SEM V

Professional Core (Theory)

		Wald	chand College (Government Aide	of Engineering d Autonomous Institute	, San	gli					
			AY	2023-24							
			Course	Information							
Progra	amme		B.Tech. (Electrica	al Engineering)							
Class,	Semester		Third Year B. Te	ch., Sem V							
Cours	e Code		6EL301								
Cours	e Name		Power System Ar	alysis and Stability							
Desire	d Requisi	tes:	Electrical transmi	ssion and distributio	n and	A.C. Machin	nes				
			1								
	Teaching	Scheme		Examination Sc	heme	(Marks)					
Lectur	re	3 Hrs/week	MSE	ISE	F	ESE	Total				
Tutori	ial		30	20		50	100				
		I									
			Course	e Objectives							
1	To gain k	nowledge of loa	ad flow analysis an	d short circuit studie	s.						
2	To provid	le knowledge at	out stability proble	ems and dynamic me	chanis	ms in electr	c power systems.				
3	To analys	se case studies a	nd real-world exan	nples of power system	m stabi	ility and dev	elop critical				
	thinking	skills for proble	m solving.								
4	To help s	tudents in prepa	ring for competitiv	e examinations.	т						
At the	and of the	Course	Outcomes (CO) v	vith Bloom's Taxon	omy I	Jevel					
At the		course, me stud	ents will be able to	,		Bloom's	Bloom's				
СО		Cours	e Outcome Staten	nent/s		Taxonomy Level	Taxonomy Description				
CO1	Summari	ze the use of va	rious load flow and	alysis method and as	ssess	п	Understanding				
	the powe	r system under s	symmetrical fault.			11	Understanding				
CO2	Analyse	symmetrical co	omponents of netv	vork and power sys	stem	IV	Analysing				
<u> </u>	Evoluato	the power susta	m stability for rate	mangla voltaga stah	.ility						
005	and to so	lve swing equat	ion	n angle, vonage stat		V	Evaluating				
	und to so	ive sving equa									
Modu	le		Module (Contents			Hours				
	Powe	r Flow Analvsi	S								
I	Bus equat flow r	classification, 1 ions, Gauss-Sei nethods, Reacti	Bus admittance m del and Newton-R ve power control a	natrix, General forr aphson methods, C nd Series compensat	n of ompari ion.	power flow ison of load	7				
П	Iterative power control and bertes compensation. Symmetrical Components Symmetrical components, Dr. Fortescue Theorem, Component synthesis, II Component analysis, Sequence impedances and Sequence networks, Sequence 6 impedances of transmission lines, transformers, and synchronous machines, Construction of sequence network of a power system										
III	Fault Introc Balan capac	Analysis: Bala luction, Classifi ced three phas ity, Symmetric	nced Fault cation, Severity and se fault, Transient fault analysis using	d occurrence of fault t on transmission 1 bus impedance mat	, Effec line, S rix.	t of faults, Short circuit	6				
IV	Fault Introc for an Short	Analysis: Unb luction, Assump alysis of variou circuit studies of	alanced Fault otions, Sequence vo s faults, Analysis o of a large power sys	oltages of generator, f unbalanced faults-S stem network.	Genera SLG,L	al procedure L and DLG,	6				

v	Powe Basic basec stabil appli	er Syster c conce l resou lity ,sw cations	em Sta epts an rces(IE ving ec , critic	bility- d defin R), Po Juation al clear	Revisi nitions, wer an ,M an ring ar	ted and Classi ngle cu nd H co ngle, R	l exten fication rve, A onstant otor at	ded n of sta n elem t, Equa ngle sta	ability entary 1 Area ability,	includi view o Criter Voltag	ng invo of trans ion and ge stab	erter sient d its ility,	,	7
	Factor Case Case	ors influ Studie studie	uencing es and s of po	transie Real-W wer sy	ent stab V orld A stem o	ility. Applica scillation	tions f	for Stal d their	bility E impac	valuat t on gr	ion id stab	ility,		
VI	real-v inver grid Rese	world ter bas stabilit arch ch	power ed resc y, Eme allenge	stabilit ources erging s and o	y even (IBR), techno opportu	nts in Role o logies nities in	power of adva and tro	grid v nced te ends in ield.	vith hi echnolo powe	gh pen ogies in r syster	etration enhan m stab	n of cing ility,	,	7
			0		TT							I		
						Te	xtbool	κs						
1	I.J. N 2015	lagrath	and D.	P. Kotł	nari, "P	ower S	ystem	Analysi	is", 2 nd	Editior	and T	MH Pu	blicatio	on
2	Hadi	Saadat	, Powe	r Systei	m Anal	ysis, T	MH, 1 ^s	st Editio	on, 2002	2				
3	"Pow	ver Syst	tem An	alysis"	, B.S.R	. Murty	, B.S.	Publica	tions.					
	References													
1	Glov	er, Sha	rma, O	verbye	Power	System	ns Anal	lysis an	d Desig	gn, Tho	mpson	$, 5^{\text{th}} \text{Ed}$., 2012.	
2	Steve	enson V	V.D., E	lements	s of Po	wer Sys	stem A	nalysis	, TMH	$, 4^{\text{th}} \operatorname{Ed}$	ition, 2	014.		
3.	Powe	er Syste	em Stab	oility an	d Cont	rol" by	Prabh	a Kund	ur					
						Use	ful Lir	nks						
1	NPT	EL Co	urses:	https://	/nptel.	ac.in/								
2	Rese	arch P	apers l	EEE :	https:/	//ieeex	olore.ie	eee.org	L					
	N. H	atziarg	yriou e	t al., "I	Definiti	on and	Classi	ficatior	1 of Po	wer Sy	stem S	tability	– Rev	isited &
3.	Exter	nded,"	in IEEl	E Trans	saction	s on Po	ower S	ystems,	vol. 3	6, no. 4	4, pp. 3	3271-32	281, Jul	ly 2021,
	doi:	10.1109	P/TPWI	<u>RS.202</u>	0.3041	774.	1		11 .1	-	·		• 1 • • • •	.1
4	Y. C	heng e	t al., "	Real-W	orld S	ubsync	hronou	is Osci	llation	Events	in Po	wer Gr	1ds W1	th High
4	Penel	$\frac{17}{216}$	01 IIIV 20 Jan	erter-В	doi: 10	1100/	r_{DWD}	$\frac{1}{2} = \frac{1}{2}$	21614	1011S OF 1 Q	Power	r Syster	ns, voi	. 38, 110.
	1, pp	. 510-5	50, Jan	. 2023,	uoi. 10	СО-Р		5.2022	.51014	10.				
				T	Progra	mma (utcor						D	50
	1	2	2	1	10g1a					10	11	12	1	$\frac{30}{2}$
<u> </u>	1 2		5	+	5	0	/	0	7	10	11	12	1 2	<u> </u>
		2											2	
		3			2								2	
003														
The stren	gth of r	nappin	g is to l	be writt	en as 1	: Low,	2: Med	lium, 3:	High					
Each CO	of the c	course 1	must m	ap to at	least c	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.

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 ((Government Aided	of Engineering, Sa Autonomous Institute)	ngli							
	AY 2023-24 Course Information											
			Course I	nformation								
Progra	amme		B.Tech. (Electrica	al Engineering)								
Class,	Semes	ter	Third Year B. Te	ch., Sem V								
Cours	e Code	9	6EL302									
Cours	e Nam	e	Control System E	ngineering								
Desire	d Req	uisites:	Engineering Math	nematics III, Signals and	Systems, Elec	ctrical Circuit						
			Analysis									
			·									
	Teach	ing Scheme	Examination Sch	eme (Marks)								
Lectur	re	3 Hrs/week	MSE	ISE	ESE	Total						
Tutori	ial - 30 20 50											
	Credits: 3											
			Course	Objectives								
1	To in	part knowledge for	modeling physical	systems.								
2	To analyze physical systems using various time and frequency domain methods.											
	Toer	able students for de	termining the stabi	lity of linear systems usi	ng different m	ethods.						
4	4 To introduce the use of state space method for system analysis.											
		Course	Outcomes (CO) w	ith Bloom's Taxonomy	Level							
At the	end of	the course, the stud	ents will be able to	,								
CO	Bloom's Bloom's Course Outcome Statement/s Tevenemy											
	Course Outcome Statement/s Taxonomy T											
	Calci	late system transf	er function and s	ustem characteristics of	Level	Description						
C01	Calcu differ	llate system transf ent Systems.	er function and s	ystem characteristics of	Level III	Description Applying						
CO1 CO2	Calcu differ Analy	llate system transf ent Systems. //ze performance //	er function and s	ystem characteristics of ns using mathematica	Level III IV	Description Applying Analysing						
CO1 CO2 CO3	Calcu differ Analy mode	late system transf ent Systems. /ze performance ls. k the stability of lin	er function and s of physical system ear systems in time	ystem characteristics or ns using mathematica and frequency domain.	Level III IV V	Description Applying Analysing Evaluating						
CO1 CO2 CO3	Calcu differ Analy mode Chec	llate system transf ent Systems. //ze performance ls. k the stability of lin	er function and s of physical system ear systems in time	ystem characteristics of ns using mathematica and frequency domain.	Level III IV V	Description Applying Analysing Evaluating						
CO1 CO2 CO3 Modu	Calcu differ Analy mode Chec	late system transf ent Systems. /ze performance ls. k the stability of lin	er function and s of physical system ear systems in time Module (ystem characteristics of ns using mathematica and frequency domain.	Level III IV V	Description Applying Analysing Evaluating Hours						
CO1 CO2 CO3 Modu	Calcu differ Analy mode Chec	late system transf ent Systems. /ze performance ls. k the stability of lin	er function and s of physical system ear systems in time Module (in Frequency Dor	ystem characteristics of ms using mathematica and frequency domain. Contents nain	Level III IV V	Description Applying Analysing Evaluating Hours						
CO1 CO2 CO3 Modu	Calcu differ Analy mode Chec	Late system transf ent Systems. //ze performance of ls. k the stability of lin Analysis of System History of control s	er function and s of physical system ear systems in time Module (in Frequency Dor systems, Laplace tr	ystem characteristics of ns using mathematica and frequency domain. Contents nain ransforms review, transf	Level III IV V	Description Applying Analysing Evaluating Hours f						
CO1 CO2 CO3 Modu	Calcu differ Analy mode Chec	late system transf ent Systems. /ze performance ls. k the stability of lin Analysis of System History of control s Electrical systems,	er function and s of physical system ear systems in time Module (in Frequency Dor systems, Laplace tr Mechanical system	ystem characteristics of ns using mathematica and frequency domain. Contents nain ransforms review, transf s, Rotational Systems, F	Level III IV V	Description Applying Analysing Evaluating Hours f 6						
CO1 CO2 CO3 Modu	Calcu differ Analy mode Chec	Analysis of Systems. Hate systems. Ze performance of the stability of line Analysis of System History of control se Electrical systems, for the stability of System Analysis of System Analysis of System	er function and s of physical system ear systems in time <u>Module (</u> in Frequency Dor systems, Laplace tr Mechanical system hsfer function of D(in Time Domain	ystem characteristics of ns using mathematica and frequency domain. Contents nain ransforms review, transf s, Rotational Systems, E C motor	Level III IV V	Description Applying Analysing Evaluating Hours f 6						
CO1 CO2 CO3 Modu	Calcu differ Analy mode Chec	Analysis of System History of control s Electrical systems, Electrical systems, Electrical systems, Electrical systems, Electrical system State space represe	er function and s of physical system ear systems in time Module (in Frequency Dor systems, Laplace tr Mechanical system insfer function of DO in Time Domain ntation, Convertin	ystem characteristics of ns using mathematica and frequency domain. Contents nain ransforms review, transf s, Rotational Systems, E C motor g transfer function to	Level III IV V er function o lectrical state space:	Description Applying Analysing Evaluating Hours f 6						
CO1 CO2 CO3 Modu I	Calcu differ Analy mode Chec	Analysis of System History of control s Electrical systems, Tran Analysis of System State space represe Phase Variable Form	er function and s of physical system ear systems in time Module (in Frequency Dor systems, Laplace tr Mechanical system insfer function of D(in Time Domain ntation, Convertin n, State space to tr	ystem characteristics of ns using mathematica and frequency domain. Contents nain ransforms review, transf s, Rotational Systems, E C motor g transfer function to ransfer function, State T	Level III IV V er function o lectrical state space: ransition	Description Applying Analysing Evaluating Hours f 6 7						
CO1 CO2 CO3 Modu I II	Calcu differ Analy mode Chec	Analysis of System History of control s Electrical systems, Examples of System Analysis of System History of control s Electrical systems, Examples of System State space represe Phase Variable Form Matrix, Solutionof s	er function and s of physical system ear systems in time <u>Module (</u> in Frequency Dor systems, Laplace tr Mechanical system insfer function of DC in Time Domain ntation, Converting n, State space to tr state equation, Cont	ystem characteristics of ns using mathematica and frequency domain. Contents nain ansforms review, transf s, Rotational Systems, E C motor g transfer function to ransfer function, State T rollability, Observability	Level III IV V er function o lectrical state space: ransition	Description Applying Analysing Evaluating Hours f 6 7						
CO1 CO2 CO3 Modu I II	Calcu differ Analy mode Chec	Analysis of System Hate systems. Ze performance Is. K the stability of lin Analysis of System History of control s Electrical systems, Tran Analysis of System State space represe Phase Variable Form Matrix, Solutionof s Fransient Response	er function and s of physical system ear systems in time Module (in Frequency Dor systems, Laplace tr Mechanical system insfer function of D(in Time Domain intation, Convertin n, State space to tr state equation, Cont e and Reduction o	ystem characteristics of ns using mathematica and frequency domain. Contents nain cansforms review, transf s, Rotational Systems, H C motor g transfer function to cansfer function, State T rollability, Observability f multiple subsystem	Level III IV V er function o lectrical state space: ransition	Description Applying Analysing Evaluating Hours f 6 7						
CO1 CO2 CO3 Modu I II	Calcu differ Analy mode Chec	Analysis of System History of control s Electrical systems, Examples of System Analysis of System History of control s Electrical systems, Examples of System State space represe Phase Variable Form Matrix, Solutionof s Fransient Respons Fime response, polo	er function and s of physical system ear systems in time Module (in Frequency Dor systems, Laplace tr Mechanical system insfer function of DC in Time Domain intation, Converting n, State space to tr state equation, Cont e and Reduction o es, zero and system	ystem characteristics of ns using mathematica and frequency domain. Contents nain ransforms review, transf s, Rotational Systems, E C motor g transfer function to ransfer function, State T rollability, Observability f multiple subsystem n response, Response of stem response with add	Level III IV V er function o lectrical state space: ransition first, second itional poles	Description Applying Analysing Evaluating Hours f 6 7						
CO1 CO2 CO3 Modu I II	Calcu differ Analy mode Chec	Analysis of System Hate systems. Ze performance Is. Analysis of System History of control se Electrical systems, Electrical systems, Electrical systems, Electrical systems, Encuit analogs, Tran Analysis of System State space represe Phase Variable Form Matrix, Solutionof se Fransient Response Fime response, pole and general second additional zeros Blo	er function and s of physical system ear systems in time Module (in Frequency Dor systems, Laplace tr Mechanical system insfer function of D(in Time Domain intation, Converting n, State space to tr state equation, Cont e and Reduction o es, zero and system order system, system ock diagram analy	ystem characteristics of ms using mathematica and frequency domain. Contents nain cansforms review, transf s, Rotational Systems, H C motor g transfer function to cansfer function, State T rollability, Observability f multiple subsystem n response, Response of stem response with add sis and design of feedl	Level III IV V er function o lectrical state space: ransition first, second itional poles, pack systems.	Description Applying Analysing Evaluating Hours f 6 7 7						
CO1 CO2 CO3 Modu I II	Calcu differ Analy mode Chec Ile	Analysis of System History of control s Electrical systems, Extra space represe Phase Variable Form Matrix, Solutionof s Firme response, pole and general second diditional zeros Ble ignal flow graph,	er function and s of physical system ear systems in time Module (in Frequency Dor systems, Laplace th Mechanical system asfer function of DC in Time Domain ntation, Converting n, State space to the state equation, Conte e and Reduction of es, zero and system l order system, system ock diagram analy mason's rule, sig	ystem characteristics of ns using mathematica and frequency domain. Contents nain ansforms review, transf s, Rotational Systems, H C motor g transfer function to ransfer function, State T rollability, Observability f multiple subsystem n response, Response of stem response with add sis and design of feedl gnal flow graphs of st	Level III IV V er function o lectrical state space: ransition first, second itional poles, ack systems, ate equation,	Description Applying Analysing Evaluating Hours f 6 7 7						

	Steady State Error	
	Steady state error for unity feedback systems, static error constants, and	
IV	system type. Steady state error specifications, steady state error for system	4
	with disturbances, non-unity feedback systems. steady state error for	
	systems in state space, PID Controllers.	
	Stability Analysis: Routh Criterion and Root Locus	
	Routh criterion for stability and stability in state space, Sketching the root	
V	locus, transient response design via gain adjustment, Root locus for positive	7
	feedback system, pole sensitivity, lag, lead, lag-lead compensators in root	
	locus domain.	
	Stability Analysis: Bode Plot and Nyquist Plot, Compensators	
VI	Bode plot, Nyquist criterion, Determination of stability, gain margin, phase	8
¥1	margin via the Nyquist diagram and bode plots Introduction to	0
	Compensators, lag, lead, lag-lead compensator in frequency domain.	
	Textbooks	
1	Norman Nise, "Control System Engineering", John Wiley, Sixth Edition, 2011.	
2	I.J. Nagrath and M. Gopal, "Control System Engineering", Anshan Publishers 2008.	, Fifth edition,
	References	
1	M Gopal, "Control System Principle & Design", T.M.H., Fourth Edition, 2012.	
2	K Ogata, "Modern Control Engineering", P.H.I., Fourth Edition, 2002.	
3	Dorf and Bishop, "Modern Control System", Adison Wesley Longman, Eight Ed	ition, 1998.
	Useful Links	
1	https://nptel.ac.in/courses/108/106/108106098/	

CO-PO Mapping														
		Programme Outcomes (PO) PSO												SO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		3												
CO2		3												2
CO3		3												2

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.

		Wald	hand College	of Engineerin	σ Sar	nali					
		vv arc	(Government Aide	d Autonomous Institu	g, 5a1 1te)	Ign					
			AY	2023-24							
			Course	Information							
Progra	amme		B.Tech. (Electric	al Engineering)							
Class,	Semester		Third Year B. Te	ch., Sem V							
Cours	e Code		6EL303								
Cours	e Name		Digital Signal Pro	ocessing							
Desire	d Requisi	tes:	Engineering Matl	nematics –III, Signa	als and	Systems					
						-					
	Teaching	Scheme		Examination S	Scheme	(Marks)					
Lectur	re	3 Hrs/week	MSE	ISE		ESE	Total				
Tutori	al	-	30	20		50	100				
				Cree	dits: 3						
			1								
			Course	e Objectives							
1	To devel	op basic knowle	dge of DSP system	s and signal proces	ssing.						
2	To devel	op basic knowle	dge of FFT and filt	er design.	0						
3	To enabl	e students to lea	rn different moderr	n signal processing	tools.						
		Course	Outcomes (CO) v	vith Bloom's Taxo	nomy]	Level					
At the	end of the	course, the stud	ents will be able to	,							
CO		Course	a Autoomo Staton	nontla		Bloom's	Bloom's				
		Cours	se Outcome Staten	nenu's		Level	Description				
CO1	Apply th	e signal process	ing tools and transf	orms.		III	Applying				
CO2	Apply di	fferent techniqu	es for Filter design			III	Applying				
CO3	Explain	modern signal p	rocessing tools and	algorithms.		II	Understanding				
Modu	le		Module (Contents			Hours				
	Digit	al Signals and S	Systems-	D • • •							
	Sam	pling, transfer fu	inction and frequer	icy response, Digit	al syste	m's response	6				
		rete Fourier Tr	aneform								
	DISCI	Relation betwe	en DFT & Z- Trat	usform. Circular co	nvoluti	on and DFT.					
II	FFT	Algorithms –Dľ	Γ-FFT and DIF-FF	T, Overlap save alg	gorithm	, overlap add	7				
	algor	ithm.			-						
	IIR I	Filter Design-									
III	III Filter design using impulse invariant technique, bilinear transformation and 7										
	Anal	by filter approxit	mation (Butterwort	n) and Realization.							
	FIR	Filter Design-	inear phase proper	ty Fourier series i	method	Windowing					
IV	meth	od. Filter des	sign using wind	ow. frequency	samplir	g methods.	7				
	quant	tization and real	ization.	·, <u>1</u>		0					
	Digit	al Signal Proce	ssors-								
V	Intro	duction, real ti	ime signals proce	ssing, modification	ns in s	structure and	6				
1	archi	tecture importa	nt blocks. Programi	ming Aspects, App	lication	S.					

