Walchand College of Engineering

(Government Aided Autonomous Institute) Vishrambag, Sangli. 416415



Course Content for M. Tech. (Power System Engineering) 2022-24

PG Coordinator

HOD (Electrical Engg.)

Semester- I Professional Core (Theory) Courses

		Walc	hand College ((Government Aidea	of Engineering, San	gli	
			AY	2022-23		
			Course I	Information		
Progr	amme		M.Tech. (Power S	System Engineering)		
Class,	Semester	•	First Year M. Tec	ch., Sem I		
Cours	e Code		6PS501			
Cours	e Name		Digital Protection	n of Power System		
Desire	ed Requis	ites:	Power System Pre	otection		
	T 1.	<u> </u>				
T 4	Teaching	Scheme	MCE	Examination Scheme	(Marks)	
Lectu	re ial	3 Hrs/week	MSE		ESE	100
Tutor	181	-		Crodits: 3	50	100
				Creans: 5		
			Course	Ohiectives		
1	To make	e students unders	tand digital technic	ues for realizing various r	needs of protec	tion
2	To stren	gthen the concept	ots in power system	protection.		
3	To deve	lop the skills nec	essary to analyze, o	design and implement digi	tal protective r	elays.
		Course	Outcomes (CO) w	ith Bloom's Taxonomy I	Level	
At the	end of the	e course, the stud	ents will be able to	,		
со		Course Outcome Statement/s Bloom's Taxonomy				Bloom's Taxonomy Description
C01	Interpret digital p	Interpret the performance of devices like CT, PT and relays used in III III			Applying	
CO2	Analyse power s	the use of digita ystem.	l systems for protec	ction of different parts of	IV	Analyzing
CO3	Estimate of powe	e and Justify setti r system.	ngs of relays for pro	otection of different parts	V	Evaluating
CO4	Design systems	analog/digital	protection scheme	e for simple electrical	VI	Creating
						1
Modu	ıle		Module (Contents		Hours
I	Revi Prote Tran sche Elec	ew of Relaying ection schemes f smission line pro mes, drawbacks tromagnetic CT a	Schemes for alternator, trans otection using over of of these scheme and PT.	former, bus bar and indu current- time graded and c es, differential & distar	ction motors. Furrent graded ace schemes,	6
П	Electromagnetic C 1 and P1. Comparators a. Dual Input Comparator: Amplitude comparator, phase comparator, duality between amplitude and phase comparators, cosine-type and sine type phase comparators, coincidence type phase comparator. II b. Multi Input Comparator: Amplitude comparator, phase comparator.					4
ш	Over Diffe Micr curre base	r Current Relay erent time-cur oprocessor/micro ent relay and its d scheme.	s rent characteris ocontroller based s implementation	tics of over cur over current relay, Dire using microprocessor/mi	rent relay, ectional over crocontroller-	8

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.	8
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.	8
VI	Recent Developments in Digital Protection Digital Relaying techniques based on modern tools of digital signal processing like DFT, Haar Transform, WT etc.	4
	Textbooks	
1	Badri Ram, D.N. Vishwakarma, "Power System Protection and Switchgear", TM	IH, 2004.
2	Y.G. Paithankar, S.R. Bhide, "Fundamentals of Power System Protection", PHI,	2003.
	~ ^	
	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 Mapping								
Programme Outcomes (PO)								
	1	2	3	4	5	6		
CO1	2							
CO2				3				
CO3			2					
CO4		2				1		
The strength of map	pping is to be w	vritten as 1: Lo	w, 2: Medium,	3: High				

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.

		Walc	hand College	of Engineering, San	gli	
AY 2022-23						
			Course	Information		
Progra	amme		M.Tech. (Power	System Engineering)		
Class,	Semester		First Year M. Te	<u>ch., Sem I</u>		
Cours	e Code		6PS502	· · , · · ·		
Cours	e Name		Application of Po	ower Electronics to Power	system	
Desire	d Requisi	tes:	Power System Er	ngineering, Power Electror	nics	
	-			<u> </u>		
	Teaching	Scheme		Examination Scheme	(Marks)	
Lectu	re	3 Hrs/week	MSE	ISE	ESE	Total
Tutor	ial	-	30	20	50	100
				Credits: 3	1	
		·	·			
			Course	Objectives		
1	To make	students unders	tand concept of FA	CTs envisages the use of j	power electron	nics to improve
	system o	peration by fast	& reliable control.			
2	To cover	concepts of FA	CTs including the	description, principle of w	orking and ana	alysis of
2	various F	ACTs controlle	rs.			
3	10 streng	<u>Course</u>	\mathbf{O} of FACTs and sys	stem interactions.	aval	
At the	end of the	course the stud	ents will be able to			
		course, the stud	ients will be able to	,	Bloom's	Bloom's
CO		Cours	se Outcome Stater	nent/s	Taxonomy Level	Taxonomy Description
	CO1 Explain necessity, operating principals and benefits of FACTs II					
CO1	explain devices.	necessity, oper	ating principals a	and benefits of FACTs	II	Understandin g
CO1 CO2	Explain devices. Choose t application	he suitable FAC	rating principals a	and benefits of FACTs er for particular	II III	Understandin g Applying
CO1 CO2 CO3	Explain devices. Choose t applicatio Analyze	he suitable FAC	rating principals a Ts device/controlle tics of FACTs C	and benefits of FACTs er for particular controllers and effect of	II III IV	Understandin g Applying Analyzing
CO1 CO2 CO3	Explain devices. Choose t application Analyze location	he suitable FAC on. the characteris	Ts device/controlle tics of FACTs C on Power System.	and benefits of FACTs er for particular controllers and effect of	II III IV	Understandin g Applying Analyzing
CO1 CO2 CO3	Explain devices. Choose t application Analyze location	necessity, oper he suitable FAC on. the characteris of the controller	rating principals a Ts device/controlle tics of FACTs C on Power System.	and benefits of FACTs er for particular ontrollers and effect of	II III IV	Understandin g Applying Analyzing
CO1 CO2 CO3 Modu	Explain devices. Choose t application Analyze location	he suitable FAC on. the characteris of the controller	Ts device/controlle tics of FACTs C on Power System.	and benefits of FACTs er for particular controllers and effect of Contents	II III IV	Understandin g Applying Analyzing Hours
CO1 CO2 CO3 Modu	Explain devices. Choose t application Analyze location lle Intro	he suitable FAC on. the characteris of the controller duction	rating principals a Ts device/controlle tics of FACTs C on Power System. Module (ble AC transmission)	and benefits of FACTs er for particular ontrollers and effect of Contents	II III IV	Understandin g Applying Analyzing Hours
CO1 CO2 CO3 Modu	Explain devices. Choose t application Analyze location Ile Intro The c powe	he suitable FAC on. the characteris of the controller duction concept of flexil r transmission 1	Ts device/controlle tics of FACTs C on Power System. Module ble AC transmission ines -uncompensation	and benefits of FACTs er for particular controllers and effect of Contents on - reactive power control ted transmission line - ser	II III IV l in electrical ies and shunt	Understandin g Applying Analyzing Hours
CO1 CO2 CO3 Modu	Explain devices. Choose t application Analyze location location Ile Intro The c powe comp	he suitable FAC on. the characteris of the controller duction concept of flexil r transmission 1 ensation. Overv	Ts device/controlle Ts device/controlle tics of FACTs C on Power System. Module ble AC transmissic ines -uncompensat iew of FACTS dev	and benefits of FACTs er for particular controllers and effect of Contents on - reactive power contro ted transmission line - ser vices - Static Var Compensi	II III IV I in electrical ies and shunt sator (SVC) -	Understandin g Applying Analyzing Hours 6
CO1 CO2 CO3 Modu	Explain devices. Choose t application location of the powe comp Thyri	he suitable FAC on. the characteris of the controller duction concept of flexil r transmission 1 ensation. Overv stor Switched S	Ts device/controlle tics of FACTs C on Power System. Module ble AC transmissic ines -uncompensat iew of FACTS dev Series capacitor (T	and benefits of FACTs er for particular controllers and effect of Contents on - reactive power contro ted transmission line - ser vices - Static Var Compens CSC) - Unified Power Flo	II III IV l in electrical ies and shunt sator (SVC) - ow controller	Understandin g Applying Analyzing Hours 6
CO1 CO2 CO3 Modu	Explain devices. Choose t application Analyze location Ile Intro The c powe comp Thyri (UPF	he suitable FAC on. the characteris of the controller duction concept of flexil r transmission 1 ensation. Overv stor Switched S C) - Integrated 1	Ts device/controlle Ts device/controlle tics of FACTs C on Power System. Module ble AC transmissic ines -uncompensat iew of FACTS devices Series capacitor (Trepower Flow Control	and benefits of FACTs er for particular controllers and effect of Contents on - reactive power contro ted transmission line - ser vices - Static Var Compens CSC) - Unified Power Flo oller (IPFC).	II III IV l in electrical ies and shunt sator (SVC) - ow controller	Understandin g Applying Analyzing Hours 6
CO1 CO2 CO3 Modu	Explain devices. Choose t application Analyze location of Ile Intro The c powe comp Thyri (UPF Station	necessity, oper he suitable FAC on. the characteris of the controller duction concept of flexil r transmission 1 ensation. Overv stor Switched S C) - Integrated 1 c VAR Comper	Ts device/controlle Ts device/controlle tics of FACTs C on Power System. Module (ble AC transmissic ines -uncompensat iew of FACTS dev Series capacitor (T Power Flow Control Isator (SVC) and .	and benefits of FACTs er for particular controllers and effect of Contents on - reactive power contro ted transmission line - ser vices - Static Var Compens CSC) - Unified Power Fle oller (IPFC). Applications	II III IV l in electrical ies and shunt sator (SVC) - ow controller	Understandin g Applying Analyzing Hours 6
CO1 CO2 CO3 Modu	Explain devices. Choose t application Analyze location location Intro The c powe comp Thyri (UPF) Station Volta influe	he suitable FAC on. the characteris of the controller duction concept of flexil r transmission 1 ensation. Overv stor Switched S C) - Integrated 1 c VAR Comper ge control by S	Ts device/controlle Ts device/controlle tics of FACTs C on Power System. Module ble AC transmissic ines -uncompensat iew of FACTS dev Series capacitor (T Power Flow Control sator (SVC) and SVC - advantages system voltage A	and benefits of FACTs er for particular controllers and effect of Contents on - reactive power contro- ted transmission line - ser- vices - Static Var Compen- CSC) - Unified Power Flo- bller (IPFC). Applications of slope in dynamic cha	II III IV I in electrical ies and shunt sator (SVC) - ow controller aracteristics - t of transient	Understandin g Applying Analyzing Hours 6
CO1 CO2 CO3 Modu I II	Explain devices. Choose t application Analyze location Ile Intro The c powe comp Thyri (UPF Station Volta influe stabil	necessity, open he suitable FAC on. the characterist of the controller duction concept of flexil r transmission 1 ensation. Overv stor Switched S C) - Integrated 1 c VAR Comper ge control by S ence of SVC on ity - steady state	Ts device/controlle Ts device/controlle tics of FACTs C on Power System. Module ble AC transmissic ines -uncompensat iew of FACTS devices Series capacitor (T Power Flow Control sator (SVC) and SVC - advantages system voltage. A power transfer - e	and benefits of FACTs er for particular controllers and effect of Contents on - reactive power contro ted transmission line - ser vices - Static Var Compens CSC) - Unified Power Fle oller (IPFC). Applications of slope in dynamic cha applications - enhancement nhancement of power syste	II III IV I in electrical ies and shunt sator (SVC) - ow controller aracteristics - it of transient em damping -	Understandin g Applying Analyzing Hours 6
CO1 CO2 CO3 Modu I	Explain devices. Choose t application Analyze location Ile Intro The c powe comp Thyri (UPF Station Volta influe stabil preve	he suitable FAC on. the characteris of the controller duction concept of flexil r transmission 1 ensation. Overv stor Switched S C) - Integrated 1 c VAR Comper ge control by S ence of SVC on ity - steady state ntion of voltage	Ts device/controlle tics of FACTs C on Power System. Module ble AC transmissic ines -uncompensat iew of FACTS dev Series capacitor (T Power Flow Control sator (SVC) and SVC - advantages system voltage. A power transfer - en instability.	and benefits of FACTs er for particular controllers and effect of Contents on - reactive power control ted transmission line - ser vices - Static Var Compens CSC) - Unified Power Fle oller (IPFC). Applications of slope in dynamic char applications - enhancement nhancement of power syste	II III IV I in electrical ies and shunt sator (SVC) - ow controller aracteristics - it of transient em damping -	Understandin g Applying Analyzing Hours 6
CO1 CO2 CO3 Modu I II	Explain devices. Choose t application Analyze location of Ile Intro The c powe comp Thyri (UPF Station Volta influe stabil preve	he suitable FAC on. the characteris of the controller duction concept of flexil r transmission 1 ensation. Overv stor Switched S C) - Integrated 1 c VAR Comper ge control by S ence of SVC on ity - steady state ntion of voltage istor Controlled	Ts device/controlle Ts device/controlle tics of FACTs C on Power System. Module ble AC transmissic ines -uncompensat iew of FACTS devices Series capacitor (T Power Flow Control sator (SVC) and SVC - advantages system voltage. A power transfer - e instability. d Series Capacitor	and benefits of FACTs er for particular controllers and effect of Contents on - reactive power contro ted transmission line - ser- vices - Static Var Compens CSC) - Unified Power Fle oller (IPFC). Applications of slope in dynamic cha applications - enhancement nhancement of power system r (TCSC) and Application	II III IV I in electrical ies and shunt sator (SVC) - ow controller aracteristics - it of transient em damping - ns	Understandin g Applying Analyzing Hours 6 6
CO1 CO2 CO3 Modu I II	Explain devices. Choose t application Analyze location of the powe comp Thyri (UPF Station Volta influe stabil preve Thyri Opera	he suitable FAC on. the characteris of the controller duction concept of flexil r transmission 1 ensation. Overv stor Switched S C) - Integrated 1 c VAR Comper ge control by S ence of SVC on ity - steady state ntion of voltage ation of the TCS	Ts device/controlle Ts device/controlle tics of FACTs C on Power System. Module ble AC transmission ines -uncompensative iew of FACTS devices Series capacitor (T Power Flow Control sator (SVC) and a SVC - advantages system voltage. A power transfer - e instability. d Series Capacitor SC - different mod	and benefits of FACTs er for particular controllers and effect of Contents on - reactive power contro ted transmission line - ser vices - Static Var Compens CSC) - Unified Power Fle oller (IPFC). Applications of slope in dynamic cha applications - enhancement nhancement of power system r (TCSC) and Application les of operation - modellin	II III IV I in electrical ies and shunt sator (SVC) - ow controller aracteristics - it of transient em damping - ns ng of TCSC -	Understandin g Applying Analyzing 6 6
CO1 CO2 CO3 Modu I II	Explain devices. Choose t application Analyze location of Ile Intro The c powe comp Thyri (UPF Station Volta influe stabil preve Thyr Opera varial	he suitable FAC on. the characteris of the controller duction concept of flexil r transmission 1 ensation. Overv stor Switched S C) - Integrated 1 c VAR Comper ge control by S cnce of SVC on ity - steady state ntion of voltage istor Controller ation of the TCS	Ts device/controlle Ts device/controlle tics of FACTs C on Power System. Module ble AC transmissic ines -uncompensat iew of FACTS dev Series capacitor (T Power Flow Control sator (SVC) and SVC - advantages system voltage. A power transfer - e instability. d Series Capaciton SC - different mod nodel - modelling	and benefits of FACTs er for particular controllers and effect of Contents on - reactive power contro- ted transmission line - ser- vices - Static Var Compen- CSC) - Unified Power Fle- oller (IPFC). Applications of slope in dynamic char applications - enhancement nhancement of power system r (TCSC) and Application les of operation - modelling for stability studies. A	II III IV I in electrical ies and shunt sator (SVC) - ow controller aracteristics - it of transient em damping - ng of TCSC - pplications -	Understandin g Applying Analyzing Hours 6 6
CO1 CO2 CO3 Modu I II	Explain devices. Choose t application Analyze location of Ile Intro The c powe comp Thyri (UPF Station Volta influe stabil preve Volta influe stabil preve	necessity, open he suitable FAC on. the characterist of the controller duction concept of flexil r transmission 1 ensation. Overvistor Switched S C) - Integrated 1 c VAR Comper ge control by S ence of SVC on ity - steady state ntion of voltage istor Controlled ation of the TCS oble reactance in ovement of the s	Ts device/controlle Ts device/controlle tics of FACTs C on Power System. Module ble AC transmissic ines -uncompensat iew of FACTS devices Series capacitor (T Power Flow Control sator (SVC) and SVC - advantages system voltage. A power transfer - et instability. d Series Capacitor SC - different mod nodel - modelling system stability lin	and benefits of FACTs er for particular controllers and effect of Contents on - reactive power contro ted transmission line - ser- vices - Static Var Compens CSC) - Unified Power Fle oller (IPFC). Applications of slope in dynamic char applications - enhancement nhancement of power syste r (TCSC) and Application les of operation - modellir g for stability studies. A nit - enhancement of syste	II III IV I in electrical ies and shunt sator (SVC) - ow controller aracteristics - it of transient em damping - ms ng of TCSC - pplications - em damping -	Understandin g Applying Analyzing Hours 6 6
CO1 CO2 CO3 Modu I I II	Explain devices. Choose t application Analyze location of Ile Intro The c powe comp Thyri (UPF Station Volta influe stabil preve Thyr Opera varial improve	he suitable FAC on. the characteris of the controller duction concept of flexil r transmission 1 ensation. Overv stor Switched S C) - Integrated 1 c VAR Comper ge control by S once of SVC on ity - steady state ntion of voltage istor Controller ation of the TCS ole reactance movement of the s ge collapse prev	Ts device/controlle Ts device/controlle tics of FACTs C on Power System. Module (ble AC transmissic ines -uncompensat iew of FACTS device Series capacitor (T Power Flow Control sator (SVC) and SVC - advantages system voltage. A power transfer - e instability. d Series Capaciton SC - different mod nodel - modelling system stability lin ention.	and benefits of FACTs er for particular controllers and effect of Contents on - reactive power control ted transmission line - ser vices - Static Var Compens CSC) - Unified Power Fle oller (IPFC). Applications of slope in dynamic cha applications - enhancement nhancement of power system r (TCSC) and Application les of operation - modelling for stability studies. A nit - enhancement of system	II III IV I in electrical ies and shunt sator (SVC) - ow controller aracteristics - it of transient em damping - mg of TCSC - pplications - em damping -	Understandin g Applying Analyzing 6 6 6
CO1 CO2 CO3 Modu I II III	Explain devices.Choose t applicationAnalyze locationlocationlocationIdeIntro The c powe comp Thyri (UPFStationVolta influe stabil preveThyr Opera varial impro- volta EmeiEmei Station	he suitable FAC on. the characteris of the controller duction oncept of flexil r transmission 1 ensation. Overv stor Switched S C) - Integrated 1 c VAR Comper ge control by S ence of SVC on ity - steady state ntion of voltage istor Controlled ation of the TCS ole reactance in ovement of the s ge collapse prev rging FACTS C	Ts device/controlle Ts device/controlle tics of FACTs C on Power System. Module ble AC transmissic ines -uncompensative iew of FACTS devices Series capacitor (Trest Power Flow Control sator (SVC) and SVC - advantages system voltage. A power transfer - et instability. d Series Capacitor SC - different mod nodel - modelling system stability lin ention. Compensator (ST	and benefits of FACTs er for particular controllers and effect of Contents on - reactive power contro- ted transmission line - ser- vices - Static Var Compen- CSC) - Unified Power Fle- oller (IPFC). Applications of slope in dynamic char applications - enhancement nhancement of power system r (TCSC) and Application les of operation - modelling of stability studies. A nit - enhancement of system CATCOM) - operating p	II III IV I v I in electrical ies and shunt sator (SVC) - ow controller aracteristics - it of transient em damping - ms og of TCSC - pplications - em damping -	Understandin g Applying Analyzing Hours 6 6 6

