid" CRC press, Taylor & Fancis group, 2011. S. P. Chowdhary, P. Crosley and S. Chowdhary, "Micro-grids and active and networks", The institution of engineering and technology, London, 2009. J. S. Thorp, A.G. Phadke, "Synchronized Phasor Measurement and Their Apple Springer 2008. Useful Links http://nptel.ac.in/downloads/117105077 http://www.nptelvideos.in/2012/12/digital-communication.html	V	Load flow in smart grid, load flow methods, congestion management flow effect, load flow for smart grid design, dynamic stochastic optimal power flow (DSOPF), DSOPF application to smart grid. Static security assessment	7
Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Y. "Smart Grid: Technology and Applications". G. M. Masters, "Renewable and Efficient Electric Power Systems", John Wiley & 2004. References Gilbert N. Sorebo, Michael C. Echols, "Smart grid security: An end to end view of new Electrical grid" CRC press, Taylor & Fancis group, 2011. S. P. Chowdhary, P. Crosley and S. Chowdhary, "Micro-grids and active and networks", The institution of engineering and technology, London, 2009. J. S. Thorp, A.G. Phadke, "Synchronized Phasor Measurement and Their Apple Springer 2008. Useful Links http://nptel.ac.in/downloads/117105077 http://www.nptelvideos.in/2012/12/digital-communication.html	VI	Voltage stability assessment and its techniques, angle stability assessment and state estimation, optimization techniques, classical optimization methods, Heuristic optimization, evolutionary computational Techniques, Hybrid	6
Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Y. "Smart Grid: Technology and Applications". G. M. Masters, "Renewable and Efficient Electric Power Systems", John Wiley & 2004. References Gilbert N. Sorebo, Michael C. Echols, "Smart grid security: An end to end view of new Electrical grid" CRC press, Taylor &Fancis group, 2011. S. P. Chowdhary, P. Crosley and S. Chowdhary, "Micro-grids and active and networks", The institution of engineering and technology, London, 2009. J. S. Thorp, A.G. Phadke, "Synchronized Phasor Measurement and Their Apple Springer 2008. Useful Links http://nptel.ac.in/downloads/117105077 http://www.nptelvideos.in/2012/12/digital-communication.html		Textbooks	
References Gilbert N. Sorebo, Michael C. Echols, "Smart grid security: An end to end view of new Electrical grid" CRC press, Taylor &Fancis group, 2011. S. P. Chowdhary, P. Crosley and S. Chowdhary, "Micro-grids and active a networks", The institution of engineering and technology, London, 2009. J. S. Thorp, A.G. Phadke, "Synchronized Phasor Measurement and Their App Springer 2008. Useful Links http://nptel.ac.in/downloads/117105077 http://www.nptelvideos.in/2012/12/digital-communication.html	1	Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akih	iko Yokoyama
Gilbert N. Sorebo, Michael C. Echols, "Smart grid security: An end to end view of new Electrical grid" CRC press, Taylor & Fancis group, 2011. S. P. Chowdhary, P. Crosley and S. Chowdhary, "Micro-grids and active an networks", The institution of engineering and technology, London, 2009. J. S. Thorp, A.G. Phadke, "Synchronized Phasor Measurement and Their Apples Springer 2008. Useful Links http://nptel.ac.in/downloads/117105077 http://www.nptelvideos.in/2012/12/digital-communication.html	2	G. M. Masters, "Renewable and Efficient Electric Power Systems", John Wil	ey & Sons Inc
Gilbert N. Sorebo, Michael C. Echols, "Smart grid security: An end to end view of new Electrical grid" CRC press, Taylor & Fancis group, 2011. S. P. Chowdhary, P. Crosley and S. Chowdhary, "Micro-grids and active an networks", The institution of engineering and technology, London, 2009. J. S. Thorp, A.G. Phadke, "Synchronized Phasor Measurement and Their Apples Springer 2008. Useful Links http://nptel.ac.in/downloads/117105077 http://www.nptelvideos.in/2012/12/digital-communication.html		Deferences	
S. P. Chowdhary, P. Crosley and S. Chowdhary, "Micro-grids and active of networks", The institution of engineering and technology, London, 2009. J. S. Thorp, A.G. Phadke, "Synchronized Phasor Measurement and Their App Springer 2008. Useful Links http://nptel.ac.in/downloads/117105077 http://www.nptelvideos.in/2012/12/digital-communication.html	1	Gilbert N. Sorebo, Michael C. Echols, "Smart grid security: An end to end vid	ew of security is
Springer 2008. Useful Links http://nptel.ac.in/downloads/117105077 http://www.nptelvideos.in/2012/12/digital-communication.html	2	S. P. Chowdhary, P. Crosley and S. Chowdhary, "Micro-grids and account of the control of the con	tive distributio
1 http://nptel.ac.in/downloads/117105077 2 http://www.nptelvideos.in/2012/12/digital-communication.html	3		r Applications
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2 http://www.nptelvideos.in/2012/12/digital-communication.html			
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https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-450-princ digital-communications-i-fall-2006/video-lectures/		https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-450	-principles-of-

		CO-I	PO Mappin	g		
		Programn	ne Outcome	es (PO)		
2422232	1	2	3	4	5	6
CO1		3				
CO2	1					
CO3	3	3				

Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

DSMore

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute) AY 2023-24 **Course Information Programme** M. Tech. (Power System Engineering) Class, Semester First Year M. Tech., Sem I **Course Code** 7PS512 Course Name Professional Elective 1: FACTS **Desired Requisites:** Power System Engineering, Power Electronics **Teaching Scheme Examination Scheme (Marks)** Lecture 3Hrs/week **MSE** ISE ESE **Total Tutorial** 30 20 50 100 Credits: 3 **Course Objectives** To make students understand concept of FACTs envisages the use of power electronics to improve 1 system operation by fast & reliable control. To cover concepts of FACTs including the description, principle of working and analysis of various 2 FACTs controllers. To strengthen the control of FACTs and system interactions. 3 Course Outcomes (CO) with Bloom's Taxonomy Level Bloom's Bloom's CO **Course Outcome Statement/s Taxonomy Taxonomy** Description Level Explain necessity, operating principals and benefits of FACTs CO₁ Understanding II devices. Choose the suitable FACTs device/controller for particular CO₂ Applying Ш application. Analyze the characteristics of FACTs Controllers and effect of CO₃ Analyzing IV location of the controller on Power System. Module **Module Contents** Hours Introduction The concept of flexible AC transmission, Reactive power control in electrical power transmission lines, Uncompensated transmission line, series and shunt I compensation. Overview of FACTS devices, Static Var Compensator (SVC), 6 Thyristor Switched Series capacitor (TCSC), Unified Power Flow controller (UPFC), Integrated Power Flow Controller (IPFC). Static VAR Compensator (SVC) and Applications Voltage control by SVC - advantages of slope in dynamic characteristics influence of SVC on system voltage. Applications - Enhancement of transient II 7 stability - Steady state power transfer - enhancement of power system damping - prevention of voltage instability.

Diwar.

voltage collapse prevention.

III

Thyristor Controlled Series Capacitor (TCSC) and Applications

Operation of the TCSC - different modes of operation - modelling of TCSC - variable reactance model - modelling for stability studies. Applications -

improvement of the system stability limit - enhancement of system damping

7

	Emerging FACTS Controllers I	
	Static Synchronous Compensator (STATCOM) - operating Principle, V-I	_
IV	characteristics	7
	Static Synchronous Series Compensator (SSSC) - Operating Principle, Control System, Applications	
***************************************	Emerging FACTS Controllers II	
V	Unified Power Flow Controller (UPFC) – Principle of operation - modes of operation –applications – modelling of UPFC for power flow studies.	6
	Co-Ordination of FACTS Controllers	
VI	FACTs Controller interactions – SVC–SVC interaction - co-ordination of	6
	multiple controllers using linear control techniques – Quantitative treatment of control.	
	Text Books	
1	Text Books R. Mohan Mathur, Rajiv. K. Varma, "Thyristor – Based Facts Controlle Transmission Systems", IEEE press and John Wiley & Sons Inc., 2002	rs for Electric
1	R. Mohan Mathur, Rajiv. K. Varma, "Thyristor - Based Facts Controlle	rs for Electric
1	R. Mohan Mathur, Rajiv. K. Varma, "Thyristor – Based Facts Controlle Transmission Systems", IEEE press and John Wiley & Sons Inc., 2002	-
1 2	R. Mohan Mathur, Rajiv. K. Varma, "Thyristor – Based Facts Controlle Transmission Systems", IEEE press and John Wiley & Sons Inc., 2002 References A.T. John, "Flexible AC Transmission System", Institution of Electrical	and Electron
1 2	R. Mohan Mathur, Rajiv. K. Varma, "Thyristor – Based Facts Controlle Transmission Systems", IEEE press and John Wiley & Sons Inc., 2002 References A.T. John, "Flexible AC Transmission System", Institution of Electrical Engineers (IEEE), 1999. NarainG.Hingorani, Laszio. Gyugyl, "Understanding FACTS Concepts and	and Electron
1 2	R. Mohan Mathur, Rajiv. K. Varma, "Thyristor – Based Facts Controlle Transmission Systems", IEEE press and John Wiley & Sons Inc., 2002 References A.T. John, "Flexible AC Transmission System", Institution of Electrical Engineers (IEEE), 1999. NarainG.Hingorani, Laszio. Gyugyl, "Understanding FACTS Concepts and	and Electron

CO-PO Mapping										
	Programme Outcomes (PO)									
	1	2	3	4	5	6				
CO1			1	no do e						
CO2	1			2		ey.				
CO3						2				

Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)