VI	Multirate Signal Processing- Up-sampling and down-sampling time and frequency effects, aliasing and imaging effects, Applications.	6
	Textbooks	
1	John G, Proakis' Digital Signal Processing Principles, Algorithms and Applic Education, 2008.	ations', Pearson
2	Sanjeet Mitra, 'Digital Signal Processing', The MIT Press, 2007.	
3	Venkatramani, Bhaskar, 'Digital Signal Processors', TMH Pub., 2006.	
	References	
1	Oppenheim and R. W. Schafer, 'Discrete Time Signal Processing' PHI Pub., 200	15
	Useful Links	
1	https://nptel.ac.in/	

CO-PO Mapping														
		Programme Outcomes (PO) PSO												
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3													2
CO2			3											2
CO3	CO3 3 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.

Professional Core (Lab)

		Wa	alchand College (Government Aide	of Engineering, Sa	ngli						
			AY	2023-24							
			Course	Information							
Progra	amme		B.Tech. (Electrical l	Engineering)							
Class,	Semes	ter	Third Year B. Tech.	, Sem V							
Cours	e Code	e	6EL351								
Cours	e Nam	e	Power System Anal	ysis and Stability Lab							
Desire	d Req	uisites:	Electrical Transmiss	sion and Distribution, AC	Machines						
T	eachin	g Scheme		Examination Scheme	(Marks)						
Practical 2 Hrs/Week LA1 LA2 Lab Total ESE ESE											
Intera	Interaction - 30 30 40 100										
				Credits: 1							
			~								
	T	. 1	Course	e Objectives							
1		over steady state	analysis and fault stu	Idles for a power system.							
$\frac{2}{3}$	Topi	v the foundation	for conducting highe	er level study in power sys	tem						
		Cou	rse Outcomes (CO) v	with Bloom's Taxonomy	Level						
At the	end of	the course, the	students will be able t	.0,							
СО	Cour	rse Outcome Sta	atement/s		Bloom's Taxonomy Level	Bloom's Taxonomy Description					
C01	Simu	late various met	hods of power system	n analysis.	II	Understanding					
CO2	Carry	vout simulation	for symmetrical comp	ponents of network and	Ш	Applying					
	analy	se the power sys	stem under various fa	ult.							
<u> </u>	Evalu	ate the equal A	rea criterion and swin	g curve for stability.	V	Evaluating					
			List of Exposin	ants / Lob Activitios							
List of 1. Deve	f Expe i lopmei	r iments: nt of the MATL.	AB program of bus ad	dmittance matrix Ybus.							
2. Outli	ne of S	IM Power Syste	ems toolbox in MATL	LAB							
3. Analy	yze Loa	ad flow using M	iPower/MATLAB/E	ГАР.							
4. Simu	lation of	of Short circuit a	analysis using MiPow	ver/MATLAB/ETAP.							
5. Simu	lation	of Transient ana	lysis using MiPower/	MATLAB/ETAP.							
6. Demo	onstrati	ion of unbalance	d Fault Using transm	ission line simulator (TLS	5)						
7. Anal	yse Syı	nmetrical comp	onents of 3phase unb	alanced system using MA	TLAB.						
8. Deve	lopmei	nt of the program	n for Equal Area Crite	eria analysis using MATL	AB.						
9. Examination of Swing Curve using power world/ MiPower/MATLAB/ETAP simulation											
10. Dev	10. Development of the MATLAB programm to calculate series compensation										
11. Out	line of	MiPower/MAT	LAB/ETAP for powe	r system analysis and stab	ility.						

12. Small Signal Stability Analysis: Measurement and analysis of system eigenvalues and damping ratios

- 13 .Determination of critical clearing time for a transient stability event
- 14. Develop programme for Eigen value analysis of power system stability

15. Analysis of the dynamic response of the power system to disturbances

16. Analysis of power system oscillations in real world application

17. Simulation Case Studies and Real-World Applications for Stability Evaluation

18. Impact of Surge Impedance loading on high voltage transmission lines

Note: Any eight to nine experiments will be conducted during practical

	Text Books
1	I.J. Nagrath and D.P. Kothari, "Power System Analysis", 2nd Edition and TMH Publication
	2015.
	References
1	Glover, Sharma, Overbye Power Systems Analysis and Design, Thompson, 5th Ed., 2012.
2	Hadi Saadat, Power System Analysis, TMH, 1st Edition, 2002.
3	Stevenson W.D., Elements of Power System Analysis, TMH, 4th Edition, 1994.
4	Power System Stability and Control" by Prabha Kundur
	Useful Links
1	NPTEL Courses: <u>https://nptel.ac.in/</u>
2	Research Papers IEEE : <u>https://ieeexplore.ieee.org/</u>
3	N. Hatziargyriou et al., "Definition and Classification of Power System Stability – Revisited &
	Extended," in IEEE Transactions on Power Systems, vol. 36, no. 4, pp. 3271-3281, July 2021, doi:
	10.1109/TPWRS.2020.3041774.
4	Y. Cheng et al., "Real-World Subsynchronous Oscillation Events in Power Grids With High
	Penetrations of Inverter-Based Resources," in IEEE Transactions on Power Systems, vol. 38, no. 1,
	pp. 316-330, Jan. 2023, doi: 10.1109/TPWRS.2022.3161418.

	CO-PO Mapping														
		Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1				3									2		
CO2															
CO3			2	2									2		
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High															
Each CO	O of the	e course	e must 1	nap to	at least	one PC), and p	referab	ly to or	nly 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	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	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	ents and							
related activitie	es if any.										

	Walchand College of Engineering, Sangli										
			AY	2023-24							
	Course Information										
Progr	amme		B Tech (Electrical I	Engineering)							
Class	Seme	ster	Third Year B Tech	nird Year B Tech Sem V							
Cours	e Code		6FI 352								
Cours	e Nam	e	Control System Eng	ineering Lab							
Desire	d Rea	nisites.	Engineering Mathematics III. Signals and Systems, Electrical Circuit								
Desire	uncq	uisites.	Analysis								
T	eachin	g Scheme		Examination Sch	eme (M	arks)					
Practi	cal	2 Hrs/Week	LA1	LA2	L	ab ESE	Total				
Intera	ction	_	30	30		40	100				
				Credit	s: 1						
		1	I								
			Course	e Objectives							
1	To pi	ovide practical	knowledge regarding	modelling of differe	nt physic	cal systems.					
2	To in	npart skills to ev	aluate the performance	e of systems using t	ransient	analysis.					
3	3 To estimate the stability of linear systems.										
		Cou	rse Outcomes (CO) v	with Bloom's Taxor	10my Le	evel					
At the end of the course, the students will be able to,											
СО	Cour	rse Outcome Sta	atement/s			Bloom's Taxonomy Level	Bloom's Taxonomy Description				
CO1	Solve	e and analyze ph	ysical systems using s	simulation tools.		III	Applying				
CO2	Asse	ss the stability of	f systems using freque	ency domain technic	jues.	IV	Analyzing				
CO3	Study	y transient analy	sis of physical system	IS.		IV	Analyzing				
			List of Experim	nents / Lab Activiti	es						
List of	f Expe	riments:									
1.	Cons	truct transfer fu	nction using software	tools.							
2.	Anal	yze the effect of	feedback using softw	vare and simulation t	ools.						
3.	Conv	version of transfe	er functions to state sp	bace and vice versa i	ising sof	tware tools					
4.	Calci	ulate the transfer	Tunction of Electrica	I, Mechanical and R	otationa.	systems usin	Ig MAILAB				
5.	Evalu	uate the transien	t response of first and	second order system	Electrica	a systems.					
0. 7	Com	pute the Control	lability and Observab	ility of physical system	ems						
8.	Stabi	lity analysis of c	control system using s	oftware tools.	ems						
9.	Skete	ch root locus and	l design compensator	using G.U.I. and so	ftware to	ols.					
10	. Sketo	ch Nyquist, Bod	e Diagram and design	compensator using	G.U.I. a	nd software to	ools.				
11	. Desig	gn a PID control	ler for speed control of	of electric machine.							
1	NT	N: 40	Tex	xt Books		. 2011					
1	INORN	han Nise, "Contr	OI System Engineerin	ig", John Wiley, Six	the Editio	n, 2011.	adition 2000				
	1.J. IN	agraui and M. C	iopai, Control Syster	in Engineering, An		onshers, Filth	eutuon, 2008.				
			Do	ferences							
1	MG	opal. "Control S	vstem Principle & De	sign". T.M.H Four	th Editio	n. 2012.					

2	K Ogata, "Modern Control Engineering", P.H.I., Fourth Edition, 2002.									
3	Dorf and Bishop, "Modern Control System", Adison Wesley Longman, Eight Edition, 1998.									
	Useful Links									

	CO-PO Mapping													
		Programme Outcomes (PO) PSO												
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1			3											
CO2				3										2
CO3				3										2
The strength of	The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High													
				. 1		20								

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								
LA1	Lab activities,	Lab Course	During Week 1 to Week 8	30								
LAI	attendance, journal	Faculty	Marks Submission at the end of Week 8	30								
LA2	Lab activities,	Lab Course	During Week 9 to Week 16	20								
	attendance, journal	Faculty	Marks Submission at the end of Week 16	50								
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40								
Week 1 indic experiments, nature and re- related activit	ates starting week of a mini-project, presenta quirement of the lab co ties if any.	semester. Lab ac tions, drawings, p purse. The experir	tivities/Lab performance shall include perfor rogramming, and other suitable activities, as nental lab shall have typically 8-10 experime	ming per the nts and								

Walchand College of Engineering, Sangli											
			(Oovernment Ald	7 2023-24							
			Course	e Information							
Progra	amme		B Tech (Electric	al Engineering)							
Class	Somostor		Third Year B. Tech., Sem V								
Course	o Code										
Cours	e Coue		UEL333 Digital Signal Processing Lab								
Dogino	d Dogwigi	toge	Engineering Methometrics III Signals and Sustaine								
Desire	a Kequisi		Engineering Mathematics –III, Signals and Systems								
r	Feaching	Scheme		Examination	n Scheme (Marks)					
Practi	cal	2 Hrs/ Week	LA1	LA2	Lab I	ESE	Total				
Intera	ction	-	30	30	40)	100				
				С	redits: 1	I					
			1								
			Cours	se Objectives							
1	To devel	op basic knowle	edge of DSP syster	ns and signal proc	cessing.						
2	To devel	op basic knowle	edge of FFT and fil	lter design.							
3	To enable	e students to lea	arn different moder	n signal processi	ng tools.						
		Cours	e Outcomes (CO)	with Bloom's Ta	axonomy L	evel					
At the	end of the	course, the stud	dents will be able to	0,							
CO		Com	na Autoomo Stat	montla	Bloom's	Bloom's					
CO		Cou	ise Outcome State	ement/s		Level	Description				
CO1	Apply the	e signal process	sing tools and trans	forms.		III	Applying				
CO2	Apply di	fferent techniqu	ies for Filter design	1		III	Applying				
CO3	Explain r	nodern signal p	processing tools and	d algorithms.		II	Understanding				
]	List of Experimen	ts / Lab Activitie	es/Topics						
List of	Lab Acti	vities: Minimu	m 10-12 experimer	nts using Matlab a	and DSP kit	with reference	e to following				
list-											
1.	Generation	on and convolu	tion of DT signals.								
2.	Erecuenc	requency and al	magnitude phase	npling.							
3.	Response	e of system to s	tandard test signals	piot of system.							
5.	DFT and	IDFT computa	tion and magnitude	e, phase plot.							
6.	Circular	convolution and	d comparison with	linear convolution	n.						
7.	IIR filter	design.	-								
8.	FIR filter	rs design.									
9.	IIR and F	FIR filter design	n using toolbox.	1. 1.5	1						
10	. Multirate	signal process	ing-up and down sing	ampling and Freq	uency doma	ain effects.					
11	DSP prov	e signal process	ing- anti- imaging	and antialiasing f	mer.						
12	DSP prod	cessor- Differen	ince equation and in	npulse response							
14	. DSP prod	cessor- Implem	entation of filter.	npuise response.							
	<u> </u>		· · ·								
			Т	extbooks							
1	John Educa	G, Proakis' Dation, 2008.	igital Signal Proce	essing Principles,	Algorithm	s and Applic	cations', Pearson				
2	Sanje	et Mitra, 'Digit	al Signal Processin	ng', The MIT Pres	ss, 2007.						

3	Venkatramani, Bhaskar, 'Digital Signal Processors', TMH Pub., 2006.								
References									
1	Oppenheim and R. W. Schafer, 'Discrete Time Signal Processing', PHI Pub., 2005								
Useful Links									
1	https://nptel.ac.in/								

	CO-PO Mapping													
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3													2
CO2			3											2
CO3					3									2
The stre	The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High													
CO2 CO3 The stre	ength of	f mappi	ng is to	be wri	3 tten as	1,2,3; v	where, 1	l: Low,	2: Mec	lium, 3	: High			-

Each CO of the course must map to at least one PO, and preferably to only one PO.

related activities if any.

	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 Mark												
	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 experiments, m nature and requ	es starting week o ini-project, presen irement of the lab	f a semester. Lab activities/ ntations, drawings, program o course. The experimental	Lab performance shall include perfo ming, and other suitable activities, a lab shall have typically 8-10 experim	rming s per the rents and								

	Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)										
			A	Y 2023-24							
Course Information											
Progra	amme		B.Tech. (Electri	cal Engineering)							
Class,	Class, Semester Third Year B. Tech., Sem I										
Cours	e Code		6EL354	6EL354							
Cours	e Name		Presentation and	l Report Writing							
Desire	d Requisi	ites:	MS-Office								
			1								
Г	eaching a	Scheme		Examination S	Scheme	(Marks)					
Practi	cal	-	LA1	LA2	Lab I	ESE	Total				
Intera	ction	1 Hrs/	30	30	40)	100				
		Week									
	Credits: 1										
	· · ·										
	Course Objectives										
1	1 To convey ethical guidelines during technical content preparation and showcasing										
2	To make	aware of soft	tools for informat	tion handling							
3	To provi	de various rele	vant benchmark	case studies	1 • 11						
4	To share	course	ng reading, writin	g and presentation s	SK1IIS	Loval					
At the	end of the	course the stu	idents will be able	e to	onomy	Level					
		course, the ste				Bloom's	Bloom's				
СО		Cours	se Outcome Stat	ement/s		Taxonomy	Taxonomy				
						Level	Description				
CO1	Follow presenta	ethical guid tions	lelines during	technical writing	and	ΙΙ	Understanding				
CO2	Choose a	and practice to	ols for sharing an	d linking the inform	nation	III	Applying				
CO3	Compare write-up	e and identify and demonstra	y suitable platfo ations	orms towards prac	ticing	IV	Analysing				
CO4	Discuss overall to	within groups echnical expres	s to assess his/h ssions	er own improveme	ent in	V	Evaluating				
CO5	Create c the work	ontented repor	ts and meaningfu	l presentations auth	noring	VI	Creating				
		L	ist of Experimen	nts / Lab Activities	/Topics						

List of Sessions:

PART - A Technical Report Writing

- 1. Session 1: Writing technical reports using proper Tense and grammar.
- 2. Session 2: Study of various types of technical Reports
 - a. Project report
 - b. Conference paper
 - c. Journal Paper
 - d. Intellectual Property Rights (IPR)
 - e. Selection of paper type for possible publication.
- 3. Session 3: Study of technical report Structure I
 - a. Preamble
 - b. Abstract
 - c. Literature review/survey
 - d. Problem statement
 - e. Objectives

4. Session 4: Study of technical report Structure – II

- a. Methodologies
- b. Results
- c. Discussions
- d. Conclusion
- e. Acknowledgements
- 5. Session 5: Use of Bibliographies/references and proper citations in reports.
- 6. Session 6: Use of Citations, referring style and method of using citations.
- 7. Session 7: Study of Plagiarism
 - a. Checking plagiarism
 - b. Minimizing plagiarism

PART - B Presentation

- 1. PPT's and Animations
- 2. Presentation structure, Number of slides and Time management
- 3. Presentation styles
- 4. Figures and Tables for data representations

Part - C Tools and Practices

- 1. MS Office, Open Office, Latex, MS Visio, Inkspace etc.
- 2. End Note; Mendeley, Grammarly, Ginger, 1 Checker, Turnitin etc.

	Textbooks									
1	Kothari C. R, "Research Methodology", 2 nd Edition, New Age International, 1990									
2	Chopra Deepak and Sondhi Neena, "Research Methodology: Concepts and cases", 2 nd									
	Edition, Vikas Publishing House, New Delhi,2015									
	References									
1	Melville Stuart and Goddard Wayne, "Research Methodology: An Introduction For Science									
1	& Engineering Students", 1 st Edition, Kenwyn Juta & Co. Ltd., 1996									
2	G. Ramamurthy, "Research Methodology", 2 nd Edition, Dream Tech Press, New Delhi, 2015									
	Useful Links									
1	Academic Research & Report Writing									
1	https://onlinecourses.swayam2.ac.in/ntr21_ed23/preview_									
2	Academic Writing									
2	https://onlinecourses.swayam2.ac.in/cec21_ge18/preview									

3	Qualitative Research Methods and Research Writing
	https://onlinecourses.nptel.ac.in/noc21_ge12/preview_
4	Effective Writing
	https://onlinecourses.nptel.ac.in/noc21_hs44/preview_

	CO-PO Mapping													
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1						1		3						
CO2					2								1	
CO3					1					3				
CO4									3	2				
The stre	ength of	mappi	ng is to	be wri	tten as	1,2,3; v	where, 1	: Low,	2: Med	lium, 3	High			

Each CO of the course must map to at least one PO, and preferably to only one PO.

related activities if any.