V	Emerging FACTS Controllers II Unified Power Flow Controller (UPFC) - Principle of operation - modes of operation -applications - modeling of UPFC for power flow studies	6
VI	Co-Ordination of FACTS Controllers FACTs Controller interactions - SVC-SVC interaction - co-ordination of multiple controllers using linear control techniques - Quantitative treatment of control.	6
	Textbooks	
1	R. Mohan Mathur, Rajiv. K. Varma, "Thyristor - Based Facts Controllers Transmission Systems", IEEE press and John Wiley & Sons Inc., 2002.	for Electrical
	References	
1	Purkait and Bandyopadhyay " <i>Electrical Machines</i> ", Oxford University Press, 1st A.T. John, "Flexible AC Transmission System", Institution of Electrical a Engineers (IEEE), 1999.	t Edition, 2017 and Electronic
2	Narain G.Hingorani, Laszio. Gyugyl, "Understanding FACTS Concepts and Tech Flexible AC Transmission System", Standard Publishers, Delhi, 2001.	nology of
	Useful Links	
1	https://nptel.ac.in/courses/108/107/108107114/	

CO-PO Mapping								
Programme Outcomes (PO)								
	1	2	3	4	5	6		
CO1			1					
CO2				2				
CO3						2		
The strength of may	The strength of mapping is to be written as 1: Low, 2: Medium, 3: High							
Each CO of the cou	rse must map t	o at least one H	20.					

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

		Walc	hand College	of Engineering,	San	gli			
	(Government Aided Autonomous Institute)								
			AYZ	2022-23					
	Course Information								
Progra	rogrammeM. Tech. (Power System Engineering)								
Class,	Semester		First Year M.Tec	h., Sem I					
Cours	e Code		6PS547						
Cours	e Name		Research Method	ology for Power Sys	tem E	ngineers			
Desire	d Requisi	tes:	None						
			·						
	Teaching	Scheme		Examination Sch	neme ((Marks)			
Practi	cal		MSE	ISE]	ESE	Total		
Intera	ction	2 Hrs/week	30	30		40	100		
				Credit	s: 2				
			1						
			Course	Objectives					
	To devel	on a research or	ientation among the	e students and to acc	uaint t	hem with fund	lamentals of		
1	research	methods	ientation annong un	students and to acq	uumi i				
2	To devel	op understandin	g of the basic frame	work of research pr	ocess	and technique	8		
3	To ident	ify various source	res of information f	or literature review a	and dat	a collection	5		
4	To devel	on an understan	ding of the ethical of	limensions of condu	cting a	nplied researc	`h		
5	To devel	op understandin	σ about natent proc	ess	eting e	ippiled leseure			
	10 40 101	Course	Outcomes (CO) w	ith Bloom's Taxon	mv L	evel			
At the	end of the	course the stud	ents will be able to		, my 11				
		••••••••••••••••		,		Bloom's	Bloom's		
СО		Cours	se Outcome Staten	nent/s		Taxonomy	Taxonomy		
						Level	Description		
C01	Classify	various methods	to solve research p	oroblem.		III	Applying		
CO2	Construc	t a research prol	olem in respective e	ngineering domain.		III	Applying		
CO3	Investiga	te various data a	analysis techniques	for a research proble	em.	IV	Analyzing		
CO4	Identify	various Intellect	ual Property Rights	procedures		III	Applying		
			÷ ÷	<u> </u>					
Modu	le		Module (Contents			Hours		
	Rese	arch Fundamei	ntals						
I	What	is research, typ	es of research, the	process of research	, Liter	ature survey	4		
	and r	eview, Formulat	ion of a research pi	oblem.		•			
	Rese	arch Methods		and review, Formulation of a research problem.					
п	Rese	1 1							
11	110.50	arch design- N	leaning, Need an	d Types, Research	Desi	gn Process,	5		
	Meas	arch design- Notes and sciences	feaning, Need an aling techniques,	d Types, Research Data Collection - c	Desi	gn Process, t, types and	5		
	Meas	arch design- No surement and sc ods, Processing	feaning, Need an aling techniques, and analysis of data	d Types, Research Data Collection - c , Design of Experim	Desi concep ient	gn Process, t, types and	5		
	Meas meth	arch design- M surement and sc ods, Processing ysis Techniques	feaning, Need an caling techniques, and analysis of data	d Types, Research Data Collection - c a, Design of Experim	Desi concep tent	gn Process, t, types and	5		
	Meas meth Quan	arch design- we surement and sc ods, Processing ysis Techniques titative Techniq	feaning, Need an ealing techniques, and analysis of data s ues, Sampling fund	d Types, Research Data Collection - c a, Design of Experim lamentals, Testing o	Desi concep tent f hypo	gn Process, t, types and	5		
III	Meas meth Anal Quan vario	arch design- we surement and sc ods, Processing ysis Techniques titative Techniq us tests like Mul	feaning, Need an caling techniques, and analysis of data s ues, Sampling fund tivariate analysis, U	d Types, Research Data Collection - c a, Design of Experim damentals, Testing of Use of standard statist	Desi concep tent of hypo ical so	gn Process, t, types and othesis using ftware, Data	5		
III	Meas meth Anal Quan vario proce	arch design- M surement and sc ods, Processing ysis Techniques titative Techniq us tests like Mul essing, Prelimina	Ieaning, Need an caling techniques, and analysis of data ues, Sampling func- tivariate analysis, U ary data analysis a	d Types, Research Data Collection - c a, Design of Experim lamentals, Testing of Use of standard statist and interpretation, U	Desi concep nent of hypo ical so Jni-van	gn Process, t, types and othesis using oftware, Data riate and bi-	5		
III	Meas meth Anal Quan vario proce varia	arch design- we purement and sc ods, Processing ysis Techniques titative Techniq us tests like Mul essing, Prelimina te analysis of da	feaning, Need an valing techniques, and analysis of data ues, Sampling func- tivariate analysis, U ary data analysis a ta, testing of hypoth	d Types, Research Data Collection - c a, Design of Experim damentals, Testing of Use of standard statist and interpretation, Uneses.	Desi concep ient if hypo ical so Jni-van	gn Process, t, types and othesis using oftware, Data riate and bi-	5		
III	Meas meth Anal Quan vario proce varia Rese	arch design- M purement and sc ods, Processing ysis Techniques titative Techniq us tests like Mul essing, Prelimina te analysis of da arch Communi	feaning, Need an ealing techniques, and analysis of data ues, Sampling fund tivariate analysis, U ary data analysis a ta, testing of hypoth cation	d Types, Research Data Collection - c a, Design of Experim damentals, Testing of Use of standard statist and interpretation, Uneses.	Desi concep eent f hypo ical so Jni-van	gn Process, t, types and othesis using oftware, Data riate and bi-	5		
III IV	Meas meth Anal Quan vario proce varia Rese Writi	arch design- we surement and sc ods, Processing ysis Techniques titative Techniq us tests like Mul essing, Prelimina te analysis of da arch Communi ng a conference	feaning, Need an caling techniques, and analysis of data ues, Sampling func- tivariate analysis, U ary data analysis a ta, testing of hypoth cation paper, Journal Pap	d Types, Research Data Collection - c , Design of Experim lamentals, Testing o Use of standard statist and interpretation, U neses. er, Technical report,	Desi concep lent of hypo lical so Uni-van disser	gn Process, t, types and othesis using ftware, Data tiate and bi-	5		
III IV	Meas meth Anal Quan vario proce varia Rese Writi writi	arch design- W surement and sc ods, Processing ysis Techniques titative Techniq us tests like Mul essing, Prelimina te analysis of da arch Communi ng a conference ng. Presentation	feaning, Need an valing techniques, and analysis of data ues, Sampling func- tivariate analysis, U ary data analysis a ta, testing of hypoth cation paper, Journal Pap techniques, software	d Types, Research Data Collection - c , Design of Experim lamentals, Testing of Use of standard statist and interpretation, Uneses. er, Technical report, vare used for report	Desi concep ient f hypo ical so Jni-van dissen t writ	gn Process, t, types and othesis using oftware, Data riate and bi- rtation/thesis ing such as	5		
III IV	Meas meth Anal Quan vario proce varia Rese Writi writin WOF	arch design- M nurement and sc ods, Processing ysis Techniques titative Techniq us tests like Mul essing, Prelimina te analysis of da arch Communi ng a conference ng. Presentation RD, Latex etc. Ty here Present	feaning, Need an saling techniques, and analysis of data ues, Sampling func- tivariate analysis, U ary data analysis a ta, testing of hypoth cation paper, Journal Pap techniques, softw ypes of journal/con-	d Types, Research Data Collection - c a, Design of Experim damentals, Testing of lse of standard statist and interpretation, Uneses. er, Technical report, vare used for report ference papers.	Desi concep ient f hypo ical sc Jni-van dissen t writ	gn Process, t, types and othesis using oftware, Data riate and bi- rtation/thesis ing such as	5		
III IV	Meas meth Anal Quan vario proce varia Rese Writi writi WOF Intel	arch design- M ourement and sc ods, Processing ysis Techniques titative Techniq us tests like Mul essing, Prelimina te analysis of da arch Communi ng a conference ng. Presentation CD, Latex etc. Ty lectual Propert	Ieaning, Need an caling techniques, and analysis of data ues, Sampling func- tivariate analysis, U ary data analysis a ta, testing of hypoth cation paper, Journal Pap techniques, softw ypes of journal/com y Rights	d Types, Research Data Collection - c a, Design of Experim damentals, Testing o Use of standard statist and interpretation, U neses. er, Technical report, vare used for report ference papers.	Desi concep ient of hypo ical sc Jni-van dissen t writ	gn Process, t, types and othesis using ftware, Data tiate and bi- rtation/thesis ing such as	5 4		
III IV	Meas meth Anal Quan vario proce varia Rese Writi writin WOF Intel Natur	arch design- W surement and sc ods, Processing ysis Techniques titative Techniq us tests like Mul essing, Prelimina te analysis of da arch Communi ng a conference ng. Presentation RD, Latex etc. Ty lectual Property	Ieaning, Need an caling techniques, and analysis of data ues, Sampling func- tivariate analysis, U ary data analysis a ta, testing of hypotl cation paper, Journal Pap techniques, softw ypes of journal/com y Rights Property: Patents,	d Types, Research Data Collection - c , Design of Experim lamentals, Testing of Use of standard statist and interpretation, Uneses. er, Technical report, vare used for report ference papers.	Desi concep ent f hypo ical so Jni-van disser t writ	gn Process, t, types and othesis using ftware, Data tiate and bi- rtation/thesis ing such as	5		
III IV V	Meas meth Anal Quan vario proce varia Rese Writi writi WOF Intel Natur of Pa	arch design- W surement and sc ods, Processing ysis Techniques titative Techniq us tests like Mul essing, Prelimina te analysis of da arch Communi ng a conference ng. Presentation RD, Latex etc. Ty lectual Propert re of Intellectual itenting and Dev	Ieaning, Need an valing techniques, and analysis of data ues, Sampling func- tivariate analysis, U ary data analysis a ta, testing of hypoth cation paper, Journal Pap techniques, softw ypes of journal/com y Rights Property: Patents, yelopment: technol	d Types, Research Data Collection - c , Design of Experim lamentals, Testing of Use of standard statist and interpretation, Uneses. er, Technical report, vare used for report ference papers. Designs, Trade and ogical research, inner	Desi concep ent f hypo ical so Uni-var disser t writ Copyriovatio	gn Process, t, types and othesis using oftware, Data riate and bi- rtation/thesis ing such as ight. Process n, patenting,	5 4 5		
III IV V	Meas meth Anal Quan vario proce varia Rese Writi writi WOF Intel Natur of Pa devel	arch design- W purement and sc ods, Processing ysis Techniques titative Techniques titative Techniques titative Techniques us tests like Mul essing, Prelimina te analysis of da arch Communi ng a conference ng. Presentation RD, Latex etc. Ty lectual Property re of Intellectual tenting and Dev opment. Interna	Ieaning, Need an ealing techniques, and analysis of data ues, Sampling func- tivariate analysis, U ary data analysis a ta, testing of hypoth cation paper, Journal Pap techniques, softw ypes of journal/com y Rights Property: Patents, velopment: technol tional Scenario: In	d Types, Research Data Collection - c , Design of Experim damentals, Testing of lse of standard statist and interpretation, Uneses. er, Technical report, vare used for report ference papers. Designs, Trade and Cogical research, inne- ternational cooperat	Desi concep ient f hypo ical sc Jni-van dissen t writ Copyri ovatio ion or	gn Process, t, types and othesis using ftware, Data riate and bi- rtation/thesis ing such as ight. Process n, patenting, intellectual	5 5 4 5		

VI	Patents and Patenting ProceduresPatent Rights: Scope of Patent Rights. Licensing and transfer of technology.Patent information and databases. Geographical Indications. NewDevelopments in IPR: Administration of Patent System. New developments inIPR; IPR of Biological Systems, Computer Software etc. Traditional knowledgeCase Studies, IPR and IITs	4
	Textbooks	
1	C. R. Kothari, Research Methodology, New Age international	
2	Deepak Chopra and Neena Sondhi, Research Methodology: Concepts and Publishing House, New Delhi	cases, Vikas
	References	
1	E. Philip and Derek Pugh, How to get a Ph. D a handbook for students and the open university press	eir supervisors,
2	Stuart Melville and Wayne Goddard, Research Methodology: An Introduction fo Engineering Students	r Science &
	Useful Links	
1	NPTEL Lectures	

CO-PO Mapping								
Programme Outcomes (PO)								
	1	2	3	4	5	6		
CO1	2		1					
CO2					2	2		
CO3				2				
CO4		2						
The strength of map	The strength of mapping is to be written as 1: Low, 2: Medium, 3: High							

		Assessment					
There are three components of lab assessment, LA1, LA2 and Lab ESE.							
IMP: Lab ESE	is a separate head	of passing (min 40 %), LA	1+LA2 should be min 40%				
Assessment	Based on	Conducted by	Typical Schedule	Marks			
	Lab activities,		During Week 1 to Week 8				
LA1	attendance,	Lab Course Faculty	Marks Submission at the end of	30			
	journal		Week 8				
	Lab activities,		During Week 9 to Week 16				
LA2	attendance,	Lab Course Faculty	Marks Submission at the end of	30			
	journal		Week 16				
	Lab activities,	Lab Course Faculty and	During Week 18 to Week 19				
Lab ESE	journal/	External Examiner as	Marks Submission at the end of	40			
	performance	applicable	Week 19				
Week 1 indicat	es starting week o	f a semester. Lab activities/	Lab performance shall include perfo	rming			

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.

