	Walchai	nd College of	Engineerin	ıg, Sangli			
	(G	overnment Aided A	utonomous Instit	tute)			
		AY 20)21-22	·			
		Course In	formation				
Programme		M. Tech. (Cont	trol System Eng	gineering)			
Class, Seme	ster	Second Year M	I. Tech., Sem II	I			
Course Cod	e	5CS601					
Course Nam	ne	Legal, Financia	al aspects of ind	ustrial project			
Desired Req	uisites:						
Teachi	ng Scheme		Examination S	Scheme (Marks)			
Lecture	2 Hrs/Week	T1	T2	ESE	T	otal	
Tutorial	-	20	20	60		100	
Practical	-		-	1			
Interaction	-		Crea	lits: 2			
		Course O					
	To identify an		•	sues involved in	Indue	trial	
1	-	minal matters a	•		muus	uiui	
			U	turn, capital inve	etmor	nt	
2			,	ice schemes, lab			
				ty in cyber space		w 5.	
3	different cyber		icetual propert	ly in cyber space	anu		
			L DI 9 T	T1			
	Course Out	comes (CO) wit	II DIUUIII S I AX	Unully Level			
At the end of	the course, studer	nts will be able to)				
		the terms invol		applicable for			
CO1	an Industrial P				Und	erstand	
		ited with invest	ments taxes a	nd employee			
CO2	schemes.		ments, taxes a	na employee	App	ly	
		with Cyber law	s applicable f	or cyber			
CO3	crimes.	with Cyber law	s applicable is	SI CYUCI	App	ly	
	crimes.						
Module		Modul	le Contents			Hours	
Wiodule			le Contents			Hours	
	Economic Deci	ision Making					
			T T T T T				
Ι		Introduction, Mathematics of Time Value of Money: Compound					
	Interest, Cash Flow Diagram, Uniform Annual Series, Irregular Cash Flows, Cost Comparison: Present Worth Analysis, Annual						
		-		rth Analysis, Ar	inual		
	Cost Analysis,	1	t Analysis				
	Taxes and Pro	fitability					
II		•		of Return, Pay		4	
11	Period, Net Pr	esent Worth, I	nternal Rate	of Return, Infla	tion,	•	
	•	Break-Even A	analysis, Unce	rtainty in Econ	omic		
	Analysis						
	Factories Act,	1948					
тт						Λ	
III	Health, Safety,	Provisions relat	ting to Hazard	ous Processes,		4	
	Welfare, Worki		U U				
		<u> </u>	· I J	· · ·			

	persons, Annual Leave with wages. The Employees Provident Fund and Miscellaneous Provisions Act, 1952.	
	Constitution and Labour Laws	
IV	labour laws, Equality before law and its application in Labour Laws, Equal pay for equal work; and Article-16 and reservation policies, Articles 19, 21, 23 and 24 and its implications.	4
	Intellectual Property in Cyber Space	
V	Computer Software and Copyright Law, Software Licences, Computer Databases and the law, Domain Names and the law, Trademark issues in cyberspace	4
	Cyber Crimes and Cyber Laws	
VI	Cyber Crimes, Malware, Computer Source Code, Digital Signature, Information Technology Laws, IT ACT & how to prevent yourself from being a victim of Cyber Crime.	5
	Text Books	
1	P.L. Mehta, Managerial Economics Analysis, Problems and cases Chand & Concerner Concer	, S.
2	Dieter G.E., Engineering Design, McGraw-Hill Education 5 th ed 2012.	ition,
3	N. Godbole, S. Belapure, "Cyber Security Understanding Cyber C Computer Forensics and Legal Perspectives", Wiley India Pvt. Ltd	
4	Canter, L. W, Environmental Impact Assessment, McGraw-Hill, 2 Edition, 1997.	2 nd
5	"Environmental Auditing", Published by CPCB, Govt. of India Publication, New Delhi.	
	References	
1	Peterson and Lewis: Managerial Economics, 4 th Ed., Prentice Ha 2004	ıll,
2	R. Drefuss, J. Pila; The Oxford Handbook of Intellectual Property Oxford University Press, 2018.	Law,
3	Adv. P. Mali, Cyber Law & amp; Cyber Crimes Simplified, Cyber Infomedia, 2017.	•
4	No.29 of 1986, [23/5/1986] - The Environment (Protection) Act, amended 1991	1986,
5	G.S.R.830(E), [24/11/2011] - The Water (Prevention and Control Pollution) Amendment Rules, 2011.	of
6	No.14 of 1981, [29/3/1981] - The Air (Prevention and Control of Pollution) Act 1981, amended 1987	
	Useful Links	
1		
	CO-PO Mapping	
	Programme Outcomes (PO)	

		1	2	3	4	5	6
	CO1				2		
	CO2		2			1	
	CO3				2		
The	strength of n	napping is to b	e written as 1,	,2,3; Where, 1	Low, 2:Mediu	ım, 3:High	
Eac	h CO of the c	ourse must m	ap to at least o	ne PO			
Luc				or Theory Co	ourse)		
The	assessment i			minations in t		(Test-1) and	T2
(Tes	st-2) of 20 ma	arks each. Also	o, there shall b	e 1 End-Sem e	examination (H	ESE) of 60 ma	arks. T1
				ed typically or			
	nodules with	nearly 50% w	eightage on m	odules 1 to 4 a	and 50% weigh	htage on mod	ules 5,
6.	A	Diana harrada	DL) - T-	TT			
	Assessment	Plan Dased o	n Bloom's La	xonomy Leve	el (Ivlarks) Fol	r Theory Col	irse
	Bloom's Ta	xonomy Leve	l T1	1 T2	ES	E	Гotal
1	R	emember					
2	U	nderstand					
3		Apply	5	5	20)	30
4		Analyze	5	5	20)	30
5	I	Evaluate	10) 10	20)	40
6		Create					
	т	otal	20	20	60		100