		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	30							
LA2	attendance,	Lab Course Faculty	Marks Submission at the end of								
	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 experiments, m nature and requ	es starting week o ini-project, presen irement of the lab	f a semester. Lab activities/ ntations, drawings, program o course. The experimental	Lab performance shall include perfo ming, and other suitable activities, a lab shall have typically 8-10 experim	rming s per the lents and							

Course Contents for T Y B. Tech. Programme, Department of Electrical Engineering AY 2023-24

Professional Elective 1

		Wale	chand College (Government Aide	of Engineering d Autonomous Institu	g, Sa i	ngli				
			AY	2022-23						
			Course	Information						
Progra	amme		B.Tech. (Electrica	al Engineering)						
Class,	Semester		Third Year B. Te	ch., Sem V						
Cours	e Code		6EL311							
Cours	e Name		Professional Elec	tive I: Electromagne	etic Fie	eld				
Desire	d Requisi	tes:	Electrical Circuits	s, DC Machines and	Trans	formers				
	Teaching	Scheme		Examination S	cheme	(Marks)				
Lectu	re	3 Hrs/week	MSE	ISE		ESE	Total			
Tutor	ial	_	30	20		50	100			
				Crea	lits: 3					
			1							
			Course	e Obiectives						
1	This cou	rse develops fou	ndational concepts	in electrostatic and	electro	magnetic fie	lds.			
	It familia	rizes the studen	ts with electrical fie	eld and scalar potent	ial, ma	ignetic field a	and vector			
2	potential	, Maxwell's equ	ations, Biot-Savart	Law, electrostatic b	ounda	ry conditions	, time varying			
2	potential		donto in nuononino f	on competitive even	inatio	n 0				
3		Course	Outcomes (CO)	or competitive examination with Bloom's Taxo		ns. Lovol				
At the	end of the	course the stud	ents will be able to	vitii Diooni s 1 axu	nomy					
СО		Cours	se Outcome Staten	nent/s		Bloom's Taxonomy	Bloom's Taxonomy			
CO1	Catch th	e concepts of ele	ectrostatic and elect	romagnetic fields.		II	Understanding			
	Apply v	arious laws in e	lectromagnetics to	identify the nature	and					
	atronath	A								
CO3	strength of electric and magnetic fields.									
	Test the	of electric and n boundary value	nagnetic fields. conditions in electr	omagnetic fields.		IV	Applying Analyzing			
	Test the	of electric and n boundary value	nagnetic fields. conditions in electr	omagnetic fields.		IV	Applying Analyzing			
Modu	Test the	of electric and n boundary value	nagnetic fields. conditions in electr Module (omagnetic fields.		IV	Applying Analyzing Hours			
Modu	Ile Vector Field Syster Strok	of electric and n boundary value or Analysis or Algebra, Rect , Dot Product, C m, Vector Calcu or and Divergen e's Theorem Cl	nagnetic fields. conditions in electr Module (angular Coordinate ross Product, Circu ilus, Del Operator, nce Theorem, Curl assification of Vec	comagnetic fields. Contents System, Vector Co ilar and Cylindrical Gradient of Scalar, of a Vector and tor Fields	empone Coord Diverg	IV IV ent, Vector inate gence of	Applying Analyzing Hours 6			
Modu I II	Ile Vector Field Syster Vector Strok Elect Dipol Field	of electric and n boundary value or Analysis or Algebra, Rect , Dot Product, C m, Vector Calcu or and Divergen e's Theorem, Cl rostatic Fields ombs Law and F ibutions, Electric ric Potential, Re le and Flux Line s.	Module C Module C angular Coordinate ross Product, Circu ilus, Del Operator, nce Theorem, Curl assification of Vect Field Intensity, Elec c Flux Density, Gau lationship between es, Energy Density	omagnetic fields. Contents System, Vector Co lar and Cylindrical Gradient of Scalar, of a Vector and tor Fields. tric Fields due to Co uss's Law- Maxwell E and V-Maxwell's in Electrostatic	ompone Coord Diverg ontinud I's Equa	IV IV ent, Vector inate gence of ous Charge ation, tion, Electric	Applying Analyzing Hours 6 7			

	Electrostatic Boundary-Value Problems	
	Introduction, Poisson's and Laplace's Equations, Uniqueness Theorem,	
IV	General Procedures for Solving Poisson's and Laplace's Equations, Resistance	7
	and Capacitance, Method of Images.	
	Magneto Static Fields and Magnetic Forces	
	Biot- Savart's Law, Ampere's Circuital Law-Maxwell's Equation, Application	
	of Ampere's Law, Magnetic Flux Density-Maxwell's Equation, Maxwell's	
	Equation for Static Fields, Magnetic Scalar and	7
V	Vector Potentials. Introduction, Forces due to Magnetic Torque and Moment,	
	Magnetic Dipole.	
	Maxwell's Equations	
	Introduction, Faraday's Law, Transformer and Motional ElectromotiveForces,	(
VI	Displacement Current, Maxwell's equations in Final Forms, Time-	0
, ,	Varying Potentials, Time Harmonic Fields.	
	Textbooks	
1	W.H. Hayt, J A Buck, M J Akhtar "Engineering Electromagnetic", McGraw	Hill, 8th
	Edition 2014.	
2	M. Sadiku, "Elements of Electromagnetics", Oxford University Press, 4th Edition	n 2007.
	References	
1	Joseph A. Edminster, "Electromagnetics", Tata Mc Graw Hill, 2nd Edition. 2010	
2	John D. Kraus, "Electromagnetics", Tata Mc Graw Hill, 4th Edition 2006	
2	Jorden and Balmen, "Electromagnetic Wave and Radiation System" Pearson	Publication 2 nd
5	Edition 2015.	
	Useful Links	
1	https://nptel.ac.in/courses/108/106/108106073/	

CO-PO Mapping Programme Outcomes (PO) PSO 2 3 4 5 6 7 8 9 10 11 12 1 2 1 CO1 3 **CO2** 3 2 **CO3** 2 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.

	Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)											
			AY	2023-24								
			Course I	Information								
Progra	amme		B.Tech. (Electrica	al Engineering)								
Class,	Semester		Third Year B. Te	ch., Sem V								
Cours	e Code		6EL312									
Cours	e Name		Professional Elec	tive I : Linear Algebra								
Desire	d Requisi	tes:	Engineering Math	nematics I								
	Teaching	Scheme	Examination Sche	eme (Marks)								
Lectur	re	3 Hrs/week	MSE	ISE	ESE	Total						
Tutori	ial	-	30	20	50	100						
				Credits: 3								
			1									
			Course	Objectives								
1	To becom	ne computationa	al proficiency invol	ving procedures in Linear	Algebra.							
2	To under simple p	stand the axiom roofs.	atic structure of a n	nodern mathematical subj	ect and learn to	o construct						
3	To solve	problems that a	pply Linear Algebra	a to Economics and Engin	neering.							
		Course	Outcomes (CO) w	ith Bloom's Taxonomy	Level							
At the	end of the	course, the stud	ents will be able to	,	DI	DL						
СО		Cours	se Outcome Staten	nent/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description						
CO1	Apply m geometry	athematical met y, and graphs to	hods involving aritl solve problems.	hmetic, algebra,	III	Applying						
CO2	Analyze	the solution set	of a system of linea	r equations	IV	Analysing						
CO3	Evaluate	Engineering pro	oblems using the co	oncept of Linear Algebra.	V	Evaluating						
Modu	le		Module (Contents		Hours						
I	Solv Vec Mat	v ing Linear Equ tors, The Idea or rixOperations, I	nations of Elimination, Elin nverse Matrices, El	mination Using Matrices imination = Factorization	, Rules for : A = LU,	4						
	Tra	nsposes and Peri	nutations									
Matrix Operations, inverse Matrices, Elimination = Factorization: A = LU, Transposes and PermutationsVector Spaces and Subspaces Spaces of Vectors, The Nullspace of A: Solving Ax = 0 and Rx = 0, The Complete Solution to Ax = b, Independence, Basis and Dimension, Dimensions of the Four Subspaces, Orthogonality, Orthogonality of the Four Subspaces. Projections, Least Squares Approximations, Orthonormal Bases and Gram-Schmidt ,The Properties of Determinants, Permutations and Cofactors, Cramer's Rule, Inverses, and Volumes, Review of Eigenvalues and Eigenvectors , Review of Diagonalizing a Matrix , Systems of Differential Equations , Review of Symmetric Matrices, Positive Definite												
III	The Ima Prin SVI Mat	Singular Value ge Processing cipal Compone D, Linear Transf rix of a Linear	e Decomposition by Linear Algebra nt Analysis (PCA formations, The Ide Transformation, Th	a, Bases and Matrices i by the SVD), The Geor ea of a Linear Transforr ne Search for a Good Basi	n the SVD, metry of the nation , The s.	7						

IV	Complex Vectors and Matrices Complex Numbers, Hermitian and Unitary Matrices, The Fast Fourier Transform, Matrices in Engineering, Markov Matrices, Population, Linear Programming, Fourier Series: Linear Algebra for Functions, Computer Graphics, Linear Algebra for Cryptography.	8
V	Numerical Linear Algebra Gaussian Elimination in Practice, Norms and Condition Numbers, IterativeMethods and Preconditioners	7
VI	Linear Algebra in Probability & Statistics Mean, Variance, and Probability, Covariance Matrices and Joint Probabilities, Multivariate Gaussian and Weighted Least Squares	6
	Textbooks	
1	Gilbert Strang, "Linear Algebra and its Applications", Fourth Edition, Cengage L ISBN: 9788131501726	Learning, 2005,
2	David C Lay, "Linear Algebra and its Applications", third Edition, Pearson Educ ISBN: 8177583336	ation,2002,
	References	
1	Kenneth M Hoffman, "Linear Algebra", Pearson Education, second 2015, ISBN: 9332550077	d Edition,
2	Kuldeep Singh, "Linear Algebra", Oxford University Press, 2013, ISBN: 978019	9654444
	Useful Links	
1	https://nptel.ac.in/courses/108/104/108104174/	
2	https://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/vi	deo-lectures/

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3													
CO2		2												
CO3			2											
The streng	gth of 1	nappir	ng is to	be wri	tten as	1,2,3;	Where	e, 1:Lo	w, 2:M	ledium	, 3:Hig	,h		

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.

	Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)											
			AY	2022-23								
			Course	Information								
Progr	amme		B.Tech. (Electrica	al Engineering)								
Class,	Semester		Third Year B. Teo	ch., Sem V								
Cours	se Code		6EL313									
Cours	e Name		Professional Elect	tive I: Energy Storage	Systems for EV	T						
Desire	ed Requisi	tes:	Power Electronics	8								
			1									
	Teaching	Scheme		Examination Scl	neme (Marks)							
Lectu	re	3 Hrs/week	MSE	ISE	ESE	Total						
Tutor	ial	-	30	20	50	100						
				Credit	s: 3							
			Course	e Objectives								
1	This cou	rse aims to prov	ide the foundation l	evel knowledge of di	fferent energy st	orage systems.						
2	The cour	se will enable st	udent to use variou	s energy systems and	study various co	omponents of						
2	battery n	anagement syst	em.	the neuron convention	for alastria vak	iolog						
	The cour	se will also helr	the students to examine	the power converter	of fuel cells and	supercapacitors						
	The cour	<u>Se will also heip</u> Course	e Outcomes (CO) y	vith Bloom's Taxon	mv Level	supercapacitors.						
At the	end of the	course, the stud	lents will be able to	,								
со		Cours	se Outcome Staten	nent/s	Bloom's Taxonom Level	Bloom's y Taxonomy Description						
CO1	Examine Electrica	e the operation of Vehicle applic	of various energy s ations	torage systems used	for II	Understanding						
CO2	Analyse system, criteria	the component fuel cells and	nts and working of supercapacitors to	of battery managem meet the performa	ent nce III	Applying						
CO3	Investigation converter	ate the perfors used in electric	rmance of difference of difference of the second se	rent power electro	nic IV	Analysing						
Modu	ıle		Module (Contents		Hours						
I	Intro Intro histor and I suppl scena fly-w	duction to Energy duction and new by of electric very mportance of E ^V y requirements, rio, battery, fue heels, Comparis	rgy Storage System ed for storage for hicles (EV) and hy V and HEV, classifit , traditional energy 1 cell, supercapacities on of different Ene	ns EV, Basics of veh brid electric vehicles ication of EV and HE y storage systems, g ors, compressed air, l rgy Storage Systems.	icle mechanism (HEV), need fo V, Power/Energ lobal market ar hydrogen storag	s, or y 6 d e,						

	Batteries	
II	Introduction to Batteries, Batteries Types and Battery Packs, Recent EVs and Battery Chemistries, Basic Battery Operation, Basic Electrochemistry, Lead- Acid Battery, Nickel-Metal Hydride, Lithium-Ion, Lithium-Ion Chemistries Units of Battery Energy Storage, Battery Parameters and Comparisons, Cell Voltage, Specific Energy, Cycle Life, Specific Power, Self-Discharge, Life time and Sizing Considerations, Examples of Battery Sizing, BEV Battery Sizing, PHEV Battery Sizing, Aging. Battery Models, applications of batteries, future developments.	8
	Converters for Batteries	
III	Introduction, Power Conversion–Common and Basic Principles, The Basic Topologies, The Buck or Step-Down Converter, Analysis of Voltage Gain of Buck Converter in CCM, Analysis of Buck Converter in CCM, BCM, DCM, Examples, The Boost or Step-up Converter, Analysis of Voltage Gain of Boost Converter in CCM, Analysis of Boost Converter in CCM, BCM, DCM, Examples, Power Semiconductors, Power Semiconductor Power Loss, Conduction Losses of IGBT and Diode, Examples, Passive Components for Power Converters, Example: Inductor Sizing, Capacitor Sizing, Interleaving, Example: Two-Phase Interleaved Boost Converter.	7
	Battery Management System	
IV	Objectives and functions of the BMS, SOC and DOD, charge controller, sensors in BMS, protection of batteries, CCCV, charging topologies, cell equalization, pulse power capability, dynamic power limits.	6
	Fuel Cells and its Classification	
V	Basic structure and functions of fuel cell, its characteristics and working, fuel cell power conversion, classification of fuel cells, PEM and alkaline fuel cells, molten carbonate fuel cells, phosphoric acid, solid oxide fuel cells.	6
VI	Supercapacitors and Hydrogen Storage Systems Supercapacitor: characteristics, components, schematic, classification, advantages, disadvantages, Hydrogen storage systems: Basics, working and applications.	6
	Textbooks	
1	"Electric Powertrain", John G Hayes and G. Abas Gudarazi, First edition, A Jol Ltd. Publication, 2018	hn Wiley & Sons
2	"Electrical Vehicle Technology Explained", James Larminie and John Lowry, S John Wiley & Sons Ltd. Publication, 2012	Second edition, A
	References	
1	"Renewable and efficient electric power systems ", Masters, Gilbert M., Joh 2013.	n Wiley & Sons,
2	"Lithium-ion batteries: fundamentals and performance ", Wakihara, Masata Yamamoto, eds. John Wiley & Sons, 2008.	aka, and Osamu
	Useful Links	
1	https://nptel.ac.in/courses/113105102	
<u>.</u>		

	CO-PO Mapping														
	Programme Outcomes (PO)													PSO	
	1 2 3 4 5 6 7 8 9 10 11 12									1	2				
CO1	3														
CO2		2												2	
CO3		2												2	
CO4															
The stren	The strength of mapping is to be written as 1: Low, 2: Medium, 3: High														
Each CO	of the c	ourse 1	must m	ap to at	t least c	ne 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.

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

Open Elective - 1

		Wald	chand College	of Engineering	g, Sai	ngli	
				2022-23	(0)		
			Course	Information			
Ducan			P. Tash (Electric)	1 Engineering)			
Progra			D. I ech. (Electrica	al Engineering)			
Class,	Semester		Third Year B. Te	ch., Sem V			
Cours	e Code		6OE343				
Cours	e Name		Open Elective I :	Electrical Machine	Techn	ology	
Desire	d Requisi	tes:	Basic Electrical E	Engineering			
	Teaching	Scheme		Examination S	cheme	(Marks)	
Lectu	re	3 Hrs/week	MSE	ISE		ESE	Total
Tutori	ial	_	30	20		50	100
			Course	Objectives			
1	T 1	- 4		Objectives			
	To make	students unders	hard operation and	performance of ac	and de	macmines.	
	To make	students learn c	so rotings of ac and	de machines for y	rious	nnlightions	
- 3		Course	Outcomes (CO) w	vith Bloom's Taxo	nomv		
At the	end of the	course the stud	ents will be able to		lioniy		
				,		Bloom's	Bloom's
СО		Cours	e Outcome Staten	nent/s		Taxonomy	Taxonomy
						Level	Description
CO1	Explain 1	the construction	and working prin	ciple of A.C. and	D.C.	т	Understanding
	Machine	5.				11	
CO2	Examine	the various char	racteristics of A.C.	and D.C. machines.		III	Applying
CO3	Analyze	the performance	e of A.C. and D.C.	C. machines for va	rious	IV	Analysing
	application	ons.				11	
Modu	le		Module (Contents			Hours
	DC N	lotors					
	Revie	w of Constructi	on, Working and T	ypes, Back emf, Sp	eed eq	uation,	
I	Arma	ture Reaction, T	orque equation, Sp	eed torque characte	ristics	, 1 (7
	Appli	cations, Power I	osses in d.c. motor	s. Need of starter sp	eed co	ntrol of	
	D.C. S	sol of rotation	Flectric braking of	shunt and series mo	or D.C	. motor.	
	Singl	e Phase Transf	ormer	situint and series mo			
	Const	ruction and type	e EMF equation ph	asor diagram equiv	valent	circuit	
	efficie	ency, losses, reg	ulation, Experiment	tal determination of	f equiv	alent circuit	
	paran	neters and calcul	ation of efficiency	and regulation, Intr	oducti	onto three	6
	Phase	Transformer, C	Connection of three	Phase Transformer,			
	Appli	cations of Trans	formers				
	Three	e Phase Inducti	on Motor				
Ш	Const	ruction, Types,	Working, Speed eq	uation, Torque equ	ation, S	Starting	7
	torque	·			. D	ower stages	
	· · -	e, Concept of fu	ll load torque, torqu	ue speed characteris	tics, P	ower stages	
	in mo	e, Concept of fu tor, Induction G	ll load torque, torque enerator.	ue speed characteris	stics, P		
	in mo Three	e, Concept of fu tor, Induction G e Phase Inducti	ll load torque, torque enerator. on Motor Control	ue speed characteris	stics, P		
IV	in mo Three Need	e, Concept of fu tor, Induction G e Phase Inducti of starter, Speed	Il load torque, torque enerator. on Motor Control l control methods-	ue speed characteris	tage co	ontrol, VFD	6

V	Synchronous Machines Alternator, Construction of Alternator, Synchronous Motor, Equivalent Circuit, Motor on load, Pull-Out Torque, Motor Phasor Diagram, MechanicalPower Developed by Motor, Power Factor of Synchronous Motor, Application of Synchronous Motor, Comparison of Synchronous Motor with Induction Motor.	б
VI	Special-Purpose Electric MachinesStepper motor-Variable-Reluctance Motor, Permanent Magnet Motor, HybridStepper Motor, Servomechanism, D.C. Servomotors, A.C. Servomotors,Switched Reluctance Motor, Permanent Magnet D.C. Motor, Brushless D.C.Motor. Selection and Sizing of Motors based on applications.	7
	Textbooks	
1	S. J. Chapman, "Electric Machinery Fundamentals", Tata Mc Graw Hill publication 2011, ISBN: 9780071070522	ion, 4th Edition,
2	M. G. Say. "Performance Design of AC Machines", CBS Publishers, 3rd Edition ISBN: 9788123910277	, 2017,
	References	
1	SK Bhattacharya, "Electrical Machines", Tata Mc Graw Hill, 3rd Edition, 2010, ISBN: 9789332902855	
2	J. B. Gupta, "Electrical Machines", SK Kataria and Sons, 2013, ISBN: 97893501	40550
	Useful Links	
1	https://nptel.ac.in/courses/108/102/108102146/	
2	https://nptel.ac.in/courses/108/105/108105155/	
3	https://nptel.ac.in/courses/108/105/108105131/	

	CO-PO Mapping														
	Programme Outcomes (PO)													PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	3														
CO2		2													
CO3		2													
The stren	gth of n	napping	g is to b	be writt	en as 1	: Low,	2: Med	ium, 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.