		Wal	chand College	e of Engineerin	ng, Sang	gli		
	AY 2022-23							
Course Information								
Programme M.Tech. (Power System Engineering)								
Class,	Semester		First Year M. Tec	ch., Sem I				
Cours	e Code		6PS545					
Cours	e Name		Digital Protection	of Power System	Laboratory	у		
Desire	d Requisi	tes:	Digital Protection	of Power System				
	Teaching	Scheme		Examination	Scheme (1	Marks)		
Practi	cal	2 Hrs/ Week	LA1	LA2	Lab F	ESE		Total
Intera	ction		30	30	40)		100
				Cre	dits: 1			
			Course	o Obiostinos				
1	To doval	on analytical sk	Cours	nd halm to avaluate	modorn r	oloving r	rooti	200
1	To enabl	e the student to	develop protective	relaying concepts	modern n as well as	provide a	an on	portunity for
2	designin	g relaying hardv	vare and software.	relaying concepts a	is well as		un opj	portunity for
		Course	e Outcomes (CO)	with Bloom's Tax	onomy Le	evel		
At the	end of the	course, the stud	lents will be able to),				
СО		Cou	rse Outcome State	ement/s		Bloom Taxono Leve	n's omy el	Bloom's Taxonomy Description
CO1	Demonst	rate the operation	on of electromagne	tic & digital relays.		III		Applying
CO2	Test digi	tal relays to ver	fy the operating ch	naracteristics.		IV &	V	Analyzing & Evaluating
CO3	Design h group tas	ardware and co	mpile programs for	r simple digital rela	ays, as a	VI		Creating
. .	•••		List of Experiment	ts / Lab Activities/	Topics			
Lab ac visit, la per nat	ab experin ture and re	rformance shall nent, tutorials, as quirement of lab	ssignments, group o course.	ct, presentations, di discussion, progran	awings, ca iming, and	ase study d other si	, repo uitable	e activities as
			Те	extbooks				
1	Badri	Ram, D.N. Vis	hwakarma, "Power	System Protection	and Swite	chgear",	TMH	, 2004.
			Re	eferences				
1	PRD	C Relay user ma	inuals					
$\frac{2}{2}$	Mi-P	ower user manu	als	1 min C D	····· · · · · · · · · · · · · · · · ·	X7:1 - T	1. 1	
	A.G.	Phadke, J.S. Th	orp, <i>Computer Re</i>	elaying for Power S	ystems",	wiley In	a1a, 11	Ed1., 2012.
			Use	aful Links				
1	https	//nptel.ac.in/cou	Ust urses/108/107/1081	07167/				
2	https://	//nptel.ac.in/cou	urses/108/105/1081	05167/				

CO-PO Mapping								
Programme Outcomes (PO)								
	1	2	3	4	5	6		
CO1			3					
CO2				2	2			
CO3		2				2		
The strength of map	oping is to be w	vritten as 1: Lo	w, 2: Medium,	3: High	·	·		
Each CO of the cou	rse must map t	o at least one I	PO.					

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

		Wal	chand Colleg (Government Aid	e of Engineer ded Autonomous Ins	i ng, San	ıgli	
			AY	Y 2022-23			
			Cours	e Information			
Progra	amme		M.Tech. (Power	System Engineerin	ng)		
Class,	Semester		First Year M. Te	ch., Sem I			
Cours	e Code		6PS546				
Cours	e Name		Application of Po	ower Electronics to	Power S	ystem Labora	tory
Desire	d Requisi	ites:	Power System Er	ngineering, Power	Electronic	es	
r	D 1 •	<u> </u>			C 1		
Draati	l eaching	Scheme	T A 1	Examination	Scheme	(Marks)	Total
Practi		2 Hrs/ week		LA2		ESE	100
Intera	cuon			<u> </u>	4	0	100
					euns: 1		
			Cour	se Objectives			
	To make	students under	stand concept of E	ACTs envisages th	e use of p	ower electror	uics to improve
1	system o	peration by fast	& reliable control	······································			
2	To cover FACTs o	concepts of FA controllers.	CTs including the	description, princ	iple of wo	rking and ana	llysis of various
3	To stren	gthen the contro	ol of FACTs and sy	stem interactions.			
		Cours	e Outcomes (CO)	with Bloom's Ta	xonomy I	Level	
At the	end of the	course, the stud	dents will be able t	0,			1
СО		Cou	rse Outcome State	ement/s		Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Simulati modellin	on of various l lg.	FACTs devices to	o understand princ	ciple and	II	Understanding
CO2	Choose applicati	the suitable on.	FACTs device/	controller for j	particular	III	Applying
CO3	Analyze location	the characteri of the controller	stics of FACTs r on Power System	Controllers and	effect of	IV	Analyzing
]	List of Experimen	nts / Lab Activitie	s/Topics		
Lab ac visit, la per nat	tivities/pe ab experin ture and re	rformance shall nent, tutorials, a quirement of la	include mini proje ssignments, group b course	ect, presentations, discussion, progra	drawings, umming, au	case study, re nd other suita	port writing, site ble activities as
		E 1 3 E 4	T	extbooks			
1	R. N	Iohan Mathur, smission System	Rajıv. K. Varma ns", IEEE press and	a, "Thyristor - I d John Wiley & So	Based Fac	ots Controlle	rs for Electrical
		Y 1 ((17)) -1 1	R	eferences	0.51		
1	A. T. (IEE	John, "Flexible E), 1999.	e AC Transmission	<i>System"</i> , Instituti	on of Elec	trical and Ele	ctronic Engineers
2	Narai Flexi	in G. Hingoran ble AC Transmi	i, Laszio. Gyugy Sission System", Sta	l, "Understanding undard Publishers,	g <i>FACTS</i> Delhi, 200	Concepts and 01.	d Technology of
			Us	eful Links			
1							

		CO-	PO Mapping			
		Program	me Outcomes	(PO)		
	1	2	3	4	5	6
CO1			2			
CO2				2		
CO3						2
TT11 C		· 1 T	0.16.1	A TT' 1		

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.

		Assessment		
There are three	components of la	b assessment, LA1, LA2 ar	nd Lab ESE.	
IMP: Lab ESE	is a separate head	of passing.(min 40 %), LA	1+LA2 should be min 40%	
Assessment	Based on	Conducted by	Typical Schedule	Marks
	Lab activities,		During Week 1 to Week 8	
LA1	attendance,	Lab Course Faculty	Marks Submission at the end of	30
	journal		Week 8	
	Lab activities,		During Week 9 to Week 16	
LA2	attendance,	Lab Course Faculty	Marks Submission at the end of	30
	journal		Week 16	
	Lab activities,	Lab Course Faculty and	During Week 18 to Week 19	
Lab ESE	journal/	External Examiner as	Marks Submission at the end of	40
	performance	applicable	Week 19	
Week 1 indicat	es starting week o	f a semester. Lab activities/	Lab performance shall include perfo	rming
experiments, m	ini-project, preser	ntations, drawings, program	ming, and other suitable activities, a	s per the
nature and requ	irement of the lab	course. The experimental	lab shall have typically 8-10 experim	nents and
related activitie	es if any.			

		Wal	chand College (Government Aid	e of Engineeri led Autonomous Insti	ng, San	gli	
			AY	Y 2022-23	,		
			Cours	e Information			
Progra	amme		M. Tech. (Power	System Engineerin	ng)		
Class,	Semester		First Year M. Teo	ch., Sem I			
Cours	e Code		6PS551				
Cours	e Name		Presentation and	Technical Report V	Vriting		
Desire	d Requisi	tes:	None				
	Teaching	Scheme		Examination	Scheme ((Marks)	
Practi	cal		LA1	LA2	Lab I	ESE	Total
Intera	ction	1 Hrs/ Week	30	30	40)	100
				Cre	edits: 1		
			C				
1	Tomori	4	Cours	se Objectives			
1	To provi	ue an opportuni	inking process in t	work independent	y on a top	DIC.	
3	To enabl	e student for go	od technical report	writing and effect	ive presen	itations	
	10 chiaol	Cours	e Outcomes (CO)	with Bloom's Tax	konomy L	evel	
At the	end of the	course, the stud	dents will be able to	0,	v		
со		Cou	rse Outcome State	ement/s		Bloom' Taxonor Level	s Bloom's ny Taxonomy Description
CO1	Demonst	rate the charact	eristics of technica	l and business writ	ing.	III	Applying
CO2	Produce	documents relat	ted to technology a	nd writing in the wo	orkplace		
	and will accuratel	have improved y.	their ability to w	rite clearly, concis	ely, and	VI	Creating
CO3	Use a va	riety of materia nents, such as in	ils to produce appr nstructions, descrip	copriate visual pres ptions, and research	entation reports.	V	Evaluating
]	List of Experimen	ts / Lab Activities	/Topics		
This c to sup proces This c ready.	course intropolement sses, and v course is d	oduces studen text, workpl writing reports lesigned for stu	ats to the disciplin ace communicat are the major top udents enrolled ir	ne of technical co tion, descriptions pics included. n technical degree	mmunica s of me program	ation. Prej chanisms as for mal	paration of visuals explanations of ting them industry
			Т	extbooks			
1	Suita	ble books based	T l on the contents of	extbooks the topic.			
1	Suita	ble books based	T on the contents of	extbooks The topic.			
1	Suita	ble books based	T l on the contents of R	extbooks The topic. eferences		1 2	
1	Suita Suita and in	ble books based ble books based nternational jou	T l on the contents of R on the contents of rnals and conference	extbooks the topic. eferences the selected topic and ces.	nd researc	h papers fi	om reputed national
1	Suita Suita and in	ble books based ble books based nternational jou	T l on the contents of R on the contents of rnals and conference	extbooks the topic. eferences the selected topic and ces. eful Links	nd researc	h papers fi	om reputed national
1	Suital Suital and in	ble books based ble books based iternational jou	T l on the contents of R on the contents of rnals and conference Us e topic of report or	extbooks The topic. eferences the selected topic and ces. eful Links ad presentation	nd researc	h papers fr	om reputed national

		CO-	PO Mapping			
		Program	ne Outcomes	(PO)		
	1	2	3	4	5	6
CO1		3				
CO2		2		1		
CO3		1				2
	• • • •	· 1 T	A A C 1 ¹	A TT' 1		

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.

		Assessment		
There are three	components of la	b assessment, LA1, LA2 ar	nd Lab ESE.	
IMP: Lab ESE	is a separate head	of passing.(min 40 %), LA	1+LA2 should be min 40%	
Assessment	Based on	Conducted by	Typical Schedule	Marks
	Lab activities,		During Week 1 to Week 8	
LA1	attendance,	Lab Course Faculty	Marks Submission at the end of	30
	journal		Week 8	
	Lab activities,		During Week 9 to Week 16	
LA2	attendance,	Lab Course Faculty	Marks Submission at the end of	30
	journal		Week 16	
	Lab activities,	Lab Course Faculty and	During Week 18 to Week 19	
Lab ESE	journal/	External Examiner as	Marks Submission at the end of	40
	performance	applicable	Week 19	
Week 1 indicat	es starting week o	f a semester. Lab activities/	Lab performance shall include perfo	rming
experiments, m	ini-project, preser	ntations, drawings, program	ming, and other suitable activities, a	s per the
nature and requ	irement of the lab	course. The experimental	lab shall have typically 8-10 experim	nents and
related activitie	es if any.			