(Government Aided Autonomous Institute) AY 2021-22 Course Information Programme M. Tech. (Control System Engineering) Output Description					
Course Information Programme M. Tech. (Control System Engineering)					
Programme M. Tech. (Control System Engineering)					
Class, Semester Second Year M. Tech., Sem I					
Course Code 5CS690					
Course Name Dissertation Phase I					
Desired Requisites: Concept knowledge of research methodology, project mar Electrical Engineering	agement,				
Teaching Scheme (Hrs) Examination Scheme (Marks)	Examination Scheme (Marks)				
Lecture - LA1 LA2 ESE	Total				
Tutorial - 30 30 40	100				
Practical 20					
Interaction - Credits: 10	Credits: 10				
Course Objectives					
1 To develop the student to apply the knowledge gained to identify problems for resear provide the solutions by self-study and interaction with stakeholders.	arch and				
2 Acquire knowledge to tackle real world problems of societal concerns					
3 Impart flexibility to the student to have increased control over his/ her learning	<u> </u>				
4 Teachers would serve as mentor/facilitator of inquiry and reflection rather than as an					
5 Enhance a students' learning through increased interaction with peers and colleague	×s.				
Course Outcomes (CO) with Bloom's Taxonomy Level					
At the end of the course, students will be able to,	A 1				
CO1 Search the existing literature and identification of research problemCO2 Design and develop the solution for complex engineering problem	Analyze Evaluate				
CO2Design and develop the solution for complex engineering problemCO3Create the new knowledge in the specialized field	Create				
COS Create the new knowledge in the specialized new					
Course Content					

In dissertation Phase 1, the student has to complete the partial work of the Dissertation in Electrical

Engineering which will consist of problem statement, literature review from IEEE Transactions and

Journals, design, and scheme of implementation (viz. Block diagram, Mathematical Model, Algorithm, Simulation tool, hardware setup requirements etc.)

The student is expected to complete the dissertation at least up to the design phase. As a part of the

progress report of Dissertation Phase I, the candidate shall deliver a presentation on the advancement in Technology pertaining to the selected dissertation topic.

The student shall submit the duly approved and certified progress report of Dissertation Phase I in

standard format for satisfactory completion of the work by the concerned guide and head of the Department. The student will be assessed by a panel of examiners in the department for LA. In ESE there will be one external examiner, internal examiner/guide and a chairman for assessment. The assessment will be broadly based on literature study, work undergone, content delivery, presentation skills, documentation and report.