				d Autonomous Institute) 2023-24					
				Information					
Prog	gramme			System Engineering)					
Clas	s, Semester		First Year M. Tee	ch Sem I					
	rse Code		7PS513	on., gem i					
Cou	rse Name			tive 1: DSP Application	to Power See	4			
Desi	red Requisites:		Signals and Syste	eme	to rower sys	tem			
			- grad and Syste			2244			
	Teaching Sch	ieme		Examination Schem	o (Morks)				
Lect		Hrs/week	MSE	ISE ISE	ESE	T-4-1			
Tuto	rial	-	30	20	50	Total			
				Credits: 3		100			
	<u>_</u>			Credits: 3					
			Course	Objectives					
1	To provide a	mathematic	al introduction to the	ne theory and application	as of outhorses	011-4			
1	then use in a	naryzing tui	ictions and function	spaces					
	It includes a	brief survey	of Fourier series re	presentation of function	s Fourier tran	sform and the			
2	1 ast I bullet	Transform (rri) before procee	ding to the Haar wavele	touctom mult	i magalutian			
~	analysis, dece	wavelet cons	truction and						
······································	other wavele	i systems.							
3	It aims at imp	parting skills	s to develop wavele	t-based algorithms for a	pplications in	the area of			
	Power Syster	115.							
\t the	and of the serv	Course	Outcomes (CO) wi	th Bloom's Taxonomy	Level				
Yt till	end of the coup	rse, the stud	ents will be able to,						
~ -			and of the course, the students will be able to, Bloom's						
CO	1.000000		Bloom's						
CO	25/07/5000	Course	Outcome Stateme	ent/s	Taxonomy	Taxonomy			
	Explain the h								
	Explain the background Fourier Tech	pasic conce	ots and terminolog	v that are used in the	Taxonomy Level	Taxonomy Description			
	Explain the E Fourier Tech analysis.	pasic conce	ots and terminolog		Taxonomy	Taxonomy			
C O 1	analysis. Calculate filte	pasic conceptioniques, was	ots and terminology velets Transforms	y that are used in the and Time frequency	Taxonomy Level	Taxonomy Description			
CO ₂	analysis. Calculate filte STFT and DV	pasic conceptioniques, was the bank coeff VT for signal	ots and terminology velets Transforms ficients and apply I analysis.	y that are used in the and Time frequency the concepts of CWT,	Taxonomy Level	Taxonomy Description			
CO ₂	rourier Tech analysis. Calculate filte STFT and DV Construct pe	pasic conceptioniques, was er bank coeff VT for signal erfect record	ots and terminology velets Transforms ficients and apply I analysis.	y that are used in the and Time frequency the concepts of CWT,	Taxonomy Level	Taxonomy Description Understandin Applying			
CO2	calculate filte STFT and DV Construct pe particular app	pasic conceptioniques, was er bank coeff VT for signal erfect record	ots and terminology velets Transforms ficients and apply I analysis.	y that are used in the and Time frequency the concepts of CWT,	Taxonomy Level	Taxonomy Description Understandin			
CO2	rourier Tech analysis. Calculate filte STFT and DV Construct pe	pasic conceptioniques, was er bank coeff VT for signal erfect record	ots and terminology velets Transforms ficients and apply I analysis.	y that are used in the and Time frequency the concepts of CWT,	Taxonomy Level II	Taxonomy Description Understandin Applying			
CO2 CO3	rourier Tech analysis. Calculate filte STFT and DV Construct pe particular app tool.	pasic conceptioniques, was er bank coeff VT for signal erfect record	ots and terminology velets Transforms ficients and apply I analysis. astruction wavelet I justify why wave	y that are used in the and Time frequency the concepts of CWT, filter banks for a elets provide the right	Taxonomy Level II	Taxonomy Description Understandin Applying			
CO2 CO3	Calculate filte STFT and DV Construct pe particular app tool.	pasic conceptioniques, was the content of the conte	ots and terminology velets Transforms Ficients and apply I analysis. Instruction wavelet I justify why wave	y that are used in the and Time frequency the concepts of CWT, filter banks for a elets provide the right	Taxonomy Level II	Taxonomy Description Understandin Applying			
CO2 CO3	Calculate filte STFT and DV Construct pe particular app tool.	pasic conceptioniques, was the content of the conte	ots and terminology velets Transforms Ficients and apply I analysis. Instruction wavelet I justify why wave Module Co	y that are used in the and Time frequency the concepts of CWT, filter banks for a elets provide the right	Taxonomy Level II III IV	Taxonomy Description Understandin Applying Analyzing			
CO2 CO3	Calculate filte STFT and DV Construct per particular approach. le Fundament Vector spa	pasic conceptioniques, was the result of the content of the conten	ots and terminology velets Transforms Ficients and apply I analysis. Instruction wavelet I justify why wave Module Co ear Algebra Orthogonality, Or	y that are used in the and Time frequency the concepts of CWT, filter banks for a elets provide the right ntents th normality, Projection	Taxonomy Level II III IV	Taxonomy Description Understandin Applying Analyzing Hours			
CO1 CO2 CO3	Calculate filte STFT and DV Construct per particular approached by tool. le Fundament Vector spand and functions and functions and functions are supported by the support of the support	pasic conceptioniques, was the content of the conte	ots and terminology velets Transforms Ficients and apply I analysis. Instruction wavelet I justify why wave Module Co ear Algebra Orthogonality, Orts, Orthogonal fi	y that are used in the and Time frequency the concepts of CWT, filter banks for a elets provide the right	Taxonomy Level II III IV	Taxonomy Description Understandin Applying Analyzing			
CO1 CO2 CO3	Calculate filte STFT and DV Construct pe particular app tool. le Fundamer Vector spa and funciorthogona	pasic conceptioniques, was the content of the conte	ots and terminology velets Transforms ficients and apply I analysis. Instruction wavelet I justify why wave Module Co ear Algebra Orthogonality, Orts, Orthogonal ficions.	y that are used in the and Time frequency the concepts of CWT, filter banks for a elets provide the right ntents th normality, Projection unctions, Orthonormal	Taxonomy Level II III IV	Taxonomy Description Understandin Applying Analyzing Hours			
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Introduction to Wavelet Transform: The origins of wavelets, Wavelets and other wavelet like transforms, History of wavelet from Morlet to Daubechies via Mallat, Different communities and family of wavelets, Different families of wavelets within wavelet communities Discrete wavelet transforms: Introduction, Haar Sealing Functions and Function Spaces, Translation and Scaling, Orthogonality of Translates, Function Space Vo, Finer Haar Scaling Functions, Nested Spaces Haar Wavelet Function, Scaled Haar Wavelet Functions, Orthogonality of p(f) and w(f), Normalization of Haar Bases at Different Scales, Standardizing the Notations, Refinement Relation with Respect to Normalized Bases, Support of a Wavelet System, Triangle Scaling Function, Daubechies Wavelets. Discrete Wavelet Transform and Relation to Fliter Banks Signal decomposition (Analysis), Relation with filter banks, Frequency response, Signal reconstruction: Synthesis from coarse scale to fine scale, Up sampling and filtering, Perfect reconstruction filters, QMF conditions, Computing initial sj+1 coefficient, Concepts of Multi-Resolution Analysis (MRA) and Multi-rate signal processing, Applications of DWT in power systems. Short Time Fourier Transform: Signal representation with continuous Wavelet Transform (CWT) Short Time Fourier Transform: Signal representation with continuous and discrete STFT, concept of time-frequency resolution, Resolution problem associated with STFT, Heisenberg's Uncertainty principle and time frequency tiling, why wavelet transform: Continuous Wavelet Transform: Wavelet transform—A first level introduction, Continuous wavelet transform—Frequency representation of signals, Properties of wavelets used in continuous wavelet transform, Condition-2: Orth normality of translates of scaling functions, Condition-3: Orth normality of scaling and wavelet functions, Condition-4: Approximation conditions (Smoothness conditions), Designing Daubechies orthogonal wavelet system coefficients, Constraints for Daubechies' 6 tap scaling		Discrete Wavelet Transform	
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Signal decomposition (Analysis), Relation with filter banks, Frequency response, Signal reconstruction: Synthesis from coarse scale to fine scale, Up sampling and filtering, Perfect reconstruction filters, QMF conditions, Computing initial sj+1 coefficient, Concepts of Multi-Resolution Analysis (MRA) and Multi-rate signal processing, Applications of DWT in power systems. Short Time Fourier Transform (STFT) and Continuous Wavelet Transform (CWT) Short Time Fourier Transform: Signal representation with continuous and discrete STFT, concept of time-frequency resolution, Resolution problem associated with STFT, Heisenberg's Uncertainty principle and time frequency tiling, why wavelet transform? Continuous Wavelet Transform: Wavelet transform-A first level introduction, Continuous time-frequency representation of signals, Properties of wavelets used in continuous wavelet transform, Continuous versus discrete wavelet transform. Designing Orthogonal Wavelet Systems-A Direct Approach Refinement relation for orthogonal wavelet systems, Restrictions on filter coefficients, Condition-1: Unit area under scaling function, Condition-2: Orth normality of translates of scaling functions, Condition-3: Orth normality of translates of scaling functions, Condition-3: Orth normality of scaling and wavelet functions, Condition-4: Approximation conditions (Smoothness conditions), Designing Daubechies orthogonal wavelet system coefficients, Constraints for Daubechies' 6 tap scaling function. Textbooks K P Soman, Ramachandran, Resmi, "Insights into wavelets from theory to practice", Pren Hall, New Delhi, A.N. Akansu and R.A. Haddad, "Multiresolution signal Decomposition: Transforms, Subboand Wavelets", Academic Press, Oranld, Florida, 1992. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing", Pearson Pren Hall, 2007. References C. Sidney Burrus, Ramesh A. Gopinath, HaitaoGuo, "Introduction to Wavelets and Wan Transform" in Ramashand Rapiter Ph International Editions, 1998. Raghuveer M. Rao, Ajit S. Bopardikar	111	Function Spaces, Translation and Scaling, Orthogonality of Translates, Function Space Vo, Finer Haar Scaling Functions, Nested Spaces Haar Wavelet Function, Scaled Haar Wavelet Functions, Orthogonality of $\varphi(t)$ and $\psi(t)$, Normalization of Haar Bases at Different Scales, Standardizing the Notations, Refinement Relation with Respect to Normalized Bases, Support	,
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Short Time Fourier Transform: Signal representation with continuous and discrete STFT, concept of time-frequency resolution, Resolution problem associated with STFT, Heisenberg's Uncertainty principle and time frequency tiling, why wavelet transform? Continuous Wavelet Transform: Wavelet transform-A first level introduction, Continuous time-frequency representation of signals, Properties of wavelets used in continuous wavelet transform, Continuous versus discrete wavelet transform. Designing Orthogonal Wavelet Systems-A Direct Approach Refinement relation for orthogonal wavelet systems, Restrictions on filter coefficients, Condition-1: Unit area under scaling function, Condition-2: Orth normality of translates of scaling functions, Condition-3: Orth normality of scaling and wavelet functions, Condition-4: Approximation conditions (Smoothness conditions), Designing Daubechies orthogonal wavelet system coefficients, Constraints for Daubechies' 6 tap scaling function. Textbooks K P Soman, Ramachandran, Resmi, "Insights into wavelets from theory to practice", Pren Hall, New Delhi, A.N. Akansu and R.A. Haddad, "Multiresolution signal Decomposition: Transforms, Subbeand Wavelets", Academic Press, Oranld, Florida, 1992. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing", Pearson Pren Hall, 2007. References C. Sidney Burrus, Ramesh A. Gopinath, HaitaoGuo, "Introduction to Wavelets and Wava Transform"s, A Primer PH International Editions, 1998. Raghuveer M. Rao, Ajit S. Bopardikar, "Wavelet Transforms - Introduction to Theory Application's", Addison Wesley Pearson Education Asia, 2000.		Short Time Fourier Transform (STFT) and Continuous Wavelet	
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K P Soman, Ramachandran, Resmi, "Insights into wavelets from theory to practice", Pren Hall, New Delhi, A.N. Akansu and R.A. Haddad, "Multiresolution signal Decomposition: Transforms, Subbational Wavelets", Academic Press, Oranld, Florida, 1992. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing", Pearson Pren Hall, 2007. References C. Sidney Burrus, Ramesh A. Gopinath, HaitaoGuo, "Introduction to Wavelets and	VI	Designing Orthogonal Wavelet Systems-A Direct Approach Refinement relation for orthogonal wavelet systems, Restrictions on filter coefficients, Condition-1: Unit area under scaling function, Condition-2: Orth normality of translates of scaling functions, Condition-3: Orth normality of scaling and wavelet functions, Condition-4: Approximation conditions (Smoothness conditions), Designing Daubechies orthogonal wavelet system	6
K P Soman, Ramachandran, Resmi, "Insights into wavelets from theory to practice", Pren Hall, New Delhi, A.N. Akansu and R.A. Haddad, "Multiresolution signal Decomposition: Transforms, Subbational Wavelets", Academic Press, Oranld, Florida, 1992. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing", Pearson Pren Hall, 2007. References C. Sidney Burrus, Ramesh A. Gopinath, HaitaoGuo, "Introduction to Wavelets and		Textbooks	
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C. Sidney Burrus, Ramesh A. Gopinath, HaitaoGuo, "Introduction to Wavelets and Wavelets and Wavelets", A Primer PH International Editions, 1998. Raghuveer M. Rao, Ajit S. Bopardikar, "Wavelet Transforms - Introduction to Theory Application's", Addison Wesley Pearson Education Asia, 2000.		References	
Raghuveer M. Rao, Ajit S. Bopardikar, "Wavelet Transforms - <i>Introduction to Theory Application's</i> ", Addison Wesley Pearson Education Asia, 2000.	1	C. Sidney Burrus, Ramesh A. Gopinath, HaitaoGuo, "Introduction to Wavel	ets and Wave
	2	Raghuveer M. Rao, Ajit S. Bopardikar, "Wavelet Transforms - Introduction	n to Theory a
3 IEEE Transaction Papers.	3		



		CO	-PO Mapping			
		Program	me Outcomes	(PO)		
	1	2	3	4	5	6
CO1			2			
CO2		-		2		***************************************
CO3						3

Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Biwar

Professional Elective 2

		vv alt	Government Aide	e of Engineering, Sa ed Autonomous Institute)	nglı	
				2023-24		
D			***************************************	Information		
	gramme s, Semeste		M. Tech. (Powe	r System Engineering)		
	rse Code	ſ	First Year M. To	ech., Sem I		
	rse Name		7PS514			
	red Requis	sites.	Professional Ele Power Electroni	ctive 2: Modern Power El	ectronics	
************************		, , , , , , , , , , , , , , , , , , ,	1 Ower Electronic	CS		
	Teaching	g Scheme		Examination Scheme	(Marke)	
Lecti	ure	3 Hrs/week	MSE	ISE	ESE	Total
Tuto	rial	-	30	20	50	1 0tai 1 00
Minimum				Credits: 3	30	1 00
	It is sim	od 4- : 1:	Course	e Objectives		***************************************
1	power fi	led to impart skillters	is of analysis for	different types of advance	ed converters a	and shunt acti
			inted with control	strategies of different type	C 1	
2	shunt ac	tive power filters		strategies of different type	es of advanced	converters a
3	To make	aware of research	ch avenues in the f	ield of power electronics.		
		Course	Outcomes (CO) w	vith Bloom's Taxonomy	Level	
At the	end of the	course, the stud	ents will be able to),		
CO		Cours	e Outcome Stater	ment/s	Bloom's Taxonomy	Bloom's Taxonomy
C O 1	converte	rs.		arious Power Electronic	Level III	Descriptio Applying
CO ₂	Analyze	various Power E	lectronic converter	rs and systems.	IV	A n a l :
C O3	÷	various power		using power electronic	V	Analyzing Evaluating
Modu	1					
Iouu	·····	I rectifiers	Module C	Contents		Hours
Ι	Advarand trectificand ap	ntages & disadva hree phase VSI ers, analysis and oplications.	PWM converter	chase thyristor converter, rs working, types, Contr ree phase CSI PWM conv	ol of PWM	6
II	Three Multil flying of mu	evel Voltage so capacitor multil	urce inverter, Typevel inverter, cases, comparison of	ce inverter, various PW bes: Diode clamp multile caded multilevel inverter, multilevel inverter. Con	evel inverter,	7
Ш	Reson Series resona voltage	ant pulse inverted resonant inverted int inverters, volted switching resonant	ers with unidirection age control of res	al and bi-directional switconant inverters, zero curresoro-quadrant ZVS resonant chnique.	ent and zero	6

DeMos

	Photovoltaic Inverters	
IV	Photovoltaic Inverters structures derived from H bridge topology such as H5 inverter, Heric inverter, REFU inverter, full bridge inverter with DC bypass, inverter structures derived from NPC topology such as neutral point clamped half bridge inverter, co-energy NPC inverter, three phase PV inverter.	7
V	Matrix Converters and Z source inverters Topology, working and control methods of Matrix converters, Various circuit topologies and control of Z source inverter, Application of Z source in induction motor control.	7
VI	Active power filters Power Quality Issues due to power Electronics, Introduction to active power filter, types of active power filters overall control of shunt active power filter, control of shunt active filter based on SRF theory. Control of shunt active filter based on instantaneous power theory. Harmonic compensation & reactive power compensation.	6
	Textbooks	
1	M. H. Rashid, "Power Electronics: circuits devices and applications", Pearson Ededition.	lucation, Thir
	References	
1	B. K. Bose, "Modern Power Electronics and AC drives", PHIPL, New Delhi.	
2	M. B. Patil, V. Ramayanan and V. T. Ranganathan, "Simulation of Power Electron Narosa publication.	onics circuits'
3	Remus Teodorescu, Marco Liserre and Pedro Rodrigues, "Grid- Converters fo and Wind Power Converters", A john Wiley and sons Ltd., first edition 2011.	r Photovoltai
4	IEEE Transaction papers.	
•		
1	Useful Links	
1	https://onlinecourses.nptel.ac.in/noc20_ee28/	

		CO	-PO Mapping					
Programme Outcomes (PO)								
(Augusta)	1	2	3	4	5	6		
CO1			1					
CO2		W-144		1				
CO3			11/1/13/13/14/14	2		1		

Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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				2023-24		
			Course	Information		
	ramme		M. Tech. (Power	System Engineering)		
	s, Semeste	er	First Year M. Te			
	se Code		7PS515			
Cour	se Name		Professional Ele Power System	ective 2: Neural Netwo	ork and fuzz	y Application
Desir	ed Requi	sites:	Power System			
***************************************	Teachin	g Scheme		Evenination S.L.	(2)/	
Lectu		3 Hrs/week	MSE	Examination Schen ISE		
Tutor	rial		30	20	ESE	Total
***************************************				Credits: 3	50	100
				Creans: 3		
			Course	Objectives		
1	To mak	e the student con	versant with basic l	snowledge of Neural Ne	twork.	
2	10 mak	e the student con	versant with design	and programming know	ledge for pow	er system
3	operano	n and control.				
3	10 max	Course	Outcomes (CO)	knowledge of fuzzy syste	em and fuzzy a	applications.
At the	end of the	course, the stud	ents will be able to	ith Bloom's Taxonomy	Level	
				2	Bloom's	Bloom's
CO		Course	e Outcome Statem	ent/s	Taxonomy	Taxonomy
CO1	F 1.				Level	Description
CO1	Explain	the basic knowle	dge of Neural Netv	vork	II	Understandin
CO2	Apply t	ne Neural netwo	ork and fuzzy know	wledge about different		1
	neurai n	etworks, their ar	chitecture and trair	ning algorithm to solve	III	Applying
C O3		stem problems.				
COS	Study th	e different applic	ations of neural net	works and fuzzy logic.	IV	Analyzing
Modu	le		Module Co			
		duction to Neur	al Networks	Jutents		Hours
				, Biological Neuron, B	ological and	
I	Artifi	cial Neuron M	Models. Historica	Developments, Neu	ron Model	_
	McCı	alloch and Pitts	s models of neur	ron, ANN terminologi	es weights	7
	sigmo	oidal functions, E	Bias.	in in terminologi	es, weights,	
		tials of Neural			***************************************	
				n, Neural networks a	rchitectures	
II	Linea	rly separable an	d linearly non sen	arable systems and the	ir examples	6
	Learn	ing Strategy (S	Supervised, Unsup	ervised, Reinforcement	t) Learning	O
***************************************	Rules	, Hebbian learnir	ng rule, Perceptron	learning rule etc.	o,, zearning	
	Feed	Forward Neura	l Networks		,	
	Introd	uction, single la	yer Perceptron Mod	dels, architecture, Limit	ations of the	
III	Perce	otron Model, A	pplications, Back	Propagation Network,	architecture.	7
	Multil	ayer Feed Forwa	ard Neural Network	ks. Use of ANN MATL	AB tools for	www.fea
	progra	mming.				
	1	Systems				
IV	Basic	Fuzzy logic the	ory, history, operat	ion of Fuzzy Logic, Fu	zzy relation	
1 /	and ex	tension principle	e, Fuzzy membersh	ip functions and linguist	ic variables	6
		I	,	p remetions and implific	ic variani.	

Except.

	Application of Neural Network and fuzzy to power system operation and control problems					
V	Use of MATLAB tools of ANN and fuzzy logic for power system					
	applications. Case studies such as load fore-casting, optimal power flow,					
	control applications in FACTS devices, etc.					
	Application of Neural Network and fuzzy to recent power system					
	protection problems					
VI	Use of MATLAB tools of ANN and fuzzy logic for protection applications.	6				
	Case studies such as fault analysis, fault detection, fault classification, fault					
	location, etc.					
	Textbooks NATION OF THE	M C 1:				
1	S. N. Sivanandam, "Introduction to Neural Networks using MATLAB 6", Tate education, 2006.	ta McGraw hi				
1 2	S. N. Sivanandam, "Introduction to Neural Networks using MATLAB 6", Tat					
***************************************	S. N. Sivanandam, "Introduction to Neural Networks using MATLAB 6", Tate education, 2006. Hagan, Demuth, Mark Beale, "Neural Network Design", Cengage Learing Limited, 2011.					
***************************************	S. N. Sivanandam, "Introduction to Neural Networks using MATLAB 6", Tate education, 2006. Hagan, Demuth, Mark Beale, "Neural Network Design", Cengage Learing	g India Priva				
2	S. N. Sivanandam, "Introduction to Neural Networks using MATLAB 6", Tate education, 2006. Hagan, Demuth, Mark Beale, "Neural Network Design", Cengage Learing Limited, 2011. References Stamatios V. Kartalopoulos, "Understanding neural networks and fuzzy logic	g India Priva				
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1 2	S. N. Sivanandam, "Introduction to Neural Networks using MATLAB 6", Tate education, 2006. Hagan, Demuth, Mark Beale, "Neural Network Design", Cengage Learing Limited, 2011. References Stamatios V. Kartalopoulos, "Understanding neural networks and fuzzy logic and applications", Prentice Hall of India (P) Ltd, New Delhi, 2000. J.M. Zurada, "Introduction to artificial neural systems", Jaico Publishers, 1992. Timothy Ross, "Fuzzy Logic with Engineering Applications", Tata McGraw F.	g India Privat				
1 2 3	S. N. Sivanandam, "Introduction to Neural Networks using MATLAB 6", Tate education, 2006. Hagan, Demuth, Mark Beale, "Neural Network Design", Cengage Learing Limited, 2011. References Stamatios V. Kartalopoulos, "Understanding neural networks and fuzzy logic and applications", Prentice Hall of India (P) Ltd, New Delhi, 2000. J.M. Zurada, "Introduction to artificial neural systems", Jaico Publishers, 1992. Timothy Ross, "Fuzzy Logic with Engineering Applications", Tata McGraw F. 1993 George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic", PHI Learning F.	g India Privat				
1 2 3 4	S. N. Sivanandam, "Introduction to Neural Networks using MATLAB 6", Tate education, 2006. Hagan, Demuth, Mark Beale, "Neural Network Design", Cengage Learing Limited, 2011. References Stamatios V. Kartalopoulos, "Understanding neural networks and fuzzy logic and applications", Prentice Hall of India (P) Ltd, New Delhi, 2000. J.M. Zurada, "Introduction to artificial neural systems", Jaico Publishers, 1992. Timothy Ross, "Fuzzy Logic with Engineering Applications", Tata McGraw F. 1993 George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic", PHI Learning F. 1995.	g India Privat				

		CO-	PO Mapping			
		Programi	me Outcomes	(PO)		
	1	2	3	4	5	6
CO1						1
CO2				3		
CO3				2		

Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

1

		alchand College (Government Aide	d Autonomous Institute)		
		AY	2023-24		
Duog		······································	Information		
***************************************	ramme	M. Tech. (Power	System Engineering)		
	s, Semester rse Code	First Year M. Tee	ch., Sem I		
	rse Name	7PS516			
	red Requisites:	Professional Electronic Power System	tive 2: Advanced Power	System for C	irid Resilience
		Tower System			
	Teaching Scheme		Examination Schem	e (Marks)	***************************************
Lecti	- 110/ 11001	MSE	ISE	ESE	Total
uto	rial -	30	20	50	100
***************************************			Credits: 3		
1	To explore the fundam	ental concents and pr	Objectives inciples of power system	•••	
	To study the advanced	techniques for mode	line and it	resilience.	
2	normal and abnormal	perating conditions	eling, analysis, and simu	lation of pow	er systems ur
	To examine the challe	enges and vulnerability	ties of power grids and		
3	their resilience.	inges and vameraum	nes of power grids and	explore strat	egies to enha
	To understand the rol	e of nower grid tech	nologies and renewable	•	
4	world applications for	grid resilience	mologies and renewable	e energy integ	gration with
	Cours	e Outcomes (CO) wi	th Bloom's Taxonomy		
the	end of the course, the st	udents will be able to,	th bloom's Taxonomy	Level	
	And Days			Bloom's	Bloom's
CO	Cou	rse Outcome Stateme	ent/s	Taxonomy	Taxonom
***************************************	Understand Power S	vetom Transitud O	•	Level	Description
01	Understanding of power	r system transients: G	ain a comprehensive		
•	understanding of powe the factors contributing	to their occurrence	eir characteristics, and	II	Understandi
	Analyze Transient Eff	ects: Analyza tha in-			
02	transients on various	components such	pact of power system		
-	transformers, generator	and protective device	s transmission lines,	IV	Analyzing
	Evaluate Grid Resilien	ce: Evoluete the resil	es.		
~~	against transients and i	dentify vulnerabilities	nence of power grids	e engal it ig	
13	of failure	dentity vullerabilities	s and potential points	V	Evaluating
J3					
		Module Co	ntents		Hours
	Introduction to Pov	ver System Resilienc	e		Hours
	Introduction to Pour Definition and impo	ver System Resilienc ortance of power syst	e tem resilience, Key cha	illenges and	
odul	Introduction to Pov Definition and impovulnerabilities in po	ver System Resilienc ortance of power syst	ntents e tem resilience, Key charks and metrics for ass	illenges and sessing grid	Hours 6
odul	Introduction to Pow Definition and impo vulnerabilities in poresilience.	ver System Resilience ortance of power system ower grids, Framework	e tem resilience, Key cha	illenges and sessing grid	
odul	Introduction to Power System Mod	ver System Resilience ortance of power system were grids, Framewood eling and Analysis	e tem resilience, Key charks and metrics for ass	sessing grid	
odul	Introduction to Power System Mod Power system compo	ver System Resilience ortance of power system ower grids, Framework eling and Analysis onents and their mathe	etem resilience, Key charks and metrics for assembles.	Power flow	6
odul I	Introduction to Pow Definition and important vulnerabilities in power system Mod Power System Mod Power system composition analysis and optimize	ver System Resilience ortance of power system were grids, Framewood eling and Analysis onents and their mathematication techniques, Station	etem resilience, Key charks and metrics for assematical representation, ability analysis: transie	Power flow	
odul I	Introduction to Power System Mod Power System compound analysis and optimizand frequency stabili	ver System Resilience ortance of power system were grids, Framework eling and Analysis onents and their mathematication techniques, Staty, Harmonic analysis	etem resilience, Key charks and metrics for assembles.	Power flow	6
odul I	Introduction to Pow Definition and important vulnerabilities in power system Mod Power System Mod Power system compound analysis and optimicand frequency stability Power System Oscil	ver System Resilience ortance of power system were grids, Framework eling and Analysis onents and their mathematication techniques, Staty, Harmonic analysis lations	etem resilience, Key charks and metrics for assembles and metrics for assembles and representation, ability analysis: transies and mitigation strategies	Power flow nt, voltage, es.	6
odul I	Introduction to Power System Mod Power System Compound and frequency stability Power System Oscil Overview of Sub s	ver System Resilience or tance of power system were grids, Framework eling and Analysis onents and their mathematication techniques, Staty, Harmonic analysis lations	etem resilience, Key charks and metrics for assematical representation, ability analysis: transie	Power flow nt, voltage, es.	6

	Grid Integration of Renewable Energy Sources				
	Impact of renewable energy sources on grid resilience, Grid codes and				
IV	standards for renewable energy integration, Power quality issues and	7			
	solutions, Battery energy storage for grid resilience.				
	Case Studies and Real-World Applications				
	Analysis of grid resilience in response to natural disasters and cyber-attacks,				
V	Case studies of power system oscillations and their impact on grid resilience,	1			
V	Evaluation of resilience-enhancing strategies in power grids, Role of	/			
	advanced technologies in enhancing grid resilience				
	Research Trends and Future Directions				
VI	Emerging technologies and trends in power system resilience, Research	6			
	challenges and opportunities in the field, Discussion on ongoing research	000000000000000000000000000000000000000			
	projects and advancements				
	Textbooks				
	Power System Analysis and Design" by J. Duncan Glover, Mulukutla S. Sarı	na, and Thomas			
1	Overbye				
2	Power System Transients: Parameter Determination" by Juan A. Martinez-Velasco				
3	Transient Analysis of Power Systems: A Practical Approach" by Eiichi Haginomori, Tadash Koshiduka, Junichi Arai, and Hisato Fujisawa				
4	Power System Transients: Theory and Applications" by Akihiro Ametani, Naoto Nagaoka, a Teruo Ohno				
	References				
1	Power System Stability and Control" by Prabha Kundur				
2	Power System Transients: Parameter Determination" by Juan A. Martinez-Velasco				
3	Power System Dynamics and Stability" by Peter W. Sauer and M. A. Pai				
4	Electromagnetic Transients in Power Systems" by Akihiro Ametani, Naoto Nagaoka, ar Teruo Ohno				
	Useful Links				
1	NPTEL Courses: https://nptel.ac.in/	1.2000.			
2	Research Papers IEEE: https://ieeexplore.ieee.org/				
	N. Hatziargyriou et al., "Definition and Classification of Power System Stabili	ty – Revisited &			
3	Extended," in IEEE Transactions on Power Systems, vol. 36, no. 4, pp. 3271-3281, July 202 doi: 10.1109/TPWRS.2020.3041774.				
4	Y. Cheng et al., "Real-World Subsynchronous Oscillation Events in Power Grids With Hig Penetrations of Inverter-Based Resources," in IEEE Transactions on Power Systems, vol. 38 no. 1, pp. 316-330, Jan. 2023, doi: 10.1109/TPWRS.2022.3161418.				

		CO	-PO Mapping			
Programme Outcomes (PO)						
	1	2	3	4	5	6
CO1			3			
CO2				3		
CO3	3					

Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

At

Semester- II Professional Core (Theory) Courses

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute) AY 2023-24 **Course Information Programme** M. Tech. (Power System Engineering) Class, Semester First Year M. Tech., Sem II **Course Code** 7PS521 Course Name Power Quality in Distribution Systems **Desired Requisites:** Power Systems, Power Electronics **Teaching Scheme Examination Scheme (Marks)** Lecture 3 Hrs/week MSE ISE ESE Total **Tutorial** 30 20 50 100 Credits: 3 **Course Objectives** To make the students to understand basic knowledge of causes, consequences and solutions of 1 power quality problems that affect the operation of computerized processes and electronic systems. To provide a theoretical background to correctly approach the problem of reactive, harmonic and 2 unbalance compensation. 3 To understand and apply the power theories for compensation problems. Course Outcomes (CO) with Bloom's Taxonomy Level At the end of the course, the students will be able to, Bloom's Bloom's CO Course Outcome Statement/s **Taxonomy Taxonomy** Level Description State and explain the basic concepts of Power Quality disturbances, reactive power compensation, voltage regulation, CO₁ Understanding power definitions and other figures of merit under distorted, II operation and modelling of series and shunt compensators. Apply the theory and algorithms to realize reference current generation, reactive power compensation, voltage regulation and CO₂ III Applying harmonic compensation. Analyze theories of load compensation, reference generation, figures of merits and power definitions, Standards applicable to CO₃ IV Analyzing Power Quality. Module **Module Contents** Hours Introduction to Power quality Power Quality: Introduction, State of the Art on Power Quality, Classification of Power Quality Problems, Causes of Power Quality Problems, Effects of Power Quality Problems on Users, Classification of Mitigation Techniques for Power Quality Problems. I 7 Power Quality Standards and Monitoring: Introduction, State of the Art on Power Quality Standards and Monitoring, Power Quality Terminologies, Power Quality Definitions, Power Quality Standards, Power Quality Monitoring, Numerical Examples. Power Definitions in Single Phase and Three phase Circuits Definitions of various powers, power factor and other figures of merit under balanced, unbalanced and non-sinusoidal conditions applicable to single II phase circuits. Definitions of various powers, power factor and other figures

of merit under balanced, unbalanced and non-sinusoidal conditions. IEEE

1459 power definitions applicable to three phase circuits

1	https://nptel.ac.in/courses/108/106/108106025/			
	Useful Links			
	1 - mgene 2 mgginn, 11 annuaean an 1 annuaean guarri, 3 annuaean an 1 annuaean an 1 annuaean an 1 annuaean an 1			
2	Systems Quality", Mc-Graw Hill, Edition II, 1996. Angelo Baggini, "Handbook on Power Quality", John Wiley & Sons, New Jersey, USA, 2008			
	References Roger C. Dugan, Mark F. McGranaghan, Surya Santoso, H. Wayne Beaty, "A	Electrical Pow		
2	Bhim Singh, Ambrish Chandra, Kamal Al-Haddad, "Power Quality Problems and Mitigation Techniques", Wiley, 2015.			
1	Dr. Mahesh Kumar, IIT Chennai, "Power Quality in Distribution Systems".			
	Textbooks			
	1 citorinance of of Qes, Numerical Examples.	***************************************		
	Design of Unified Power Quality Compensators, Modelling, Simulation, and Performance of UPQCs, Numerical Examples.			
VI	Operation and Control of Unified Power Quality Compensators, Analysis and	6		
	Introduction, State of the Art on Unified Power Quality Compensators, Classification of Unified Power Quality Compensators, Principle of			
	Numerical Examples. Unified Power Quality Compensators			
	Modelling, Simulation, and Performance of Active Series Compensators,	7		
V	of Active Series Compensators, Principle of Operation and Control of Active Series Compensators, Analysis and Design of Active Series Compensators,			
	Active Series Compensation Introduction, State of the Art on Active Series Compensators, Classification			
	Performance of DSTATCOMs, Numerical Examples.			
IV	DSTATCOMS, Principle of Operation and Control of DSTATCOMS, Analysis and Design of DSTATCOMS, Modelling, Simulation, and	6		
III	Active Shunt Compensation Introduction, State of the Art on DSTATCOMs, Classification of			
	Operation of Passive Shunt and Series Compensators, Analysis and Design of Passive Shunt Compensators, Modelling, Simulation, and Performance of Passive Shunt and Series Compensators, Numerical Examples	7		
	Theories of Load compensation Introduction, State of the Art on Passive Shunt and Series Compensators, Classification of Passive Shunt and Series Compensators, Principle of			

		CO-P	O Mapping	5			
Programme Outcomes (PO)							
	1	2	3	4	5	6	
CO1			1				
CO2	2						
CO3				1		2	

Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute) AY 2023-24 **Course Information Programme** M. Tech. (Power System Engineering) Class, Semester First Year M. Tech., Sem II **Course Code** 7PS522 **Course Name** PLC and Embedded Systems **Desired Requisites:** Instrumentation Techniques, Electrical Measurements, Microcontroller and Applications **Teaching Scheme Examination Scheme (Marks)** Lecture 3 Hrs/week MSE **ISE ESE Total Tutorial** 30 20 50 100 Credits: 3 **Course Objectives** To exploit the PLC and Embedded Control for industrial automation. 1 2 To developing programs using ladder logic for industrial automation. To analyze the performance of automation systems employing PLC and Embedded Control. 3 Course Outcomes (CO) with Bloom's Taxonomy Level At the end of the course, the students will be able to, Bloom's Bloom's CO Course Outcome Statement/s **Taxonomy** Taxonomy Level Description Interpret features of PLC and Embedded Control Systems used for CO₁ Industrial Automation. III Applying Use ladder logic programming technique for various PLC CO₂ applications. III Applying Evaluate the performance of PLC network configurations, PLC CO₃ V functions used for different application **Evaluating** Module **Module Contents** Hours Introduction to PLC Introduction, Advantages, Disadvantages, Parts of PLC, PLC Input module, I PLC Output Module, PLC Architecture, PLC Operation, PLC as a computer, 6 PLC memory and interfacing, Power Supply for PLC PLC programming Ladder Logic Symbols, Latching and Unlatching of PLC, Programming on/ Π off inputs to produce on/off outputs, relation of digital gate logic to contact / 7 coil logic, creating ladder diagrams from process control description. **PLC Timer and Counter Functions** PLC timer functions, Types of PLC timers, Programming of Non-retentive timers for various applications, Programming of ON timers, OFF timers, PLC III 7 counter functions, Programming of UP, DOWN counters, Case studies related to Industrial Automations PLC Arithmetic, Comparison and Branch functions PLC Arithmetic functions, PLC comparison functions, Conversion functions, Master control relay functions, PLC jump functions, Jump with return and IV 6 Jump with No return functions, Programs related to Arithmetic, Comparison and Branch functions **Advanced PLC functions** Data move system, Data handling functions, Digital bit functions and V applications, Sequencer functions, Analog PLC operations, PID control of

continuous process, PID modules & tuning, Typical PID functions

Course Contents for F Y M Tech Programme, Department of Electrical Engineering, AY 2023-24

6

VI	PLC Networking Networking of PLCs, Levels of Industrial Control, Types of Networking, Network Communications, Cell control by PLC Networks, Factors to consider in selecting a PLC	7
	Textbooks	
1	John W. Webb, Ronald A. Reis, "Programmable logic controllers, principles & a PHI publication, Eastern Economic Edition, 1994.	applications",
	References	
1	John R. Hackworth and Peterson, "PLC controllers programming methods and a PHI, 2004.	pplications",
2	Gary dunning, "Introduction to PLC, Thomson learning", Edition III, 2006	
3	William H. Bolton," Programmable logic controllers", Newnes, Edition VI, 2006	•
plat.		
	Useful Links	

CO-PO Mapping Programme Outcomes (PO)						
CO1			2	J = 14 / 1 1 1		
CO2			2			
CO3				2		

Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Val.