		Wal	Ichand College (Government Aid	e of Engineerii led Autonomous Insti	ng, Sang	gli	
			AY	Y 2022-23			
			Cours	e Information			
Progra	amme		M.Tech. (Power	System Engineering	g)		
Class,	Semester		First Year M. Te	ch., Sem I			
Cours	e Code		6PS552				
Cours	e Name		Professional Skil	ls 1			
Desire	d Requisi	tes:	None				
r	Teaching	Scheme		Examination	Scheme (Marks)	
Practi	cal		LA1	LA2	Lab F	ESE	Total
Intera	ction	1 Hr/ Week	30	30	40		100
				Cre	edits: 1		
			Cour	se Objectives			
1	To provi	de a hands-on e	xperience of softw	are in solving comp	plex Elect	rical Engineer	ing problems.
2	To enhar	ice the employa	bility of Electrical	Engineering studer	nt.	_	
Atthe	and of the	Cours	e Outcomes (CO)	with Bloom's Tax	conomy L	evel	
At the	end of the	course, the stud	dents will be able t	0,		Bloom's	Bloom's
со		Cou	rse Outcome State	ement/s		Taxonomy	Taxonomy
						Level	Description
CO1	Use of th	e software rela	ted to Electrical Er	igineering effective	ly.	V	Evaluating
CO1 CO2	Use of th Develop software	the software related the solution	ted to Electrical Er for Electrical Er	ngineering effective ngineering problen	ly. n using	V VI	Evaluating Creating
CO1 CO2 CO3	Use of th Develop software Explain t	the software relation the solution the process of p	ted to Electrical Er for Electrical Er roblem-solving usi	ngineering effective ngineering problen ing computing tools	ly. n using s.	V VI II	Evaluating Creating Understanding
CO1 CO2 CO3	Use of th Develop software Explain t	the solution the solution the process of p	ted to Electrical Er for Electrical Er roblem-solving usi	ngineering effective ngineering problen ing computing tools	ly. n using 3.	V VI II	Evaluating Creating Understanding
CO1 CO2 CO3	Use of th Develop software Explain t	the solution the process of p	ted to Electrical Er for Electrical Er roblem-solving usi	ngineering effective ngineering problen ing computing tools nts / Lab Activities	ly. n using s. / Topics	V VI II	Evaluating Creating Understanding
CO1 CO2 CO3 This commoder on con fundam studen	Use of th Develop software Explain t ourse is ba n day work mputers. ' nentals and t can be en	the solution the solution the process of p used on comput c environment, to The Electrical d computer sof thanced by prov	ted to Electrical Er for Electrical Er roblem-solving usi List of Experimer ing as a tool to de the Electrical Engin Engineer must b tware proficiency viding software trai	ngineering effective ngineering problem ing computing tools ints / Lab Activities sign and analyze th neer should be able be highly compute is highly in demar ning.	ly. n using s. / Topics ne Electric to simulat er literate nd from in	V VI II al Engineerin e and solve co . The engine ndustry. Empl	Evaluating Creating Understanding g system. In the mplex problems eer with strong oyability of the
CO1 CO2 CO3 This co modern on co fundan studen	Use of th Develop software Explain t ourse is ba n day work mputers. ' nentals and t can be en	the solution the solution the process of p used on comput c environment, the The Electrical d computer sof thanced by prov	ted to Electrical Er for Electrical Er roblem-solving usi List of Experimer ing as a tool to dea the Electrical Engin Engineer must b tware proficiency viding software trai	ngineering effective ngineering problem ing computing tools ing computing tools is and analyze the neer should be able be highly compute is highly in deman ning.	ly. n using 3. / Topics ne Electric to simulat er literate nd from in	V VI II al Engineerin e and solve co . The engine ndustry. Empl	Evaluating Creating Understanding g system. In the mplex problems eer with strong oyability of the
CO1 CO2 CO3 This con moder on con fundant studen	Use of th Develop software Explain t ourse is ba n day work mputers. ' nentals an t can be en	the solution the solution the process of p used on comput c environment, the The Electrical d computer sof thanced by prov	ted to Electrical Er for Electrical Er roblem-solving usi List of Experimer ing as a tool to de the Electrical Engin Engineer must b tware proficiency viding software trai	ngineering effective ngineering problem ing computing tools ints / Lab Activities sign and analyze th neer should be able be highly compute is highly in demar ning.	ly. n using s. / Topics ne Electric to simulat er literate nd from in	V VI II al Engineerin e and solve co . The engine ndustry. Empl	Evaluating Creating Understanding g system. In the mplex problems eer with strong oyability of the
CO1 CO2 CO3 This con fundar studen	Use of th Develop software Explain t ourse is ba n day work mputers. ' nentals and t can be en	the solution the solution the process of p used on comput c environment, the The Electrical d computer soft thanced by prove	ted to Electrical Er for Electrical Er roblem-solving usi List of Experimen ing as a tool to dea the Electrical Engin Engineer must b tware proficiency viding software trai I on the contents of	ngineering effective ngineering problem ing computing tools ing computing tools is / Lab Activities sign and analyze th neer should be able be highly compute is highly in deman ning.	ly. n using 3. / Topics ne Electric to simulat er literate nd from in	V VI II al Engineerin e and solve co . The engine ndustry. Empl	Evaluating Creating Understanding g system. In the mplex problems eer with strong oyability of the
CO1 CO2 CO3 This co moder on co fundan studen	Use of th Develop software Explain t ourse is ba n day work mputers. ' nentals an t can be en	the solution the solution the process of p ased on comput c environment, the The Electrical d computer sof thanced by prove	ted to Electrical Er for Electrical Er roblem-solving usi List of Experimer ing as a tool to de the Electrical Engin Engineer must b tware proficiency /iding software trai I on the contents of	ngineering effective ngineering problem ing computing tools ing computing tools is / Lab Activities sign and analyze th neer should be able be highly compute is highly in deman ning.	ly. n using s. / Topics ne Electric to simulat er literate nd from in	V VI II al Engineerin e and solve co . The engine ndustry. Empl	Evaluating Creating Understanding g system. In the mplex problems eer with strong oyability of the
CO1 CO2 CO3 This con fundar studen	Use of th Develop software Explain t ourse is ba n day work mputers. ' nentals and t can be en Suital	the solution the solution the process of p used on comput c environment, the The Electrical d computer soft thanced by prove ble books based ble books based	ted to Electrical Er for Electrical Er roblem-solving usi List of Experimer ing as a tool to dea the Electrical Engin Engineer must b tware proficiency viding software trai I on the contents of R I on the contents of	ngineering effective ngineering problem ing computing tools ing computing tools is / Lab Activities sign and analyze the neer should be able be highly compute is highly in demar ning. Fextbooks f software selected f software selected	ly. n using s. / Topics le Electric to simulat er literate nd from in	V VI II al Engineerin e and solve co . The engine ndustry. Empl	Evaluating Creating Understanding g system. In the mplex problems eer with strong oyability of the
CO1 CO2 CO3 This con fundam studen	Use of th Develop software Explain t ourse is ba n day work mputers. ' nentals and t can be en Suital	the solution the solution the process of p used on comput c environment, t The Electrical d computer sof thanced by prov ble books based ble books based	ted to Electrical Er for Electrical Er roblem-solving usi List of Experimen ing as a tool to de the Electrical Engin Engineer must b tware proficiency /iding software trai I on the contents of R I on the contents of	ngineering effective ngineering problem ing computing tools ing computing tools is / Lab Activities sign and analyze th neer should be able be highly compute is highly in deman ning. *extbooks f software selected eferences f software selected	ly. n using 3. / Topics ne Electric to simulat er literate nd from in	V VI II al Engineerin e and solve co . The engine ndustry. Empl	Evaluating Creating Understanding g system. In the mplex problems eer with strong oyability of the
CO1 CO2 CO3 This co moder on co fundan studen	Use of th Develop software Explain t ourse is ba n day work mputers. ' nentals and t can be en Suital	the solution the solution the process of p used on comput a environment, the computer sof thanced by prove ble books based	ted to Electrical Er for Electrical Er roblem-solving usi List of Experimer ing as a tool to de the Electrical Engin Engineer must b tware proficiency /iding software trai I on the contents of R I on the contents of Us	ngineering effective ngineering problem ing computing tools ing computing tools is / Lab Activities sign and analyze th neer should be able be highly compute is highly in demar ning. Sextbooks F software selected eferences F software selected eful Links	ly. n using s. / Topics ne Electric to simulat er literate nd from in	V VI II al Engineerin e and solve co . The engine ndustry. Empl	Evaluating Creating Understanding g system. In the mplex problems eer with strong oyability of the

		CO	-PO Mapping			
		Program	me Outcomes	(PO)		
	1	2	3	4	5	6
CO1	2					
CO2			2			
CO3		3				1
The strength of map	pping is to be v	written as 1: Lo	w, 2: Medium,	3: High		

		Assassment		
		Assessment		
There are three	components of la	b assessment, LA1, LA2 ar	nd Lab ESE.	
IMP: Lab ESE	is a separate head	of passing.(min 40 %), LA	1+LA2 should be min 40%	
Assessment	Based on	Conducted by	Typical Schedule	Marks
	Lab activities,		During Week 1 to Week 8	
LA1	attendance,	Lab Course Faculty	Marks Submission at the end of	30
	journal		Week 8	
	Lab activities,		During Week 9 to Week 16	
LA2	attendance,	Lab Course Faculty	Marks Submission at the end of	30
	journal		Week 16	
	Lab activities,	Lab Course Faculty and	During Week 18 to Week 19	
Lab ESE	journal/	External Examiner as	Marks Submission at the end of	40
	performance	applicable	Week 19	
Week 1 indicate	es starting week o	f a semester. Lab activities/	Lab performance shall include perfo	rming
experiments, m	ini-project, presei	ntations, drawings, program	ming, and other suitable activities, a	s per the
nature and requ	irement of the lab	o course. The experimental	lab shall have typically 8-10 experim	ients and
related activitie	es if any.			

Professional Elective

		Walc	hand College	of Engineering, Sar	ngli	
			AY	2022-23		
			Course	Information		
Progre	amme		M Tech (Power	System Engineering)		
Class	Somostor		First Vear M Tec	ch Sem I		
Course	o Codo		6P\$511			
Cours	e Coue		Drofogional Elas	tive 1. Derver Appendix	Acdelling	
Cours		4	Professional Elec	cive 1: Power Apparatus r	Description	··· • • • • • • • • • • •
Desire	d Requisi	tes:	Power System Er	ngineering, A.C. Machines	s, Power Syste	m Analysis and
			Stability			
	Teaching	Scheme		Evamination Scheme	(Marks)	
Lectur	ro	3 Hrs/week	MSF	ISF	FSF	Total
Tutor		5 HIS/ WEEK	20	13E 20	ESE	100
Tutori	al	-	50		30	100
				Credits: 3		
			Course	Objectives		
	Toprovi	de the students t	he ability to under	stand the problem of stabil	ity of single m	achine
1	connecte	d to infinite bur	and multi machine	stand the problem of stabil	ity of single fi	
		the students a so	und mathematical	approach towards modelli	ng of various a	nnroach used
2	in nower	system	and mathematical (approach towards modelin		pprouen useu
	in power	Course	Outcomes (CO) w	vith Bloom's Taxonomy l	level	
At the	end of the	course, the stud	ents will be able to).		
				,	Bloom's	Bloom's
СО		Cours	se Outcome Stater	nent/s	Taxonomy	Taxonomy
					Level	Description
CO1	Construc	t models of app	aratus in power sys	stem.	III	Applying
CO2	Analyze	models for stabi	lity of power syste	ms.	IV	Analyzing
<u>CO3</u>	Recomm	end solutions to	the problem of po	wer system stability and		Evaluating
	control	iend solutions to	, the problem of pe	Jwer system stating and	V	Lvaluating
	control.					
Modu	le		Module (Contents		Hours
	Intro	duction to Pow	er System Stabilit	tv Problem		
T	Class	ification of stab	ility, resolution of	stability problem by clas	sical method,	6
1	trans	ient stability of r	nulti-machine syste	em.	,	0
	Mod	oling of Synchr	onous machina			
	Dhye	ical description	mathematical des	cription of synchronous	machina dall	
II	trans	formation per	unit representation	n equivalent circuits fo	or direct and	6
	quad	rature axis.	unit representatio	n, equivalent encurts re	ancer und	
	Exci	tation System				
III	Elem	ents of excitat	ion system, types	s of excitation system,	necessity of	6
	stabi	izing circuits IE	EE excitation syste	ems.		
	Prim	e Movers and I	Energy supply Sys	stems		
IV	Turb	ines and govern	ing systems, mode	eling of steam turbines, s	steam turbine	6
	contr	ols, steam turbir	ne off-frequency ca	pability.		
	Dyna	mic modeling o	of hydro turbine a	and governors		_
	Hydr	aulic turbine tra	inster function, gov	vernors for hydraulic turb	ines, detailed	6
	hydra	aulic system mod	aei, guidelines for i	modeling hydraulic turbine	es	
	Load	i modeling for s	studies	load models demande	load models	
VI	Basic	ling of induction	g concepts, static	load models, dynamic	load models,	6
	etudi		n motor, per unit re	epresentation, representation	on in stadility	
<u> </u>	Studi	60				
			Tor	zthooks		
1		indur Dower C.	stom Stability and	Control Toto Macrow II	II Now Dalk:	100/
1	r. N	maar, i ower sy	siem, siaviilly and	Control, Tata MCOlaw H		1774.

	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

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

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High 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.

Progra Class, S Course Desired I Lectur Tutoria	amme M. Semester Fir e Code 6P e Name Pro ed Requisites: Sig Teaching Scheme re 3 Hrs/week ial -	AY 20 AY 20 Course Inf Tech. (Power Sy st Year M. Tech. S512 ofessional Electiv gnals and System MSE 30	utonomous Institute 22-23 formation //stem Engineering , Sem I //e 1: DSP Applica s Examination Sc ISE 20 Credi	;) tion to P heme (N ES 50	ower Syster Iarks)	n Total
Progra Class, S Course Desired Lectur Tutoria	amme M. Semester Fir e Code 6P e Name Pro ed Requisites: Sig Teaching Scheme re re 3 Hrs/week ial - To provide a mathematical in	A Y 20 Course Inf Tech. (Power Sy st Year M. Tech. \$512 ofessional Electiv gnals and System MSE 30	ZZ-ZS Formation /stem Engineering , Sem I /re 1: DSP Applica /s Examination Sc ISE 20 Credi	tion to P heme (N ES 50	ower Syster	n Total
Progra Class, S Course Desired Lectur Tutoria	amme M. Semester Fir e Code 6P e Name Pro ed Requisites: Sig Teaching Scheme re re 3 Hrs/week ial - To provide a mathematical in	Tech. (Power Syst st Year M. Tech. \$512 ofessional Elective gnals and System MSE 30	vstem Engineering , Sem I ve 1: DSP Applica s Examination Sc ISE 20 Credi	tion to P heme (N ES 50	ower Syster Iarks)	n Total
Class, S Course Desired Lectur Tutoria	Semester Fit e Code 6P e Name Pro ed Requisites: Sig Teaching Scheme re re 3 Hrs/week ial -	st Year M. Tech. S512 ofessional Electiv gnals and System MSE 30	, Sem I ve 1: DSP Applica s Examination Sc ISE 20 Credi	tion to P heme (M ES 50	ower Syster	n Total
Course Course Desired Lectur Tutoria	e Code 6P e Name Pro ed Requisites: Sig Teaching Scheme re re 3 Hrs/week ial -	Solution Solution Solution Solution Solution Solution Solution Solution MSE 30	ve 1: DSP Applica s Examination Sc ISE 20 Credi	tion to P heme (M ES 50	ower Syster Iarks)	n Total
Course Desired Lectur Tutoria	e Name Pro ed Requisites: Sig Teaching Scheme re re 3 Hrs/week ial -	ofessional Electiv gnals and System MSE 30	re 1: DSP Applica s Examination Sc ISE 20 Credi	tion to P heme (M ES 50	ower Syster	n Total
Desired	End Requisites: Signature Teaching Scheme Image: Scheme re 3 Hrs/week ial - To provide a mathematical in	MSE 30	s Examination Sc ISE 20 Credi	heme (N ES 5(Iarks)	Total
Lectur Tutoria	Teaching Scheme re 3 Hrs/week ial - To provide a mathematical in	MSE 30	Examination Sc ISE 20 Credi	heme (N ES 5(Iarks)	Total
Lectur Tutoria	Teaching Scheme re 3 Hrs/week ial - To provide a mathematical in	MSE 30	Examination Sc ISE 20 Credi	heme (N ES 50	Iarks)	Total
Lectur Tutoria	re 3 Hrs/week ial -	MSE 30	ISE 20 Credi	ES		Total
Tutoria	To provide a mathematical in	30	20 Credi	5	n l	
1	To provide a mathematical in		Credi	-	0	100
1	To provide a mathematical in			ts: 3		
1	To provide a mathematical in					
1	To provide a mathematical in	Course O	bjectives			
2	their use in englyzing function	troduction to the	theory and applic	ations of	orthogonal	wavelets and
2	It includes a brief survey of E	lis and function s	paces.	tions Fo	urier transf	orm and the
1 7 1	Fast Fourier Transform (FFT) before proceedi	ng to the Haar wa	velet svs	tem, multi r	resolution
<u> </u>	analysis, decomposition and	reconstruction of	functions, Daube	chies way	velet constru	uction, and
	other wavelet systems.					
3	It aims at imparting skills to a	levelop wavelet-	based algorithms	for applie	cations in th	e area of
	Power Systems.	·····	. DI		-1	
At the e	end of the course the students	will be able to	1 Bloom's Taxon	omy Lev	'el	
At the		will be able to,			Bloom's	Bloom's
СО	Course O	utcome Stateme	nt/s	ר	axonomy	Taxonomy
					Level	Description
CO1	Explain the basic concepts	and terminology	that are used in	1 the		Understandir
		· · · · · · · · · · · · · · · · · · ·	and Time from	ency		a
	Fourier Techniques, wavele	ets Transforms	and time nequ	eneg		g
CO2	Fourier Techniques, wavele analysis.	ets Transforms	and Time frequ	'T		Applying
CO2	Fourier Techniques, wavele analysis. Calculate filter bank coefficie STFT and DWT for signal an	ents and Apply th	e concepts of CW	T,	III	g Applying
CO2 CO3	Fourier Techniques, wavele analysis. Calculate filter bank coefficie STFT and DWT for signal and Construct perfect reconstruct	ents and Apply th alysis. ion wavelet filter	e concepts of CW	T,		g Applying Analyzing
CO2 CO3	Fourier Techniques, wavele analysis. Calculate filter bank coefficie STFT and DWT for signal an Construct perfect reconstruct application and justify why w	ents and Apply th alysis. ion wavelet filter avelets provide t	e concepts of CW banks for a parti he right tool.	T, cular	III IV	Applying Analyzing
CO2 CO3	Fourier Techniques, wavele analysis. Calculate filter bank coefficie STFT and DWT for signal an Construct perfect reconstruct application and justify why w	ents and Apply th alysis. ion wavelet filter vavelets provide t	e concepts of CW banks for a parti he right tool.	T, cular	III IV	g Applying Analyzing
CO2 CO3 Modul	Fourier Techniques, wavele analysis. Calculate filter bank coefficie STFT and DWT for signal an Construct perfect reconstruct application and justify why w	ents and Apply th alysis. ion wavelet filter vavelets provide t Module Co	e concepts of CW banks for a parti he right tool.	T, cular	III IV	g Applying Analyzing Hours
CO2 CO3 Modul	Fourier Techniques, wavele analysis. Calculate filter bank coefficie STFT and DWT for signal an Construct perfect reconstruct application and justify why w lle Fundamentals of Linear	ents and Apply th alysis. ion wavelet filter vavelets provide t Module Co Algebra	the concepts of CW banks for a partine right tool.	T, cular	III IV	g Applying Analyzing Hours
CO2 CO3 Modul	Fourier Techniques, wavele analysis. Calculate filter bank coefficies STFT and DWT for signal an Construct perfect reconstruct application and justify why w lle Fundamentals of Linear Vector spaces, Bases, Orthog	ents and Apply th alysis. ion wavelet filter vavelets provide t Module Co Algebra hogonality, Orth	the concepts of CW to banks for a parting the right tool. Intents	T, cular tion, Fur	III IV IV	g Applying Analyzing Hours 4
CO2 CO3 Modul	Fourier Techniques, wavele analysis. Calculate filter bank coefficies STFT and DWT for signal an Construct perfect reconstruct application and justify why w Ile Fundamentals of Linear Vector spaces, Bases, Orthog basis functions	ents and Apply th alysis. ion wavelet filter vavelets provide t Module Co Algebra hogonality, Orth onal functions,	and Time frequence of CW to banks for a parti he right tool. ntents normality, Projector Orthonormal fun	tion, Fur	III IV IV Inctions and Drthogonal	g Applying Analyzing Hours 4
CO2 CO3 Modul	Fourier Techniques, wavele analysis. Calculate filter bank coefficies STFT and DWT for signal an Construct perfect reconstruct application and justify why w le Fundamentals of Linear Vector spaces, Bases, Ort function Spaces, Orthog basis functions. Signal Representation in	ents and Apply th alysis. ion wavelet filter vavelets provide t Module Co Algebra hogonality, Orth onal functions,	and Time frequence of CW to banks for a partine right tool. ntents normality, Projector Orthonormal function	tion, Functions, C	III IV IV actions and Drthogonal	g Applying Analyzing Hours 4
CO2 CO3 Modul	Fourier Techniques, wavele analysis. Calculate filter bank coefficies STFT and DWT for signal an Construct perfect reconstruct application and justify why w Ile Fundamentals of Linear Vector spaces, Bases, Orth function Spaces, Orthog basis functions. Signal Representation in Fourier series, Orthogona	ents and Apply th alysis. ion wavelet filter vavelets provide t Module Co Algebra hogonality, Orth onal functions, a Fourier Domai ality, Orth norm	and Time frequence concepts of CW banks for a parti he right tool. ntents normality, Projec Orthonormal fun n ality and the met	tion, Functions, C	III IV IV Inctions and Drthogonal	g Applying Analyzing Hours 4
CO2 CO3 Modul	Fourier Techniques, wavele analysis. Calculate filter bank coefficie STFT and DWT for signal and Construct perfect reconstruct application and justify why w Ile Fundamentals of Linear Vector spaces, Bases, Orth function Spaces, Orthog basis functions. Signal Representation in Fourier series, Orthogona Fourier coefficients Co	ents and Apply th alysis. ion wavelet filter vavelets provide t Module Co Algebra hogonality, Orth onal functions, a Fourier Domai ality, Orth norm mplex Fourier	 and Time frequencies of CW banks for a partine right tool. ntents normality, Project Orthonormal fundality and the mether series, Orthogon 	tion, Functions, C	III IV actions and Drthogonal	g Applying Analyzing Hours 4
CO2 CO3 Modul I	Fourier Techniques, wavele analysis. Calculate filter bank coefficies STFT and DWT for signal an Construct perfect reconstruct application and justify why w Ile Fundamentals of Linear Vector spaces, Bases, Orth function Spaces, Orthog basis functions. Signal Representation in Fourier series, Orthogona Fourier coefficients Co exponential bases, Math	ents and Apply th alysis. ion wavelet filter vavelets provide t Module Co Algebra hogonality, Orth onal functions, Fourier Domai ality, Orth norm mplex Fourier ematical prelimi	and Time frequencies of CW banks for a parti- he right tool. Intents normality, Projec Orthonormal fun ality and the met series, Orthogor inaries for contir	tion, Fur cular ctions, C hod of f ality of uous an	III IV IV Actions and Drthogonal Finding the Complex d discrete	g Applying Analyzing Hours 4 6
CO2 CO3 Modul I	Fourier Techniques, wavele analysis. Calculate filter bank coefficies STFT and DWT for signal and Construct perfect reconstruct application and justify why w le Fundamentals of Linear Vector spaces, Bases, Orth function Spaces, Orthog basis functions. Signal Representation in Fourier series, Orthogona Fourier coefficients Co exponential bases, Math Fourier transform, limitat	ents and Apply th alysis. ion wavelet filter vavelets provide t Module Co Algebra hogonality, Orth onal functions, Fourier Domai ality, Orth norm mplex Fourier ematical prelimitions of Fourier of	normality, Project Orthonormal fun ality and the met series, Orthogor inaries for contin lomain signal pro	tion, Fur cular tion, Fur ctions, C hod of f hality of iuous an cessing,	III IV IV IV Inctions and Drthogonal	g Applying Analyzing Hours 4 6
CO1	Explain the basic concepts	and terminology	that are used in	1 the	П	Understand