SEM VI

Professional Core (Theory)

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)											
			Course	Information							
Progr	amme		B.Tech. (Electric	al Engineering)							
Class,	, Semes	ter	Third Year B. Te	ch., Sem VI							
Cours	se Code		6EL321								
Cours	se Nam	2	Power System Pre	otection							
Desire	ed Requ	isites:	Power System En	Power System Engineering							
	Teachi	ng Scheme		Examination Scheme	e (Marks)						
Lectu	re	3 Hrs /week	MSE	ISE	ESE	Total					
Tutor	ial	-	30	20	50	100					
				Credits: 3							
1	To tea	ch need for power	system protection a	and basic principles of circ	cuit breakers	and relays.					
2	To dis	cuss protection of	feeders, transmissio	on lines, transformers, gen	erators and th	eir					
	imple	mentation using ele	ectromagnetic & mi	croprocessor based relays	•						
3	To dis	cuss causes of over	r voltages in power	system and protection ag	ainst these ov	er voltages.					
A (1) -		Course	Outcomes (CO) v	vith Bloom's Taxonomy	Level						
At the		the course, the stud	ients will be able to	,	Bloom's	Bloom's					
СО		Cours	se Outcome Staten	nent/s	Taxonomy Level	Taxonomy Description					
CO1	Descr	ibe basic principle	s & working of circ	cuit breakers & fuses and	п	Understanding					
	select	proper CB/fuse for	a particular applic	ation.	11	Chiderstanding					
CO2	Class	fy the requirement	s of protection for o	different parts of a	III	Applying					
	power	system and select	proper relay schem	ie.		rippiying					
CO3	Analy digita	se the performance relaying technique	e of various protect	ion devices and discuss	IV	Analysing					
Modu	ıle		Module (Contents		Hours					
	0	ver Current Relay	/S								
	Ne	ed of protection, B	rief theory and con	struction of electromagne	tic relays.						
I		fferent time curren	t characteristics of	7							
	M	croprocessor based	1 over current relay								
			rrent schemes.								
		c Interruption Pr	OCESS racteristics of arc. I								
п	in	erruntion high rec	istance and current	age	6						
		ansient Restriking	Voltage (TRV) Re	covery voltage RRRV of	urrent						
	ch	opping, resistance	switching, capacitiv	ve current interruption							

III Classification of circuit breakers, brief study of construction and working of III Air break and Air Blast CB, SF6 and Vacuum CB, HVDC breakers, ratings of 6 CB and testing of CB, Fuse –Rewirable and HRC fuse, fuse characteristics, application and selection of fuse 6 Protection of Transformer, Generator and Bus Bar Circulating current differential protection, percentage differential protection of power transformers, through fault stability, effect of magnetizing inrush, effect of over voltage inrush ,Buchholz relay, Differential protection of generator, stator and rotor protection schemes of generator, loss of excitation, prime mover failure protection, bus bar protection. 7 V Protection of Transmission Line 7 Principles of distance relays, Effect of arc resistance, and power swing on relay operation, Microprocessor based impedance, reactance and admittance relays, 7 7 Quadrilateral characteristics, carrier aided protection of transmission line. 7 Protection dgainst Over Voltages. 6 Introduction to numerical/digital relay techniques. New numerical /digital relaying algorithms, introduction of various transform techniques - Discrete Fourier Transform, Haar Transform etc. 6 I S.S. Rao, <i>"Switchgear & Protection "</i> , Khanna Pub., XI edition, 2005. 8 1 S.S. Rao, <i>"Switchgear & Protection "</i> , Khanna Pub., XI edition, 2005. 8 2 B.Ram & Vishwakarma, <i>"Power System Pro</i>		Circuit Breakers & Fuses	
III Air break and Air Blast CB, SF6 and Vacuum CB, HVDC breakers, ratings of CB and testing of CB, Fuse –Rewirable and HRC fuse, fuse characteristics, application and selection of fuse 6 IV Protection of Transformer, Generator and Bus Bar Circulating current differential protection, percentage differential protection of power transformers, through fault stability, effect of magnetizing inrush, effect of over voltage inrush ,Buchholz relay, Differential protection of generator, stator and rotor protection schemes of generator, loss of excitation, prime mover failure protection, bus bar protection. 7 V operation, Microprocessor based impedance, reactance and admittance relays, Quadrilateral characteristics, carrier aided protection of transmission line. Protection Against Over Voltages. 7 VI Recent Developments in Protection Introduction to numerical/digital relay techniques. New numerical /digital relaying algorithms, introduction of various transform techniques - Discrete Fourier Transform, Haar Transform etc. 6 V S.S. Rao, <i>"Switchgear & Protection"</i> , Khanna Pub., XI edition, 2005. 2 2 B.Ram & Vishwakarma, <i>"Power System Protection & Switchgear"</i> , MGH pub., 2011. 2 2 C.R. Mason, <i>"Art & Science of Protective Relaying"</i> , GE e-book. 2 4 Y.G. Paithankar & S.R. Bhide, <i>"Fundamentals of Power System Protection"</i> , PHI pub., I		Classification of circuit breakers, brief study of construction and working of	
CB and testing of CB, Fuse –Rewirable and HRC fuse, fuse characteristics, application and selection of fuse Protection of Transformer, Generator and Bus Bar IV Protection of Transformer, Generator and Bus Bar 7 Girculating current differential protection, percentage differential protection of power transformers, through fault stability, effect of magnetizing inrush, effect of over voltage inrush, Buchholz relay, Differential protection of generator, stator and rotor protection, bus bar protection. 7 Protection of Transmission Line Protection of Transmission Line 7 Vi Operation, Microprocessor based impedance, reactance and admittance relays, quadrilateral characteristics, carrier aided protection of transmission line. 7 VI Recent Developments in Protection New numerical /digital relay techniques. New numerical /digital relaying algorithms, introduction of various transform techniques - Discrete Fourier Transform, Haar Transform etc. 6 References 1 S.S. Rao, <i>"Switchgear & Protection"</i> , Khanna Pub, XI edition, 2005. 2 2 B.Ram & Vishwakarma, <i>"Power System Protection & Switchgear"</i> , MGH pub., 2011. 2 2 C.R. Mason, <i>"Art & Science of Protective Relaying"</i> , GE e-book. 2 3 Y.G. Paithankar & S.R. Bhide, <i>"Fundamentals of Power System Protection"</i> , PHI pub., I	III	Air break and Air Blast CB, SF6 and Vacuum CB, HVDC breakers, ratings of	6
application and selection of fuse IV Protection of Transformer, Generator and Bus Bar Circulating current differential protection, percentage differential protection of power transformers, through fault stability, effect of magnetizing inrush, effect of over voltage inrush ,Buchholz relay, Differential protection of generator, stator and rotor protection, bus bar protection. 7 Protection of Transmission Line Protection of Transmission Line 7 Principles of distance relays, Effect of arc resistance, and power swing on relay operation, Microprocessor based impedance, reactance and admittance relays, 7 7 Quadrilateral characteristics, carrier aided protection of transmission line. 7 Protection to numerical/digital relay techniques. New numerical /digital relaying algorithms, introduction of various transform techniques - Discrete Fourier Transform, Haar Transform etc. 6 Extbooks 1 S.S. Rao, "Switchgear & Protection", Khanna Pub., XI edition, 2005. 8 2 B.Ram & Vishwakarma, "Power System Protection & Switchgear", TMH Pub., III edition, 2008. C.R. Mason, "Art & Science of Protective Relaying", GE e-book. 2 C.R. Mason, "Art & S.R. Bhide, "Fundamentals of Power System Protection", PHI pub., 1		CB and testing of CB, Fuse – Rewirable and HRC fuse, fuse characteristics,	
IV Protection of Transformer, Generator and Bus Bar Circulating current differential protection, percentage differential protection of power transformers, through fault stability, effect of magnetizing inrush, effect of over voltage inrush, Buchholz relay, Differential protection of generator, stator and rotor protection schemes of generator, loss of excitation, prime mover failure protection, bus bar protection. 7 V Protection of Transmission Line 7 Principles of distance relays, Effect of arc resistance, and power swing on relay operation, Microprocessor based impedance, reactance and admittance relays, Quadrilateral characteristics, carrier aided protection of transmission line. 7 VI Recent Developments in Protection 6 VII S.S. Rao, "Switchgear & Protection", Khanna Pub., XI edition, 2005. 6 2 B.Ram & Vishwakarma, "Power System Protection & Switchgear", TMH Pub., III edition, 2008. 7 VI Ca., Nair, Mehta & Makwana, "Power System Protection & Switchgear", MGH pub., 2011. 2 2 C.R. Mason, "Art & Science of Protective Relaying", GE e-book. 7		application and selection of fuse	
IV Circulating current differential protection, percentage differential protection of power transformers, through fault stability, effect of magnetizing inrush, effect of or over voltage inrush, Buchholz relay, Differential protection of generator, stator and rotor protection schemes of generator, loss of excitation, prime mover failure protection, bus bar protection. 7 V Protection of Transmission Line Principles of distance relays, Effect of arc resistance, and power swing on relay operation, Microprocessor based impedance, reactance and admittance relays, 7 Quadrilateral characteristics, carrier aided protection of transmission line. Protection Against Over Voltages. 7 VI Recent Developments in Protection Introduction to numerical/digital relay techniques. New numerical /digital relaying algorithms, introduction of various transform techniques - Discrete Fourier Transform, Haar Transform etc. 6 Extbooks 1 S.S. Rao, "Switchgear & Protection", Khanna Pub., XI edition, 2005. 2 2 B.Ram & Vishwakarma, "Power System Protection & Switchgear", TMH Pub., III edition, 2008. CReferences 1 Oza, Nair, Mehta & Makwana, "Power System Protection & Switchgear", MGH pub., 2011. 2 C.R. Mason, "Art & Science of Protective Relaying", GE e-book. 3 Y.G. Paithankar & S.R. Bhide, "Fundamentals of Power System Protection", PHI pub., I		Protection of Transformer, Generator and Bus Bar	
IV power transformers, through fault stability, effect of magnetizing inrush, effect of over voltage inrush ,Buchholz relay, Differential protection of generator, stator and rotor protection schemes of generator, loss of excitation, prime mover failure protection, bus bar protection. 7 V Protection of Transmission Line Principles of distance relays, Effect of arc resistance, and power swing on relay operation, Microprocessor based impedance, reactance and admittance relays, 7 Quadrilateral characteristics, carrier aided protection of transmission line. Protection Against Over Voltages. 7 VI Recent Developments in Protection Introduction of various transform techniques - Discrete Fourier Transform, Haar Transform etc. 6 VI S.S. Rao, "Switchgear & Protection ", Khanna Pub., XI edition, 2005. 8 1 S.S. Rao, "Switchgear & Protection ", Khanna Pub., XI edition, 2005. 1 2 Draw & Vishwakarma, "Power System Protection & Switchgear", TMH Pub., III edition, 2008. 0 C.R. Mason, "Art & Science of Protective Relaying", GE e-book. 3 Y.G. Paithankar & S.R. Bhide, "Fundamentals of Power System Protection", PHI pub., I		Circulating current differential protection, percentage differential protection of	
IV of over voltage inrush ,Buchholz relay, Differential protection of generator, stator and rotor protection schemes of generator, loss of excitation, prime mover failure protection, bus bar protection. // Protection of Transmission Line Protection of Transmission Line // Principles of distance relays, Effect of arc resistance, and power swing on relay operation, Microprocessor based impedance, reactance and admittance relays, Quadrilateral characteristics, carrier aided protection of transmission line. 7 Protection Against Over Voltages. Recent Developments in Protection 7 VI Introduction to numerical/digital relay techniques. New numerical /digital relaying algorithms, introduction of various transform techniques - Discrete Fourier Transform, Haar Transform etc. 6 VI S.S. Rao, <i>"Switchgear & Protection"</i> , Khanna Pub., XI edition, 2005. 1 S.S. Rao, <i>"Switchgear & Protection & Switchgear"</i> , TMH Pub., III edition, 2008. VI C.R. Mason, <i>"Art & Science of Protective Relaying"</i> , GE e-book. 2 Y.G. Paithankar & S.R. Bhide, <i>"Fundamentals of Power System Protection"</i> , PHI pub., I		power transformers, through fault stability, effect of magnetizing inrush, effect	7
stator and rotor protection schemes of generator, loss of excitation, prime mover failure protection, bus bar protection. Protection of Transmission Line Principles of distance relays, Effect of arc resistance, and power swing on relay v operation, Microprocessor based impedance, reactance and admittance relays, Quadrilateral characteristics, carrier aided protection of transmission line. Protection Against Over Voltages. Recent Developments in Protection Introduction to numerical/digital relay techniques. New numerical /digital relaying algorithms, introduction of various transform techniques - Discrete Fourier Transform, Haar Transform etc. 6 Retences 1 S.S. Rao, <i>"Switchgear & Protection"</i> , Khanna Pub., XI edition, 2005. 2 B.Ram & Vishwakarma, <i>"Power System Protection & Switchgear"</i> , TMH Pub., III edition, 2008. References 1 Oza, Nair, Mehta & Makwana, <i>"Power System Protection & Switchgear"</i> , MGH pub., 2011. 2 C.R. Mason, <i>"Art & Science of Protective Relaying"</i> , GE e-book. Y.G. Paithankar & S.R. Bhide, <i>"Fundamentals of Power System Protection"</i> , PHI pub., I	IV	of over voltage inrush ,Buchholz relay, Differential protection of generator,	/
mover failure protection, bus bar protection. Protection of Transmission Line Principles of distance relays, Effect of arc resistance, and power swing on relay v operation, Microprocessor based impedance, reactance and admittance relays, Quadrilateral characteristics, carrier aided protection of transmission line. Protection Against Over Voltages. Recent Developments in Protection Introduction to numerical/digital relay techniques. New numerical /digital relaying algorithms, introduction of various transform techniques - Discrete Fourier Transform, Haar Transform etc. 6 Retent Developments in Protection ", Khanna Pub., XI edition, 2005. 2 B.Ram & Vishwakarma, "Power System Protection & Switchgear", TMH Pub., III edition, 2008. References 1 Oza, Nair, Mehta & Makwana, "Power System Protection & Switchgear", MGH pub., 2011. 2 C.R. Mason, "Art & Science of Protective Relaying", GE e-book. 3 Y.G. Paithankar & S.R. Bhide, "Fundamentals of Power System Protection", PHI pub., I		stator and rotor protection schemes of generator, loss of excitation, prime	
Protection of Transmission Line Principles of distance relays, Effect of arc resistance, and power swing on relay v operation, Microprocessor based impedance, reactance and admittance relays, Quadrilateral characteristics, carrier aided protection of transmission line. Protection Against Over Voltages. Recent Developments in Protection Introduction to numerical/digital relay techniques. New numerical /digital relaying algorithms, introduction of various transform techniques - Discrete Fourier Transform, Haar Transform etc. 6 Textbooks 1 S.S. Rao, "Switchgear & Protection & Switchgear", TMH Pub., III edition, 2008. References 1 Oza, Nair, Mehta & Makwana, "Power System Protection & Switchgear", MGH pub., 2011. 2 C.R. Mason, "Art & Science of Protective Relaying", GE e-book. 3 Y.G. Paithankar & S.R. Bhide, "Fundamentals of Power System Protection", PHI pub., I		mover failure protection, bus bar protection.	
Principles of distance relays, Effect of arc resistance, and power swing on relay operation, Microprocessor based impedance, reactance and admittance relays, Quadrilateral characteristics, carrier aided protection of transmission line. Protection Against Over Voltages. 7 VI Recent Developments in Protection Introduction to numerical/digital relay techniques. New numerical /digital relaying algorithms, introduction of various transform techniques - Discrete Fourier Transform, Haar Transform etc. 6 VI Textbooks 1 S.S. Rao, <i>"Switchgear & Protection"</i> , Khanna Pub., XI edition, 2005. 2 B.Ram & Vishwakarma, <i>"Power System Protection & Switchgear"</i> , TMH Pub., III edition, 2008. 1 VI Oza, Nair, Mehta & Makwana, <i>"Power System Protection & Switchgear"</i> , MGH pub., 2011. 2 C.R. Mason, <i>"Art & Science of Protective Relaying"</i> , GE e-book. Y.G. Paithankar & S.R. Bhide, <i>"Fundamentals of Power System Protection"</i> , PHI pub., I		Protection of Transmission Line	
V operation, Microprocessor based impedance, reactance and admittance relays, Quadrilateral characteristics, carrier aided protection of transmission line. Protection Against Over Voltages. 7 VI Recent Developments in Protection Introduction to numerical/digital relay techniques. New numerical /digital relaying algorithms, introduction of various transform techniques - Discrete Fourier Transform, Haar Transform etc. 6 VI Excent Developments in Protection Introduction to numerical/digital relay techniques. New numerical /digital relaying algorithms, introduction of various transform techniques - Discrete Fourier Transform, Haar Transform etc. 6 VI S.S. Rao, "Switchgear & Protection", Khanna Pub., XI edition, 2005. 6 2 B.Ram & Vishwakarma, "Power System Protection & Switchgear", TMH Pub., III edition, 2008. 10 2 Oza, Nair, Mehta & Makwana, "Power System Protection & Switchgear", MGH pub., 2011. 2 2 C.R. Mason, "Art & Science of Protective Relaying", GE e-book. 2 3 Y.G. Paithankar & S.R. Bhide, "Fundamentals of Power System Protection", PHI pub., I		Principles of distance relays, Effect of arc resistance, and power swing on relay	
Quadrilateral characteristics, carrier aided protection of transmission line. Protection Against Over Voltages. Recent Developments in Protection Introduction to numerical/digital relay techniques. New numerical /digital relaying algorithms, introduction of various transform techniques - Discrete Fourier Transform, Haar Transform etc. 6 Textbooks 1 S.S. Rao, "Switchgear & Protection", Khanna Pub., XI edition, 2005. 2 B.Ram & Vishwakarma, "Power System Protection & Switchgear", TMH Pub., III edition, 2008. References 1 Oza, Nair, Mehta & Makwana, "Power System Protection & Switchgear", MGH pub., 2011. 2 C.R. Mason, "Art & Science of Protective Relaying", GE e-book. 3 Y.G. Paithankar & S.R. Bhide, "Fundamentals of Power System Protection", PHI pub., I	V	operation, Microprocessor based impedance, reactance and admittance relays,	7
Protection Against Over Voltages. VI Recent Developments in Protection Introduction to numerical/digital relay techniques. New numerical /digital relaying algorithms, introduction of various transform techniques - Discrete Fourier Transform, Haar Transform etc. 6 Image: S.S. Rao, "Switchgear & Protection", Khanna Pub., XI edition, 2005. 8 Image: S.S. Rao, "Switchgear & Protection", Khanna Pub., XI edition, 2005. 9 Image: S.S. Rao, "Switchgear & Protection", Khanna Pub., XI edition, 2005. 9 Image: S.S. Rao, "Switchgear & Protection", Khanna Pub., XI edition, 2005. 1 Image: S.S. Rao, "Switchgear & Protection", Khanna Pub., XI edition, 2005. 1 Image: S.S. Rao, "Switchgear & Protection & Switchgear", TMH Pub., III edition, 2008. 1 Image: S.S. Rao, "Art & Science of Protective Relaying", GE e-book. 1 Image: S.S. Rao, "Art & Science of Protective Relaying", GE e-book. 1 Image: S.S. Rao, "Art & S.R. Bhide, "Fundamentals of Power System Protection", PHI pub., I		Quadrilateral characteristics, carrier aided protection of transmission line.	
VI Recent Developments in Protection Introduction to numerical/digital relay techniques. New numerical /digital relaying algorithms, introduction of various transform techniques - Discrete Fourier Transform, Haar Transform etc. 6 Image: Second		Protection Against Over Voltages.	
VI Introduction to numerical/digital relay techniques. New numerical /digital relaying algorithms, introduction of various transform techniques - Discrete Fourier Transform, Haar Transform etc. 6 Textbooks 1 S.S. Rao, <i>"Switchgear & Protection"</i> , Khanna Pub., XI edition, 2005. 8 2 B.Ram & Vishwakarma, <i>"Power System Protection & Switchgear"</i> , TMH Pub., III edition, 2008. 10 Control References 1 Oza, Nair, Mehta & Makwana, <i>"Power System Protection & Switchgear"</i> , MGH pub., 2011. 2 C.R. Mason, <i>"Art & Science of Protective Relaying"</i> , GE e-book. 3 Y.G. Paithankar & S.R. Bhide, <i>"Fundamentals of Power System Protection"</i> , PHI pub., I		Recent Developments in Protection	
relaying algorithms, introduction of various transform techniques - Discrete Fourier Transform, Haar Transform etc. 0 Textbooks 1 S.S. Rao, "Switchgear & Protection", Khanna Pub., XI edition, 2005. 2 B.Ram & Vishwakarma, "Power System Protection & Switchgear", TMH Pub., III edition, 2008. References 1 Oza, Nair, Mehta & Makwana, "Power System Protection & Switchgear", MGH pub., 2011. 2 C.R. Mason, "Art & Science of Protective Relaying", GE e-book. 3 Y.G. Paithankar & S.R. Bhide, "Fundamentals of Power System Protection", PHI pub., I	VI	Introduction to numerical/digital relay techniques. New numerical /digital	6
Fourier Transform, Haar Transform etc. Textbooks 1 S.S. Rao, "Switchgear & Protection", Khanna Pub., XI edition, 2005. 2 B.Ram & Vishwakarma, "Power System Protection & Switchgear", TMH Pub., III edition, 2008. References 1 Oza, Nair, Mehta & Makwana, "Power System Protection & Switchgear", MGH pub., 2011. 2 C.R. Mason, "Art & Science of Protective Relaying", GE e-book. 3 Y.G. Paithankar & S.R. Bhide, "Fundamentals of Power System Protection", PHI pub., I	V1	relaying algorithms, introduction of various transform techniques - Discrete	0
Textbooks 1 S.S. Rao, "Switchgear & Protection", Khanna Pub., XI edition, 2005. 2 B.Ram & Vishwakarma, "Power System Protection & Switchgear", TMH Pub., III edition, 2008. References 1 Oza, Nair, Mehta & Makwana, "Power System Protection & Switchgear", MGH pub., 2011. 2 C.R. Mason, "Art & Science of Protective Relaying", GE e-book. 3 Y.G. Paithankar & S.R. Bhide, "Fundamentals of Power System Protection", PHI pub., I		Fourier Transform, Haar Transform etc.	
Textbooks 1 S.S. Rao, "Switchgear & Protection", Khanna Pub., XI edition, 2005. 2 B.Ram & Vishwakarma, "Power System Protection & Switchgear", TMH Pub., III edition, 2008. References 1 Oza, Nair, Mehta & Makwana, "Power System Protection & Switchgear", MGH pub., 2011. 2 C.R. Mason, "Art & Science of Protective Relaying", GE e-book. 3 Y.G. Paithankar & S.R. Bhide, "Fundamentals of Power System Protection", PHI pub., I			
1 S.S. Rao, Switchgear & Protection , Khanna Pub., Xi edition, 2005. 2 B.Ram & Vishwakarma, "Power System Protection & Switchgear", TMH Pub., III edition, 2008. References 1 Oza, Nair, Mehta & Makwana, "Power System Protection & Switchgear", MGH pub., 2011. 2 C.R. Mason, "Art & Science of Protective Relaying", GE e-book. 3 Y.G. Paithankar & S.R. Bhide, "Fundamentals of Power System Protection", PHI pub., I	1	Textbooks	
2 B.Ram & Visitwakarina, "Power System Protection & Switchgear", INH Pub., III edition, 2008. References 1 Oza, Nair, Mehta & Makwana, "Power System Protection & Switchgear", MGH pub., 2011. 2 C.R. Mason, "Art & Science of Protective Relaying", GE e-book. 3 Y.G. Paithankar & S.R. Bhide, "Fundamentals of Power System Protection", PHI pub., I	1	S.S. Kao, Switchgear & Protection, Knanna Pub., Al edition, 2005.	bub III adition
References 1 Oza, Nair, Mehta & Makwana, "Power System Protection & Switchgear", MGH pub., 2011. 2 C.R. Mason, "Art & Science of Protective Relaying", GE e-book. 3 Y.G. Paithankar & S.R. Bhide, "Fundamentals of Power System Protection", PHI pub., I	2	2008.	uo., III editioli,
References 1 Oza, Nair, Mehta & Makwana, "Power System Protection & Switchgear", MGH pub., 2011. 2 C.R. Mason, "Art & Science of Protective Relaying", GE e-book. 3 Y.G. Paithankar & S.R. Bhide, "Fundamentals of Power System Protection", PHI pub., I			
1 Oza, Nair, Mehta & Makwana, "Power System Protection & Switchgear", MGH pub., 2011. 2 C.R. Mason, "Art & Science of Protective Relaying", GE e-book. 3 Y.G. Paithankar & S.R. Bhide, "Fundamentals of Power System Protection", PHI pub., I		References	
2 C.R. Mason, "Art & Science of Protective Relaying", GE e-book. 3 Y.G. Paithankar & S.R. Bhide, "Fundamentals of Power System Protection", PHI pub., I	1	Oza, Nair, Mehta & Makwana, "Power System Protection & Switchgear", MGH	I pub., 2011.
Y.G. Paithankar & S.R. Bhide, "Fundamentals of Power System Protection", PHI pub., I	2	C.R. Mason, "Art & Science of Protective Relaying", GE e-book.	
	2	Y.G. Paithankar & S.R. Bhide, "Fundamentals of Power System Protection", PH	II pub., I
edition, 2004.		edition, 2004.	
Useful Links		Useful Links	
l https://nptel.ac.in/courses/108/101/108101039/	1	https://nptel.ac.in/courses/108/101/108101039/	