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute) AY 2023-24 **Course Information Programme** M. Tech (Power System Engineering) Class, Semester First Year M. Tech., Sem II **Course Code** 7PS523 **Course Name** Power System Dynamics **Desired Requisites:** Power system **Teaching Scheme Examination Scheme (Marks)** Lecture 3 Hrs/week **MSE ISE** ESE Total **Tutorial** 30 20 50 100 Credits: 3 **Course Objectives** To introduce the concept of small signal and transient stability analysis of power systems. 1 To provide solutions to SSR problem and voltage stability problem. 2 Course Outcomes (CO) with Bloom's Taxonomy Level At the end of the course, the students will be able to, Bloom's Bloom's CO **Course Outcome Statement/s Taxonomy Taxonomy** Level Description Distinguish various categories of system stability. CO₁ II Understanding Analyze models, use analytical tools to decide upon the stability CO₂ of various types. IV Analyzing Recommend various methods to improve various type of CO₃ stabilities of power system. V **Evaluating** Module **Module Contents** Hours Introduction to small signal stability of power system Small Signal Stability analysis of single machine connected to infinite bus. I Step by step model development of single machine connected to infinite bus. 6 Improvement of small signal stability Power system stabilizer, Simulation of Power System Dynamic response II using power system stabilizer in the small signal stability model of single 7 machine connected to infinite bus. Large scale power systems Dynamic equalization of large scale system systems. Step by step reduction Ш of large scale model to a smaller model for analysis purpose. 7 Transient stability analysis Introduction to Direct method of transient stability analysis by roller ball IV analogy. Development of model using energy concept, and analysis of model 6 for transient stability. Sub synchronous resonance Introduction to Sub-Synchronous oscillation & sub- synchronous resonance. V Effect of series compensation of transmission line. Induction generator 7 effect, stability of hydro turbines. Voltage stability Reactive power compensation and Voltage stability. Development of model Shoulth VI of power system for voltage stability. Sensitivity analysis and QV modal analysis for voltage stability. Methods of improving stability.

Course Contents for F Y M Tech Programme, Department of Electrical Engineering, AY 2023-24

	Textbooks
1	P. Kundur," Power System, Stability and Control", Tata McGraw Hill, New Delhi, 1994.
	References
1	K. R. Padiyar, "Power System Dynamic, Stability & Control", B.S. Publication, 2008.

		CO-PO	Mapping	未建设 的扩张		
	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1			3			
CO2				3		
CO3						2

Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.



Professional Core (Lab) Courses

				ided Autonomous In	stitute)	3	
	***************************************			Y 2023-24			
Proc	gramme			se Information			***************************************
	s, Semeste		M. Tech. (Powe	r System Engineer	ring)		
	rse Code		First Year M. To	ech., Sem II			-
	rse Code		7PS571		***************************************		
		• .	Power Quality in	n Distribution Syst	tems Labor	ratory	
Desi	red Requis	sites:	Power Systems,	Power Electronics	}		
***************************************	Teaching	Scheme		Fyomination	- C - 1		
Prac	tical	2 Hrs/ Week	LA1	Examination LA2			
Inter	action		30	30		ESE	Total
						-0	100
				Ci	redits: 1		
***************************************			Cour	se Objectives			
1	To educa	ate the students v	with the practical a	enacta of Darres C	Quality issu	ies	
2	Quality	ops the critical t	hinking in solving	power quality pro	blems with	h contemporar	v Power
3							,
		Course	ls of students to Po	ower Quality issue	S.		
At the	end of the	course, the stud	Outcomes (CO) ents will be able to	with Bloom's Ta	xonomy L	evel	
CO			se Outcome State			Bloom's Taxonomy	Bloom's
C O 1	Calculata					Level	Taxonom; Descriptio
COI	distorted	conditions.	onents and other	figures of mer	it under	III	
C O2	Analyze 1	Power Quality P	roblems and provi	de quitoble ===== 1			Applying
CO3	Lvaluate	meories of load	d compensation, r	eference generation	/. >>>	IV	Analyzing
	suitable s	imulation tool.	1 , ,	ererence generation	on using	V	Evaluating
ah ac	tivities/Lal	Li	st of Experiment	s / Lab Activities	Topics		
riting ctivitie	, site visit, es, as per th	lab experiment, ne nature and rec	shall include mir tutorials, assignn juirement of the la	ni-project, present nents, group discu h course	ations, dra ssion, pro	awings, case gramming and	studies, repo other suitab
			a of the la	o course.			
1	D 3-		Te	ktbooks			
1	Dr. Ma	hesh Kumar, II	Chennai, "Power	r Quality in Distri	bution Syst	tem".	
2		Singh, Ambrish ques", Wiley, 20	Chandra, Kamai	Al-Haddad, "Po	ver Qualii	ty Problems a	nd Mitigatio
			Dof	erences			
1	Roger Systems	C. Dugan, Marl	Ker F. McGranagha Graw Hill, Edition	n Surva Santoso	H. Wayn	e Beaty, "Ele	ctrical Powe
2			book on Power Q				
1	Nil		Usefi	ul Links			



		CO	-PO Mapping			
Programme Outcomes (PO)						
	1	2	3	4	5	6
CO1			2	7		
CO2				2	0.3	
CO3						3

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.

IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.



				ded Autonomous Ins Y 2023-24			
				e Information			
Prog	ramme		~~~~~	System Engineer	ing)		
	s, Semeste	r	First Year M. Tee		ilig)		
	se Code		7PS572	on., sem n			
	se Name			led Systems Labo		-	
	ed Requis	sites:		Techniques, Electi	•	ements, Micr	ocontroller ar
	Teaching	Scheme		Examination	n Scheme (V	[arke)	
Pract		2 Hrs/ Week	LA1	LA2	Lab Es		Total
Inter	action		30	30	40	3.L	100
					redits: 1		100
- Andrews and the second secon		*					
	Т- 1	1		se Objectives			
1 2	To deve	lop programming	g skills using PLC	for Industrial Aut	omation		
3	To use F	Of for control a	PLC for solving real	l world problems.	•		
	10 430 1	Course	e Outcomes (CO)	with Plant's Ta		•	
At the	end of the	e course, the stud	lents will be able to),	xonomy Lev	'el	
со		10.82	rse Outcome State			Bloom's Faxonomy Level	Bloom's Taxonomy Description
CO1	Execute	experiments bas	ed on PLC and SC	ADA systems		III	Applying
CO2	Construc	et basic control s	ystems using PLC	and SCADA.		IV	Analyzing
C O3	Design 1	adder logic prog	rams for various P	LC applications.		V	Creating
		I	List of Experiment	ts / I ab Activition	s/Tonios	~~~~	
ab a	ctivities/L	ab performance	shall include min	ni-project, presen	itations dray	vings, case	studies, repo
vriting	g, site visi	t, lab experimen	t, tutorials, assignr equirement of the la	nents, group disc	ussion, progr	ramming and	d other suitable
ctivit			Te	xtbooks			
ctivit	Tolor	w. webb, Ron	ald A. Reis, "Progern Economic Edit	grammable logic ion, 1994.	controllers,	principles &	applications
ctivit	John PHI p	oublication, East					
CUVII	PHI	oublication, East		ferences			
1	John PHI,	R. Hackworth a	and Peterson, "PLO	C controllers pro			applications
1	John PHI, 2	R. Hackworth a 2004.		C controllers pro	Edition III, 2	2006	applications

Table

Computer Usage / Lab Tool: MATLAB/TLS/Power world/MiPower Simulator

		CO	-PO Mapping	3		
Programme Outcomes (PO)						
	1	2	3	4	5	6
CO1		, , , , , , , , , , , , , , , , , , ,	2			
CO2				2		
CO3				2		

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.

IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab activities, Lab ESE journal/ performance		Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.



Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2023-24

Co	HITCH	Informs	tion

	Course Information	
Programme	M. Tech. (Power System Engineering)	
Class, Semester	First Year M. Tech., Sem II	
Course Code	7PS545	
Course Name	Seminar	
Desired Requisites:	_	

Teaching Scheme			Examinatio	n Scheme (Marks)	
Practical	2 Hr/ Week	LA1	LA2	Lab ESE	Total
Interaction		30	30	40	100
				redits: 1	100

Course Objectives

To understand industrial problems. 1

To suggest engineering solutions to the defined problem. 2

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO ₁	Chose, Formulate a clear problem.	III	
CO2	Select and apply appropriate engineering methods and tools for solving the problem.	· VI	Applying Creating
CO3	Develop the project and its results following an established project methodology.	V	Evaluating
CO4	Present the project results.	IV	Analyzing

List of Experiments / Lab Activities/Topics

Pre-Dissertation seminar will involve the selection of appropriate real time industry problem by understanding the working of particular industry application. Formulate the problem, select design and methodology to find the solution. Construct an electrical system by using appropriate hardware software tools. Each student should conceive, design and develop the idea leading to a project/product. The student should submit a soft bound report at the end of the semester. The final product as a result of Industry project should be demonstrated in phases at the time of examination.

This will help student to understand structured management in industry, sustainable development, with consideration to both scientific and ethical aspects and its presentation with technical report.

	Textbooks
1	To be used based on selected project

	References
1	Industry 4.0: fourth Industrial Revolution guide to Industry 4.0
*************	Useful Links
1	Nil



		CO-	PO Mapping				
Programme Outcomes (PO)							
	1	2	3	4	5	6	
CO1	3	2					
CO2				2		2	
CO3			2				
CO4		2				***************************************	

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.

IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
Lab activities, attendance, journal Lab activities, journal/ performance		ance, Lab Course Faculty Marks Submission at the end of		30
		Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.