	Discrete Wavelet Transform	
III	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 Scaling 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 $\varphi(t)$ and $\psi(t)$, Normalization of Haar Bases at Different Scales, Standardizing the Notations, Refinement Relation with Respect to Normalized Bases, Support of a Wavelet System,	8
	Triangle Scaling Function, Daubechies Wavelets.	
IV	Discrete Wavelet Transform and Relation to Filter 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	8
	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	
V	tiling, why wavelet transform?	6
	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.	
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 coefficients, Constraints for Daubechies' 6 tap scaling function.	6
	Taythooks	
1	K P Soman, Ramachandran, Resmi, "Insights into wavelets from theory to prac	<i>tice</i> ", Prentice
	Hall, New Delhi, A.N. Akansu and R.A. Haddad, "Multiresolution signal Decomposition: Transfo	orms, Subbands
2	and Wavelets", Academic Press, Oranld, Florida, 1992. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing", Pe	arson Prentice
3	Hall,2007.	
	References	
1	C. Sidney Burrus, Ramesh A. Gopinath, HaitaoGuo, "Introduction to Wavelet	ts and Wavelet
	<i>Transform"s</i> , A Primer PH International Editions, 1998. Raghuveer M. Rao, Ajit S. Bopardikar, "Wavelet Transforms - <i>Introduction</i>	to Theory and
2	Application's", Addison Wesley Pearson Education Asia, 2000.	-
3	IEEE Transaction Papers.	
	Usoful Linke	
1	https://pptel.ac.in/courses/117/101/117101001/	

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1			2			
CO2				2		
CO3						3
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High						
Each CO of the cou	irse must map t	to at least one H	Ю.			

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.

	Walchand College of Engineering, Sangli					
(Government Aided Autonomous Institute)						
	A Y 2022-25					
D						
Progra	amme		M. Tech. (Power	System Engineering)		
Class,	Semester		First Year M. Tec	ch., Sem I		
Cours	e Code		6PS513			
Cours	e Name		Professional Elec	tive 2: Grid Integration	of Renewable E	nergy
Desire	d Requisi	tes:	Power Electronic	s, Renewable Energy		
	Teaching	Scheme		Examination Sche	ne (Marks)	
Lectur	re	3 Hrs/week	MSE	ISE	ESE	Total
Tutori	al	-	30	20	50	100
				Credits:	3	
			Course	Objectives		
1	To make	the students con	versant with config	gurations of renewable	energy grid inte	gration.
2	To provi	de the advance l	knowledge about vo	oltage-sourced converte	rs & their contro	l.
2	To make	the students aw	are of research ave	nues in the field of rend	wable grid integ	ration along
3	with DC	micro-grid conc	cepts.			
		Course	Outcomes (CO) w	ith Bloom's Taxonom	y Level	
At the	end of the	course, the stud	ents will be able to),		
		Course Outcome Statement/s Bloom's Taxonomy				Bloom's
CO						Taxonomy
	9		1.		Level	Description
CO1 Summarize two level vol			Itage source conver	rters in various referen	ie II	Understandin
frame.					<u>g</u>	
	Apply va	rious voltage so	ource converters and	d their control.	III	Applying
<u>CO3</u>	Analyze	grid synchroniz	ation techniques an	d DC micro-gird.	IV	Analyzing
Modu	le		Module (Contents		Hours
	Over	view of Renews	able Energy			
	Statu	s & trends of 1	enewable energy	sources, solar fundam	entals, electrical	
I	chara	cteristics of PV	/, stand-alone grid	d connected PV confi	gurations, wind	7
	energ	energy assessment, fixed & variable speed turbines with reduced & full capacity				
	conv	erters.				
	Two	level, three pha	se voltage-source	d converter		
п	Intro	duction. Two 1	evel voltage sour	ced-converter: structu	re, principle of	6
	opera	operation & power loss. Average model of two level VSC, model in $\alpha\beta$ -frame,				
	mode	l & control in d	q frame.			
	Thre	e level, three pl	nase, Neutral Poin	t Clamped voltage-so	irced converter	
	Intro	a NDC awitcher	evel half bridge N	PC, PWM scheme for	three level half	6
111	three	level NPC, switched	uit structure princi	nodel for three level i	lan onuge NPC,	0
	impr	three level NPC: circuit structure, principle of operation. Three level NPC with				
	Grid	Imnosed freque	encv VSC system.	control in aß-frame	& da-frame	
	Intro	fuction structur	e of grid-imposed f	frequency VSC system	real & reactive-	
IV	powe	r controller. Dy	namic model & c	current mode control f	or real-/reactive	6
	powe	r controller in α	β -frame & dq frame	e, Phase locked Loop.		
	Grid	Synchronizatio)n			
N	Grid	synchronization	techniques for sing	gle-phase systems, grid	synchronization	6
v	using	the Fourier anal	ysis, grid synchron	ization using A phase-l	ocked loop, PLL	
	Base	d on a T/4 transp	ort delay, PLL bas	ed on the Hilbert transf	orm.	

VI	DC Micro-grid Introduction, DC micro-grid system overview, Operation and control of DC micro-grids, DC micro-grid system protection, Application of DC micro-grids to future smart grids.	5			
	· · · · · · · · · · · · · · · · · · ·				
	Textbooks				
1	Amirnaser Yazdani and Reza Iravani, "Voltage-sourced converters in power syste control, and applications" IEEE Press John Wiley, 2010.	ems_modeling,			
2	Remus Teodorescu, Marco Liserre, and Pedro Rodriguez, "Grid Converters for and Wind Power Systems", John Wiley & Sons, Ltd, 2011.	or Photovoltaic			
References					
1	Antonio Moreno-Munoz, <i>"Large Scale Grid Integration of Renewable Energy</i> Institution of Engineering and Technology, 2017.	Sources", The			
2	Math J. Bollen and Fainan Hassan, "Integration of Distributed Generation System", IEEE Press, 2011.	in the Power			
Useful Links					
1	http://nptel.ac.in/downloads				
2	http://www.nptelvideos.in				
3	https://ocw.mit.edu/courses/electrical-engineering				

CO-PO Mapping							
	Programme Outcomes (PO)						
	1	2	3	4	5	6	
CO1			3				
CO2				2			
CO3						2	
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High							

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.

	Walchand College of Engineering, Sangli						
	AY 2022-23						
			Course I	Information			
Progra	amme		M. Tech. (Power	System Engineering)			
Class.	Semester		First Year M.Tec	h Sem I			
Cours	e Code		6PS514				
Cours	e Name		Professional Elec	tive 2: Neural Network	and fuzzy Appli	cation to	
00000	• - (0		Power System				
Desire	d Requisi	tes:	Power System				
	1		1				
	Teaching	Scheme		Examination Schem	e (Marks)		
Lectur	re	3 Hrs/week	MSE	ISE	ESE	Total	
Tutori	ial	-	30	20	50	100	
				Credits: 3	I		
			1				
			Course	Objectives			
1	To make	the student con	versant with basic k	knowledge of Neural Ne	work.		
2	To make operation	the student con and control.	versant with design	and programming know	ledge for powe	er system	
3	To make	the student con	versant with basic k	knowledge of fuzzy system	em and fuzzy a	oplications.	
		Course	Outcomes (CO) w	ith Bloom's Taxonomy	Level		
At the	end of the	course, the stud	ents will be able to	,			
со		Cours	se Outcome Staten	nent/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description	
C01	Explain	the basic knowle	edge of Neural Netw	work		Understandin	
			C		11	g	
CO2	Apply th	e Neural networ	k and fuzzy knowle	edge about different			
	neural ne	etworks, their are	chitecture and training algorithm to solve III			Applying	
	power sy	stem problems.					
<u>CO3</u>	Study the	e different applie	cations of neural ne	tworks and fuzzy logic.	IV	Analyzing	
Mada	la		Modulo	Nomforda		II.anna	
Moau	Tertera	duction to Non	Niodule (ontents		Hours	
I	Intro Intro Artifi and H Bias.	duction, Organi icial Neuron Mo Pitts models of r	zation of the Brai dels, Historical Dev leuron, ANN termin	n, Biological Neuron, velopments, Neuron Mo nologies, weights, sigmo	Biological and lel, McCulloch vidal functions,	6	
II	Essentials of Neural Networks Types of Neuron Activation Function, Neural networks architectures, Linearly II separable and linearly non separable systems and their examples, Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Hebbian learning rule, Percentron learning rule ate					6	
III	Feed Forward Neural Networks Introduction, single layer Perceptron Models, architecture, Limitations of the III Perceptron Model, Applications, Back Propagation Network, architecture, Multilayer Feed Forward Neural Networks. Use of ANN MATLAB tools for programming					6	
IV	Fuzz Basic exten Mam	y Systems Fuzzy logic the sion principle, dani and sugence	eory, history, operat Fuzzy membershi s models. Use of M	tion of Fuzzy Logic, Fuz p functions and lingu IATLAB tools of fuzzy	zy relation and stic variables, logic.	6	

X7	Application of Neural Network and fuzzy to power system operation and control problems	6			
V	Use of MATLAB tools of ANN and fuzzy logic for power system applications.	6			
	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. Case	6			
	studies such as fault analysis, fault detection, fault classification, fault location,				
	etc.				
	Textbooks				
1	S. N. Sivanandam, "Introduction to Neural Networks using MATLAB 6", Tata McGraw hill				
1	education, 2006.				
2	Hagan, Demuth, Mark Beale, "Neural Network Design", Cengage Learing India P	rivate Limited,			
2	² 2011.				
	References				
1	Stamatios V. Kartalopoulos, "Understanding neural networks and fuzzy logic basis	ic concepts and			
1	applications", Prentice Hall of India (P) Ltd, New Delhi, 2000.				
2	J.M. Zurada, "Introduction to artificial neural systems", Jaico Publishers, 1992.				
3	Timothy Ross, "Fuzzy Logic with Engineering Applications", Tata McGraw H	ill Publication,			
5	1993				
4	George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic", PHI Learning Private	Limited, 1995.			
5	Research Papers.				
	Useful Links				
1	https://onlinecourses.nptel.ac.in/noc21_ge07/preview				

CO-PO Mapping							
	Programme Outcomes (PO)						
	1	2	3	4	5	6	
CO1						1	
CO2				3			
CO3				2			
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High							
Each CO of the course must map to at least one PO.							

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.