	CO-PO Mapping														
	Programme Outcomes (PO) PSO														
	<u>1 2 3 4 5 6 7 8 9 10 11 12 1 2</u>														
CO1 2															
CO2 3 .															
CO3 3 3															
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High															
Each CO	of the c	course 1	must m	ap to at	t least c	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.

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) AY 2022-23												
		AY 2022-23 Course Information B Tech (Electrical Engineering)												
			Course	Information										
Progra	amme		B.Tech. (Electrica	al Engineering)										
Class,	Semester		Third Year B. Te	ch., Sem VI										
Cours	e Code		6EL322											
Cours	e Name		Industrial Drives	and Control										
Desire	ed Requisi	tes:	DC Machines and	d Transformer, AC Machi	nes and Powe	r Electronics								
	-		1											
	Teaching	Scheme		Examination Scheme	e (Marks)									
Lectur	re	3 Hrs/week	MSE	ISE	ESE	Total								
Tutori	ial	-	30	20	50	100								
				Credits: 3	I									
		1	1											
			Course	e Objectives										
	To make	students unders	tand concept of fur	ndamental knowledge in d	ynamics and c	control of								
	Electric 1	Drives.	1	6	5									
2	To streng	gthen control pri	nciples of various I	DC and AC motors using	solid state con	verters.								
3	To cover	To cover principles of selection of Electric Motors and highlights the applications of Electrical Drives.												
	Dires.													
At the	end of the	and of the course, the students will be able to,												
со		Course Outcome Statement/sBloom's TaxonomyBloom's Taxonomy												
<u>CO1</u>	Fynlain	the various cond	ents used in Flectr	ic drives	II	Understanding								
C01	Applain Apply th	e control techni	aues for Electric dr	ives for speed control.		Applying								
CO3	Analyse	the performan	ce of various con	trol techniques used in										
	speed co	ontrol of electri	c drives and selec	ct a drive for particular	IV	Analysing								
	applicati	on.												
Modu	ıle		Module (Contents		Hours								
I	Fund Type select equate quade stead the d	Fundamentals of Electric DrivesTypes & parts of the Electrical drives, Selection criteria of drives, motor rating, selection based on duty cycle, selection of converter rating, fundamental torque equation, speed torques characteristics DC motor & Induction motor, multi quadrant operation of the drive, classification of mechanical load torques, steady state stability of the drive, constant torque and constant HP operation of the drive closed loop speed control7												
П	DC M Meth three quade DC d DC s four d	Motor Drives ods of speed co phases full com- rant operation o lrives, circulatin eries motor driv quadrant operatio	ontrol, starting and trolled and half cor f separately excite g and non – circul /e, chopper control on of chopper fed I	d braking operation, sing ntrolled converter fed DC d DC shunt motor, dual ating mode of operation, l of DC shunt and series DC shunt motor drive.	the phase and drives, Multi converter fed converter fed motor drives,	7								

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

	CO-PO Mapping														
	Programme Outcomes (PO) PSO														
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	CO1 3 2														
CO2 2 2 2 2 2 2															
CO3 2 2 2 2															
CO4															
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High															
Each CO	of the c	course 1	nust m	ap to at	least c	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.

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) AY 2023-24											
	AY 2023-24 Course Information B.Tech. (Electrical Engineering)											
			Course I	Information								
Progra	amme		B.Tech. (Electrica	al Engineering)								
Class,	Semester		Third Year B. Te	ch., Sem VI								
Cours	e Code		6EL323									
Cours	e Name		Microcontroller a	nd Applications								
Desire	d Requis	ites:	Analog and Digit	al Circuits								
	<u> </u>											
	Teaching	Scheme		Examination Sch	eme (Marks)							
Lectur	re	3 Hrs/week	MSE	ISE	ESE	Total						
Tutori	ial		30	20	50	100						
				Credit	s: 3							
			Course	Objectives								
1	To deve	on basic knowle	dge of microcontro	ollers and their feature	28.							
2	To provi	de skills for prog	gramming microcol	ntroller for application	ns in Electrical E	ngineering.						
3	To enabl	le students to inte	erface and program	different peripherals	to microcontroll	ers.						
		my Level										
At the	end of the	<u> </u>										
				Bloom's	Bloom's							
CO		Course	e Outcome Statem	Taxonomy								
			1.0		Level	Description						
<u>CO1</u>	Explain	the architecture a	and features of mic	Understanding								
CO2	Apply p	programming tec	chniques to implei	ment counters, time	s, timers, III Applying							
<u>CO3</u>	Interrupt	s and other perip	ons related to int	erface microcontrol	er III	Applying						
0.05	with elec	ctrical and electro	onics systems	errace interocontrol		Apprying						
CO4	Construc	et a microcontrol	ler based application	on.	III	Applying						
	1				I							
Modu	le		Module C	ontents		Hours						
	Micr	ocontroller Bas	ics									
I	Over mem	view of 8051, fe ory, data me	atures, Architecture mory, SFR area	e, Pin out and pin fu a, PSW, Code	nctions, program nemory space,	6						
	(Inte	rnal/External), P	ort structure, clock	circuit, Addressing N	Aodes							
	Prog	ramming ports	and timers									
	Intro	duction to Em	ibedded C progr	amming ,Basic I/() programming							
	,Dev	elopment tools f	or 8051 programs	, Programming Tim	ers and counters							
	Appl	ications Timer a	in and function, and Counter Progra	mming	1, 2 and their							
	Inter	runts and Seri	al Communication	1								
	Inter	rupt structure, W	riting ISR, interru	pt, Interrupt prioritie	es, Programming							
III	for e	xternal interrupt.	Programming time	er interrupts.		6						
	Seria	l Communicatio	n: Serial communi	ication modes, RS23	2 signals of PC,							
	Prog	ramming through	n Serial communica	ation								
	Peri	nheral Interfaci										
			ng- I		_							
IV	Inter	facing of micro	ng-1 controllers to exte	ernal peripherals an	d programming,	7						
IV	Inter LCD	facing of micro interfacing, Inte	ng-1 controllers to externation of Analog	ernal peripherals an to Digital Converte	d programming, rs and Digital to	7						

	Peripheral Interfacing- II	
X 7	DC motor interfacing, PWM programming using microcontrollers, Use of	7
	Arduno in Power Electronics Applications, Interfacing Temperature Sensors,	/
	Relay interfacing, concept of nardware-in-loop simulation, programming	
	Examples	
	Introduction to ADM and DIC processors of MSD 430 microcontrollar 16 bit	
VI	Micro-controllers overview features architecture addressing modes Low	6
	nower operation feature of MSP 430	
	Textbooks	
1	Muhammad Mazidi, Janice Mazidi and Rolin McKinlay, 'The 8051 Mic	rocontroller and
1	Embedded systems using Assembly and C', Pearson Education, 2nd Edition, 20	007
2	Kenneth Ayala ,'8051 Architecture, Programming and Applications', 3rd Editi	on, 2007
3	Massimo Banzi and Michael Shiloh, Make: Getting Started With Arduino - T	The Open Source
	Electronics Prototyping Platform, Shroff/Maker Media; 3rd edition, 2014	
	References	
1	Subrata Ghoshal, 'Embedded Systems and Robots- Projects using the 8051 N	Microcontroller',
	Cengage Learning, 1st Edition, 2009	
2	Michael Margolis, 'Arduino Cookbook', Shroff/ O'Reilly,2nd Edition, 2012	
3	Mazidi, RolinMc Kinlay and Danny Causey, 'PIC Microcontroller and Em	bedded Systems
	using Assembly and C for PIC18', Pearson Education, 2007	
4	Andrew N. Sloss, 'Arm System Developer's Guide: Designing and Opt	ımızıng System
	Software', Elsevier Publication, 2005	
5	Texas Instruments MSP 430 microcontroller: Guide and Datasheets	
	https://nptel.ac.in/courses/106/108/106108100/	
2	https://nptel.ac.in/courses/11//104/11/1040/2/	
3	https://nptel.ac.in/courses/108/102/108102045/	

	CO-PO Mapping													
	Programme Outcomes (PO) PSO													
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1 3														
CO2	CO2 3 3													
CO3	CO3 3 3													
CO4 3 2														
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High														
Each CO	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.

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) AY 2023-24											
			Course	Information								
Progra	amme		B.Tech. (Electric	al Engineering)								
Class,	Semester		Third Year B. Te	ch., Sem V								
Cours	e Code		6EL324									
Cours	e Name		Energy Audit and	l Management								
Desire	d Requisi	tes:	Nil									
			·									
	Teaching	Scheme		Examination S	cheme	e (Marks)						
Lectur	re	3 Hrs/week	MSE	ISE		ESE	Total					
Tutor	ial		30	20		50	100					
				Cred	its: 3							
		1										
			Course	Objectives								
1	To create											
2	To devel	iment										
At the	end of the	-										
со	CO Course Outcome Statement/s Bloom's Taxonomy											
	T		·· · · ·	· 1 ·	<u> </u>	Level	Description					
	Explain Energy a	udit.	vation, its impor	tance and necessit	y of	II	Understanding					
CO2	Calculat	e the financial a	nalysis for energy of	economics.		III	Applying					
<u>CO3</u>	Analyse	Energy Efficien	cy in Electrical and	Thermal Utilities		IV	Analysing					
	1						TT					
Modu			Module (Contents			Hours					
I	Energ Energ Conse Refor Princ	7 r 7 1										
II	Energy Audit Energy audit Definition as per EC-act 2001, Need of Energy Audit, Types of Energy Audit, Energy Audit Reporting Format, Understanding Energy and Costs, Benchmarking, Energy Performance, Energy Audit Instruments, Duties and Responsibilities of Energy Auditor.											
ш	Energ Energ Dutie & Ta Energ	gy Action Plann gy action Plann s & responsibili rgeting – Set up gy Consumption	ning, Monitoring 2 ing Steps, Top M ties, Evaluating Er o, Key Elements, I & Production, CU	And Targeting lanagement Support nergy Performance, Data & Information SUM Technique, Ca	t, Ene Energ Analy ase Stu	rgy Manage y monitoring ysis, Relating udy	r g 7 g 7					
IV	Ener Finan on In Risk	gy Economics icial Analysis To vestment, Interr & Sensitivity an	echniques – Pay B nal Rate Of Returr alysis.	ack Period, Net Pre	esent V Aoney	/alue, Return , Cash Flow	n, 6					

	Energy Efficiency in Electrical Utilities	
V	Electricity Billing, Electrical Load Management and Maximum Demand Control, Power Factor Improvement & Benefits, Assessment of Transmission and Distribution Losses, Estimation Of Technical Losses in Distribution System, Commercial Losses, Demand Side Management, Energy Saving Opportunities With Pumps and Fans.	7
VI	Energy Efficiency in Thermal Utilities Energy Conservation in Boilers, Steam Turbine, Industrial Heating System, Heat Exchangers, Heat Pumps, Efficiency Improvement, Energy Conservation in Buildings, Climate responsive Buildings, Thermal load modelling in Building	5
	Textbooks	
1	Amlan Chakrabarti, "Energy Engineering and Management", PHI, 2011.	
	References	
1	Bureau of Energy Efficiency, "General Aspects of Energy Management & Ener & 1.3", BEE, e-books.	gy Audit1.1, 1.2
	Useful Links	
1	https://beeindia.gov.in/content/energy-auditors	

CO-PO Mapping													
Programme Outcomes (PO) PSO													
1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1 2 2													
CO2 2 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.													
	1 2 gth of n of the c	1 2 2 2 2 2 gth of mapping of the course 1	1 2 3 2 2 2 2 gth of mapping is to be of the course must mean from the course mean from	I 2 3 4 1 2 3 4 2 2 4 2 2 4 2 4 2 4 3 4 4 4 5 5 4 4 5 5 4 4 5 5 4 4 5 5 6 6 6 7 6 7 7 7 7 7 8 7 9 7 9 7 9 7 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10	Program 1 2 3 4 5 2 2 2 2 2 2 2 2 2 2 gth of mapping is to be written as 1 1 1 1 2 1 of the course must map to at least of 1 1 1 1 1 1	CO-POProgramme O123456224562244562244562456625666256662666626772777727777277772777737777377774777757777677 <td< td=""><td>CO-PO MappProgramme Outcom123456712345672222222221122211122111122111121111211112111211121112111211131114111511141115111511151114111511151115111511151116111611161116111611161116111611171117</td><td>CO-PO MappingProgramme Outcomes (PO12345678123456782222222222222223451: Low, 2: Medium, 3: cof the course must map to at least one PO.</td><td>CO-PO MappingProgramme Outcomes (PO)12345678912345678921122111221111121111121111211112111121111211112111121113111<t< td=""><td>CO-PO Mapping Programme Outcomes (PO) 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 2 1 1 2 1 1 2 1 1 2 1</td><td>CO-PO Mapping Programme Outcomes (PO) 1 2 3 4 5 6 7 8 9 10 11 1 2 3 4 5 6 7 8 9 10 11 2 1 1 2 1</td></t<><td>CO-PO Mapping Programme Outcomes (PO) 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 2 1 1 1 2 1 1 1 1 2 1 1 1 1 1 1 1 1 2 1</td><td>CO-PO Mapping Programme Outcomes (PO) PS 1 2 3 4 5 6 7 8 9 10 11 12 1 1 2 3 4 5 6 7 8 9 10 11 12 1 2 1 1 2 1</td></td></td<>	CO-PO MappProgramme Outcom123456712345672222222221122211122111122111121111211112111211121112111211131114111511141115111511151114111511151115111511151116111611161116111611161116111611171117	CO-PO MappingProgramme Outcomes (PO12345678123456782222222222222223451: Low, 2: Medium, 3: cof the course must map to at least one PO.	CO-PO MappingProgramme Outcomes (PO)12345678912345678921122111221111121111121111211112111121111211112111121113111 <t< td=""><td>CO-PO Mapping Programme Outcomes (PO) 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 2 1 1 2 1 1 2 1 1 2 1</td><td>CO-PO Mapping Programme Outcomes (PO) 1 2 3 4 5 6 7 8 9 10 11 1 2 3 4 5 6 7 8 9 10 11 2 1 1 2 1</td></t<> <td>CO-PO Mapping Programme Outcomes (PO) 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 2 1 1 1 2 1 1 1 1 2 1 1 1 1 1 1 1 1 2 1</td> <td>CO-PO Mapping Programme Outcomes (PO) PS 1 2 3 4 5 6 7 8 9 10 11 12 1 1 2 3 4 5 6 7 8 9 10 11 12 1 2 1 1 2 1</td>	CO-PO Mapping Programme Outcomes (PO) 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 2 1 1 2 1 1 2 1 1 2 1	CO-PO Mapping Programme Outcomes (PO) 1 2 3 4 5 6 7 8 9 10 11 1 2 3 4 5 6 7 8 9 10 11 2 1 1 2 1	CO-PO Mapping Programme Outcomes (PO) 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 2 1 1 1 2 1 1 1 1 2 1 1 1 1 1 1 1 1 2 1	CO-PO Mapping Programme Outcomes (PO) PS 1 2 3 4 5 6 7 8 9 10 11 12 1 1 2 3 4 5 6 7 8 9 10 11 12 1 2 1 1 2 1

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)

		Walc	hand College (Government Aid	e of Engineerin ed Autonomous Instit	ng, Sang	gli			
	AY 2023-24								
			Course	e Information					
Progra	Programme B. Tech. (Electrical Engineering)								
Class,	Class, Semester Third Year B. Tech., Sem VI								
Cours	e Code		5EL371						
Cours	e Name]	Power System Pre	otection Lab					
Desire	Desired Requisites: Power System Engineering								
		·							
,	Teaching So	cheme		Examination	Scheme (1	Marks)			
Practi	cal	2 Hrs/ Week	LA1	LA2	Lab I	ESE	Total		
Intera	ction	-	30	30	40)	100		
				Cre	edits: 1				
			Cours	e Objectives					
1	To develop protection	hands on skills	s to test and verify	y protective relay o	peration,	used in power	system		
2	To demons	strate electroma	gnetic and digital	relays to illustrate	their oper	ating characte	ristics		
3	To experie electrical s	nce to use powe ystems.	er system analysis	s software for deve	loping pro	otection schem	es for simple		
	1	Course	Outcomes (CO)	with Bloom's Tax	onomy L	evel			
At the	end of the c	ourse, the stude	nts will be able to),					
со		Cours	e Outcome State	ement/s		Bloom's Taxonomy Level	Bloom's Taxonomy Description		
CO1	Demonstr	ate the working	of over current,	earth fault relays a	nd plot		F		
	the I-t char	acteristics			-	111	Applying		
CO2	Execute ex	xperimental stud	ly of a microcont	roller based relays.		III	Applying		
CO3	Design a s	cheme for over	current relay co-o	ordination using sir	nulation	X71	<u>Currentine</u>		
	software /	hardware.				V1	Creating		
		Li	st of Experimen	ts / Lab Activities	/Topics				
List of	f Experimer	nts:							
1.	Arrange th	e set-up & perf	orm an experime	nt to verify the Cur	rent-Time	characteristic	s of a shaded		
2	Arrange th	e set-up & perf	y. orm an experime	nt to verify the Cur	rent-Time	characteristic	s of a shaded		
2.	pole type e	earth fault relay.	orm an experime	it to verify the Cur	rent Thile	endracteristic	s of a shaded		
3.	Arrange th	e set-up & perf	orm an experime	nt to demonstrate th	ne operatio	on & use of Di	rectional over		
4.	Assemble	a circuit to obta	in & verify vario	us Current-Time cu	irves for L	Digital over Cu	rrent Relay.		
5.	Demonstra lines.	te the application	on of Quadrilatera	al Distance relay fo	or detection	n of fault on tr	ansmission		
6.	Conduct a radial feed	6. Conduct a simulation study to develop relay co-ordination scheme of over current relays for a simple radial feeder system.					ys for a simple		
	radial feeder system.7. Conduct an experiment to illustrate the over current relay co-ordination on the Transmission Line								
7.	Conduct an Simulator.	er system. n experiment to	illustrate the ove	r current relay co-c	ordination	on the Transm	ission Line		
7. 8.	Conduct an Simulator. Conduct a	er system. n experiment to simulation stud	illustrate the ove y to explain the C	r current relay co-c Circuit Breaker ope	ordination	on the Transm	iission Line ion.		