Professional Elective 3

		Wal	(Government Aide	of Engineering, S	angli		
				2023-24			
Prog	ramme			Information			
-	s, Semester		M. Tech. (Powe	r System Engineering)		-	
	se Code		First Year M. Te	ech., Sem II			
	se Name		7PS531				
	ed Requisi	tes•	Professional Ele	ctive 3: Power System P	lanning and R	eliability	
			Electrical Transf	mission and Distribution	, Power Syster	n Analysis	
T 4	Teaching			Examination Schen	ne (Marks)		
Lectu		3 Hrs/week	MSE	ISE	ESE	Total	
Tuto			30	20	50	100	
				Credits: 3			
1	To under	stand the same	Course	Objectives			
	To discus	s reliability orit	ot of load forecasti	ng.			
2	and analy	sis.	eria for generation	, transmission, distributi	on and reliabil	ity evaluation	
3			ability concepts				
***************************************		Course	Outcomes (CO)				
At the	end of the	course, the stud	ents will be able to	ith Bloom's Taxonomy	Level		
		, , , , , ,	onts will be able to	,			
CO		Course Outcome Statement/s Bloom's Taxonomy				Bloom's	
				CHI/S	Taxonomy Level	Taxonomy	
CO1	Understan	d Load forecast	ing methodology	Description			
CO ₂	Predict G	eneration, Tran	smission and Dist	tribution planning and	·II	Understanding	
	Tomaomity.				III	Applying	
CO3	Analyze d	ifferent reliabili	ty evaluation techr	niques	IV		
Modu					1 Y	Analyzing	
wioa u		Planning:	Module Co	ontents		Hours	
	Introdu						
I	Plannir	og Medium To	es & Factors affec	ting to System Planning	, Short Term	ollasing sill.	
	Plannin	b, meanin 10	erm Planning, Loi	ng Term Planning, Rea	ctive Power	7	
		orecasting					
11	Introdu	ction. Load Ch	aracteristics I and	d Driving Parameters, S	am righer bold		
II	Forecas	6					
	Econon						
	Genera	tion Planning		s, Numerical examples			
	Generat	ion Sources,	Integrated Resour	rce Planning, Generat	ion Cyata		
III	1.1000,	Loss of Load (Calculation and A	nnroaches) Outors Da	4- 0		
	Expunsi	on, scheduled	Ourage Loss	of Energy Evaluation	. 3.7 (1 1	7	
	mercon						
***************************************	1 ISSIStar	icc.			Berrel		
	Iransm	ission Plannin					
IV		Introduction, Objectives of Transmission Planning, Network Reconfiguration, System and Load Point Indices, Data required for Composite System Polichility					
	Compos	ite System Dall	em and Load P	oint Indices, Data re	equired for	6	
	Compos	ite bystem Ken	adiiiiv.				
	Radial	Networks N	and Reliability:				
V	Interrunt	ion Indices F	ffects of Lateral	uration, Evaluation	Techniques,		
	Disconne	ects, Effects of	Protection Estimate	Distribution Protection,	Effects of	7	
	Distribut	ion Reliability	Disconnects, Effects of Protection Failure, Effects of Transferring Loads, Distribution Reliability Indices				



VI	Reliability: Reliability, Failure, Concepts of Probability, Evaluation Techniques (i) Markov Process (ii) Recursive Technique, Stochastic Prediction of Frequency and Duration of Long & Short Interruption, Adequacy of Reliability, Reliability Cost	6
	Textbooks	
1	R.L. Sullivan "Power System Planning", Tata McGraw Hill Publishing Compan	y Ltd.
2	Hossein Seifi, Mohammad Sadegh Sepasian, "Electrical power system plaalgorithms and solution" Springer-Verlag Berlin Heidelberg 2011	
	References	
1	References Roy Billinton & Ronald N. Allan "Reliability Evaluation of Power System", Spr Publication	ringer
1 2	Roy Billinton & Ronald N. Allan "Reliability Evaluation of Power System", Sp.	

	CO-PO Mapping Programme Outcomes (PO)								
	1	2	3	4	5	6			
CO1	2								
CO2		2							
CO3		2							

Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.



		Wal		of Engineeri ed Autonomous Inst 2023-24	ng, Sai	ngli		
				2023-24 Information		***************************************		
Prog	ramme		· · · · · · · · · · · · · · · · · · ·		ing)			
	, Semeste	r	M. Tech. (Power System Engineering) First Year M. Tech., Sem II					
	se Code		7PS532	oni, odni ii			-	
Cour	se Name		Professional Elec	tive 3: EHVAC				
Desir	ed Requis	ites:	Power System					
1797-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1	Teaching	Scheme		Examination	Scheme	(Marks)		
Lectu	re	3 Hrs/week	MSE	ISE		ESE	Total	
Tutor	rial .	-	30	20		50	100	
				1	edits: 3		100	
			Course	e Objectives				
1	To unde	rstand parameter	s of EHVAC line.	Objectives				
2	To deve	lop a skill to desi	gn and analyze EH	VAC line.	***************************************			
3	To deve	lop a skill to unde	erstand power frequency	uency over voltag	es develo	oped in EHV	AC line	
4	To devel	lop a skill to unde	erstand insulation c	coordination based	d on light	ening.		
At the		Course	Outcomes (CO) we ents will be able to	vith Bloom's Tax	konomy l	Level		
		course, the study	ents will be able to	2		Bloom's	Bloom's	
CO			e Outcome Staten		nomen ri resev	Taxonomy Level	Taxonomy Description	
CO1	Outline parameters of EHVAC line and develop skills to design and analyze EHVAC line.						Understanding	
CO2			v over voltages dev		C line.	III	Applying	
CO3	Explain i	nsulation coordi	nation based on lig	htening.		IV	Analyzing	
Modu			Module C				Hours	
I	Grad A B	line trends an limit and surge. Calculation of temperature recapacitances, parameters of ground return. Voltage Gradiconductor line of voltage grace. Corona Effect voltage diagracerona loss	lation of Line at tor and Corona E Engineering aspect d preliminaries, post impedance loading Line and Ground ise, properties of localculation of sequences of Conductor and Section of Conductor and Section of Section of Conductor and Section of Section of Conductor and S	es and growth of Its and growth of Its and growth of Its and growth of Its and grameters: Resoluted conductors inductance inductance gations, resistances: Charge potential gradients on concetors of bundle. It a loss, corona location of transporona pulses; the corona pulses; the corona posses is a loss of the corona pulses; the corona	EHVAC to the sistance, ors, induction and capate and inductors, oss formulating was some and the sistence of t	power loss, ctances, and acitance line ductance of as for multi-distribution alae, charge aves due to	6 Additional and the solution of the solution	
II	Theor Waves case, expone trappe	August 7						

Ш	Lightning and Lightning Protection Lightning strokes to lines, their mechanism, general principals of lightning protection problem, tower footing resistance, lightning arresters and protective characteristics, different arresters and their characteristics.					
IV	Over Voltage in EHV Systems Covered by Switching Operations Over voltages their types, recovery voltage and circuit breaker, Ferro resonance over voltages calculation of switching surges single phase equivalents.					
V	Power Frequency Voltage Control and Over Voltages Generalized constants, charging current, power circle diagram and its use, voltage control shunt and series compensation, sub synchronous resonance in series capacitor compensated lines and static reactive compensating systems.					
VI	Insulation Coordination Insulation coordination, Insulation levels, voltage withstand levels of protected equipment's and insulation coordination based on lightning, Design of EHVAC lines.	6				
	Textbooks					
1	Rakosh Das Begamudre, "EHVAC Transmission Engineering", Wiley Easter Edition 2008.	n Limited, 3rd				
	References					
1	Twian Gonen, "EHVAC and HVDC Transmission System Engineering – Analyst John Wiley and Sons 1988.	sis and Design				
2	EHVAC and HVDC Transmission Engineering & Practice: S.V. Rao					
3	Twian Gonen, "Electric Power Transmission System Engineering-Analysis and Wiley and Sons 1988.	d Design", Joh				
	Useful Links					
	https://archive.nptel.ac.in/courses/108/108/108108099/					

		CO	PO Mapping				
Programme Outcomes (PO)							
***************************************	1	2	3	4	5	6	
CO1	3						
CO2				3			
CO3					vludgargarga Lautag s	2	

Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.



Professional Elective 4

		VV a10	(Government Aide	of Engineering, S d Autonomous Institute)	Sangli	
				2023-24		
			Course	Information		
	ramme		M. Tech. (Power	System Engineering)		
	s, Semeste	r	First Year M. Te	ch., Sem II		
	rse Code		7PS533			
	rse Name		Professional Elec	ctive 4: Restructured Po	wer System	
Desii	red Requis	ites:	Power System Er	ngineering		
	Teaching	Scheme		Examination Scher	ne (Marks)	
Lecti		3 Hrs/week	MSE	ISE	ESE	Total
Tuto	rial	-	30	20	50	100
				Credits:		
	To 4-1:	on 41- 1	Course	Objectives	Part of the Control o	
1	deregula	er the knowledge	e of basic concepts	and terminologies used	in restructurin	g and
2	acregula	tion.				
3	To impai	t knowledge of	various trading made	l and restructured powe dels, market architectur	r system.	
	1	Course	Outcomes (CO) wi	ith Bloom's Taxonomy	e and market p	ower.
t the	end of the	course, the stude	ents will be able to,	ith Bloom's Taxonomy	v Level	
					Bloom's	Bloom's
CO		Course	Outcome Stateme	ent/s	Taxonomy	Taxonomy
CO1 Recognize recent change					Level	Description
OI	Recognize recent changes occurring in the structure of power supply utilities and electric supply market.					Rememberin
Explain the problems associated				tod		
CO3	Solve son	ne problem associ	ciated with deregular	iation.	II	Understandin
		ne problem assoc	ciated with deregula	ate power system.	Ш	Applying
Iodu			Module Co	ontents		TT .
	Intro	luction to Basic	Concepts			Hours
I	Basic	Concept and def	finitions, privatizati	ion, restructuring, trans	mission open	
1	access	Basic Concept and definitions, privatization, restructuring, transmission open access, wheeling, deregulation, components of deregulated system,				
	advant	ages of competin	tive system.		ised System,	
	Power	System Restru	cturing			
II	An ove	erview of the res	tructured power sy	stem, Difference betwe	en integrated	
	power	system and re	structured power	system. Explanation	with suitable	7
	practic	al examples.		star In street from all tests		
	Dereg	ulation of Powe	r Sector			
III	Separa	tion of ownersh	nip and operation,	Deregulated models,	pool model	6
***************************************	poor ar	id bilateral trade	model, multilatera	l trade model.	P moder,	O .
	Comp	Competitive Electricity Market				
	Indepe	ndent System Op	perator activities in	pool market, Wholesa	le electricity	
IV	market	Independent System Operator activities in pool market, Wholesale electricity market characteristics, central auction, single auction power pool, double				
	auction	power pool, n	narket clearing an	d pricing, Market po	wer and its	Sam I
******************	Mitigat	ion Techniques,	Bilateral trading, A	incillary services.	3	Carl Carl
	Transn	nission Pricing				
V	Margin	al pricing of ele	ctricity, nodal pric	ing, zonal pricing, emb	pedded cost	
V	Marginal pricing of electricity, nodal pricing, zonal pricing, embedded cost, Postage stamp method, Contract path method, Boundary flow method, MW-mile method, MVA – mile method, Comparison of different methods.					7
						7



	Congestion Management Congestion management in normal operation, explanation with suitable	
VI	example, Total Transfer Capability (TTC), Available Transfer Capability	6
	(ATC).	
	Textbooks	
1	Loi Lei Lai," Power System Restructuring and Deregulation: Trading, Pelinformation Technology", John Wiley & Sons Ltd., UK, 2001.	erformance and
2	M. Shahidhpour, M. Alomoush, "Restructured Electrical power systems: Ope and Volatility", Marcel Dekker Inc., New York, 2001.	erating, Trading
3	H. Lee, Willis, W. G. Scott, "Distributed Power Generation: Planning an Marcel Dekker Inc., New York, 2000.	nd Evaluation"
	References	
1	Lorrin Philipson, H. Lee Willis, "Understanding Electric Utilities and Derega Dekker Inc., New York, 1998.	lation", Marce
2	K. Bhattacharya, M.H.J. Bollen, J. E. Daalder, "Operation of Restructured F Kulwer Academic Publishers, Massachausetts, USA, 2001.	'ower Systems''
3	M. Shahidhpour, H. Yamin, Z. Li, "Market of Operations in Electric In Forecasting Scheduling, and Risk Management", John Wiley & Sons Ltd., New	
	Useful Links	
1	Nil	

			CO-PC	Mapping				
	Programme Outcomes (PO)							
	PO1	PO2	PO3	PO4	PO5	PO6		
CO1	2							
CO2		3						
CO3	an established		3					

Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.