Assessment

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

Semester- II Professional Core (Theory) Courses

		Walc	hand College	of Engineering, San	gli		
			(Government Aided	Autonomous Institute)			
	A 1 2022-25						
Ducan	0.000.000		M. Tash (Dower	Information System Engineering)			
Progr	amme		M. Tech (Power)	System Engineering)			
Class,	Class, Semester First Year M. Tech., Sem II						
Cours	se Code		6PS521	D			
Cours	se Name		Power Quality in	Distribution Systems			
Desire	ed Requ	usites:	Power Systems, I	Power Electronics			
			1				
_	Teachi	ng Scheme		Examination Scheme	(Marks)		
Lectu	re	3 Hrs/week	MSE	ISE	ESE	Total	
Tutor	ial		30	20	50	100	
				Credits: 3			
			Course	Objectives			
1	To ma	ke the students to	understand basic ki	nowledge of causes, conse	quences and so	olutions of	
	power	quality problems	that affect the operation	ation of computerized proc	cesses and elec	tronic systems.	
2	10 pro	ovide a theoretical	background to corr	ectly approach the problem	n of reactive, r	iarmonic and	
3		derstand and apply	the power theories	s for compensation probler	ns		
	10 uli	Course	Outcomes (CO) w	vith Bloom's Taxonomy I	Level		
At the	end of	the course, the stud	lents will be able to),			
					Bloom's	Bloom's	
CO		Cours	se Outcome Stater	nent/s	Taxonomy	Taxonomy	
	Level					Description	
	State and explain the basic concepts of Power Quality disturbances,					rememberin o &	
CO1	reactiv	reactive power compensation, voltage regulation, power definitions					
	and other figures of merit under distorted, operation and modelling					g	
	of ser	es and shunt comp	ensators.			_	
	Apply	the theory and	algorithms to re	ealize reference current			
CO2	genera	ation, reactive por	wer compensation,	, voltage regulation and	III	Applying	
	harmo	onic compensation.	companyation and	manage apparation figures			
CO3	of me	rits and power d	efinitions Standar	rds applicable to Power	IV	Analyzing	
	Oualit	V.	erintions, Standar	us applicable to rower	1.	7 mary 2mg	
		<u> </u>			1	1	
Modu	ıle		Module	Contents		Hours	
	In	troduction to Pow	er quality				
	Po	wer Quality: Intro	oduction, State of the	he Art on Power Quality,	Classification		
	of	Power Quality Pr	roblems, Causes o	f Power Quality Problem	ns, Effects of		
		wer Quality Proble	ems on Users, Clas	sification of Mitigation T	echniques for		
I Power Quality Problems.						6	
	Po	wer Ouality Stan	dards and Monite	oring: Introduction. State	of the Art on		
	Power Quality Standards and Monitoring, Power Quality Terminologies, Power						
		wer Quanty Stand	ards and Monitorin	5, I ower Quanty Termino			
	Qu	ality Definitions,	Power Quality S	Standards, Power Quality	Monitoring,		
		ality Definitions, merical Examples	Power Quality S	Standards, Power Quality	Monitoring,		
	Qu Nu Po	ality Definitions, merical Examples wer Definitions in	Power Quality S	andards, Power Quality I Three phase Circuits	Monitoring,		
	Qu Nu Po De	uality Definitions, umerical Examples wer Definitions in finitions of variou	Power Quality S Single Phase and s powers, power f	I Three phase Circuits factor and other figures of	Monitoring,		
II	Qu Nu Po De ba	wer Quarty Stand ality Definitions, merical Examples wer Definitions in finitions of variou lanced, unbalanced cuits, Definitions	Power Quality S Single Phase and Is powers, power f and non-sinusoida of various powers	Three phase Circuits factor and other figures of al conditions applicable to power factor and other fig	Monitoring, f merit under o single phase gures of merit	6	
П	Qu Nu Po De ba cin un	wer Quarty Stand nality Definitions, merical Examples wer Definitions in finitions of variou lanced, unbalanced cuits. Definitions der balanced, unba	Power Quality S Single Phase and s powers, power f and non-sinusoid of various powers, alanced and non-si	I Three phase Circuits factor and other figures of al conditions applicable to power factor and other figures nusoidal conditions. IEEE	Monitoring, f merit under single phase gures of merit E 1459 power	6	

III	Theories of Load compensation Introduction, State of the Art on Passive Shunt and Series Compensators, Classification of Passive Shunt and Series Compensators, Principle 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	6			
IV	Active Shunt Compensation Introduction, State of the Art on DSTATCOMs, Classification of DSTATCOMs, Principle of Operation and Control of DSTATCOMs, Analysis and Design of DSTATCOMs, Modelling, Simulation, and Performance of DSTATCOMs, Numerical Examples.	6			
V	Active Series Compensation Introduction, State of the Art on Active Series Compensators, Classification of Active Series Compensators, Principle of Operation and Control of Active Series Compensators, Analysis and Design of Active Series Compensators, Modelling, Simulation, and Performance of Active Series Compensators, Numerical Examples.	6			
VI	Unified Power Quality Compensators Introduction, State of the Art on Unified Power Quality Compensators, Classification of Unified Power Quality Compensators, Principle of Operation and Control of Unified Power Quality Compensators, Analysis and Design of Unified Power Quality Compensators, Modelling, Simulation, and Performance of UPQCs, Numerical Examples.	6			
1	I extbooks				
2	Bhim Singh, Ambrish Chandra, Kamal Al-Haddad, "Power Quality Problems of Techniques", Wiley, 2015.	and Mitigation			
References					
1	Roger C. Dugan, Mark F. McGranaghan, Surya Santoso, H. Wayne Beaty, "El Systems Quality", Mc-Graw Hill, Edition II, 1996.	ectrical Power			
2	Angelo Baggini, "Handbook on Power Quality", John Wiley & Sons, New Jerse	y, USA, 2008			
	Looful I inka				
1	https://pptel.ac.in/courses/108/106/108106025/				
1	nups.//nptei.ac.nl/courses/100/100/100/0023/				

CO-PO Mapping							
	Programme Outcomes (PO)						
	1	2	3	4	5	6	
CO1			1				
CO2	2						
CO3				1		2	
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High							
Each CO of the ac	Each CO of the course must men to at least one DO						

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.

	Walchand College of Engineering, Sangli						
	(Government Aided Autonomous Institute)						
			Course	2022-23			
Drogre			M Tash (Dower	Sustam Engineerin	a)		
Progra	Same agt an		M. Tech. (Power	System Engineering	g)		
Class,	Semester		CDS522				
Cours			0PS522	lad Crustanea			
Cours		4	PLC and Embedd	led Systems	1.М.		M ²
Desire	a kequisi	tes:	and Applications	l'echniques, Electri		asurements,	Microcontroller
	Teaching	Scheme		Examination S	cheme	(Marks)	
Lectu	re	3 Hrs/week	MSE	ISE		ESE	Total
Tutori	ial		30	20		50	100
Tuton			50	Cred	lits: 3	50	100
		1					
			Course	Objectives			
1	Toevolo	it the PLC and I	Embedded Control	for industrial autor	nation		
2	To devel	oping programs	using ladder logic	for industrial autor	nation.		
3	To analy	ze the performation	nce of automation	systems employing	PLC a	nd Embedd	ed Control.
		Course	Outcomes (CO) w	vith Bloom's Taxo	nomy]	Level	
At the	end of the	course, the stud	ents will be able to),			
СО		Course Outcome Statement/s Bloom's Taxonomy Level					Bloom's Taxonomy Description
CO1 Interpret features of PLC and Embedded Control Systems used for IIII Industrial Automation.					Applying		
CO2	Use lad applicati	der logic pro ons.	gramming techni	que for various	PLC	III	Applying
CO3	Evaluate function	the performan	ce of PLC netwo	rk configurations,	PLC	V	Evaluating
	101100101				I		
Modu	le		Module (Contents			Hours
I	Intro Intro PLC PLC	duction to PLC duction, Advant Output Module memory and int	2 ages, Disadvantag PLC Architecture erfacing, Power Su	es, Parts of PLC, c, PLC Operation, I apply for PLC	PLC Ir PLC as	nput module a computer	² , 6
Π	PLC Ladd input logic	programming er Logic Symbo s to produce on/ , creating ladder	ls, Latching and Un off outputs, relation diagrams from pro-	nlatching of PLC, P on of digital gate lo occess control descri	Program gic to ption.	nming on/ of contact / co	f 1 6
Ш	PLC Timer and Counter Functions PLC timer functions, Types of PLC timers, Programming of Non-retentive III timers for various applications, Programming of ON timers, OFF timers, PLC counter functions, Programming of UP, DOWN counters, Case studies related to Industrial Automations					e C 6 d	
IV	IV 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 Jump with No return functions, Programs related to Arithmetic, Comparison and Branch functions 6					s, d 6 n	
v	Adva Data applic conti	mored PLC fund move system, cations, Sequen nuous process, F	tions Data handling cer functions, An D modules & tun	functions, Digital alog PLC operatio ing, Typical PID fu	bit fu ons, PII unction	unctions an D control c s	d 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	б
	Textbooks	
1	John W. Webb, Ronald A. Reis, "Programmable logic controllers, principles & PHI publication, Eastern Economic Edition, 1994.	& applications",
	References	
1	John R. Hackworth and Peterson, "PLC controllers programming methods and PHI, 2004.	d applications",
2	Gary dunning, "Introduction to PLC, Thomson learning", Edition III, 2006	
3	William H. Bolton, "Programmable logic controllers", Newnes, Edition VI, 20)06.
	Useful Links	

CO-PO Mapping						
Programme Outcomes (PO)						
	1	2	3	4	5	6
CO1			2			
CO2			2			
CO3 2						
The strength of map	oping is to be v	vritten as 1: Lo	w, 2: Medium,	3: High		

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

		Wal	chand College (Government Aide	e of Engineerir ed Autonomous Instit	ng, Sang	gli		
			AY	2022-23	,			
			Course	Information				
Progra	amme		M. Tech. (Power	System Engineerin	g)			
Class,	Semester		First Year M. Tec	h., Sem II				
Cours	e Code		6PS591					
Cours	e Name		Power Quality in	Distribution Syster	ns Labora	tory		
Desire	d Requisi	tes:	Power Systems, P	ower Electronics				
-	Teaching	Scheme		Examination	Scheme (I	Marks)		
Practi	cal	2 Hrs/ Week	LA1	LA2	Lab E	ESE		Total
Intera	ction		30	30	40)		100
				Cre	dits: 1			
			Cours	e Objectives				
1	To educa	te the students	with the practical as	spects of Power Qu	ality issue	es.		D
2	Quality	ops the critical f	thinking in solving	power quality prot	olems with	contemp	orary	Power
3	To enhar	nce research skil	ls of students to Po	wer Quality issues	•			
A (1	1.6.1	Cours	e Outcomes (CO)	with Bloom's Tax	onomy Le	evel		
At the	end of the	course, the stuc	lents will be able to),		Dloom	20	Ploom's
СО		Cou	rse Outcome State	ement/s		Taxono Level	s my l	Taxonomy Description
CO1	Calculate condition	e power compor 1s.	ents and other figu	res of merit under o	listorted	III		Applying
CO2	Analyze	Power Quality	Problems and provi	de suitable remedy		IV		Analyzing
CO3	Evaluate suitable s	theories of loa simulation tool.	ad compensation, 1	reference generation	on using	V		Evaluating
]	List of Experiment	ts / Lab Activities/	Topics			
Lab ac site vis as per	tivities/Lab sit, lab exp the nature	b performance s eriment, tutoria and requiremen	hall include mini-pr ls, assignments, gro t of the lab course.	roject, presentation oup discussion, pro	s, drawing gramming	s, case stug and othe	idies er sui	, report writing, table activities,
1	D. 1	Johogh Vyman	IT Channai "Davi	extbooks	hution C-	atom "		
1	Bhim	Singh Ambri	sh Chandra Kama	<u>er Quality in Distri</u> 1 Al-Haddad "Po	wer Quality	ity Probl	oms	and Mitigation
2	Tech	niques", Wiley,	2015.		wer Quui		ems (
			_	forman				
1	Roge	r C. Dugan, M	ark F. McGranagh	an, Surya Santoso	, H. Way	ne Beaty	, " <i>El</i>	ectrical Power
2	Syster	ms Quality", M	c-Graw Hill, Editio	n II, 1996. Quality?' John Wi	ev & Sone	New Io	reev	USA 2008
	Alige	io Daggiiii, 114	mubbon on I ower	<i>Juany</i> , John Will		5, INCW JE	iscy,	007,2000
			Use	eful Links				
1								
1								

CO-PO Mapping						
Programme Outcomes (PO)						
	1	2	3	4	5	6
CO1			2			
CO2				2		
CO3						3
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High						
Each CO of the cou	arse must map t	o at least one F	Ю.			