Textbooks						
1	S.S. Rao, "Switchgear & Protection", Khanna Pub., XI edition, 2005					
r	B.Ram and Vishwakarma, "Power System Protection & Switchgear", TMH Pub., III edition,					
2	2008.					
	References					
1	Oza, Nair, Mehta and Makwana, "Power System Protection and Switchgear", MGH pub., 2011.					
2	C.R. Mason, "Art and Science of Protective Relaying", GE e-book.					
2	Y.G. Paithankar and S.R. Bhide, "Fundamentals of Power System Protection", PHI pub., I					
3	edition, 2004.					
	Useful Links					
1	https://nptel.ac.in/courses/108/101/108101039/					

	CO-PO Mapping													
		Programme Outcomes (PO) PSO												
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1													
CO2	3	3												
CO3		2												
The stre	ngth of	f mappi	ng is to	be wri	tten as	1,2,3; v	where,	l: Low,	2: Med	lium, 3	High			
Each CO) of the	e course	e must 1	map to	at least	one PC), and p	referab	ly to or	nly 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 %), 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, 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								
				2022-25				
Drogromme P. Toch (Electrical Engineering)								
Progra	amme		B. I ech. (Electric	al Engineering)				
Class,	Semester		Third Year B. Te	ch., Sem VI				
Cours	e Code		6EL372					
Cours	e Name		Industrial Drives	and Control Lab				
Desire	d Requisi	tes:	DC Machines and	l Transformer, AC Mach	nes and Po	wer El	ectronics	
, r	Teaching Scheme Evomination Scheme (Marks)							
Practi	cal	2 Hrs/ Week	LA1	LA2 I	ab ESE		Total	
Intera	ction		30	30	40		100	
Intera	cuon			Credits			100	
				Ci cuits.				
			Cours	a Objectives				
	Toimpor	t Imorriladaa an	cours	a fundamental control ne	ations asso	aiotad	with AC and	
1	DC mach	ines (starting, r	eversing, braking,	plugging, etc.) using soli	l state conv	erters.	with AC and	
2	To devel	op the skills for	the use of compute	er-based analysis tools to	review the	major	classes of	
	machines	s and their physi	ical basis for opera	tion and suitability for a	particular op	peratio	n	
3								
4		Course	o Outcomes (CO)	with Dloom's Toyonon	u Lovol			
At the	and of the	Course the stud	e Outcomes (CO)	with Bloom's Taxonon	y Level			
At the		course, me stuc),	Bloo	m's	Bloom's	
СО		Соц	rse Outcome State	ement/s	Taxon	nomv	Taxonomy	
					Lev	vel	Description	
CO1 Demonstrate experiments on basics of DC and AC drives III Applying						A		
CO1	Demonst	trate experimer	nts on basics of DC	and AC drives.	II	I	Applying	
CO1 CO2	Demonst Analyze	trate experiment the performation	nts on basics of DC nce of drives usi	and AC drives. ng hardware circuits a	nd IV	I7	Applying Analysing	
CO1 CO2 CO3	Demonst Analyze simulatic Evaluate	trate experiment the performant the performance	nts on basics of DC nce of drives usi	and AC drives. ng hardware circuits a g hardware circuits a	nd IV	I 7	Applying Analysing Evaluating	
CO1 CO2 CO3	Demonst Analyze simulatic Evaluate simulatic	trate experiment the performant on. e performance on.	nts on basics of DC nce of drives usi of drives using	and AC drives. ng hardware circuits a g hardware circuits a	nd IV	I 7 I	Applying Analysing Evaluating	
CO1 CO2 CO3	Demonst Analyze simulatic Evaluate simulatic	trate experiment the performan on. e performance on.	nts on basics of DC nce of drives usi of drives using	and AC drives. ng hardware circuits a g hardware circuits a	nd IV	I 7 I	Applying Analysing Evaluating	
CO1 CO2 CO3	Demonst Analyze simulatic Evaluate simulatic	trate experiment the performance performance on.	nts on basics of DC nce of drives usi of drives using List of Experimen	and AC drives. ng hardware circuits a g hardware circuits a ts / Lab Activities/Topi	nd III nd IV nd V s	I 7 I	Applying Analysing Evaluating	
CO1 CO2 CO3	Demonst Analyze simulatic Evaluate simulatic	trate experiment the performance performance on.	nts on basics of DC nce of drives usi of drives using List of Experimen	and AC drives. ng hardware circuits a g hardware circuits a ts / Lab Activities/Topi	nd IV nd V s	I 7 I	Applying Analysing Evaluating	
CO1 CO2 CO3 List of	Demonst Analyze simulatic Evaluate simulatic	trate experiment the performance on. e performance on. vities: peed – Torque c	nts on basics of DC nce of drives using of drives using List of Experimen	and AC drives. ng hardware circuits a g hardware circuits a ts / Lab Activities/Topi nopper fed D. C. series m	nd III nd IV nd V s	I 7 I ware)	Applying Analysing Evaluating	
CO1 CO2 CO3 List of 1. 2.	Demonst Analyze simulatic Evaluate simulatic	trate experiment the performance on. e performance on. vities: peed – Torque conthe performance	tts on basics of DC nee of drives using of drives using List of Experimen characteristics of ch e of chopper fed D	and AC drives. ng hardware circuits a g hardware circuits a ts / Lab Activities/Topi nopper fed D. C. series m . C. drive for closed – lo	III nd IV nd V s otor. (Hardway p speed correctly)	I 7 I ware) ntrol (s	Applying Analysing Evaluating imulation).	
CO1 CO2 CO3 List of 1. 2. 3.	Demonst Analyze simulatic Evaluate simulatic Clab Acti Verify Sp Analyze Demonst	trate experiment the performance on. e performance on. vities: peed – Torque of the performance rate operation a	tts on basics of DC nee of drives usi of drives using List of Experimen characteristics of ch e of chopper fed D and application of	and AC drives. ng hardware circuits a g hardware circuits a ts / Lab Activities/Topi hopper fed D. C. series m . C. drive for closed – loo single-phase full wave, I lordware)	III nd IV nd V s IV otor. (Hardward IV p speed corral f controll IV	I 7 I ware) ntrol (s ed con	Applying Analysing Evaluating imulation).	
CO1 CO2 CO3 List of 1. 2. 3.	Demonst Analyze simulatic Evaluate simulatic Clab Acti Verify Sj Analyze Demonst loop spee	trate experiment the performance on. e performance on. vities: peed – Torque of the performance rate operation a ed control of D.	tts on basics of DC nee of drives usi of drives using List of Experimen characteristics of ch e of chopper fed D and application of C. shunt motor. (H and application of	and AC drives. ng hardware circuits a g hardware circuits a ts / Lab Activities/Topi hopper fed D. C. series m . C. drive for closed – loo single-phase full wave, I lardware). single-phase full wave	III nd IV nd V s otor. (Hardw p speed cor alf controll	I V I ware) ntrol (s ed con	Applying Analysing Evaluating imulation). werter for open	
CO1 CO2 CO3 List of 1. 2. 3. 4.	Demonst Analyze simulatio Evaluate simulatio	trate experiment the performance on. e performance on. vities: peed – Torque c the performance rate operation a ed control of D. rate operation a ed control of D.	tts on basics of DC nee of drives usi of drives using List of Experimen characteristics of ch e of chopper fed D and application of C. shunt motor. (H and application of C. shunt motor. (H	and AC drives. ng hardware circuits a g hardware circuits a ts / Lab Activities/Topi hopper fed D. C. series m . C. drive for closed – loo single-phase full wave, 1 lardware). single-phase full wave, lardware).	III nd IV nd V s IV otor. (Hardway IV p speed corral f controll IV ull controll IV	I ware) ntrol (s ed con	Applying Analysing Evaluating imulation). everter for open everter for open	
CO1 CO2 CO3 List of 1. 2. 3. 4. 5.	Demonst Analyze simulatic Evaluate simulatic Construction Construction Demonst loop spee Analyze	trate experiment the performance on. e performance on. vities: peed – Torque of the performance the performance rate operation a ed control of D. trate operation a ed control of D.	tts on basics of DC nee of drives usi of drives using List of Experimen characteristics of ch e of chopper fed D and application of C. shunt motor. (H and application of C. shunt motor. (H e of converter fed I	and AC drives. ng hardware circuits a g hardware circuits a ts / Lab Activities/Topi hopper fed D. C. series m . C. drive for closed – loo single-phase full wave, 1 lardware). Single-phase full wave, lardware). D. C. drive for closed loo	III nd IV nd V s otor. (Hardw p speed cor alf controll ull controllo o speed con	I ware) ntrol (s ed con ed con trol. (S	Applying Analysing Evaluating imulation). overter for open everter for open Simulation).	
CO1 CO2 CO3 List of 1. 2. 3. 4. 5. 6.	Demonst Analyze simulatic Evaluate simulatic Evaluate simulatic Construction Verify Sp Analyze Demonst loop spee Analyze Study the	trate experiment the performance on. e performance on. vities: peed – Torque of the performance the performance rate operation a ed control of D. trate operation a ed control of D. the performance ed control of D.	tts on basics of DC nee of drives usi of drives using List of Experimen characteristics of ch e of chopper fed D and application of C. shunt motor. (H and application of C. shunt motor. (H e of converter fed I wo quadrant single	and AC drives. ng hardware circuits a g hardware circuits a ts / Lab Activities/Topi hopper fed D. C. series m . C. drive for closed – loc single-phase full wave, 1 Hardware). Single-phase full wave, 2 Hardware). D. C. drive for closed loc phase converter fed 5 H	III nd IV nd V nd V s IV s IV otor. (Hardward) p speed controll IV ull controll IV p speed controll IV IV IV	I ware) ntrol (s ed con ed con trol. (S Simuli	Applying Analysing Evaluating imulation). werter for open werter for open Simulation). ation).	
CO1 CO2 CO3 List of 1. 2. 3. 4. 5. 6. 7.	Demonst Analyze simulatio Evaluate simulatio Construction Construction Demonst loop spee Analyze Study the Study the	trate experiment the performance on. e performance on. vities: peed – Torque of the performance rate operation a ed control of D. rate operation a ed control of D. the performance e operation of twe e operation of twe e four-quadrant	tts on basics of DC nee of drives usi of drives using List of Experimen characteristics of ch e of chopper fed D and application of C. shunt motor. (H and application of C. shunt motor. (H e of converter fed I wo quadrant single operation of 5 HP	and AC drives. ng hardware circuits a g hardware circuits a ts / Lab Activities/Topi hopper fed D. C. series m . C. drive for closed – loo single-phase full wave, 1 lardware). single-phase full wave, lardware). D. C. drive for closed loo phase converter fed 5 H DC motor using single p	III nd IV nd V s IV otor. (Hardways IV p speed corral f controll IV ull controll IV p speed con IV p of the provided controll IV <th>I ware) ntrol (s ed con ed con trol. (S Simula ter. (Si</th> <th>Applying Analysing Evaluating imulation). everter for open everter for open simulation). ation). mulation).</th>	I ware) ntrol (s ed con ed con trol. (S Simula ter. (Si	Applying Analysing Evaluating imulation). everter for open everter for open simulation). ation). mulation).	
CO1 CO2 CO3 List of 1. 2. 3. 4. 5. 6. 7. 8.	Demonst Analyze simulatic Evaluate simulatic Evaluate simulatic Construction Demonst loop spee Analyze Study the Study the Study the	trate experiment the performant on. e performance on. vities: peed – Torque of the performance the performance rate operation a ed control of D. the performance ed control of D. the performance ed control of D. the performance ed control of D. the performance ed control of D.	tts on basics of DC nee of drives usi of drives using List of Experimen characteristics of ch e of chopper fed D and application of C. shunt motor. (H and application of C. shunt motor. (H e of converter fed I wo quadrant single operation of 5 HP pur quadrant chopp	and AC drives. ng hardware circuits a g hardware circuits a ts / Lab Activities/Topi hopper fed D. C. series m . C. drive for closed – loo single-phase full wave, 1 lardware). Single-phase full wave, 1 lardware). D. C. drive for closed loo phase converter fed 5 H DC motor using single p er fed DC drive (simulat	III nd IV nd V nd V s IV otor. (Hardway IV p speed corral IV alf controll IV ull controll IV p speed con IV p speed con<	I ware) ntrol (s ed con ed con trol. (S Simula ter. (Si	Applying Analysing Evaluating imulation). averter for open averter for open Simulation). ation). mulation).	
CO1 CO2 CO3 List of 1. 2. 3. 4. 5. 6. 7. 8. 9.	Demonst Analyze simulatic Evaluate simulatic Evaluate simulatic Construction Construction Demonst loop spee Analyze Study the Study the Assess the	trate experiment the performance on. e performance on. vities: peed – Torque of the performance rate operation a ed control of D. trate operation a ed control of D. the performance e operation of twe e four-quadrant e operation of for the performance	tts on basics of DC nee of drives usi of drives using List of Experimen characteristics of ch e of chopper fed D and application of C. shunt motor. (H and application of C. shunt motor. (H e of converter fed I wo quadrant single operation of 5 HP our quadrant chopp of rotor resistance	and AC drives. ng hardware circuits a g hardware circuits a ts / Lab Activities/Topi hopper fed D. C. series m . C. drive for closed – loo single-phase full wave, 1 lardware). Single-phase full wave, 1 lardware). D. C. drive for closed loo phase converter fed 5 H DC motor using single p er fed DC drive (simulat control method for spee	III nd IV nd V nd V s IV otor. (Hardways IV p speed controll IV ull controll IV p speed controll IV DC drive (nase convertion). IV	I ware) ntrol (s ed con ed con trol. (S Simula ter. (Si Slip –	Applying Analysing Evaluating imulation). werter for open werter for open Simulation). ation). mulation). Ring Induction	
CO1 CO2 CO3 List of 1. 2. 3. 4. 5. 6. 7. 8. 9.	Demonst Analyze simulatio Evaluate simulatio E Lab Acti Verify Sp Analyze Demonst loop spee Analyze Study the Study the Study the Study the	trate experiment the performance on. e performance on. vities: peed – Torque of the performance rate operation a ed control of D. rate operation a ed control of D. the performance e operation of twe e four-quadrant e operation of for the performance simulation)	tts on basics of DC nee of drives usi of drives using List of Experimen characteristics of ch e of chopper fed D and application of C. shunt motor. (H and application of C. shunt motor. (H e of converter fed I wo quadrant single operation of 5 HP our quadrant chopp of rotor resistance	and AC drives. ng hardware circuits a g hardware circuits a ts / Lab Activities/Topi hopper fed D. C. series m . C. drive for closed – loo single-phase full wave, H lardware). Single-phase full wave, H lardware). D. C. drive for closed loo phase converter fed 5 H DC motor using single p er fed DC drive (simulat control method for spee	III nd IV nd V s IV s IV otor. (Hardway) s IV ull controll IV o speed con DC drive (nase convertion). control of IV	I ware) ntrol (s ed con trol. (S Simula ter. (Si Slip –	Applying Analysing Evaluating imulation). everter for open everter for open Simulation). ation). mulation). Ring Induction	
CO1 CO2 CO3 List of 1. 2. 3. 4. 5. 6. 7. 8. 9. 10	Demonst Analyze simulatic Evaluate simulatic Evaluate simulatic Construction Constr	trate experiment the performant e performance on. vities: peed – Torque of the performance rate operation at ed control of D. the performance e operation of twe e four-quadrant e operation of four- the performance simulation) rate speed control	tts on basics of DC nee of drives usi of drives using List of Experimen characteristics of ch e of chopper fed D and application of C. shunt motor. (H and application of C. shunt motor. (H e of converter fed I wo quadrant single operation of 5 HP our quadrant chopp of rotor resistance	and AC drives. ng hardware circuits a g hardware circuits a ts / Lab Activities/Topi hopper fed D. C. series m . C. drive for closed – loo single-phase full wave, 1 lardware). Single-phase full wave, 1 lardware). D. C. drive for closed loo phase converter fed 5 H DC motor using single p er fed DC drive (simulat control method for spee botor using V/f method. (H	III nd IV nd V s IV s IV otor. (Hardware) IV p speed corralf controll IV	I ware) ntrol (s ed con trol. (S Simula ter. (Si Slip –	Applying Analysing Evaluating imulation). averter for open averter for open Simulation). ation). mulation). Ring Induction	
CO1 CO2 CO3 List of 1. 2. 3. 4. 5. 6. 7. 8. 9. 10 11	Demonst Analyze simulatic Evaluate simulatic Evaluate simulatic Construction Construction Construction Construction Construction Study the Study t	trate experiment the performance on. e performance on. vities: peed – Torque of the performance rate operation a ed control of D. the performance e operation of two e four-quadrant e operation of for the performance comparison of two e four-quadrant e operation of two e performance Simulation) rate speed control	tts on basics of DC nee of drives usi of drives using List of Experimen characteristics of ch e of chopper fed D and application of C. shunt motor. (H and application of C. shunt motor. (H e of converter fed I wo quadrant single operation of 5 HP our quadrant chopp of rotor resistance rol of Induction motor c	and AC drives. ng hardware circuits a g hardware circuits a ts / Lab Activities/Topi hopper fed D. C. series m . C. drive for closed – loo single-phase full wave, 1 Hardware). D. C. drive for closed loo phase converter fed 5 H DC motor using single p er fed DC drive (simulat control method for spee btor using V/f method. (H lrive with Six – step VSI	III nd IV nd V nd V s IV s IV<	I ware) ntrol (s ed con ed con trol. (S Simula ter. (Si Slip – nulatio	Applying Analysing Evaluating imulation). werter for open werter for open Simulation). ation). mulation). Ring Induction	
CO1 CO2 CO3 List of 1. 2. 3. 4. 5. 6. 7. 8. 9. 10 11 122	Demonst Analyze simulatic Evaluate simulatic Evaluate simulatic Evaluate simulatic Study the Study the Stu	trate experiment the performance on. e performance on. vities: peed – Torque of the performance rate operation a ed control of D. the performance e operation of twe e four-quadrant e operation of four- the performance simulation) rate speed control the operation of rate speed control the operation of rate speed control the operation of	tts on basics of DC nee of drives usi of drives using List of Experimen characteristics of ch e of chopper fed D and application of C. shunt motor. (H and application of C. shunt motor. (H e of converter fed I wo quadrant single operation of 5 HP our quadrant chopp of rotor resistance rol of Induction motor co on of brushless DC	and AC drives. ng hardware circuits a g hardware circuits a ts / Lab Activities/Topi hopper fed D. C. series m . C. drive for closed – loo single-phase full wave, 1 lardware). Single-phase full wave, 1 lardware). D. C. drive for closed loo phase converter fed 5 H DC motor using single p er fed DC drive (simulat control method for spee ptor using V/f method. (H lrive with Six – step VSI motor drive with softwat tor using V/remove and the stor using V/remove and the the softwat	III nd IV nd IV nd V s IV	I ware) ntrol (s ed con ed con trol. (S Simula ter. (Si Slip – nulatic on. (Sin	Applying Analysing Evaluating imulation). werter for open werter for open Simulation). ation). mulation). Ring Induction on). mulation)	
CO1 CO2 CO3 List of 1. 2. 3. 4. 5. 6. 7. 8. 9. 10 11 12 13	Demonst simulation Evaluate simulation Evaluate simulation Evaluate simulation Construction Demonst loop speed Demonst loop speed Demonst loop speed Study the Study t	trate experiment the performance on. e performance on. vities: peed – Torque of the performance rate operation a ed control of D. the performance e operation of tw e four-quadrant e operation of tw e four-quadrant e operation of four- the performance Simulation) rate speed contri- the operation of rate the operation of rate the operation of rate speed contri-	tts on basics of DC nee of drives usi of drives using List of Experimen characteristics of ch e of chopper fed D and application of C. shunt motor. (H and application of C. shunt motor. (H e of converter fed I wo quadrant single operation of 5 HP our quadrant chopp of rotor resistance rol of Induction motor co on of brushless DC rol of Induction motor co rol of Induction motor co on of brushless DC	and AC drives. ng hardware circuits a g hardware circuits a ts / Lab Activities/Topi hopper fed D. C. series m . C. drive for closed – loo single-phase full wave, 1 lardware). D. C. drive for closed loo phase converter fed 5 H DC motor using single p er fed DC drive (simulat control method for spee ptor using V/f method. (H lrive with Six – step VSI motor drive with softwa ptor using Kramer speed	III nd IV nd V s III otor. (Hardware) control of III ardware) Control (Sime Simulation on the second on	I ware) ntrol (s ed con trol. (S Simula ter. (Si Slip – nulatio on. (Sin nod. (E	Applying Analysing Evaluating imulation). averter for open averter for open Simulation). ation). mulation). Ring Induction on). mulation) Hardware)	

	Textbooks
1	"Fundamentals of Electrical Drives", G. K. Dubey, Narosa publication, 2nd edition.
	References
1	"Modern Power Electronics and AC drives" by B. K. Bose, Prentice Hall of India Pvt. India
2	"Power Electronics - Converter application" By N. Mohan T.M. Undeland and W. P. Robbins,
2	John Wiley and sons
3	"Electrical Drives - Concept and application" Vedam Subramanyam.
	Useful Links
1	https://nptel.ac.in/courses/108/104/108104140/

						CO-P	O Map	ping						
		Programme Outcomes (PO)								PS	50			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		3												
CO2		2												2
CO3			2											2
CO4														
The stre	ngth of	mappi	ng is to	be wri	itten as	1,2,3; v	where, 1	: Low,	2: Mec	lium, 3	High			
Each CO	O of the	e course	e must i	map to	at least	one PC), and p	referab	ly to or	nly one	PO.			