1	As per the rese	orch toni	0	Text]	BOOKS					
1	As per the rest		C							
				Refer	ences					
1	National and I	nternation	nal Journ							
				Useful	Links					
1	https://nptel.ac									
2	https://www.youtube.com/watch?v=mAVswCbz_jM&feature=emb_imp_woyt https://nptel.ac.in/courses/110/104/110104073/									
3										
4	https://nptel.ac	c.1n/course		CO-PO		10				
						tcomes (PO)				
	1	2		3		4	5		6	
CO1	1			5		1	5		2	
CO1	1			1		1	2		1	
CO2 CO3	1	2		1			2		1	
	h of mapping i			2.2. W/h	1.T	Q.M. alinu			1	
-	f the course mu	ist map to	at least	one PO.						
Each CO o	f the course mu			Assess		d Lab ESE.				
Each CO o	hree componen	its of lab a	assessme	Assess nt, LA1, 1	LA2 an					
Each CO o There are t IMP: Lab l	hree componen ESE is a separat	its of lab a	assessme passing.	Assess nt, LA1, 1 LA1, LA	LA2 an A2 toge	ther is treated a	as In-Semester E			
Each CO o There are t IMP: Lab I Assessmen	hree componen ESE is a separat	its of lab a	assessme passing.	Assess nt, LA1, 1	LA2 an A2 toge	ther is treated a	as In-Semester E (for 26-week Se		Mark	
Each CO o There are t IMP: Lab I Assessmen t	hree componen ESE is a separat n Based	ts of lab a te head of on	assessme passing. Condu	Assess nt, LA1, 1 LA1, LA cted by	LA2 an A2 toge Typ	ther is treated a ical Schedule	(for 26-week Se			
Each CO o There are t IMP: Lab I Assessmen	hree componen ESE is a separat Based Lab activ	ts of lab a te head of on vities,	assessme passing. Condu Lab C	Assess nt, LA1, L LA1, LA cted by	LA2 an A2 toge Typ Durin	ther is treated a sical Schedule g Week 1 to W	(for 26-week Solution Veek 6	em)	Mark	
Each CO o There are t IMP: Lab I Assessmen t LA1	hree componen ESE is a separat Based Lab activ attendance,	tts of lab a te head of on vities, , journal	assessme passing. Condu Lab C Fac	Assess nt, LA1, LA LA1, LA cted by Course ulty	LA2 an A2 toge Typ Durin Marks	ther is treated a ical Schedule g Week 1 to W s Submission a	(for 26-week So Veek 6 t the end of Wee	em)	Mark s 30	
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Each CO o There are t IMP: Lab I Assessmen t LA1 LA2	hree componen ESE is a separat Based Lab activ attendance, Lab activ attendance,	tts of lab a te head of on vities, , journal vities, , journal	assessme passing. Condu Lab C Fac Lab C Fac	Assess nt, LA1, LA LA1, LA cted by Course ulty Course ulty	LA2 an A2 toge Typ Durin Marks Durin Marks	ther is treated a s Submission a g Week 7 to W s Submission a	(for 26-week So Veek 6 t the end of Wee Veek 12 t the end of Wee	em) ek 6	Mark s 30 30	
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Each CO o There are t IMP: Lab I Assessmen t LA1 LA2 Lab ESE Week 1 inc considering	hree componen ESE is a separat Based Lab activ attendance, Lab activ attendance, Lab activ attendance, Lab activ attendance, attendance, g a 26-week ser	tts of lab a te head of on vities, , journal vities, , journal vities, , journal week of a mester. Th	E passing. Condu Lab C Fac Lab C Fac Lab C Fac a semeste ne actual	Assess nt, LA1, LA cted by Course ulty Course ulty Course ulty course ulty course ulty course	LA2 an A2 toge Typ Durin Marks Durin Marks pical sc shall b	ther is treated a bical Schedule g Week 1 to W s Submission a g Week 7 to W s Submission a g Week 15 to V s Submission a hedule of lab a e as per acader	(for 26-week So Veek 6 t the end of Wee Veek 12 t the end of Wee Week 18 t the end of Wee ssessments is sh nic calendar. La	em) k 6 k 12 k 18 own, b	Mark s 30 30 40	
Each CO o There are t IMP: Lab I Assessmen t LA1 LA2 Lab ESE Week 1 ind considering activities/I	hree componen ESE is a separat Based Lab activ attendance, Lab activ attendance, Lab activ attendance, licates starting g a 26-week ser ab performance	tts of lab a te head of on vities, , journal vities, , journal vities, , journal week of a mester. Th e shall inc	F passing. Condu Lab C Fac Lab C Fac Lab C Fac semeste ne actual clude per	Assess nt, LA1, LA cted by Course ulty Course ulty Course ulty course ulty r. The typ schedule forming of	LA2 an A2 toge Typ Durin Marks Durin Marks pical sci shall b experim	ther is treated a bical Schedule g Week 1 to W s Submission a g Week 7 to W s Submission a g Week 15 to V s Submission a hedule of lab a e as per acader nents, mini-pro-	(for 26-week So /eek 6 t the end of Wee /eek 12 t the end of Wee Week 18 t the end of Wee ssessments is sh nic calendar. La ject, presentation	em) k 6 k 12 k 18 own, b ns, drav	Mark s 30 30 40	
Each CO o There are t IMP: Lab I Assessmen t LA1 LA2 Lab ESE Week 1 inc considering activities/I programmi	hree componen ESE is a separat Based Lab activ attendance, Lab activ attendance, Lab activ attendance, licates starting g a 26-week ser ab performance ng and other su	tts of lab a te head of on vities, , journal vities, , journal vities, , journal week of a mester. Th e shall inc nitable act	F passing. Condu Lab C Fac Lab C Fac Lab C Fac a semeste ne actual clude per ivities, a	Assess nt, LA1, LA LA1, LA cted by Course ulty Course ulty Course ulty Course ulty Course ulty Course ulty Course ulty Course schedule forming of sper the	LA2 an A2 toge Typ Durin Marks Durin Marks pical sc shall b experim nature a	ther is treated a bical Schedule g Week 1 to W s Submission a g Week 7 to W s Submission a g Week 15 to V s Submission a hedule of lab a e as per acader nents, mini-pro- and requiremen	(for 26-week So Veek 6 t the end of Wee Veek 12 t the end of Wee Week 18 t the end of Wee ssessments is sh nic calendar. La ject, presentation t of the lab cour	em) k 6 k 12 k 18 own, b ns, drav se.	Mark s 30 30 40	
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Each CO o There are t IMP: Lab I Assessmen t LA1 LA2 Lab ESE Week 1 ind considering activities/L programmi	hree componen ESE is a separat Based Lab activ attendance, Lab activ attendance, Lab activ attendance, licates starting g a 26-week ser ab performance ng and other su Assessment Pl	tts of lab a te head of on vities, , journal vities, , journal vities, , journal week of a mester. Th e shall inc nitable act an based my Level	F passing. Condu Lab C Fac Lab C Fac Lab C Fac semeste ne actual clude per ivities, a on Bloo	Assess nt, LA1, LA cted by Course ulty Course	LA2 an A2 toge Typ Durin Marks Durin Marks pical sc shall b experim nature a	ther is treated a bical Schedule g Week 1 to W s Submission a g Week 7 to W s Submission a g Week 15 to V s Submission a hedule of lab a e as per acader and requirement Level (Marks	(for 26-week So Veek 6 t the end of Wee Veek 12 t the end of Wee Week 18 t the end of Wee ssessments is sh nic calendar. La ject, presentation t of the lab cour	em) k 6 k 12 k 18 own, b ns, drav se. ses)	Mark s 30 30 40 wings,	
Each CO o There are t IMP: Lab I Assessmen t LA1 LA2 Lab ESE Week 1 ind considering activities/L programmi	hree componen ESE is a separat Based Lab activ attendance, Lab activ attendance, Lab activ attendance, licates starting g a 26-week ser ab performance ng and other su Assessment Pl pom's Taxonol	tts of lab a te head of on vities, , journal vities, , journal vities, , journal week of a mester. The e shall incontrational intable act an based my Level	F passing. Condu Lab C Fac Lab C Fac Lab C Fac semeste ne actual clude per ivities, a on Bloo	Assess nt, LA1, LA cted by Course ulty Course	LA2 an A2 toge Typ Durin Marks Durin Marks pical sc shall b experim nature a	ther is treated a bical Schedule g Week 1 to W s Submission a g Week 7 to W s Submission a g Week 15 to V s Submission a hedule of lab a e as per acader and requirement Level (Marks	(for 26-week So Veek 6 t the end of Wee Veek 12 t the end of Wee Week 18 t the end of Wee ssessments is sh nic calendar. La ject, presentation t of the lab cour	em) k 6 k 12 k 18 own, b ns, drav se. ses)	Mark s 30 30 40 wings,	

Analyze	10	10	10	30
Evaluate	10	10	10	30
Create	10	10	20	40
Total Marks	30	30	40	100