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% Conducted by **Typical Schedule** Assessment **Based** on Marks Lab activities, During Week 1 to Week 8 LA1 attendance, Marks Submission at the end of 30 Lab Course Faculty journal Week 8 During Week 9 to Week 16 Lab activities, Marks Submission at the end of 30 LA2 attendance, Lab Course Faculty journal Week 16 During Week 18 to Week 19 Lab activities, Lab Course Faculty and External Examiner as Marks Submission at the end of 40 Lab ESE journal/ Week 19 performance applicable 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	2022-23			
			Course	e Information			
Progra	amme		M. Tech. (Power	System Engineerin	g)		
Class,	Semester		First Year M.Tec	h., Sem II	-		
Cours	e Code		6PS592				
Cours	e Name		PLC and Embedd	led Systems Labora	tory		
Desire	d Requisi	tes:	Instrumentation T	Techniques, Electric	al Measur	ements, Mid	procontroller and
	_		Applications	-			
,	Teaching	Scheme		Examination	Scheme (N	Marks)	
Practi	cal	2 Hrs/ Week	LA1	LA2	Lab E	SE	Total
Intera	ction		30	30	40		100
				Cre	dits: 1	I	
		1					
			Cours	se Objectives			
1	To devel	op programmin	g skills using PLC	for Industrial Autor	mation		
2	To introc	luce the use of I	PLC for solving rea	al world problems.			
3	To use P	LC for control a	pplications in elect	trical engineering	-		
A (1	1 6 4	Cours	e Outcomes (CO)	with Bloom's Tax	onomy Le	evel	
At the end of the course, the students will be able to,							
						Ploom's	Bloom's
со		Cou	rse Outcome State	ement/s		Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO CO1	Execute	Course experiments bas	rse Outcome State	ement/s		Bloom's Taxonomy Level III	Bloom's Taxonomy Description Applying
CO CO1 CO2	Execute Construc	Course control s	rse Outcome State sed on PLC and SC systems using PLC	ement/s CADA systems and SCADA.		Bloom's Taxonomy Level III IV	Bloom's Taxonomy Description Applying Analyzing
CO CO1 CO2 CO3	Execute Construc Design la	Course experiments base of basic control s adder logic prog	rse Outcome State sed on PLC and SC systems using PLC grams for various P	ement/s CADA systems and SCADA. LC applications.		Bloom's Taxonomy Level III IV V	Bloom'sTaxonomyDescriptionApplyingAnalyzingCreating
CO CO1 CO2 CO3	Execute Construc Design la	Course experiments base of basic control s adder logic prog	rse Outcome State sed on PLC and SC systems using PLC grams for various P	ement/s CADA systems and SCADA. LC applications.	Torios	Bloom's Taxonomy Level III IV V	Bloom's Taxonomy Description Applying Analyzing Creating
CO CO1 CO2 CO3	Execute Construc Design la	Course experiments base ext basic control s adder logic prog	rse Outcome State sed on PLC and SC systems using PLC grams for various P List of Experimen	ement/s CADA systems and SCADA. LC applications. ts / Lab Activities/	Topics	Bloom's Taxonomy Level III IV V	Bloom's Taxonomy Description Applying Analyzing Creating
CO CO1 CO2 CO3 Lab ac site vis as per	Execute Construc Design la tivities/La sit, lab exp the nature	Courses experiments base to basic control stadder logic prog dder logic prog	rse Outcome State sed on PLC and SC systems using PLC grams for various P List of Experimen hall include mini-p ls, assignments, gro t of the lab course.	ement/s CADA systems and SCADA. LC applications. ts / Lab Activities/ roject, presentation oup discussion, pro	Topics s, drawing gramming	Bloom's Taxonomy Level III IV V s, case studio g and other s	Bloom's Taxonomy Description Applying Analyzing Creating es, report writing, uitable activities,
CO CO1 CO2 CO3 Lab ac site vis as per	Execute Construc Design la tivities/La sit, lab exp the nature	Courses adder logic prog	rse Outcome State and on PLC and SC systems using PLC grams for various P List of Experiment hall include mini-p ls, assignments, gro t of the lab course.	ement/s CADA systems and SCADA. LC applications. ts / Lab Activities/ roject, presentation oup discussion, pro	Topics s, drawing gramming	Bloom's Taxonomy Level III IV V s, case studio ; and other s	Bloom's Taxonomy Description Applying Analyzing Creating es, report writing, uitable activities,
CO CO1 CO2 CO3 Lab ac site vis as per	Execute Construc Design la tivities/La sit, lab exp the nature	Courses experiments base adder logic prog b performance s periment, tutoria and requiremen	rse Outcome State sed on PLC and SC systems using PLC grams for various P List of Experimen hall include mini-p ls, assignments, gro t of the lab course.	ement/s CADA systems and SCADA. LC applications. ts / Lab Activities/ roject, presentation oup discussion, pro	Topics s, drawing gramming	Bloom's Taxonomy Level III IV V s, case studie g and other s	Bloom's Taxonomy Description Applying Analyzing Creating es, report writing, uitable activities,
CO CO1 CO2 CO3 Lab ac site vis as per	Execute Construc Design la tivities/La sit, lab exp the nature	Courses control sectors basic control sectors adder logic prograder logic prograder logic programment, tutoria and requirement sectors become control sectors be	rse Outcome State sed on PLC and SC systems using PLC grams for various P List of Experimen hall include mini-p ls, assignments, gra t of the lab course.	ement/s CADA systems and SCADA. LC applications. ts / Lab Activities/ roject, presentation oup discussion, pro extbooks ammable logic cont	Topics s, drawing gramming rollers, pri	Bloom's Taxonomy Level III IV V s, case studio ; and other s inciples & a	Bloom's Taxonomy Description Applying Analyzing Creating es, report writing, uitable activities,
CO CO1 CO2 CO3 Lab ac site vis as per	Execute Construc Design la tivities/La sit, lab exp the nature John publi	Courses experiments base adder logic prog b performance s periment, tutoria and requirement W. Webb, Rona cation, Eastern 1	rse Outcome State sed on PLC and SC systems using PLC grams for various P List of Experimen hall include mini-p ls, assignments, gro t of the lab course. Te ald A. Reis, "Progra Economic Edition,	ement/s CADA systems and SCADA. LC applications. ts / Lab Activities/ roject, presentation oup discussion, pro extbooks ammable logic cont 1994.	Topics s, drawing gramming rollers, pri	Bloom's Taxonomy Level III IV V s, case studies and other s	Bloom's Taxonomy Description Applying Analyzing Creating es, report writing, uitable activities,
CO CO1 CO2 CO3 Lab ac site vis as per	Execute Construc Design la tivities/La sit, lab exp the nature John publi	Courses adder logic programments basic control services adder logic programment, tutoria and requirement. W. Webb, Rona cation, Eastern 1	rse Outcome State sed on PLC and SC systems using PLC grams for various P List of Experimen hall include mini-p ls, assignments, gra t of the lab course. To Id A. Reis, "Progra Economic Edition,	ement/s CADA systems and SCADA. LC applications. ts / Lab Activities/ roject, presentation oup discussion, pro extbooks ammable logic cont 1994. eferences	Topics s, drawing gramming rollers, pri	Bloom's Taxonomy Level III IV V s, case studio ; and other s inciples & a	Bloom's Taxonomy Description Applying Analyzing Creating es, report writing, uitable activities,
CO CO1 CO2 CO3 Lab ac site vis as per	Execute Construc Design la tivities/La sit, lab exp the nature John publi	Courses adder logic programments basic control stander logic programment, tutoria and requirement w. Webb, Rona cation, Eastern M. R. Hackworth a	rse Outcome State sed on PLC and SC systems using PLC grams for various P List of Experimen hall include mini-p ls, assignments, gro t of the lab course. Te ald A. Reis, "Progra Economic Edition, Re nd Peterson, "PLC	ement/s CADA systems and SCADA. LC applications. ts / Lab Activities/ roject, presentation oup discussion, pro extbooks ammable logic cont 1994. eferences controllers program	Topics s, drawing gramming rollers, pri	Bloom's Taxonomy Level III IV V s, case studies and other s inciples & a	Bloom's Taxonomy Description Applying Analyzing Creating es, report writing, uitable activities, pplications", PHI
CO CO1 CO2 CO3 Lab ac site vis as per 1	Execute Construc Design la tivities/La sit, lab exp the nature John publi	Courses adder logic programments basic control states adder logic programment, tutoria and requirement. W. Webb, Rona cation, Eastern 1400 R. Hackworth at adder 1000 R. Hackworth at a	rse Outcome State sed on PLC and SC systems using PLC grams for various P List of Experimen hall include mini-p ls, assignments, gra t of the lab course. To ald A. Reis, "Progra Economic Edition, Reind Peterson, "PLC	ement/s CADA systems and SCADA. LC applications. ts / Lab Activities/ roject, presentation oup discussion, pro extbooks ammable logic cont 1994. eferences controllers program	Topics s, drawing gramming rollers, pri nming met	Bloom's Taxonomy Level III IV V s, case studio and other s inciples & a hods and ap	Bloom's Taxonomy Description Applying Analyzing Creating es, report writing, uitable activities, pplications", PHI,
CO CO1 CO2 CO3 Lab ac site vis as per 1 1 2	Execute Construc Design la tivities/La sit, lab exp the nature John publi	Courses experiments base of basic control se adder logic proget b performance se periment, tutoria and requirement W. Webb, Rona cation, Eastern 1 R. Hackworth ac dunning, "Intro	rse Outcome State sed on PLC and SC systems using PLC grams for various P List of Experiment hall include mini-p ls, assignments, gra- t of the lab course. Te ald A. Reis, "Progra- Economic Edition, Re nd Peterson, "PLC duction to PLC", T	ement/s CADA systems and SCADA. LC applications. ts / Lab Activities/ roject, presentation oup discussion, pro extbooks ammable logic cont 1994. eferences controllers program	Topics s, drawing gramming rollers, pri nming met Edition III	Bloom's Taxonomy Level III IV V s, case studie and other s inciples & a hods and ap , 2006	Bloom's Taxonomy Description Applying Analyzing Creating es, report writing, uitable activities, pplications", PHI plications ", PHI,
CO CO1 CO2 CO3 Lab ac site vis as per 1 1 1 2 3	Execute Construc Design la tivities/La sit, lab exp the nature John publi John 2004 Gary Willi	Courses experiments base et basic control s adder logic prog b performance s periment, tutoria and requiremen W. Webb, Rona cation, Eastern b R. Hackworth a dunning, "Intro am H. Bolton, "	rse Outcome State sed on PLC and SC systems using PLC grams for various P List of Experimen hall include mini-p ls, assignments, gra t of the lab course. To ald A. Reis, "Progra Economic Edition, Reind Peterson, "PLC eduction to PLC", The Programmable log	ement/s CADA systems and SCADA. LC applications. ts / Lab Activities/ roject, presentation oup discussion, pro extbooks ammable logic cont 1994. eferences controllers program Thomson learning, I gic controllers ", Ne	Topics s, drawing gramming rollers, pri nming met Edition III wnes, Edit	Bloom's Taxonomy Level III IV V s, case studio and other s inciples & a <i>hods and ap</i> , 2006 tion VI, 200	Bloom's Taxonomy Description Applying Analyzing Creating es, report writing, uitable activities, pplications", PHI plications ", PHI,
CO CO1 CO2 CO3 Lab ac site vis as per 1 1 1 2 3	Execute Construc Design la tivities/La sit, lab exp the nature John publi 2004 Gary Willi	Courses experiments base to basic control se adder logic proget b performance se periment, tutoria and requirement W. Webb, Rona cation, Eastern M R. Hackworth at dunning, "Intro- am H. Bolton, "	rse Outcome State sed on PLC and SC systems using PLC grams for various P List of Experiment hall include mini-puls, assignments, grave t of the lab course. The seconomic Edition, Reconstruction to PLC, The Programmable log	ement/s CADA systems and SCADA. LC applications. ts / Lab Activities/ roject, presentation oup discussion, pro extbooks ammable logic cont 1994. eferences controllers program Thomson learning, I gic controllers ", Ne	Topics s, drawing gramming rollers, pri nming met Edition III wnes, Edit	Bloom's Taxonomy Level III IV V s, case studie s, case studie and other s inciples & a hods and ap , 2006 tion VI, 200	Bloom's Taxonomy Description Applying Analyzing Creating es, report writing, uitable activities, pplications", PHI plications ", PHI,
CO CO1 CO2 CO3 Lab ac site vis as per 1 1 1 2 3 3	Execute Construc Design la tivities/La sit, lab exp the nature John publi 2004 Gary Willi	Courses Courses and requirements that and requirement and requirement with the course of the courses of the cou	rse Outcome State sed on PLC and SC systems using PLC grams for various P List of Experimen hall include mini-p ls, assignments, gra t of the lab course. Te ald A. Reis, "Progra Economic Edition, Reind Peterson, "PLC duction to PLC", T Programmable log	ement/s CADA systems and SCADA. LC applications. ts / Lab Activities/ roject, presentation: oup discussion, pro extbooks ammable logic cont 1994. eferences controllers program Thomson learning, 1 gic controllers ", Ne eful Links (TL S/Decrement)	Topics s, drawing gramming rollers, pri nming met Edition III wnes, Edit	Bloom's Taxonomy Level III IV V s, case studio and other s inciples & a hods and ap , 2006 tion VI, 200	Bloom's Taxonomy Description Applying Analyzing Creating es, report writing, uitable activities, pplications", PHI plications ", PHI, 6.

CO-PO Mapping						
Programme Outcomes (PO)						
	1	2	3	4	5	6
CO1			2			
CO2				2		
CO3				2		
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High						
Each CO of the cou	irse must map t	o at least one F	Ю.			

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% **Based** on Conducted by **Typical Schedule** Assessment Marks Lab activities, During Week 1 to Week 8 LA1 attendance, Lab Course Faculty Marks Submission at the end of 30 journal Week 8 Lab activities, During Week 9 to Week 16 30 LA2 attendance, Lab Course Faculty Marks Submission at the end of journal Week 16 Lab activities. During Week 18 to Week 19 Lab Course Faculty and journal/ External Examiner as Marks Submission at the end of Lab ESE 40 Week 19 performance applicable 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 Autonomous Institute)							
			Course	Information				
Progra	amme		M.Tech. (Power S	System Engineering	g)			
Class,	Semester		First Year M. Tec	h., Sem II				
Cours	e Code		6PS593					
Cours	e Name		Pre-dissertation V	Vork and Seminar				
Desire	d Requisi	tes:	-					
			1					
	Teaching	Scheme		Examination	Scheme (Marks)		
Practi	cal	4 Hr/ Week	LA1	LA2	Lab I	ESE		Total
Intera	ction		30	30	40)		100
				Cre	edits: 2			
1	T 1		Cours	e Objectives				
	To under	stand industrial	problems.	ned problem				
	10 sugge	<u>St engineering s</u> Cours	e Outcomes (CO)	with Bloom's Tax	onomy L	evel		
At the	end of the	course, the stud	lents will be able to),	<u> </u>			
						Bloon	n's	Bloom's
CO		Cou	rse Outcome Statement/s Taxonomy Taxonom					Taxonomy
<u> </u>	Chose F	ormulata a alaa	r problem				el	Description
CO1	Select an	d apply appropr	i problem.	ethods and tools for	r solving			Creating
	the probl	em.			5011118	VI		crouning
CO3	Develop methodo	the project and logy.	d its results follow	ving an established	l project	V		Evaluating
CO4	Present t	he project result	ts.			IV		Analyzing
]	List of Experimen	ts / Lab Activities	/Topics			
Pre-Di	ssertation	seminar will inv	volve the selection of	of appropriate real	ime indus	try probl	em by	understanding
the wo	orking of pa	articular industr	y application. Form	nulate the problem	, select de	sign and	meth	odology to find
the sol	ution. Con	struct an electri	cal system by using	g appropriate hardw	are software	are tools.	Each	student should
concei	ve, design	and develop th	e idea leading to a	project/product. 7	The studen	t should	subm	nit a soft bound
report	at the end	of the semester	r. The final product	as a result of Indu	istry proje	ect should	d be c	lemonstrated in
phases	at the time	e of examination	n.					1
This v	vill help s	tudent to unde	erstand structured	management in in	dustry, su	istainable	e dev	elopment, with
consid	eration to I	both scientific a	ind ethical aspects a	and its presentation	with tech	nical rep	ort.	
			т	wthooka				
1	To be	used based on	selected project	TALUUUKS				
-	1000		<u> </u>					
			Re	eferences				
1	Indus	try 4.0 : fourth	Industrial Revolution	on guide to Industr	y 4.0			
1			Use	eful Links				
J								

CO-PO Mapping							
Programme Outcomes (PO)							
	1 2 3 4 5 6						
CO1	3	2					
CO2				2		2	
CO3			2				
CO4		2					
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High							
Each CO of the cou	rse must map t	to at least one I	20.				

		Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE.						
IMP: Lab ESE	is a separate head	of passing.(min 40 %), LA	1+LA2 should be min 40%			
Assessment	Based on	Conducted by	Typical Schedule	Marks		
	Lab activities,		During Week 1 to Week 8			
LA1	attendance,	Lab Course Faculty	Marks Submission at the end of	30		
	journal		Week 8			
	Lab activities,		During Week 9 to Week 16			
LA2	attendance,	Lab Course Faculty	Marks Submission at the end of	30		
	journal		Week 16			
	Lab activities,	Lab Course Faculty and	During Week 18 to Week 19			
Lab ESE	journal/	External Examiner as	Marks Submission at the end of	40		
	performance	applicable	Week 19			
Week 1 indicate	es starting week o	f a semester. Lab activities/	Lab performance shall include performance	rming		
experiments, m	experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the					
nature and requ	irement of the lab	o course. The experimental	lab shall have typically 8-10 experim	ents and		
related activitie	es it any.					

Professional Elective

		Walc (Gove	hand College rnment Aided	of Engineering, S Autonomous Ins	angli titute)	
			AY	2022-23		
			Course l	Information		
Progra	amme		M. Tech. (Power	System Engineering)		
Class,	Semester		First Year M. Teo	ch., Sem II		
Cours	e Code		6PS531			
Cours	e Name		Professional Elec	tive 3: Modern Power I	Electronics	
Desire	ed Requisi	tes:	Power Electronic	28		
		~ .				
-	Teaching	Scheme		Examination Scher	ne (Marks)	
Lectu	re	3 Hrs/week	MSE	ISE	ESE	Total
Tutor	ial		30	20	50	100
				Credits:	3	
	1		Course	Objectives		
1	It is aime power fil	ed to impart skil ters.	ls of analysis for di	ifferent types of advanc	ed converters	and shunt active
2	Make the shunt act	e students acqua ive power filter	inted with control s	strategies of different ty	pes of advanc	ed converters and
3	To make	aware of resear	ch avenues in the f	ield of power electronic	cs.	
		Course	Outcomes (CO) w	vith Bloom's Taxonom	y Level	
At the	end of the	course, the stud	lents will be able to	Э,		
со	CO Course Outcome Statement/s Bloom's Taxonomy Level				y Taxonomy Description	
C01	CO1 Interpret configuration and working of various Power Electronic III				Applying	
CO2	Analyze	various Power I	Electronic converte	ers and systems.	IV	Analyzing
CO3	Evaluate	various power	electronic systems	s using power electronic	° V	Evaluating
	converte					
Modu	ıle		Module (Contents		Hours
	PWN	1 rectifiers				
T	Adva	ntages & disad	vantages of three p I PWM converted	bhase thyristor converters working types Co	r, Single phas	se M 5
	rectif	iers, analysis ar	d application. Thr	ee phase CSI PWM co	nverter, contro	ol
	and a	pplications.				
	Mult Three	ilevel inverters e phase two le	evel Voltage sour	ce inverter, various P	WM method	s,
П	flvin	capacitor mult	ilevel inverter cas	caded multilevel invert	er application	¹ , 5
	of m	ultilevel inverte	ers, comparison of	multilevel inverter. C	ontrol method	d:
	Mult	ple carrier PWN	A for MLI			
	Reso	nant pulse inve	rters			
	Serie	s resonant invert	ter with unidirection	nal and bi-directional sv	vitches, paralle	el _
	reson	ant inverters, vo	oltage control of re	sonant inverters, zero c	urrent and zer	o 5
	reson	ant DC link inv	erters and control t	echnique	iant converter	8,
	Phot	ovoltaic Inverte	erters and control t	connique.		
	Photo	voltaic Inverter	e structures derive	1.6 11.1 1	ow such as H	5
137	1		s situctures derive	ed from H bridge topolo	gy such as H	
1 V	inver	ter, Heric invert	ter, REFU inverter	the full bridge inverter w	ith DC bypas	s, 5
IV	inver inver	ter, Heric invert ter structures de	ter, REFU inverter	, full bridge inverter w	ith DC bypas point clampe	s, 5 ed

	Matrix Converters and Z source inverters				
V	topologies and control of Z source inverter Application of Z source in	4			
	induction motor control.				
	Active power filters				
	Power Quality Issues due to power Electronics, Introduction to active power				
VI	filter, types of active power filters overall control of shunt active power filter,	4			
V 1	control of shunt active filter based on SRF theory. Control of shunt active filter	-			
	based on instantaneous power theory. harmonic compensation & reactive				
	power compensation.				
	Textbooks				
1	M. H. Rashid, "Power Electronics: circuits devices and applications", Pearson F	Education, Third			
	edition.				
	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 Elect	ronics circuits",			
	Narosa publication.				
3	Remus Teodorescu, Marco Liserre and Pedro Rodrigues, "Grid- Converters for H	Photovoltaic and			
	Wind Power Converters", A john Wiley and sons Ltd., first edition 2011.				
4	IEEE Transaction papers.				
	Useful Links				
1	NPTEL lectures on Advanced Power Electronics				

CO-PO Mapping						
Programme Outcomes (PO)						
	1	2	3	4	5	6
CO1			1			
CO2				1		
CO3				2		1
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High						

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.