		Wal		d Autonomous Insti	ng, Sangli			
			***************************************	2023-24				
Prog	gramme			Information				
Clas	s, Semester	•	First Year M. Te	System Engineer	ing)			
Cou	rse Code		7PS534	cn., sem n				
Cou	rse Name			ctive 4: Modern El	la atri: D:			
Desi	red Requis	ites:	Power Electronic	S	lectric Drives			
	Teaching	Scheme						
Lecti		3 Hrs/week	MSE		Scheme (Marks)			
Tuto	rial		30	ISE	ESE	Total		
			30	20	50	100		
				Cre	dits: 3			
			Course	Objectives				
1	To provid	de the latest kno	wledge in the field	of electrical drives				
_	To provid	de sufficient kno	wledge in the area	of advanced court	s rol techniques for in			
2	synchron	ous machines.	mage in the area	or advanced cont	rol techniques for in	duction motor a		
3			e of the research in	41 - 6 11 6 1				
		Course	Putacres (CO)	the field of electi	rical drives			
At the	end of the	course, the stude	Outcomes (CO) wients will be able to,	th Bloom's Taxo	nomy Level			
		- solve, the study	hits will be able to,					
CO		Course Outcome Statement/s Bloom's Taxonomy						
				mus	Taxonomy	Taxonomy		
CO1	Understan	d the basics of e	electrical drives		Level II	Description		
CO ₂	Apply the	knowledge for	designing the drive	system		Understanding		
CO3	***************************************	***************************************	of Electrical Drive		Ш	Applying		
***************************************		perrormanee	of Electrical Drives	S	V	Evaluating		
Modu			Module Co	ntents		Hours		
		uction to the D				Hours		
	Brief 1	review of DC	drives, closed loo	p speed control	constant HP and			
T	constar	Brief review of DC drives, closed loop speed control, constant HP and constant torque operation. Scalar control of induction motor (frequency control). VSL 6-d in the control of induction motor (frequency control).						
I		it torque operat	ion. Scalar contro	l of induction	motor (fragues			
1	control), VSI fed indu	tion. Scalar contro	l of induction	motor (frequency	6		
ı	control), VSI fed indu	tion. Scalar contro	l of induction	motor (frequency	6		
1	speed c), VSI fed indu	non. Scalar control action motor speed op speed control b	l of induction	motor (frequency	6		
1	speed control Inverte), VSI fed indu ontrol, closed lo er Fed AC Driv dq transformation	non. Scalar control ction motor speed control best	l of induction l control, CSI fee lock diagrams of i	motor (frequency d induction motor induction motor.	6		
1	speed control Inverte), VSI fed indu ontrol, closed lo er Fed AC Driv dq transformation	non. Scalar control ction motor speed control best	l of induction l control, CSI fee lock diagrams of i	motor (frequency d induction motor induction motor.	6		
	speed control speed control Inverte Abc – synchro), VSI fed indu ontrol, closed lo er Fed AC Driv dq transformationously rotating	non. Scalar control cition motor speed control best on, transformation reference frame ar	l of induction l control, CSI fee lock diagrams of i from stationary r	motor (frequency d induction motor induction motor.	6		
I	speed control Inverte Abc – synchro of indu), VSI fed induction on trol, closed lear Fed AC Drived transformation on usly rotating action motor in	non. Scalar control ction motor speed cop speed control beson, transformation reference frame are dynamic dq stati	l of induction l control, CSI fee lock diagrams of i from stationary r nd vice versa. Eq	motor (frequency d induction motor induction motor.	7		
	speed control speed control Abc – synchro of indu), VSI fed inducentral, closed lear Fed AC Driving dq transformation ously rotating action motor in the frame. Permitted in the control of th	non. Scalar control of action motor speed control best on, transformation reference frame are dynamic dq stationament magnet syr	l of induction l control, CSI fee lock diagrams of i from stationary r nd vice versa. Eq onary and synch	motor (frequency d induction motor induction motor. reference frame to quivalent circuits aronously rotating	7		
	speed control Inverte Abc — synchro of indu reference circuits.	ontrol, closed locar Fed AC Driving dq transformation motor in the frame. Perm The three phase	con. Scalar control of the control o	l of induction l control, CSI fee lock diagrams of i from stationary r nd vice versa. Eq onary and synch achronous machin	motor (frequency d induction motor induction motor. reference frame to quivalent circuits fronously rotating the dq equivalent see PWM inverter.	7		
	speed c Inverte Abc – synchro of indu reference circuits. PWM t	ontrol, closed loor Fed AC Driving dq transformation motor in the frame. Perm The three phase echniques such	ction. Scalar control by the control	l of induction l control, CSI fee lock diagrams of in from stationary rand vice versa. Equationary and synch inchronous machinary three phases. M. selected harm	motor (frequency d induction motor induction motor. reference frame to quivalent circuits fronously rotating the dq equivalent see PWM inverter.	7		
	speed control speed control Abc — synchro of indu reference circuits. PWM to	ontrol, closed locar Fed AC Driving dq transformation motor in the frame. Perm The three phase chniques such ector PWM hyst	con. Scalar control by the second control by	l of induction l control, CSI feed lock diagrams of induction from stationary rand vice versa. Equipment on the control PWM	motor (frequency d induction motor induction motor. reference frame to quivalent circuits fronously rotating the dq equivalent see PWM inverter.	7		
II	speed control Inverte Abc — synchro of indu reference circuits. PWM t space ve	ontrol, closed lot ontrol, closed lot ontrol, closed lot or Fed AC Driving dq transformation motor in the frame. Perm The three phase chniques such ector PWM hyst Control of Indu	con. Scalar control by the control b	l of induction l control, CSI fee lock diagrams of in from stationary restricted in the control of the control	motor (frequency d induction motor induction motor. reference frame to quivalent circuits aronously rotating ne dq equivalent se PWM inverter, nonic elimination,	7		
	speed control speed control Abc — synchro of indu reference circuits. PWM t space ve Vector	ontrol, closed locar Fed AC Driving dq transformation motor in the frame. Permanent the three phase changes such ector PWM hyst Control of Inductor of indication of indic	con. Scalar control by the control b	l of induction l control, CSI fee lock diagrams of in from stationary restricted in the control of the control PWM lock drive analogy of the control PWM lock drive analogy of the control of the control PWM lock drive analogy of the control of the control of the control of the control PWM lock drive analogy of the control of the contro	motor (frequency d induction motor induction motor. reference frame to quivalent circuits aronously rotating the dq equivalent se PWM inverter, nonic elimination,	7		
II	speed control speed control Abc — synchro of indu reference circuits. PWM t space ve Vector Vector phasor co	ontrol, closed loser Fed AC Driving dq transformation motor in the frame. Perm The three phase chniques such ector PWM hyst Control of indiagram. Direct	con. Scalar control by the control b	l of induction l control, CSI fee lock diagrams of in from stationary restricted in the control of the control PWM lock drive analogy of the control PWM lock drive analogy of the control of the control PWM lock drive analogy of the control of the control of the control of the control PWM lock drive analogy of the control of the contro	motor (frequency d induction motor induction motor. reference frame to quivalent circuits aronously rotating the dq equivalent se PWM inverter, nonic elimination,	7		
II	speed control speed control Abc — synchro of indu reference circuits. PWM t space ve Vector phasor c oriented	ontrol, closed locar Fed AC Driving de transformation motor in the frame. Perm The three phase chniques such ector PWM hyst Control of inclingram. Direct vector control	ction. Scalar control by the control contro	l of induction l control, CSI fee lock diagrams of in from stationary restricted in the control of the control PWM lock drive analogy of the control PWM lock drive analogy of the control of the control PWM lock drive analogy of the control of the control of the control of the control PWM lock drive analogy of the control of the contro	motor (frequency d induction motor induction motor. reference frame to quivalent circuits aronously rotating the dq equivalent se PWM inverter, nonic elimination,	7		
II	speed of Inverte Abc — synchro of indu reference circuits. PWM t space ve Vector phasor of oriented Sensorle	ontrol, closed locar Fed AC Driving dq transformation motor in the frame. Perm The three phase chniques such ector PWM hyst Control of Indiagram. Direct vector control of Indiagram.	con. Scalar control of the control o	l of induction l control, CSI fee lock diagrams of induction lock diagrams of induction stationary results of the control stationary and synch and see the control PWM les drive analogy, existing indirect vector control recontrol synchronic	motor (frequency d induction motor induction motor. reference frame to quivalent circuits ronously rotating ne dq equivalent se PWM inverter, nonic elimination, equivalent circuit, entrol, stator flux-	7		
II	speed of Inverte Abc — synchro of indu reference circuits. PWM t space ve Vector phasor of oriented Sensor-le	ontrol, closed locar Fed AC Driving dependent on the control of the control of Indiagram. Direct vector control of Indiagram. Direct vector control of Indiagram	con. Scalar control by the control of the control by the control by the control by the control of the control o	l of induction l control, CSI fee lock diagrams of in from stationary restricted in the stationary restricted in the stationary and synchological machine inverter, three phases are control PWM es drive analogy, estimated indirect vector components of the stationary restricted in the stationary restricted	motor (frequency d induction motor induction motor. reference frame to quivalent circuits ronously rotating ne dq equivalent se PWM inverter, nonic elimination, equivalent circuit, entrol, stator flux-	7		
Ш	speed of Inverte Abc — synchro of indu reference circuits. PWM t space ve Vector phasor of oriented Sensor-le methods	ontrol, closed looper Fed AC Driving department of the process of the control of Indicated and Indicated	con. Scalar control of the control o	l of induction l control, CSI fee lock diagrams of in from stationary restricted in the stationary restricted in the stationary and synch in the stationary and synchronic in the stationary and stationary are sta	motor (frequency d induction motor induction motor. reference frame to quivalent circuits aronously rotating me dq equivalent se PWM inverter, nonic elimination, aquivalent circuit, antrol, stator flux-	7		

Course Contents for F Y M Tech Programme, Department of Electrical Engineering, AY 2023-24

,	PMDC and BLDC Drives	
V	Permanent magnet synchronous motor drives, sinusoidal surface PM machine drive, self-control and vector control of surface PM machine. Trapezoidal SPM machine drive (BLDC drive)	6
	DSP control of the Drives Digital Signal Processor for induction motor drive, event manager functional	
VI	block diagram for PWM waveform generation, quadrature encoder pulse circuit and event manager interrupts	6
	Textbooks	
1	B. K. Bose, "Modern Power Electronics and AC drives", Prentice Hall of India I	Pvt. India
	References	
1	Peter Vas, "Vector Control of AC machines", Clarendon Press Oxford, 1999.	
2	Hamid Toiyat and Campbell, "DSP Based Electromechanical Motion Control" 2004	by CPC press
3	Ned Mohan, "Advanced Electrical drives – Analysis, control and modeling us John Wiley and sons, 2001	ing Simulink"
4	Yasuhiko Dote, "Servo Motor and Motion Control Using Digital Signal Process Hall Eagle ward cliffs, New Jersey,	ssor", Prentice
5	G. K. Dubey "Fundamentals of Electrical Drives", Narosa publication, 2 nd edition	n.
parrops		
1	Useful Links	
1	Nil	

			CO-PC) Mapping				
	Programme Outcomes (PO)							
	PO1	PO2	PO3	PO4	PO5	PO6		
CO1			3					
CO2				3				
CO3	3					and the spirit of the		

Assessment

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ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

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For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

DSMor

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2023-24

Course	Information

M. Tech. (Power System Engineering)	
First Year M. Tech Sem II	
7PS535	
Professional Elective 4: HVDC Transmission	
Power Electronics, Power System Engineering	
	Professional Elective 4: HVDC Transmission

1 each	ing Scheme		Examination S	cheme (Marks)	
Lecture	3 Hrs/week	MSE	ISE	ESE	.
Tutorial	-	30	20		Total
			Cred	its: 3	100

Course Objectives

- It is aimed to provide detailed knowledge of controlled converters for HVDC transmission system. 1 2
 - It demonstrates use of different control and protection methods in HVDC transmission system. It provides recent trends in HVDC transmission system. 3

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO ₁	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
COI	Investigate appropriate control and protection schemes for HVDC transmission System.	III	Applying
CO2	Interpret performance of converter for HVDC transmission systems.	IV	Analyzing
CO3	Appraise recent trends in HVDC transmission systems.	V	Evaluating

Module	Module Contents	TT
	Introduction to HVDC Transmission Technology	Hours
I	Comparison of EHVAC and HVDC Transmission, types of HVDC transmission system	6
	Analysis of HVDC converter	
II	Different modes of valve operation, o/p voltage waveforms and D C voltage in rectification, and inverter operation, valve voltages, equivalent electrical circuit, converter charts.	7
	HVDCTS control features	
Ш	Control modes, control schemes and their comparisons, energization and de- energization of bridges, starting and stopping of D C link.	6
	Faults and over-voltages	
IV	Converter mal-operations, commutation failure, over-voltages in HVDCTS, protection of converters, D C reactor and damper circuits.	7
	Harmonics and their suppression in HVDCTS	
V	Harmonic analysis, filter design, minimum cost tuned A C filters, reactive power requirements.	7
	Multi terminal HVDCTS	
VI	Series and parallel MTDCTS, their control, introduction to HVDC light, recenttrends in HVDCTS.	6

Textbooks



1	E.W. Kimbark, "Direct Current Transmission", Win publisher.
2	K.R. Padiyar, "H.V.D.C. Power Transmission", Wiley Eastern New Delhi.
	A CONTROL OF THE CONT
	References
1	J. Arrillaga, "H.V.D.C. Transmission", Peter limited.
2	S.Rao, "E.H.V.A.C. & H.V.D.C. Transmission", Khanna Publishers.
	Useful Links
1	Nil

			CO-F	O Mapping				
	Programme Outcomes (PO)							
	PO1	PO2	PO3	PO4	PO5	PO6		
CO1				3				
CO2			3					
CO3	-			44		2		

Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.