	Walchan	d Colleg	ge of Engi	neering, Sa	angli				
	(Gov	vernment A	Aided Autonome	ous Institute)					
	·	A	Y 2021-22	· · · ·					
		Cou	rse Informati	on					
Programme	M. Tech. (Co	ontrol Sys	stem Engineer	ing)					
Class, Semester		ond Year M. Tech., Sem I							
Course Code	5CS602								
Course Name Desired	Industry Ori	entation C	Course						
Requisites:									
Teaching S	cheme (Hrs)		E	xamination S	cheme (Mai	·ks)			
Lecture		-	LA1	LA2	ESE	Total			
Tutorial		-	30	30	40	100			
Practical		-				1			
Interaction		1		Crea	lits: 1				
		Cou	rse Objectiv	es		<u>/</u>			
1				e of software	in solving co	omplex			
		-	ing problems.						
2			<u> </u>	f electrical cor	<u> </u>	ring student.			
			,	n's Taxonomy	y Level				
At the end of the cour				esign of electri	ical system	Evaluate			
CO1	effective			sign of cleetin	ical system	Lvaluate			
CO2		•	ion for electri	cal engineerir	ng problem	Create			
02	using sof			-					
CO3	Explain departme		rking of rese	earch and de	evelopment	Understand			
	departitie	л и.							
		Co	ourse Conten	t					
This course is based of modern day work env problems on compute strong fundamentals i from industry. Emplo Analysis and simulati	vironment, Ele rs. Electrical 1 n Control Eng yability of the	ctrical En Engineer : gineering student c	ngineer should must be highl and computer can be enhance	be able to sin y computer lit software prof ed by providir	nulate and so erate. The en iciency is hig	lve complex gineer with ghly in demand			
		,	Text Books						
1	Suitable boo	ks based	on the softwa	re selected.					
			References						
1	Suitable boo			s of software	selected				
			J seful Links						
1	As per the no	eed of the	software train	ning					

		P	rogramme O	utcomes (PO)	
	1	2	3	4	5	6
CO1		1				
CO2			2			2
CO3				3		
The strength of n	napping is to be	written as 1,2,	3; Where, 1:I	Low, 2:Mediur	n, 3:High	

		Assessment		
There are three co	omponents of lab assessm	nent, LA1, LA2 and	Lab ESE.	
IMP: Lab ESE is	a separate head of passin	g. LA1, LA2 togeth	er is treated as In-Semester Ev	valuation.
Assessment	Based on	Conducted by	Typical Schedule (for	Marks
			26-week Sem)	
			During Week 1 to Week	
LA1	Lab activities,	Lab Course	6	30
LAI	attendance, journal	Faculty	Marks Submission at the	50
	-		end of Week 6	
			During Week 7 to Week	
LA2	Lab activities,	Lab Course	12	20
LAZ	attendance, journal	Faculty	Marks Submission at the	30
			end of Week 12	
			During Week 15 to Week	
	Lab activities,	Lab Course Faculty	18	40
Lab ESE	attendance, journal		Marks Submission at the	40
			end of Week 18	
Week 1 indicates	starting week of a semes	ter. The typical sche	dule of lab assessments is sho	own,
			as per academic calendar. Lab	
			nts, mini-project, presentation	
			e nature and requirement of th	
	rimental lab shall have ty			

Assessment Plan based on Bloom	Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)								
Bloom's Taxonomy Level	LA1	LA2	Lab ESE	Total					
Remember									
Understand	10	10	10	30					
Apply									
Analyze									
Evaluate	10	10	15	35					
Create	10	10	15	35					
Total Marks	30	30	40	100					

				Aided Autonomous	Institute)						
				AY 2021-22 <mark>rse Informatio</mark> i	n						
Progra	mme		I	trol System En							
Class,		ster		M. Tech., Sem I							
Course			5CS611								
Course		-		Elective 5: Mode	ern Power Electronics						
		uisites:	Power Electro								
			<u> </u>								
Tea	aching	g Scheme		Examination	on Scheme (Marks)						
Lectur		2 Hrs/week	T1	T2	ESE To	tal					
Tutori	al	-	20	20	60 10)0					
Practio	al	-		I							
Intera	ction	-		(Credits: 2						
				ırse Objectives							
1		aimed to impar e power filters	-	sis for different	types of advanced converters	and shun					
2	Mak	e the students	acquainted wi		tegies of different types of	advanced					
			nt active power								
3	10 n				power electronics. s Taxonomy Level						
At the	end of		e students will b	/							
CO1		,		/	ower Electronic converters.	Apply					
CO2				converters and		Analyze					
CO3	Eval	uate various p	ower electronic	systems using [power electronic converters.	Evaluat e					
Modu	le		Me	odule Contents		Hours					
¹ phase and thre PWM rectifiers		Advantages & hase and three	disadvantages of three phase thyristor converter, Single phase VSI PWM converters working, types, Control of analysis and application. Three phase CSI PWM converter,								
Multilevel inverterIIMultilevel Volinverter, flyingapplications of			o level Voltage source inverter, various PWM methods, tage source inverter, Types: Diode clamp multilevel capacitor multilevel inverter, cascaded multilevel inverter, multilevel inverters, comparison of multilevel inverter.								
III				Control method: Multiple carrier PWM for MLI Resonant pulse inverters							

 Series resonant inverter with unidirectional and bi-directional switches,

 Couse Contents for M.Tech Programme, Department of Electrical Engineering, AY 2021-22

C02 C03				1 2		1			
CO1 CO2			1	1					
0.01	PO1	PO2	PO3	PO4	PO5	PO)6		
		1		mme Outcome	1	1			
) Mapping					
1	NPTEL lea	ctures on Ad	dvanced Power						
-		pupo.		ul Links					
4		saction paper		ers", A john W	iley and sons Ltd	., first edit	100201		
3	Remus Te	odorescu, N	Marco Liserre		Rodrigues, "Gri		-		
2		l, V. Ramay Iarosa public		. кanganathan	, "Simulation of	Power El	ectronic		
1					es", PHIPL, New				
				erences					
1	M. H. Rash Third editio		Electronics: circ	cuits devices an	ed applications",	Pearson E	ducation		
		:1 ((D) -		t Books	1 1		1		
			ctive power con						
			based on ins			armonic			
VI	power f	Power Quality Issues due to power Electronics, Introduction to active power filter, types of active power filters overall control of shunt active power filter, control of shunt active filter based on SRF theory. Control of							
	Power	Ouality Issu	ies due to pow	ver Electronics	. Introduction t	o active			
		power filter							
V	circuit t		nd control of Z		trix converters, , Application of 2		4		
	Matrix	Converters	and Z source	inverters					
IV	H5 inve bypass, clamped inverter	Photovoltaic Inverters structures derived from H bridge topology such as H5 inverter, Heric inverter, REFU inverter, full bridge inverter with DC bypass, inverter structures derived from NPC topology such as neutral point clamped half bridge inverter, conergy NPC inverter, three phase PV inverter.							
						•			
	current and zero voltage switching resonant converters, two-quadrant ZVS resonant converters, resonant DC link inverters and control technique. Photovoltaic Inverters								