		Walc	hand College	of Engineering	, San	gli	
			AY	2022-23	c)		
			Course	Information			
Progra	amme		M. Tech. (Power	System Engineerin	g)		
Class.	Semester		First Year M Tec	ch Sem II	5/		
Cours	e Code		6PS532	,			
Cours	e Name		Professional Elec	tive 3: EHVAC			
Desire	d Requisi	tes:	Power System				
	Teaching	Scheme		Examination Sector	cheme	(Marks)	
Lectur	re	3 Hrs/week	MSE	ISE		ESE	Total
Tutori	ial	-	30	20		50	100
				Cred	its: 3	1	
			1				
			Course	Objectives			
1	To under	rstand parameter	s of EHVAC line.				
2	To devel	op a skill to des	ign and analyze EH	IVAC line.			
3	To devel	op a skill to und	erstand power freq	uency over voltages	s devel	oped in EHVA	C line.
4 To develop a skill to understand insulation coordination based on lightening.							
	1 6 1	Course	Outcomes (CO) w	rith Bloom's Taxor	iomy I	Level	
At the	end of the	course, the stud	ents will be able to),			
CO Course Outcome Statement/s			a Outaama Statamant/a		Bloom's	Bloom's Toyonomy	
			nenvs		Level	Description	
CO1	CO1 Outline parameters of EHVAC line and develop skills to design and			Understandin			
analyze EHVAC line.				g			
CO2	Examine	e power frequenc	ey over voltages de	veloped in EHVAC	line.	III	Applying
CO3	Explain	insulation coord	ination based on lig	ghtening.		IV	Analyzing
Modu	ام		Modula	Contents			Hours
Mouu	Intro	duction Calc	ulation of Line	and Ground Pa	romote	ars Voltago	110015
	Grad	lients of Condu	ctor and Corona l	allu Groullu Fa Effects	rameu	ers, vonage	
		. Introduction:	Engineering aspec	ts and growth of E	HVAC	transmission	
		line trends a	nd preliminaries, p	ower transferability	y, trans	sient stability	
		limit and sur	ge impedance loadi	ng.		2	
	E	B. Calculation	of Line and Groun	nd Parameters: Rest	istance	, power loss,	
		temperature	rise, properties of	bundled conductor	s, indu	ictances, and	
		capacitances.	, calculation of seq	juence inductance a	ind cap	pacitance line	
I		parameters of	of modes of propa	igations, resistance	and 1	nductance of	6
		ground return	1. Jiants of Conducto	r: Charge potential	ralatic	one for multi	
		conductor lin	es surface voltage	gradients on condu	ctors d	listribution of	
		voltage gradi	ent on sub conduct	ors of bundle.	<i>ccccccccccccc</i>	instrictution of	
	I). Corona Effe	cts: I2R and coror	na loss, corona los	s forn	nulae, charge	
		voltage diag	ram with corona.	Attenuation of trav	eling v	waves due to	
		corona loss	Audible noise;	corona pulses; the	eir ge	neration and	
		properties, lin	mits for radio interl	face fields.			
	The	orv of Traveli	ng Waves and St	anding Waves			
	Wav	es at power	frequency. differ	ential equations	and s	olutions for	
	gene	ral case, stand	ing waves and na	tural frequencies	, open	ended line:	
II	doub	ole exponentia	l response, respo	onse to sinusoida	al exc	itation, line	6

Course Contents for F Y M Tech Programme, Department of Electrical Engineering, AY2022-23

energization with trapped charge voltage, reflection and refraction of

traveling waves.

III	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.	4				
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.	4				
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.	4				
VI	Insulation Coordination Insulation coordination, Insulation levels, voltage withstand levels of protected equipment's and insulation coordination based on lightning, Design of EHVAC lines.	4				
	Taythooks					
1	Rakosh Das Begamudre, "EHVAC Transmission Engineering", Wiley Eastern Edition 2008.	n Limited, 3rd				
	References	:				
1	John Wiley and Sons 1988.	is and Design				
2	2 EHVAC and HVDC Transmission Engineering & Practice: S.V. Rao					
3	Twian Gonen, "Electric Power Transmission System Engineering-Analysis and Wiley and Sons 1988.	Design", John				
1	Useful Links					
1	NPTEL Lectures					

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1	3					
CO2				3		
CO3						2
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High						
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)

Professional Elective (Lab) Courses

		Wal	chand College (Government Aide	e of Engineering, S ed Autonomous Institute)	Sang	;li	
AY 2022-23							
			Course	e Information			
Progra	amme		M. Tech. (Power	System Engineering)			
Class,	Semester		First Year M. Tec	h., Sem II			
Cours	e Code		6PS571				
Cours	e Name		Professional Elect	tive 3: Modern Power E	lectro	onics Laborate	ory
Desire	d Requisi	tes:	Power Electronics	S			5
	1			-			
,	Teaching	Scheme		Examination Sche	me (1	Marks)	
Practi	cal	2 Hrs/ Week	LA1	LA2 I	ah F		Total
Intero	etion		30	30	10		100
Intera				JU	1		100
				Creuits:	1		
			9				
			Cours	e Objectives			
1	It is aime power fil	ed to impart skil lters.	ls of analysis for di	fferent types of advance	ed cor	iverters and s	hunt active
2	Make the shunt act	e students acqua tive power filter	inted with control s s.	strategies of different ty	pes of	f advanced co	nverters and
3 To make aware of research avenues in the field of power electronics.							
		Cours	e Outcomes (CO)	with Bloom's Taxonon	ny Le	evel	
At the	end of the	course, the stuc	lents will be able to),			
со	CO Course Outcome Statement/s Bloom's Bloom's Taxonomy Taxonomy Level Description					Bloom's Taxonomy Description	
CO1 Interpret configuration and working of various Power Electronic converters.				III	Applying		
CO2	Analyze	various Power I	Electronic converte	rs and systems.		IV	Analyzing
CO3	Evaluate converte	various power	electronic system	ns using power electro	onic	V	Evaluating
	1						1
]	List of Experiment	ts / Lab Activities/Top	ics		
Lab ac site vis as per	tivities/La sit, lab exp the nature	b performance s periment, tutoria and requiremen	hall include mini-pr ls, assignments, gro t of the lab course.	roject, presentations, dra oup discussion, program	wing Iming	s, case studies g and other su	s, report writing, itable activities,
			Te	extbooks		" D =	1 .1
1	M. H editio	l. Rashid, "Pow on.	er Electronics: circ	cuits devices and applic	ation	s", Pearson E	ducation, Third
			D	£			
Keferences 1 P. K. Pose "Modern Power Electronics and AC drives" DUIDL. New Delhi							
1	M R	Patil V Ram	avanan and V T F	Ranganathan "Simulati	$\frac{1}{2}$, inc	Power Flect	ronics circuits"
2	Naros	sa publication.					<u> </u>
	Rem	us Teodorescu, I	Marco Liserre and	Pedro Rodrigues, "Grid	l- Cor	werters for P	hotovoltaic and
	Wind	Power Convert	ers", A john Wiley	and sons Ltd., first edit	ion 2	011.	
	IEEE	Transaction pa	pers.				
			Use	eful Links			
1	NPTI	EL lectures on A	Advanced Power El	ectronics			

CO-PO Mapping						
Programme Outcomes (PO)						
	1	2	3	4	5	6
CO1			1			
CO2				1		
CO3				2		1
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High						
The strength of maj	pping is to be	written as 1: Lo	w, 2: Medium	, 3: High		

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

	1	1 0 ()/			
Assessment	Based on	Conducted by	Typical Schedule	Marks	
	Lab activities,		During Week 1 to Week 8		
LA1	attendance,	Lab Course Faculty	Marks Submission at the end of	30	
	journal		Week 8		
	Lab activities,		During Week 9 to Week 16		
LA2	attendance,	Lab Course Faculty	Marks Submission at the end of	30	
	journal		Week 16		
	Lab activities,	Lab Course Faculty and	During Week 18 to Week 19		
Lab ESE	journal/	External Examiner as	Marks Submission at the end of	40	
	performance	applicable	Week 19		

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						
AY 2022-23							
			Cours	e Information			
Progra	amme		M. Tech. (Power	System Engineeri	ng)		
Class,	Semester		First Year M.Tec	h., Sem II			
Cours	e Code		6PS572				
Cours	e Name		Professional Elec	tive 3: EHVAC L	aboratory		
Desire	d Requisi	tes:	Power System				
			•				
r	Teaching	Scheme		Examination	Scheme ((Marks)	
Practi	cal	2 Hrs/ Week	LA1	LA2	Lab I	ESE	Total
Intera	ction		30	30	40)	100
				Cı	edits: 1		
			Cours	se Objectives			
1	To under	stand the break	down mechanisms	in gaseous, liquid	and solid i	insulation.	
2	To under current.	stand methods	of generation and r	neasurement of hi	gh voltage.	, impulse v	oltage and impulse
3	To lay a	foundation for l	nigher studies in ex	tra high voltage a	с.		
A / /1	1.6.1	Cours	e Outcomes (CO)	with Bloom's Ta	xonomy L	level	
At the	end of the	course, the stud	tents will be able to	0,		Dloom?	a Dloom's
СО	Course Outcome Statement/s					Taxonom Level	ny Taxonomy Description
C01	Summari insulation	ze breakdown ns.	mechanisms in	gaseous, liquid a	nd solid	II	Understanding
CO2	Understa High cur	nd the basic ger	neration and measu	rement of High vo	ltage and	II	Understanding
CO3	Analyze	the HV generat	ion equipment and	their application.		IV	Analyzing
		<u> </u>	· ·	••			
]	List of Experimen	ts / Lab Activitie	s/Topics		
Lab ac	tivities/La	b performance s	hall include mini-p	oroject, presentatio	ns, drawing	gs, case stu	dies, report writing,
site vis	sit, lab exp	eriment, tutoria	ls, assignments, gr	oup discussion, p	ogrammin	g and other	r suitable activities,
as per	the nature	and requiremen	it of the lab course.				
	Dalva	ah Daa Daaaw	T	extbooks	:	Wiley De	stam I inside d 2nd
1	Editio	on 2008	ludre, Envac	ransmission Eng	meering ,	whey Ea	istern Linnted, Srd
	Lan	JII 2000.					
			R	eferences			
1	Twia:	n Gonen, " <i>EHV</i> Wiley and Sons	AC and HVDC T	Transmission Syste	em Enginee	ering – An	alysis and Design"
2	2 EHVAC and HVDC Transmission Engineering & Practice: S V Rao						
3	Twia Wiley	n Gonen, <i>"Elec</i> y and Sons 1988	ctric Power Trans 3.	mission System E	Ingineering	g-Analysis	and Design", John
			Us	eful Links			
1	Com	outer Usage / La	ab Tool: MATLAB	3/TLS/Power worl	d/MiPower	r Simulator	r

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1			2			
CO2				2		
CO3				2		
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High						
Each CO of the course must map to at least one PO.						

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

Open Elective

	Walchand College of Engineering, Sangli							
(Government Atdea Autonomous Institute)								
Course Information								
Course Information Programma M Tach. (Power System Engineering)								
Progra	Programme M. Lech. (Power System Engineering) Chase Summature Einst Year M. Tesh. Sum H.							
Class,	Class, Semester First Year M. Tech., Sem II							
Cours	e Code		60E506					
Cours	e Name		Open Elective: C	ontrol Techniques for E	ectrical Drives			
Desired Requisites: M.Tech. (Power System Engineering)								
		~ .						
	Teaching	Scheme		Examination Schen	e (Marks)			
Lectur	re	3 Hrs/week	MSE	ISE	ESE	Total		
Tutori	ial		30	20	50	100		
				Credits: 3	5			
			Course	Objectives				
1	To provi	de the latest kno	wledge in the field	of electrical drives.				
2	To provi	de sufficient kno	owledge in the area	of advanced control tec	hniques for indu	ction motor		
	and sync	hronous machin	es.		•			
3	To make	the student awa	re of the research 1	n the field of electrical c	rives.			
At the	and of the	course the stud	outcomes (CO) w	ith Bloom's Taxonomy				
At the		course, the stud	ients will be able to	,	Bloom's	Bloom's		
CO Course Outcome			se Outcome Stater	tcome Statement/s		Taxonomy		
	Level			Level	Description			
CO1	Explain v	various concept	used in AC and DC	C drives.	II	Understandin		
						g		
CO2	Apply co	ontrol techniques	s to AC and DC dri	ves.		Applying		
CO3	Analyze	control techniqu	les for AC and DC	drives.		Analyzing		
04	Evaluate	various control	schemes of AC and	a DC arives.		Evaluating		
Modu			Modula	Contonts		Hours		
Mouu	Degie	a of duives	Mouule			nours		
		s of urives	e Electrical drives	s fundamental torque d	austion speed			
	torau	torques characteristics DC motor & Induction motor multi quadrant operation						
I	of the	of the drive, classification of mechanical load torques, steady state stability of						
	the di	the drive, constant torque and constant HP operation of the drive, closed loop						
speed control.								
	DC n	notor drives						
	Meth	Methods of speed control, starting and breaking operation, single phase and three						
II	phase	phase full controlled and half controlled converter fed DC drives, Multi quadrant						
	circul	lating and non -	circulating mode of	ode of operation, chopper control of DC shunt				
	motor	r drives, four au	adrant operation of	chopper fed DC shunt i	notor drive.			
	Indu	ction motor dri	ves					
	Speed	Speed control methods for three phase induction motor, VSI fed induction						
	motor	motor drive, constant torque (constant E/F and constant V/F), constant HP						
	opera	operation, closed loop speed control block diagram., CSI fed induction motor						
Ш	drive	drive, speed torque characteristics of CSI fed drive, closed loop speed control				5		
	block	block diagram, comparison of CSI fed and VSI fed induction motor drive,						
	Chor	Stator voltage control.						
	Chop	converter cascade in rotor circuit, sub synchronous and super synchronous speed						
	- CONVE	тег сахсале по т	Ofor circuit sub evi	nenronous and super syn	control. Kramer speed control.			

	Modeling of Induction Motor and PWM Techniques				
	abc - dq transformation, transformation from stationary reference frame to				
	synchronously rotating reference frame and vice versa. Equivalent circuits of				
IV	induction motor in dynamic dq stationary and synchronously rotating reference				
	frame. Permanent magnet synchronous machine dq equivalent circuits. The				
	three phase six step bridge inverter, three phase PWM inverter, PWM techniques				
	such as sinusoidal PWM, hysteresis band current control PWM.				
	Vector Control and Direct Torque Control of Induction Motor				
	Vector control of induction motor, DC drive analogy, equivalent circuit, phasor				
X 7	diagram. Direct rotor flux oriented vector control and indirect rotor flux				
V	oriented vector control, stator flux oriented vector control.	5			
	Torque equation of IM in terms of stator and rotor flux, direct torque and flux				
	control method (DTC) and self-commissioning of the drive.				
	Synchronous motor and SRM Drives				
	VSI fed synchronous motor drives, true synchronous and self-control mode.				
	open loop and closed loop speed control of Permanent magnet synchronous				
VI	machine brushless DC motor drives				
	Switched reluctance motor drives torque equation converter circuits operating				
	modes and applications. Solar papel VI characteristics, solar powered nump				
	maximum power point tracking and battery operated vehicles				
	maximum power point ducking and outery operated venteres.				
	Textbooks				
1	G K Dubey "Fundamentals of Electrical Drives" Narosa publication. 2nd edit	ion. 2002			
2	2 B K Bose "Modern Power Electronics and AC drives". Prentice Hall of India Pvt. India 1986				
	References				
1 Peter Vas "Vector Control of AC machines", Clarendon Press Oxford, 1999.					
Ned Mohan, "Advanced Electrical drives – Analysis, control and modeling using Simulink".					
2	2 John Wiley and sons. 2001.				
3	3 P. S. Bhimra, " <i>Power Electronics</i> ", 2nd edition, Khanna Publishers.				
Useful Links					
1	NPTEL video lectures on Electrical Drives				

		CO	-PO Mapping			
		Program	me Outcomes	(PO)		
	1	2	3	4	5	6
CO1				1		
CO2				1		
CO3			1	2		
CO4			1	3		
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High						
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)