Open Elective

			Government Aic	e of Engineering, S ded Autonomous Institute)				
***************************************				Y 2023-24				
Pros	gramme			e Information				
Class, Semester		M. Tech. (Power System Engineering)						
Course Code		First Year M. Tech., Sem II 70E506						
**********	rse Name		***************************************	0 15	***************************************			
Desi	red Requis	ites:	M Tech (Power	Control Techniques for E	lectrical Drive	es .		
			Wi. Tech. (Powe	er System Engineering)				
	Teaching	Scheme						
Lect	Lecture 3 Hrs/week		Examination Scheme (Marks) MSE ISE ESE TO THE SECOND TO TH					
Tuto	Tutorial		30	ISE	ESE	Total		
			30	20	50	100		
			<u> </u>	Credits: 3	5			
			Corre	e Objectives				
_	To make	students unde	rstand concept of	f fundamental 1				
1	Electric 1	Orives	concept 0	f fundamental knowledg	e in dynamic	s and control		
2								
	To cover	guien control pri	nciples of various	DC and AC motors using	g solid state co	nverters.		
3	Drives.	principles of s	election of Electr	ic Motors and highlights	the applicati	ons of Electric		
	Drives.					er Breenie		
\	1 0.1	Course (Outcomes (CO) v	vith Bloom's Taxonomy	Level			
at the	end of the	course, the stude	ents will be able to	0,				
					Bloom's	Bloom's		
CO		Course	Taxonomy					
701	Б 1		***************************************	13000019329-3	Level	Taxonomy Description		
CO1	Explain th	ne various conce	pts used in Electr	ic drives.	II	Understandin		
	Annly the	control techniq	ues for Electric dr	ives for speed control		***************************************		
CO2	rippiy tile	Apply the control techniques for Electric drives for speed control. Analyze the performance of various control techniques used in						
CO2	Analyze	the performance	of various cont	rol techniques used in	111	Applying		
CO ₂	Analyze	the performance	of various cont	rol techniques used in		Applying		
	speed cor	the performance strol of electric	of various cont	rol techniques used in t a drive for particular	IV	Applying Analyzing		
	Analyze	the performance strol of electric	of various cont	rol techniques used in				
CO3	speed cor applicatio	the performance strol of electric	e of various cont drives and selec	rol techniques used in t a drive for particular				
203	speed cor applicatio	atrol of electric	e of various cont drives and select	rol techniques used in t a drive for particular				
203	speed cor applicatio	atrol of electric n. mentals of Elec	e of various cont drives and selec Module C	rol techniques used in t a drive for particular ontents	IV	Analyzing		
CO3	speed cor applicatio	ntrol of electric n. mentals of Elec & parts of the	Module C etric Drives Electrical drives	t a drive for particular ontents	IV	Analyzing		
CO3 Iodu	speed cor applicatio	mentals of Elec & parts of the selection base	Module C tric Drives Electrical drives ed on duty ever	ontents , Selection criteria of decrease of a contents	rives, motor	Analyzing		
203	speed cor applicatio	mentals of Elec & parts of the selection base	Module C etric Drives Electrical drives ed on duty cyc quation, speed to	ontents , Selection criteria of dele, selection of conve	rives, motor erter rating,	Analyzing		
CO3 Iodu	speed cor application le Funda Types rating, fundam Inducti	mentals of Electric & parts of the selection base nental torque error motor, multi	Module C tric Drives Electrical drives ed on duty cyc quation, speed to	ontents , Selection criteria of decle, selection of convergence characteristics Decletion of the drive class	rives, motor erter rating,	Analyzing		
CO3 Iodu	speed cor applicatio le Funda Types rating, fundam Inducti mechar	mentals of Elec & parts of the selection base ental torque en on motor, multical load torque	Module C tric Drives Electrical drives ed on duty cyc quation, speed to it quadrant opera	ontents Selection criteria of decle, selection of convection of the drive, class tability of the drive, contents	rives, motor erter rating,	Analyzing		
CO3 Iodu	speed cor applicatio le Funda Types rating, fundam Inducti mechar and cor	mentals of Electric & parts of the selection base nental torque en on motor, multiplical load torque estant HP operat	Module C tric Drives Electrical drives ed on duty cyc quation, speed to it quadrant opera	ontents Selection criteria of decle, selection of convection of the drive, class tability of the drive, contents	rives, motor erter rating,	Analyzing		
CO3 Iodu	speed cor applicatio le Funda Types rating, fundam Inducti mechar and cor	mentals of Elec & parts of the selection base ental torque en on motor, multical load torque	Module C tric Drives Electrical drives ed on duty cyc quation, speed to it quadrant opera	ontents , Selection criteria of decle, selection of convergence characteristics Decletion of the drive class	rives, motor erter rating,	Analyzing		
CO3 Iodu	speed cor applicatio le Funda Types rating, fundam Inducti mechar and cor DC Mo	mentals of Electric & parts of the selection base nental torque en con motor, multiplical load torque astant HP operation of Drives	Module Control drives and selected Drives Electrical drives and drives and selected drives are drives and drives are driv	ontents Selection criteria of decle, selection of convertion of the drive, class tability of the drive, conlosed loop speed control.	rives, motor erter rating, C motor & sification of stant torque	Analyzing		
CO3 Iodu	speed cor application le Funda Types rating, fundam Inducti mechar and cor DC Mo Method	mentals of Electric & parts of the selection base ental torque en on motor, multiplical load torque estant HP operate of the prives of speed control of the selection base ental torque en ental torque en ental torque ental torq	Module C tric Drives Electrical drives ed on duty cyc quation, speed to it quadrant opera es, steady state st ion of the drive, c	ontents , Selection criteria of decle, selection of convertion of the drive, class tability of the drive, con losed loop speed control.	rives, motor erter rating, C motor & diffication of stant torque	Analyzing		
CO3 Iodu	speed cor applicatio le Funda Types rating, fundam Inducti mechar and cor DC Mo Method three p	mentals of Electric m. selection base mental torque en motor, multiplical load torque micial load tor	Module C tric Drives Electrical drives ed on duty cyc quation, speed to it quadrant opera es, steady state st ion of the drive, c	ontents Selection criteria of decle, selection of converted to the drive, class tability of the drive, controlled converter, fed	rives, motor erter rating, C motor & dification of stant torque	Analyzing		
CO3 Iodu	speed cor application le Funda Types rating, fundam Inducti mechar and cor DC Mo Method three p Multi of	mentals of Electric m. mentals of Electric & parts of the selection base ental torque ental tor	Module C tric Drives Electrical drives ed on duty cyc quation, speed to it quadrant opera es, steady state st ion of the drive, c trol, starting and rolled and half c ion of separatel	ontents , Selection criteria of decle, selection of convertion of the drive, class tability of the drive, conclosed loop speed control. braking operation, single ontrolled converter fed by excited DC shunt in	rives, motor erter rating, C motor & sification of stant torque e phase and DC drives,	Analyzing		
CO3 Iodu	speed cor application le Funda Types rating, fundam Inducti mechan and cor DC Mo Method three p Multi of converted	mentals of Electric m. mental	Module C tric Drives Electrical drives ed on duty cyc quation, speed to it quadrant opera es, steady state st ion of the drive, c trol, starting and rolled and half c ion of separatel s, circulating and	ontents , Selection criteria of decle, selection of convertion of the drive, class tability of the drive, con losed loop speed control. braking operation, single ontrolled converter fed y excited DC shunt in the point of the drive of the drive.	rives, motor erter rating, C motor & diffication of stant torque e phase and DC drives, notor, dual	Analyzing		
O3 fodu	speed cor application le Funda Types rating, fundam Induction mechan and cor DC Mo Method three p Multi of converted converted	mentals of Electric m. mentals of Electric & parts of the selection base ental torque ental torque ental torque ental torque estant HP operate of Drives as of speed continuadrant operate er fed DC drives er fed DC series	Module Control drives and selection drives and selection drives Electrical drives and additional drives are steady state at a graph of the drive, control, starting and rolled and half control drive, chown of the drive and the	ontents Selection criteria of decle, selection of converted to the drive, class tability of the drive, controlled converter, fed	rives, motor erter rating, C motor & sification of stant torque e phase and DC drives, notor, dual f operation,	Analyzing		

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	Induction Motor Drives		
Ш	Torque equation, Speed control methods for three phase cage induction motor, braking methods, stator voltage control induction motor drive, VSI fed induction motor drive, constant torque (constant E/F and constant V/F), constant HP operation, closed loop speed control block diagram, Stator current control methods fed induction motor drive, speed torque characteristics of CSI fed drive, closed loop speed control block diagram, comparison of CSI fed and VSI fed induction motor drive.	6	
	Slip Ring Induction Motor Drives		
IV	Chopper controlled resistance in rotor circuit, slip power recovery using converter cascade in rotor circuit, sub synchronous and super synchronous speed control, Kramer speed control, cyclo - converter in rotor circuit.	7	
	Synchronous Motor Drives and Brushless DC Motor Drives		
V	VSI fed synchronous motor drives, true synchronous and self-control mode, open loop and closed loop speed control of Permanent magnet synchronous machine, brushless DC motor drives.	6	
***************************************	Special Drives		
VI	Construction and operating principle of switched reluctance motors, Current / Voltage control, torque equation, converter circuits, operating modes and applications of switched reluctance motors. Solar panel VI characteristics, solar powered pump, maximum power point tracking and battery-operated vehicles.	6	
	Total colo		
1	Textbooks G. K. Dubey, "Fundamentals of Electrical Drives", Narosa publication, 2nd ed	ition, 2002.	
	References	Charage Day	
1	"Fundamentals of Electrical Drives", NPTEL video lecture series by Prof. Das, Department of Electrical Engineering, IIT Kanpur.		
2	"Power Electronics - Converter Application", By N. Mohan T.M. Undel and John Wiely and sons.	W. P. Robbins	
3	"Electrical Drives - Concept and application", Vedam Subramanyam.		
	Useful Links	2000 ENGLASSES 12	
1	https://nptel.ac.in/courses/108/104/108104140/		

Programme Outcomes (PO)									
	1	2	3	4	5	6			
CO1			3						
CO2				3					
CO3	3	127 24 34 34 5 7 7 5 3 8							

Each CO of the course must map to at least one PO.

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