Assessment (for Theory Course)

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Ass	Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course							
Bloom's Taxonomy Level		T1	T2	ESE	Total			
1	Remember							
2	Understand							
3	Apply		10	20	30			
4	Analyze	10		20	30			
5	Evaluate	10	10	20	40			
6	Create							
	Total 20 20 60 100							

	Walchand College of Engineering, Sangli							
	(Government Aided Autonomous Institute)							
				AY 2021-22	,			
	Course Information							
Program	Programme M.Tech. (Control System Engineering)							
Class, S	Class, Semester Second Year M. Tech., Sem I							
Course	Course Code 5CS612							
Course	Name	9	Professional E	lective 5: Robus	t Control			
Desired	Requ	isites:	Engineering M	Iathematics				
		Scheme			on Scheme (Mai	rks)		
Lecture	9	2 Hrs/week	T1	T2	ESE		Total	
Tutoria	-	-	20	20	60		100	
Practica		-						
Interac	tion	-		0	Credits: 2			
		•		irse Objectives				
1	1			cepts of robust c				
$\frac{2}{3}$			ew of h-infinity	sign of robust co	ntrol.			
5	n gi				Taxonomy Lev	vel		
At the e	nd of		students will be	<i>'</i>				
CO1	Exp	lain basic con	cepts of robust of	control.			Understandi ng	
CO2		•	<u> </u>	tability analysis			Applying	
CO3	Ana	lyze the H \propto	-Control.				Analyzing	
Modul				ule Contents			Hours	
Ι	I S	systems, Cont	Basic Concepts roller design,		ignals, Stability Closed loop T ormations.		5	
II Internal stabilit Space Descrip					5			
III	norms Limitations on Performance III Limitations on performance SISO and MIMO systems, sensitivity, time lags, uncertainties, phase lag, performance requirements imposed by disturbances and commands.				5			
IV	In C	ntroduction Configuration,	nd Robustness to robustness, Types of Unce nance and Stabil	rtainties of Syste	and represen em Components		4	

	Robust S	Stability and	Performance			
V	Stability	and Robust		Fest, structured	nty, Introduction to and unstructured	4
		er Design	<u> </u>			
VI	LQG control, H2 and H∞-Control, H∞ loop shaping,, H∞ loop shaping design, introduction to model reduction techniques , balanced realizations, hankel norm approximation, reduction of unstable models.					
1	Vamin 7hou	"Essentials	Text I		Hall Publications, 1	007
2		u, John Do			<i>Control</i> ", Feher	
			D.f			
	P H Petkov	MM Konst	Refer		tems", Springer Pul	blications
1 1	2005.	, 101.101. 1001130	antinov, <i>Roo</i> l	usi Control 5ys	iems, springer i u	oneations,
2	Sigurd Skog Publications		stlethwaite, "M	lultivariable Fe	edback Control", V	Viley
I			Useful	Links		
1				-		
	-			Mapping		
			0	nme Outcome		
		PO2	PO3	PO4	PO5	PO6
	PO1					100
CO1	POI		1			100
CO2			1	1		100
CO2 CO3				2		1
CO2 CO3 The str	rength of maj			2 3; Where, 1:Lo	ow, 2:Medium, 3:Hi	1
CO2 CO3 The str	rength of maj	irse must map	written as 1,2, to at least one	2 3; Where, 1:Lo		1
CO2 CO3 The str Each C The as (Test-2 T1 sha	rength of map CO of the cou ssessment is 2) of 20 mar all be typica	rse must map As based on 2 ks each. Als ally on modu	written as 1,2, to at least one sessment (fo in-semester es there shall b ules 1 and 2,	2 3; Where, 1:Lo PO. r Theory Con xaminations in be 1 End-Sem T2 based typ		1 igh Test-1) and T E) of 60 marks 3, 4 and ES

Ass	Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course						
Blo	om's Taxonomy Level	T1	T2	ESE	Total		
1	Remember						
2	Understand	10		20	30		
3	Apply	10	10	20	40		
4	Analyze		10	20	30		
5	Evaluate						
6	Create						
Tot	al	20	20	60	100		

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)					
	AY 2021-22				
	Course Information				
Programme	M. Tech. (Control System Engineering)				
Class, Semester	Second Year M. Tech., Sem I				
Course Code	5CS651				
Course Name	Course Name Activity based elective lab 2: Modern Power Electronics				
Desired Requisites:	Power Electronics				

Teaching Scheme		Examination Scheme (Marks)					
Lecture	-	LA1	LA2	ESE	Total		
Tutorial	-	30	30	40	100		
Practical	2 Hrs/week						
Interaction	-		Credits: 1				

	Course Objectives						
1	1 It is aimed to impart skills of analysis for different types of advanced converters and shunt active power filters.						
2	2 Make the students acquainted with control strategies of different types of advanced converters and shunt active power filters.						
3	3 To make aware of research avenues in the field of power electronics.						
	Course Outcomes (CO) with Bloom's Taxonomy Level						
At the	end of the course, the students will be able to,						
CO1	Interpret configuration and working of various Power Electronic converters.	Apply					
CO2	Analyze various Power Electronic converters and systems.	Analyze					
CO3	CO3 Evaluate various power electronic systems using power electronic converters. Evaluate						
	List of Experiments / Lab Activities						

Lab activities/performance shall include mini project, presentations, drawings, case study, report writing, site visit, lab experiment, tutorials, assignments, group discussion, programming, and other suitable activities as per nature and requirement of lab course.