		Assessment					
There are three	There are three components of lab assessment, LA1, LA2 and Lab ESE.						
IMP: 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 indicat	es starting week o	f a semester. Lab activities/	Lab performance shall include perfo	rming			
experiments, m	experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the						
nature and requ	irement of the lab	course. The experimental	lab shall have typically 8-10 experim	ents and			
related activitie	es if any.						

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)					
AY 2023-24					
Course Information					
Programme	B.Tech. (Electrical Engineering)				
Class, Semester	Third Year B. Tech., Sem VI				
Course Code	6EL373				
Course Name	Microcontroller and Applications Lab				
Desired Requisites:	Analog and Digital Circuits Lab				

Teaching	Scheme		Examination	Scheme (Marks)	
Practical	2 Hrs/Week	LA1	LA2	Lab ESE	Total
Interaction	-	30	30	40	100
			Cre	edits: #	

	Course Objectives						
1	1 To develop the necessary skills required for programming 8051 and Arduino microcontroller						
	implement real world applications.						
2	To understand the practical problems in electrical systems and implement	nt programs fo	r same.				
3	To introduce various programming softwares and implement microcont	roller based ap	plications.				
	Course Outcomes (CO) with Bloom's Taxonomy L	evel					
At the	end of the course, the students will be able to,						
		Bloom's	Bloom's				
CO	Course Outcome Statement/s	Taxonomy	Taxonomy				
		Level	Description				
CO1	Use simulation tools to analyze microcontroller based systems	***					
	Use simulation tools to analyze interocontroller based systems.	III	Applying				
CO2	Apply programming techniques to implement counters, timers,	III III	Applying Applying				
CO2	Apply programming techniques to implement counters, timers, interrupts and other peripherals.	III III	Applying Applying				
CO2 CO3	Apply programming techniques to implement counters, timers, interrupts and other peripherals.Execute programs to interface microcontrollers with electrical and		Applying Applying Applying				
CO2 CO3	Apply programming techniques to implement counters, timers, interrupts and other peripherals.Execute programs to interface microcontrollers with electrical and electronics systems.		Applying Applying Applying				
CO2 CO3 CO4	Apply programming techniques to implement counters, timers, interrupts and other peripherals.Execute programs to interface microcontrollers with electrical and electronics systems.Construct programs for electrical applications using		Applying Applying Applying Applying				
CO2 CO3 CO4	Apply programming techniques to implement counters, timers, interrupts and other peripherals.Execute programs to interface microcontrollers with electrical and electronics systems.Construct programs for electrical applications using microcontrollers.		Applying Applying Applying Applying				

List of Experiments / Lab Activities/Topics

List of Lab Activities:

- 1. Introduction to different Development Boards, Keil/Arduino IDE, Using Keil/Arduino IDE to assemble a program, Hex file format, Downloading and running the program
- 2. Demonstrate the flashing of GPIO ports of using delay.
- 3. Implement a 8-bit up and down counter using microcontroller.
- 4. Devise a running light scheme using GPIO pins of microcontroller.
- 5. Demonstrate the process of serial communication using 8051 and Arduino microcontroller
- 6. Construct a C program using 8051 to generate pulses using various timer modes
- 7. Execute programs to demonstrate interrupts for 8051.
- 8. Construct a C program to interface LCD with Arduino.
- 9. Devise a Arduino based relay control for single phase ac loads.
- 10. Construct a C program to interface stepper motor with Arduino.
- 11. Construct a temperature control system using Arduino
- 12. Demonstration of Hardware-in-loop simulation using Arduino and Matlab /Simulink

	Textbooks
1	Muhammad Mazidi, Janice Mazidi and Rolin McKinlay, "The 8051 Microcontroller and
1	Embedded systems using Assembly and C", Pearson Education, 2nd Edition, 2007
2	Kenneth Ayala, "8051 Architecture, Programming and Applications", 3rd Edition, 2007
2	Massimo Banzi and Michael Shiloh, Make: Getting Started With Arduino - The Open Source
3	Electronics Prototyping Platform, Shroff/Maker Media; 3rd edition, 2014
	References
1	Subrata Ghoshal, "Embedded Systems and Robots- Projects using the 8051 Microcontroller",
1	Cengage Learning, 1st Edition, 2009
2	Michael Margolis, "Arduino Cookbook", Shroff/ O'Reilly, 2nd Edition, 2012
2	Mazidi, RolinMc Kinlay and Danny Causey, "PIC Microcontroller and Embedded Systems using
3	Assembly and C for PIC18", Pearson Education.
	Useful Links
1	https://nptel.ac.in/courses/106/108/106108100/
2	https://nptel.ac.in/courses/117/104/117104072/
3	https://nptel.ac.in/courses/108/102/108102045/

	CO-PO Mapping														
		Programme Outcomes (PO)												PSO	
	1	2 3 4 5 6 7 8 9 10 11 12 1 2													
CO1			3												
CO2					3										
CO3					3										
CO4 3															
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High															
Each CO of the course must map to at least one PO, and preferably to only 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											
week i 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	Y 2023-24							
	Course Information										
Progra	amme		B.Tech. (Electric	al Engineering)							
Class,	Semester		Third Year B. Te	ch., Sem VI							
Cours	e Code		6EL341								
Cours	e Name		Mini-Project-3								
Desired Requisites: -											
r -	Teaching 8	Scheme		Examination	Scheme (I	Marks)					
Practi	cal	2 Hrs/ Week	LA1	LA2	Lab E	SE	Total				
Intera	raction - 30 30 40 100										
	Credits: 1										
	· · ·										
Course Objectives											
1	1 To acquire the skills of electrical and electronic circuit design and assembly.										
2	To devel	op the skills of	analysis and fault o	liagnosis of the ele	ctrical and	electronic ci	rcuit as per				
	design.										
3	To test th	e electrical and	electronic circuit	assembly.							
A / /1	1.6.1	Cours	e Outcomes (CO)	with Bloom's Tax	konomy Le	evel					
At the	end of the	course, the stud	ients will be able to	0,		Dloom's	Dloom's				
CO		Сош	rse Outcome State	ement/s		Taxonomy	Taxonomy				
						Level	Description				
CO1	Understa	and the basics c	concepts used in M	ini Project.		III	Understanding				
CO2	Analyse	and infer the re	ference literature c	ritically and efficie	ently.	IV	Analysing				
CO3	Constru	ct the model of	the project.			VI	Creating				
CO4	CO4Evaluate the performance of the project.VEvaluating										
CO5	Write an	nd Present the 1	eport of the projec	t.		VI	Creating				
]	List of Experimen	ts / Lab Activities	/Topics						
List of Lab Activities:											
1. Visi	1. Visit to a local industry or search for the study of problems of industry.										

2. Prepare the problem based hardware Mini project.

3. Evaluate the performance of project.

4. Prepare a report on the same.

Note :

Student will have to perform a group project based on above points which will be evaluated as In Semester Examination (LA1, LA2 and Lab ESE).

Textbooks

References

Useful Links

	CO-PO Mapping														
	Programme Outcomes (PO)													PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1						3			1						
CO2		3							3						
CO3	1		3												
CO4				2	3										
CO5 3															
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High															

Each CO of the course must map to at least one PO, and preferably to only one PO.

		Assessment		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 activitie	s 11 any.													

Professional Elective-2

	Walchand College of Engineering, Sangli										
			(Government Alde	7077_73	lie)						
				2022-23							
Drogr	ammo		B Tech (Electric	al Engineering)							
Close	Somoston		D. I ecil. (Eleculied	an Engineering)							
Class,	Semester		Third Tear D.Tec	iii., Sein vi							
Cours	e Code		0EL331			. 1					
Cours	e Name		Professional Elec	tive II: ANN and Fi	izzy Co	ontrol					
Desire	d Requisi	tes:	N1l								
	Teaching	Scheme		Examination S	Scheme	e (Marks)					
Lectu	re	3 Hrs/week	MSE	ISE]	ESE	Total				
Tutor	ial	-	30	20		50	100				
				Cree	lits: 3						
			Course	e Objectives							
1	To make	students unders	tand operation and	performance of ac	and dc	machines.					
2	To make	students learn c	haracteristics of ac	c and dc machines.							
3	To devel	op skills to choo	se ratings of ac and	d dc machines for va	arious a	pplications.					
		Course	Outcomes (CO)	with Bloom's Taxo	nomy]	Level					
At the	end of the	course, the stud	ents will be able to),							
		C				Bloom's	Bloom's				
CO		Cours	e Outcome Staten	nent/s		Taxonomy	Taxonomy				
C01	Explain t	he architecture a	and features of new	ral networks		II	Understanding				
CO1	Explain t	programming tea	chniques to implem	ent neural networks	3		Understanding				
CO3	Impleme	nt the applicatio	ns related to electri	ical and electronics	, 	IV	Applying				
	r]						
Modu	le		Module (Contents			Hours				
	Neur	al Networks an	d Architecture								
т	Funda	amentals of Neu	ral Networks: Wha	t is Neural Network	k, Mode	el of	7				
1	Artifi	cial Neuron, Lea	arning rules and va	rious activation fun	ctions,	Single layer					
	Feed-	forward network	ks, Perceptron learn	ning, MLP structure	s.						
	Back	propagation N	etworks								
П	Delta	and LMS rules,	Back propagation	Networks, Architec	ture of	Back-	7				
	propa	gation (BPN) N	etworks, Back-proj	pagation Learning,	v ariati	on of					
	- Stallu Unsu	nervised netwo	rles								
	Asso	ciative Memory.	Auto correlators 1	Heterocorrelators N	Aultiple	Training					
III	Enco	ding Strategy, E	xponential BAM, a	and Associative Mer	mory fo	or Real	7				
	coded	l pattern pairs, A	pplications		2						
	Adap	tive Resonance	Networks								
IV	Adap	tive Resonance '	Theory: Cluster Str	ructure, Vector Qua	ntizatio	on, Classical	6				
1,	ART	Network, Simpl	ified ART Archited	cture, ART1 and AI	RT2 Ar	chitecture					
	and a	Igorithms, Appli	cations, Sensitiviti	es of ordering of da	.ta.						
×7	Radia	al and Convolu	tion Networks	and design Dadiet	heater	ination					
		ork working	s, pooning, working	g and design, Radial	Uasis 1	unction	0				
<u> </u>		ication to Fleet	rical								
VI	Contr	ol system design	n with neural netwo	ork- controller desig	m, tuni	ng and	6				
	VI Control system design with neural network- controller design, tuning and learning. Power system applications. Load forecasting and fault analysis 6										

	Textbooks									
1	Simon Haykin, "Neural Network", Pearson Publications, 2005.									
2	Bishop, C. M., "Neural Networks for Pattern Recognition", Oxford University Press. 1995.									
3	S.Rajasekaran and G.A. Vijayalakshmi Pai., "Neural Networks, Fuzzy Logic and Genetic									
	Algorithms", PHI publications,2012.									
	References									
1	Chin Teng Lin, C. S. George Lee, "Neuro-Fuzzy Systems", PHI.pub. 2007.									
	Useful Links									
1	https://onlinecourses.nptel.ac.in/noc21_ge07/preview_									

	CO-PO Mapping													
		Programme Outcomes (PO) PSO												
	1	2 3 4 5 6 7 8 9 10 11 12 1 2												
CO1	3												2	
CO2			2										2	
CO3 2 2 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.

	Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)										
			AY2	2023-24							
			Course I	nformation							
Progra	amme		B.Tech. (Electrica	al Engineering)							
Class,	Semester		Third Year B. Teo	ch., Sem VI							
Cours	e Code		6EL332								
Cours	e Name		Professional Elec	tive II: Nonlinear and Di	gital Control S	ystem					
Desire	d Requisi	tes:	Control System E	ngineering							
	Teaching	Scheme	Examination Sche	eme (Marks)							
Lectur	re	3 Hrs/week	MSE	ISE	ESE	Total					
Tutor	ial	50	100								
				Credits: 3							
			Course	Objectives							
1	To make	students identif	y various characteri	stics of nonlinear system	s.						
2	To devel	op skills for ana	lyzing nonlinear sy	stems.							
3	To make	students familia	r with digital control	ol system.	r)						
At the	end of the	course the stud	ents will be able to	ith Bloom's Taxonomy	Level						
At the		course, the stud	ents will be able to	,	Bloom's	Bloom's					
со		Cours	e Outcome Staten	nent/s	Taxonomy	Taxonomy					
					Level	Description					
CO1	Construc	t mathematical 1	nodels of digital co	ontrol system.	III	Applying					
CO2	Analyze	the nonlinear s	ystems using vario	us basic and commonly	IV	Analysing					
<u> </u>	used tool	S.	atom and control	lang for digital control							
	system	e une compens	ators and control	lers for digital control	V	Evaluating					
	Jorenn										
Modu	ıle		Module (Contents		Hours					
	Non	linear System									
I	Prop Sens	berties of non sitive to input a	linear system, M mplitude, Limit Cy	ultiple Equilibrium Sta vcle, Bifurcation, Jump I	ates, Chaos, Phenomenon,	5					
	Bacl	klash, Classifica	tion of Nonlinearit	ties	Hysteresis,						
	Ana	lysis of Nonline	ear System								
	Line	earization, Phase	e Plane Analysis, (Classification of Equilib	rium States,	7					
	NO0 Plan	e, Focus, Saddle	Point, Centre, Pre	diction of Limit Cycle us vanunov Stability for No.	ing Phase						
	Line	ar Systems.		yapunov Stability for No	n-nnear and						
	Digi	tal Control Sys	tem								
	Review of Z transforms, Z transform method for solving difference										
III	equa	tion,Impulse Sa	ampling and Data	Hold, Pulse Transfer Fu	inction,	7					
	Sam	pling Theorem,	Mapping between	S Plane and Z Plane, S $\mathbf{P}_{\mathbf{r}}$	tability						
		ign of Digital C	ontrol System	11a1y515.							
TT 7	Con	struction of Roc	t Locus, Design ba	sed on Root Locus, P.PI	PD,PID						
IV	Con	trollers, Lead, I	Lag, Lead-Lag Cor	npensators, Frequency R	esponse	8					
1	Ana	lysis, Bode Diag	gram.								

	State Space Analysis of Digital Control System	
	State Space representation of Digital System, Controllable Canonical	
V	form, Observable Canonical form, Diagonal form, Jordan form, Solving State	6
v	Space Equations, State Transition Matrix, Properties of State Transition	0
	Matrix, Pulse Transfer Function Matrix. Discretization of Continuous Time	
	State SpaceEquation.	
	State Space Design of Digital Control System	
	Controllability, Controller Design in State Space, Design via Pole Placement	
VI	for Controller Design, Ackermann's Formula for Controller Design,	6
V I	Observability, Observer Design, Design via Pole Placement for Observer	0
	Design, Ackermann's Formula for Observer Design, Deadbeat Design,	
	Design for Deadbeat Response	
	Textbooks	
1	K. Ogata, "Discrete Time Control Systems", Second Edition, Pearson Education,	2005,
1	ISBN: 9788120327603	
2	C.L. Phillips, J.M. Parr, "Feedback Control Systems", Fifth Edition, Pearson Edu	cation,2013,
	ISBN: 9789332507609	
	References	
	I.J. Nagrath, M.Gopal "Control Systems Engineering", New Age International	al, Sixth
1	Edition,	
	2018, ISBN: 9789386070111	
2	B.C. Kuo, "Digital Control Systems", Oxford University Press, Second Edition, 2	2012,
	ISBN: 9780198083542	
	Useful Links	
1	https://nptel.ac.in/courses/108/106/108106162/	
2	https://nptel.ac.in/courses/108/102/108102113/	

CO-PO Mapping															
		Programme Outcomes (PO)												PSO	
	1	2 3 4 5 6 7 8 9 10 11 12 1 2													
CO1	3	3													
CO2		2													
CO3	CO3 2 2														
The strength of mapping is to be written as 1,2,3; Where, 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.

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)										
			AY	2023-24							
	Course Information										
Progra	amme		B.Tech. (Electric	al Engineering)							
Class,	Semester		Third Year B. Te	ch., Sem VI							
Cours	e Code		6EL333								
Cours	e Name		Professional Elec	tive III: Introduction to	Electric Vehic	le					
Desire	d Requisi	tes:	Electrical Machin	es, Power Electronics							
			1								
	Teaching	Scheme		Examination Sche	me (Marks)						
Lectur	re	3 Hrs/week	MSE	ISE	ESE	Total					
Tutori	ial		30	20	50	100					
				Credits:	3						
			Course	Objectives							
1	To develo	op basic knowle	dge related to arch	itecture of Electric Vel	icles						
2	To provid	de knowledge re	lated to design asp	ects and dynamics of I	lectric vehicles	•					
3	standards	se aims at enables for Electric veh	ing students to und nicles.	erstand the motor spec	ifications and cr	narging					
Course Outcomes (CO) with Bloom's Taxonomy Level											
At the	At the end of the course, the students will be able to,										
со		Course	e Outcome Statem	ent/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description					
CO1	Explain	the architectur	e and features of	Electric Vehicles	II	Understanding					
CO2	Interpret Electric	t the topologies	s and various desi	gn considerations fo	II	Understanding					
CO3	Calculat	e the vehicle	e dynamics for	Electric propulsion	III	Applying					
	systems										
Modu	le		Module C	ontents		Hours					
	Intro	duction to Elec	tric Vehicles								
Ι	Backg Electr Comp	ground of Elect ric Vehicles, A parison with con	ric Vehicles, Elec dvantages of Elec ventional vehicles,	tric Vehicle System, (ctric Vehicles, Efficie Fundamentals of Elec	Components of ncy, Pollution ric Vehicles	6					
II	IITypes of Electric Vehicles and Architecture of EVs Concept of Electric, Hybrid and Plug-in Electric Vehicles, Typical configuration of Hybrid Electric Vehicle, Topologies of HEVs: Series, Parallel and Series-Parallel Configuration, Topologies of Plug-in Hybrid Electric Vehicles, Fuel Cell Electric Vehicles, Solar Powered Electric Vehicles7										
III	Desig Introc Rollin Basic vehic	In Consideration luction to EV ng resistance, T s of Electric vel le design	ns for Electric Ve design fundame ransmission efficie nicle chassis and b	hicles entals, Aerodynamic ency, Consideration of ody design, general is	Consideration, vehicle mass, ues in Electric	6					

IV	Vehicle Dynamics Roadway fundamentals, Vehicle Kinetics, Dynamics of Vehicle Motion, Propulsion power: Force velocity characteristics, Vehicle gradability, Velocity and Acceleration: Velocity Profile, Distance traversed, tractive power, Energy Required, Propulsion System Design for EV systems	7
V	EV Drive systems Types of motors used in EV, Requirements of EV drive systems, Series Hybrid Electric Drive Train - Operation Patterns, Control Strategies, Parallel Hybrid Electric Drive Train – Operation Pattern, Control Strategies	7
VI	Electric Vehicle Chargers and Charging Standards EV charging: requirements and Classification, Charging standards for Electric vehicles, Introduction to AC and DC chargers for EV systems, Working of Electric Vehicle Supply Equipment (EVSE), Fast Chargers for EV systems, ARAI Testing standards for Electric Vehicles	6
	Textbooks	
1	Iqbal Husain, 'Electric and Hybrid Vehicles: Design Fundamentals', CRC Pro	ess, 2003
2	James Larminie, John Lowry, " Electric Vehicle Technology Explained", Wil- 2012	ey, 2nd edition,
	References	
1	Sheldon Williamson, ' Energy Management Strategies for Electric and Plug-in Vehicles', Springer-Verlag, 2012	Hybrid Electric
2	M. Ehsani, Y. Gao, S. Gay and A. Emadi , Modern Electric, Hybrid Electric Vehicles, CRC Press, 2005.	c, and Fuel Cell
	Useful Links	
1	https://nptel.ac.in/courses/108/103/108103009/	
2	https://nptel.ac.in/courses/108/102/108102121/	
3	https://nptel.ac.in/courses/108/106/108106170/	

	CO-PO Mapping													
	Programme Outcomes (PO) PSO													
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3													
CO2		3												
CO3		3												
The stren	The strength of mapping is to be written as 1: Low, 2: Medium, 3: High													
Each CO	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.