	Text Books				
1	M. H. Rashid, "Power Electronics: circuits devices and applications", Pearson Education, Third				
1	edition.				
	References				
1	B. K. Bose, "Modern Power Electronics and AC drives", PHIPL, New Delhi.				
2	M. B. Patil, V. Ramayanan and V. T. Ranganathan, "Simulation of Power Electronics circuits",				
	Narosa publication.				
3	Remus Teodorescu, Marco Liserre and Pedro Rodrigues, "Grid- Converters for Photovoltaic and				
3	Wind Power Converters", A john wiley and sons Ltd., first edition 2011.				
4	IEEE Transaction papers.				
	Useful Links				
1	NPTEL lectures on Advanced Power Electronics				

			CO-PC	Mapping			
			Program	nme Outcome	s (PO)		
	PO1	PO2	PO3	PO4	PO5	PO6	
CO1			1				
CO2				1			
CO3				2		1	
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High							
Each CO	of the cour	se must map	to at least one	PO.			

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

IMP: Lab ESE is a separate head of	f passing. LA1, LA2 together is treated as In-Semester Evaluation.

Assessmen	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Mark
t				s
LA1	Lab activities,	Lab Course	During Week 1 to Week 6	30
LAI	attendance	Faculty	Marks Submission at the end of Week 6	50
LA2	Lab activities,	Lab Course	During Week 7 to Week 12	30
	attendance	Faculty	Marks Submission at the end of Week 12	50
Lab ESE	Lab activities,	Lab Course	During Week 15 to Week 18	40
Lau ESE	attendance	Faculty	Marks Submission at the end of Week 18	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)						
Bloom's Taxonomy Level	LA1	LA2	Lab ESE	Total		
Remember						
Understand						
Apply	10	10	10	30		
Analyze	10	10	20	40		
Evaluate	10	10	10	30		
Create						
Total Marks	30	30	40	100		

(Government Aided Autonomous Institute) AY 2021-22 Course Information Programme M. Tech. (Control System Engineering) Class, Semester Second Year M. Tech., Sem I Course Code SCS652 Course Name Activity based elective lab 2: Robust Control Desired Requisites: Engineering Mathematics Teaching Scheme Examination Scheme (Marks) Lecture - LA1 LA2 Total Tutorial - LA1 LA2 Examination Scheme (Marks) Lecture - LA1 LA2 Examination Scheme (Marks) Lecture - LA1 LA2 Total Tutorial - Course Objectives Interaction Course Objectives 1 This course provides the ba	Walchand College of Engineering, Sangli							
Course Information Programme M. Tech. (Control System Engineering) Class, Semester Second Year M. Tech., Sem I Course Code SCS652 Course Name Activity based elective lab 2: Robust Control Desired Requisites: Engineering Mathematics Teaching Scheme Examination Scheme (Marks) Lecture - LA1 LA2 ESE Total Tutorial - 30 30 40 100 Practical 2 Hrs/week Hrs/week Hrs/week Hrs/week 1 This course provides the basic concepts of robust control. 1 100 Practical 2 Hrs/week 1 This course provides the basic concepts of robust control. 1	(Government Aided Autonomous Institute)							
Programme M.Tech. (Control System Engineering) Class, Semester Second Year M. Tech., Sem I Course Code 5CS652 Course Name Activity based elective lab 2: Robust Control Desired Requisites: Engineering Mathematics Teaching Scheme Examination Scheme (Marks) Lecture - LA1 LA2 ESE Total Tutorial - 30 30 40 100 Practical 2 Hrs/week Hrs/week Interaction - Course Objectives 1 This course provides the basic concepts of robust control. 2 It provides the methodology of design of robust control. Image: Course Outcomes (CO) with Bloom's Taxonomy Level At the end of the course, the students will be able to. Image: Course Outcomes (CO) with Bloom's Taxonomy Level At the end of the course, the students will be able to. Image: Course Outcomes (CO) with Bloom's Taxonomy Level At the end of the course, the students will be able to. Image: Course Outcomes (CO) with Bloom's Taxonomy Level At the end of the course, the students will be able to. Applying CO3 Analyze the H∞-Control. Analyzing CO4 Explain basic concept	AY 2021-22							
Class, Semester Second Year M. Tech., Sem 1 Course Code 5CS652 Course Name Activity based elective lab 2: Robust Control Desired Requisites: Engineering Mathematics Teaching Scheme Examination Scheme (Marks) Lecture - LA1 LA2 ESE Total Tutorial - 30 30 40 100 Practical Practical 2 Hrs/week Imteraction Course Objectives 1 This course provides the basic concepts of robust control. 2 It provides the methodology of design of robust control. 2 It gives the overview of h-infinity design Understand ng Ourse Outcomes (CO) with Bloon's Taxonomy Level At the end of the course, the students will be able to, Explain basic concepts of robust control. Image Applying CO3 Apply robust control design and stability analysis Applying Applying CO3 Analyze the H°a - Control. Analyzing Ext of Experiments / Lab Activities Lab activities/performance shall include mini project, presentations, drawings, case study, report writing, site visit, lab experiment, tutorials, assignments, group discussion, programming, and other suitable activities as per nature an	Course Information							
Course Code 5CS652 Course Name Activity based elective lab 2: Robust Control Desired Requisites: Engineering Mathematics Teaching Scheme Examination Scheme (Marks) Lecture - LA1 LA2 ESE Total Tutorial - 30 30 40 100 Practical 2 Hrs/week Total Image: Course Objectives 1 This course provides the basic concepts of robust control. Course Objectives Image: Course Outcomes (CO) with Bloom's Taxonomy Level At the end of the course, the students will be able to, Understanding Malyzing CO1 Explain basic concepts of robust control. Understanding CO1 Explain basic concepts of robust control. Understanding CO3 Analyze the H∞-Control. Understanding CO3 Analyze the H∞-Control. Analyzing List of Experiments / Lab Activities Analyzing Lab activities/performance shall include mini project, presentations, drawings, case study, report writing, site visit, lab experiment, tutorials, assignments, group discussion, programming, and other suitable activities as per nature and requir	ProgrammeM.Tech. (Control System Engineering)							
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Teaching Scheme Examination Scheme (Marks) Lecture - LA1 LA2 ESE Total Tutorial - 30 30 40 100 Practical 2	Course Na	ame		Activity based	l elective lab 2: F	Robust Control		
Lecture - LA1 LA2 ESE Total Tutorial - 30 30 40 100 Practical 2 Hrs/week 100 100 Interaction - Credits: 1 100 Course Objectives 1 This course provides the basic concepts of robust control. 2 It provides the methodology of design of robust control. 1 3 It gives the overview of h-infinity design Understanding Course Outcomes (CO) with Bloom's Taxonomy Level At the end of the course, the students will be able to, CO1 Explain basic concepts of robust control. Understanding CO2 Apply robust control design and stability analysis Applying CO3 Analyze the H∞-Control. Analyzing List of Experiments / Lab Activities Lab activities/performance shall include mini project, presentations, drawings, case study, report writing, site visit, lab experiment, tutorials, assignments, group discussion, programming, and other suitable activities as per nature and requirement of lab course. 1 Kemin Zhou, "Essentials of Robust Control", Prentice Hall Publications, 1997. 2 Kemin Zhou, John Doyle, "Robust and Optimal Control",	Desired Requisites: Engineering Mathematics							
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CO1 Explain basic concepts of robust control. Understanding CO2 Apply robust control design and stability analysis Applying CO3 Analyze the H∞-Control. Analyzing List of Experiments / Lab Activities List of Experiments / Lab Activities Lab activities/performance shall include mini project, presentations, drawings, case study, report writing, site visit, lab experiment, tutorials, assignments, group discussion, programming, and other suitable activities as per nature and requirement of lab course. Text Books 1 Kemin Zhou, "Essentials of Robust Control", Prentice Hall Publications, 1997. 2 Kemin Zhou, John Doyle, "Robust and Optimal Control", Feher-Prentice H Publications, 1995. References 1 P. H. Petkov, M.M. Konstantinov, "Robust Control Systems", Springer Publications, 2005. 2 Sigurd Skogestad, Ian Postlethwaite, "Multivariable Feedback Control", Wiley				``````````````````````````````````		Faxonomy Level		
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CO2 Apply robust control design and stability analysis Applying CO3 Analyze the H∞−Control. Analyzing List of Experiments / Lab Activities List of Experiments / Lab Activities Lab activities/performance shall include mini project, presentations, drawings, case study, report writing, site visit, lab experiment, tutorials, assignments, group discussion, programming, and other suitable activities as per nature and requirement of lab course. Text Books 1 Kemin Zhou, "Essentials of Robust Control", Prentice Hall Publications, 1997. 2 Kemin Zhou, John Doyle, "Robust and Optimal Control", Feher-Prentice H Publications, 1995. References 1 P. H. Petkov, M.M. Konstantinov, "Robust Control Systems", Springer Publications, 2005. 2 Sigurd Skogestad, Ian Postlethwaite, "Multivariable Feedback Control", Wiley	CO1	Exp	lain basic con	cepts of robust of	control.			
CO3 Analyze the H∞−Control. Analyzing Intro- Control Analyze the H∞−Control. Analyze the H∞−Control. Analyze the H∞−Control. List of Experiments / Lab Activities List of Experiments / Lab Activities Lab activities/performance shall include mini project, presentations, drawings, case study, report writing, site visit, lab experiment, tutorials, assignments, group discussion, programming, and other suitable activities as per nature and requirement of lab course. Text Books 1 Kemin Zhou, "Essentials of Robust Control", Prentice Hall Publications, 1997. 2 Kemin Zhou, John Doyle, "Robust and Optimal Control", Feher-Prentice H Publications, 1995. References 1 P. H. Petkov, M.M. Konstantinov, "Robust Control Systems", Springer Publications, 2005. 1 Sigurd Skogestad, Ian Postlethwaite, "Multivariable Feedback Control", Wiley	CO2	App	lv robust cont	rol design and s	tability analysis			
List of Experiments / Lab Activities Lab activities/performance shall include mini project, presentations, drawings, case study, report writing, site visit, lab experiment, tutorials, assignments, group discussion, programming, and other suitable activities as per nature and requirement of lab course. Text Books 1 Kemin Zhou, "Essentials of Robust Control", Prentice Hall Publications, 1997. 2 Kemin Zhou, John Doyle, "Robust and Optimal Control", Feher-Prentice H Publications, 1995. References 1 P. H. Petkov, M.M. Konstantinov, "Robust Control Systems", Springer Publications, 2005. 2 Sigurd Skogestad, Ian Postlethwaite, "Multivariable Feedback Control", Wiley								
Lab activities/performance shall include mini project, presentations, drawings, case study, report writing, site visit, lab experiment, tutorials, assignments, group discussion, programming, and other suitable activities as per nature and requirement of lab course. Text Books 1 Kemin Zhou, "Essentials of Robust Control", Prentice Hall Publications, 1997. 2 Kemin Zhou, John Doyle, "Robust and Optimal Control", Feher-Prentice H Publications, 1995. References 1 P. H. Petkov, M.M. Konstantinov, "Robust Control Systems", Springer Publications, 2005. 2 Sigurd Skogestad, Ian Postlethwaite, "Multivariable Feedback Control", Wiley			<u> </u>					
writing, site visit, lab experiment, tutorials, assignments, group discussion, programming, and other suitable activities as per nature and requirement of lab course. Text Books 1 Kemin Zhou, "Essentials of Robust Control", Prentice Hall Publications, 1997. 2 Kemin Zhou, John Doyle, "Robust and Optimal Control", Feher-Prentice H Publications, 1995. References 1 P. H. Petkov, M.M. Konstantinov, "Robust Control Systems", Springer Publications, 2005. 2 Sigurd Skogestad, Ian Postlethwaite, "Multivariable Feedback Control", Wiley				List of Experi	iments / Lab Ac	tivities		
1 Kemin Zhou, "Essentials of Robust Control", Prentice Hall Publications, 1997. 2 Kemin Zhou, John Doyle, "Robust and Optimal Control", Feher-Prentice H Publications, 1995. References 1 P. H. Petkov, M.M. Konstantinov, "Robust Control Systems", Springer Publications, 2005. 2 Sigurd Skogestad, Ian Postlethwaite, "Multivariable Feedback Control", Wiley	writing, si	te visit,	lab experime	nt, tutorials, ass	ignments, group			
2 Publications, 1995. References 1 P. H. Petkov, M.M. Konstantinov, "Robust Control Systems", Springer Publications, 2005. 2 Sigurd Skogestad, Ian Postlethwaite, "Multivariable Feedback Control", Wiley	1			entials of Robus	st Control", Pren			
1 P. H. Petkov, M.M. Konstantinov, "Robust Control Systems", Springer Publications, 2005. 2 Sigurd Skogestad, Ian Postlethwaite, "Multivariable Feedback Control", Wiley	2			•	kobust and Op	otimal Control'',	Feher-Prentice Hall	
1 P. H. Petkov, M.M. Konstantinov, "Robust Control Systems", Springer Publications, 2005. 2 Sigurd Skogestad, Ian Postlethwaite, "Multivariable Feedback Control", Wiley				R	References			
	1					l Systems", Spring	er Publications,	
² Publications, 2005.	2				ite, "Multivariab	le Feedback Contr	ol", Wiley	