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

Open Elective 2

		Wal	chand College (Government Aide	of Engineering, S	angli								
	AY 2022-23												
			Course	Information									
Progra	Programme B.Tech. (Electrical Engineering)												
Class,	Class. Semester Third Year B. Tech Sem VI												
Cours	e Code		6OE350	,									
Cours	e Name		Open Elective 2:	Industrial Automation									
Desire	d Requisi	tes:	Basic Electrical F	ngineering. Basic Mecl	anical Engine	ering							
	<u></u>												
	Teaching	Scheme		Examination Sche	me (Marks)								
Lectu	re	3 Hrs/week	MSE	ISE	ESE	Total							
Tutor	ial	-	30	20	50	100							
				Credits:	3	100							
					-								
			Course	e Obiectives									
1	This cou	se intends to de	velop basics of lade	ler logic programming	or PLC.								
2	It provide	es the foundation	n level knowledge of	of SCADA System.	011201								
3	It gives o	verview of vario	ous types of control	ler for closed loop cont	ol.								
4	It provide	es the applicatio	ns of variable speed	l drives in industries.									
		Course	e Outcomes (CO) v	vith Bloom's Taxonon	iy Level								
At the	end of the	course, the stud	ents will be able to	,									
		Course	a Autoomo Staton	aantla	Bloom's	Bloom's							
	CO Course Outcome Statement/s Taxonomy												
		court	e Outcome Staten	icitus	Level	Description							
C0 C01	Explain	the working of	f various types of	measuring instruments	Level	Description Understanding							
C01	Explain controlle	the working of rs and actua	f various types of tors for implem	measuring instruments entation in industria	Level	Description Understanding							
C0 C01	Explain controlle automati	the working or rs and actua	f various types of tors for implem	measuring instruments entation in industria	Level	Description Understanding							
CO1 CO2	Explain controlle automati Identify	the working or rs and actua on. the use of variou	f various types of tors for implem	measuring instruments entation in industria strial automation	Level	Description Understanding Applying							
C01 C01 C02 C03	Explain controlle automati Identify Apply	the working or rs and actua on. the use of varior the knowledge	f various types of tors for implem us actuators in indu of PLC and S	measuring instruments entation in industria strial automation SCADA for Industria	Level Level	Description Understanding Applying Applying							
CO1 CO2 CO3 CO4	Explain controlle automati Identify Apply Automat Explore	the working of rs and actua on. the use of variou the knowledge toon.	f various types of tors for implem us actuators in indu of PLC and S	measuring instruments entation in industria strial automation SCADA for Industria Industrial Automation	Itaxinim Level 1 II 1 III 1 III 1 III	Description Understanding Applying Applying							
CO1 CO2 CO3 CO4	Explain controlle automati Identify Apply Automat Explore	the working or rs and actua on. the use of variou the knowledge ion. the use of variat	f various types of tors for implem us actuators in indu of PLC and S ble speed drives for	measuring instruments entation in industria strial automation SCADA for Industria Industrial Automation.	Level Level I II III III III	Description Understanding Applying Applying Applying							
CO1 CO2 CO3 CO4 Modu	Explain controlle automati Identify Apply Automat Explore	the working or rs and actua on. the use of variou the knowledge toon. the use of variat	f various types of tors for implem us actuators in indu of PLC and S ble speed drives for Module (measuring instruments entation in industria strial automation SCADA for Industria Industrial Automation.	Level Level	Description Understanding Applying Applying Applying Hours							
CO1 CO2 CO3 CO4 Modu	Explain controlle automati Identify Apply Automat Explore	the working or rs and actua on. the use of variou the knowledge ion. the use of variat	f various types of tors for implem us actuators in indu of PLC and S ole speed drives for Module C rious Process Para	measuring instruments entation in industria strial automation SCADA for Industria Industrial Automation.	Level Level Level I I I III III III	Applying Applying Applying Applying Hours							
CO1 CO2 CO3 CO4 Modu	Explain controlle automati Identify Apply Automat Explore	the working or rs and actua on. the use of variou the knowledge ion. the use of variat urement of Va urement of quar	f various types of tors for implem us actuators in indu of PLC and S ble speed drives for Module C rious Process Para ntities such as temp	measuring instruments entation in industria strial automation SCADA for Industria Industrial Automation. Contents meters perature, pressure, force	Level Level Li III III III Level A Level A A III III III A A A A A A A A A A A A A	Applying Applying Applying Applying Hours							
CO1 CO2 CO3 CO4 Modu	Explain controlle automati Identify Apply Automat Explore	the working of rs and actua on. the use of varior the knowledge ion. the use of variat urement of Va urement of quar acement, speed,	f various types of tors for implem us actuators in indu of PLC and S ole speed drives for Module C rious Process Para ntities such as temp flow, level, humid	measuring instruments entation in industria strial automation SCADA for Industria Industrial Automation. Contents meters perature, pressure, force ity, pH etc., signal con	Level Level Level Level I I I I I I I I I I I I I	Applying Applying Applying Applying Applying Applying							
CO1 CO2 CO3 CO4 Modu	Explain controlle automati Identify Apply Automat Explore	the working or rs and actua on. the use of varior the knowledge ion. the use of variat urement of Var urement of quar accement, speed, ation of errorsa	f various types of tors for implem us actuators in indu of PLC and S ble speed drives for Module C rious Process Para ntities such as temp flow, level, humid nd calibration.	measuring instruments entation in industria strial automation SCADA for Industria Industrial Automation. Contents meters perature, pressure, force ity, pH etc., signal con	Level Level Level Level II III III III Level Leve	Applying Applying Applying Applying Hours 6							
CO1 CO2 CO3 CO4 Modu	Explain controlle automati Identify Apply Automat Explore	the working of rs and actua on. the use of various he knowledge ion. the use of variat urement of Variat urement of quar- icement, speed, ation of errorsa	f various types of tors for implem us actuators in indu of PLC and S ole speed drives for Module C rious Process Para ntities such as temp flow, level, humid nd calibration.	measuring instruments entation in industria strial automation SCADA for Industria Industrial Automation. Contents meters perature, pressure, force ity, pH etc., signal con ers ontrollor, and tuning	Level Level Level I I I I I I I I I I I I I	Applying Applying Applying Applying Applying Fraction Base of the second sec							
CO1 CO2 CO3 CO4 Modu	Explain controlle automati Identify Automat Explore	the working or rs and actua on. the use of varior the knowledge ion. the use of variat urement of variat urement of quar acement, speed, ation of errorsa ess Control and fuction to proce	f various types of tors for implem us actuators in indu of PLC and S ble speed drives for Module C rious Process Para ntities such as temp flow, level, humid nd calibration. Various Controlle ess control, PID c	measuring instruments entation in industria strial automation SCADA for Industria Industrial Automation. Contents meters perature, pressure, force ity, pH etc., signal con ers ontroller and tuning, feed forward control	Level Level Level Level III III III Level III III Level A Level Level A Level A Level A Level A Level	Itaxinomy Description Understanding Applying Applying Applying Hours 6							
CO1 CO2 CO3 CO4 Modu I	Explain controlle automati Identify Apply Automat Explore	the working or rs and actua on. the use of various he knowledge ion. the use of variat urement of variat urement of quarticement, speed, ation of errorsa ess Control and luction to proce gurations such a ol, ratio control,	f various types of tors for implem us actuators in indu of PLC and S ole speed drives for Module C rious Process Para ntities such as temp flow, level, humid nd calibration. Various Controlle ess control, PID c as cascade control, override control an	measuring instruments entation in industria strial automation SCADA for Industria Industrial Automation. Contents meters perature, pressure, force ity, pH etc., signal con ers ontroller and tuning, feed forward control, a d selective control.	Level Level Level I I I I I I I I I I I I I I I I I I I	Itaxinomy Description Understanding Applying Applying Applying Hours 6							
CO1 CO2 CO3 CO4 Modu I II	Explain controlle automati Identify Automat Explore Ile Meas displa estim Proce Introc config contro	the working or rs and actua on. the use of varior the knowledge ion. the use of variat urement of variat urement of quar acement, speed, ation of errorsa ess Control and luction to proce gurations such a ol, ratio control, ators	f various types of tors for implem us actuators in indu of PLC and S ole speed drives for Module C rious Process Para ntities such as temp flow, level, humid ind calibration. Various Controlle ess control, PID c as cascade control, override control an	measuring instruments entation in industria strial automation SCADA for Industria Industrial Automation. Contents meters perature, pressure, force ity, pH etc., signal con ers ontroller and tuning, feed forward control, a d selective control.	Level Level Level Level II III III III Level III III Level III Level III III Level III Level III III III Level III III Level Level III III III Level Level Level III III III Level Lev	Itaxininity Description Understanding Applying Applying Applying Hours 6 1 6							
CO1 CO2 CO3 CO4 Modu I II	Explain controlle automatie Identify Apply Automat Explore	the working or rs and actua on. the use of various he knowledge ion. the use of variat urement of variat urement of quart icement, speed, ation of errorsa ess Control and luction to proce gurations such a ol, ratio control, ators luction to vario	f various types of tors for implem us actuators in indu of PLC and S ole speed drives for Module C rious Process Para ntities such as temp flow, level, humid nd calibration. Various Controlless control, PID c as cascade control, override control an us actuators such a	measuring instruments entation in industria strial automation SCADA for Industria Industrial Automation. Contents meters perature, pressure, force ity, pH etc., signal con ers ontroller and tuning, feed forward control, a d selective control.	Level Level Level Li III III III Li III Li Li Li Li Li Li Li Li Li Li Li Li Li	Itaxining Description Understanding Applying Applying Applying Hours 6 1 6 6							
CO1 CO2 CO3 CO4 Modu I II III	Explain controlle automati Identify Apply Automat Explore Ile Meas displa estim Proce Introc config contro Actua Introc	the working or rs and actua on. the use of varior the knowledge ion. the use of variat urement of variat urement of quar acement, speed, ation of errorsa ess Control and luction to proce gurations such a ol, ratio control, ators luction to vario neumatic, servo	f various types of tors for implem us actuators in indu of PLC and S ole speed drives for Module C rious Process Para ntities such as temp flow, level, humid ind calibration. Various Controlle ess control, PID c as cascade control, override control an us actuators such a motors, symbols an	measuring instruments entation in industria strial automation SCADA for Industria Industrial Automation. Contents meters perature, pressure, force ity, pH etc., signal con ers ontroller and tuning, feed forward control, a d selective control. as flow control valves, d characteristics.	Level Level Level Li III III III Li III Li Li Li Li Li Li Li Li Li Li Li Li Li	Itaxininity Description Understanding Applying Applying Applying Hours 6 1 6 6							
CO1 CO2 CO3 CO4 I II III	Explain controlle automati Identify Apply Automat Explore Ile Meas displa estim Proce Introc config contro Actua Introc andpi	the working or rs and actua on. the use of various the use of various the use of variate urement of variate urement of quartice the use of variate urement of quartice the use of variate urement, speed, ation of errorsa ess Control and luction to procee- gurations such a ol, ratio control, ators luction to various neumatic, servo	f various types of tors for implem us actuators in indu of PLC and S ole speed drives for Module C rious Process Para ntities such as temp flow, level, humid nd calibration. Various Controlless control, PID c as cascade control, override control and us actuators such a motors, symbols an	measuring instruments entation in industria strial automation SCADA for Industria Industrial Automation. Contents meters perature, pressure, force ity, pH etc., signal con ers ontroller and tuning, feed forward control, so d selective control. as flow control valves, d characteristics.	Level Level Level Level I I I I I I I I I I I I I I I I I I I	Itaxininity Description Understanding Applying Applying Applying Hours 6 1 6 6							
CO1 CO2 CO3 CO4 Modu I II III	Explain controlle automati Identify Apply Automat Explore Meas displa estim Proce Introc config contro Actua Introc andpi PLC Introc	the working or rs and actua on. the use of varior he knowledge ion. the use of variat urement of variat urement of quar acement, speed, ation of errorsa ess Control and luction to proce gurations such a ol, ratio control, ators luction to vario neumatic, servo	f various types of tors for implem us actuators in indu of PLC and S ole speed drives for Module C rious Process Para ntities such as temp flow, level, humid: nd calibration. Various Controll ess control, PID c us cascade control, override control and us actuators such a motors, symbols an	measuring instruments entation in industria strial automation SCADA for Industria Industrial Automation. Contents meters perature, pressure, force ity, pH etc., signal con ers ontroller and tuning, feed forward control, sid selective control. as flow control valves d characteristics. ay ladder logic, basic F f timers counters and I	LC system,	Itaxininity Description Understanding Applying Applying Applying Hours 6 1 6 7							

SCADA for Industrial Automation Components of SCADA systems, functions, classification of SCADA, networking and communication protocols.	7						
Variable Speed Drives Role of variable speed drives in automation, DC drives, AC drives and synchronous motor drives applications of variable speed drives.	7						
Textbooks							
John W. Webb, Ronald A. Reis "Programmable logic controllers, principles & ap	oplications"						
¹ by PHI publication, Eastern Economic Edition.							
C. D. Johnson, "Process control & instrumentation techniques". Pearson Education	n						
References							
George Stephanopoulos, "Chemical Process Control - An introduction to	Theory and						
Practice", Prentice-Hall of India, 1st Edition 1984.							
"Fundamentals of Electrical Drives", G. K. Dubey, Narosa publication, 2nd edition	on.						
Useful Links							
https://nptel.ac.in/courses/108105063							
https://archive.nptel.ac.in/courses/108/106/108106022/							
	SCADA for Industrial Automation Components of SCADA systems, functions, classification of SCADA, networking and communication protocols. Variable Speed Drives Role of variable speed drives in automation, DC drives, AC drives and synchronous motor drives applications of variable speed drives. <u>Textbooks</u> John W. Webb, Ronald A. Reis "Programmable logic controllers, principles & ap by PHI publication, Eastern Economic Edition. C. D. Johnson, "Process control & instrumentation techniques".Pearson Education <u>References</u> George Stephanopoulos, "Chemical Process Control - An introduction to Practice", Prentice-Hall of India, 1st Edition 1984. "Fundamentals of Electrical Drives", G. K. Dubey, Narosa publication, 2nd edition <u>Useful Links</u> https://nptel.ac.in/courses/108105063 https://archive.nptel.ac.in/courses/108/106/108106022/						

	CO-PO Mapping														
		Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		2													
CO2		2			2										
CO3						2								2	
		<u> </u>	<u> </u>												

The strength of mapping is to be written as 1,2,3; Where, 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.

ISEshall 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 2023-24												
Course Information												
Progr	Programme B.Tech. (Electrical Engineering)											
Class,	Semester		Third Year B. Te	ch., Sem VI								
Cours	e Code		6EL375									
Course Name Humanities 2- Project Management (Universal values, ethics)												
Desire	ed Requisi	tes:	B.Tech. (Electric	al Engineering)								
	Teaching	Scheme		Examination	on Scheme	(Marks)						
Practi	ical	-	LA1	LA2	Lab	ESE	Total					
Intera	ction	2 Hrs/ Week	30	30	40)	100					
				(Credits: 2							
	1		Cour	se Objectives								
1	To prepa	are the students es and preparing	s to manage proje g the budget.	ects by explorin	g both tech	inical and n	anagerial					
2	To make Project	aware the stuc	lents about leaders	ship and ethical	qualities in	dealing with	n real life					
	To induc	e qualities for v	vorking in interdiso	ciplinary and cro	ss functiona	l teams with	effective					
3	Commun	ication skills, e	conomical and ma	nagerial challeng	ges and com	mercial mana	igement.					
		Cours	e Outcomes (CO)	with Bloom's T	Saxonomy L	Level						
At the	end of the	course, the stud	lents will be able t	0,								
со		Cou	rse Outcome State	ement/s		Bloom's Taxonomy Level	Bloom's Taxonomy Description					
CO1	Grasp resourc comple	and perceive res required res within times	the project act and the constr ne	tivities with r aint for feas	espect to ibility or	II	Understanding					
CO2	Estima Unders	te and prepared te and commerce	are budget fo	r project co	mpletion,	IV	Analyzing					
CO3	Figure	out and s	chedule the prath networks	roject and as	ssess for	V	Evaluating					
		<u> </u>				l	1					
]	List of Experimen	nts / Lab Activit	ies/Topics							
List	of Topics(.	Applicable for	Interaction mode	:):								
1.	Introduc	tion to Project N	Aanagement.									
2.	Project C	Cost, Planning, f	easibility, risk.									
3. 1	Execution	ath Networks -	Principles of Reso	Surce Scheduling	.							
5.	Commer	cial Manageme	ng. nt and various regu	lations.								
6.	Study an	d use of softwar	re related to Projec	t Management S	ystem.							
7.	Universa	l values and eth	nics in regards to p	roject manageme	ent.							
				-								
1	D	in Locis (Des.)	T	extbooks	a Limite 1 0	012						
	Denn Samu	is LOCK, "Proje	Ir Jack R Mer	cower Publishin redith Scott M	g Limited, 2 Shafer M	1013 Iargaret M	Sutton "Project					
2	2 Samuel J. Mantel, Jr., Jack K. Meredith, Scott M. Shafer, Margaret M. Sutton, "Project Management in Practice", John Wiley & Sons, Inc., 2011											

3	B.C. Punmia and Khandelwal, "Project Planning and Control with PERT and CPM", Lakshmi Publications Pvt. Ltd., 2001									
4	Horald Kerzner, "Project Management: A systems approach to planning, scheduling and Controlling", John Wiley & Sons Inc., 2009									
5	Meri Williams, "The Principles of Project Management", Sitepoint Pvt Ltd., 2008.									
	References									
1	K. Nagarajan, "Project Management", New Age Int., 2nd ed. 2004.									
2	B.M.Naik, "Project Management-Scheduling and Monitoring by PERT/CPM", 1984									
2	William R Duncan, "A guide to the project management body of knowledge", PMI									
3	Publications, 1996									
	Useful Links									
1	https://www.apm.org.uk/resources/what-is-project-management/									
2	https://www.projectmanager.com/project-management									

	CO-PO Mapping															
		Programme Outcomes (PO)												PSO		
	1	2 3 4 5 6 7 8 9 10 11 12 1 2 3														
C01								1					1	1		
CO2									2					2		
CO3							1						2			
The streng	The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High															
Each CO	of the	course	must r	nap to	at leas	t 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%											
Assessment Based on Conducted by Typical Schedule Mar											
	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.