			CO-PO	Mapping		
			Program	me Outcomes	s (PO)	
	PO1	PO2	PO3	PO4	PO5	POe
CO1			1			
CO2				1		
CO3				2		1
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High						

Assessment

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

IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Eval	uation.
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Assessmen	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Mark
t				s
LA1	Lab activities,	Lab Course	During Week 1 to Week 6	30
LAI	attendance	Faculty	Marks Submission at the end of Week 6	50
LA2	Lab activities,	Lab Course	During Week 7 to Week 12	30
LAZ	attendance	Faculty	Marks Submission at the end of Week 12	50
Lab ESE	Lab activities,	Lab Course	During Week 15 to Week 18	40
Lau ESE	attendance	Faculty	Marks Submission at the end of Week 18	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)						
Bloom's Taxonomy Level	LA1	LA2	Lab ESE	Total		
Remember						
Understand	10	10	10	30		
Apply	10	10	20	40		
Analyze	10	10	10	30		
Evaluate						
Create						
Total Marks	30	30	40	100		

		Walc	hand College	of Engineerin	g, Sangli		
(Government Aided Autonomous Institute)							
AY 2021-22							
			Course	Information			
Progr	ramme		M. Tech. (Cont	rol System Engin	eering)		
Class	, Semest	er	Second Year M	I. Tech., Sem II			
Cours	se Code		5CS691				
Cours	se Name		Dissertation Ph	ase 2			
Desir	ed Requi	isites:	Dissertation Ph	ase 1			
			1				
	0	Scheme			Scheme (Marks)		
Lectu		-	LA1	LA2	ESE	Total	
Tutor	rial	-	30	30	40	100	
Pract	ical	24					
		Hrs/week					
Intera	action	-		Cred	its: 12		
				Objectives			
The M. Tech. Dissertation is aimed at training the students to analyze independently any problem in the field of Electrical Control Systems Engineering and applications of control theory. The Dissertation may be analytical, computational, experimental or a combination of three. The Dissertation report is expected to show clarity of thoughts and expression, critical appreciation of the existing literature and analytical, experimental, computational aptitude. The student progress of the dissertation work shall be evaluated in stage I and II in semester					ations of contro a combination of pression, critica onal aptitude.		
	and II re	espectively.	utcomos (CO) y	with Bloom's Tax	vonomy Loval		
Course Outcomes (CO) with Bloom's Taxonomy LevelCODefend the objectives of the dissertation by grasping and analysing through an extensive literature review in the area of study.					gh Understan d Analyse Evaluate		
CO 2	CO Formulate the methodology and Execute the study through conduct of Apply					of Apply Create	
CO 3	Analys					Apply Analyse Evaluate	
CO 4				n through self-lea ds of documentati	rning and justify t	he Evaluate	

Lab Activities / Course Contents

The third semester is completely devoted to dissertation work which is defined based on the interest of the students to specialize in a particular area. Student is expected to carry out independent research work on the chosen topic. In this semester it is expected that the student has carried out substantial research work including exhaustive literature survey, formulation of the research problem, development/fabrication of experimental set-up (if any/required) and testing, and

analysis of initial results thus obtained. In fourth semester, the student continues his/her dissertation work. It is expected that the student has completed most of the experimental/computation works and analyzed the results so obtained as proposed in the synopsis. The work should be completed in all respects in this semester. The student is required to submit the dissertation work in the form of report as per the institute rule.

	Text Books				
1					
	References				
1	Proceedings of Reputed National and International journals in Control Systems (Electrical Engineering)[a. IEEE Transactions on – Automatic control systems, Power Electronics, Circuits and systems, Control systems technology, Automatic Control etc. b. IEEE magazines/ newsletters/ proceedings on- Control systems, Industrial electronics magazine, etc. c. IET Proceedings/ journals/ magazines on – Control Theory and Control Systems etc. d. Elsevier journals and magazines on- Electrical and Electronics Engineering, Circuits and systems, Advance process control, Dynamics and control etc. e. Journal of Institution of Engineers India- Electrical Engineering f. The Journal of the Institute of Electrical Engineers of Japan, g. Circuits, Systems & Signal Processing – Springer, h. Energy Efficiency – Springer i. Mathematics of Control, Signals, and Systems – Springer j. Soft Computing– Springer k. An International Journal for Simulation-Based Engineering – Springer 1. Journal of Control Theory and Applications –Springer m. Journal of Dynamical and Control Systems – Springer Proceedings of Reputed International Conferences organized by IFAC, IEEE in association with IITs and NITs, Elsevier and Springer conferences and IET conferences.				
	Useful Links				
1					

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

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

Assessment

Assessment	Marks
LA1	30
LA2	30
Lab ESE	40

LA1,LA2 for dissertation phase II is based on the progress made during the semester for the objectives defined in the synopsis and the report submitted by the students. It shall be evaluated through progress seminar(s) at the end of the semester. The parameters for evaluation include extent of work done, results and discussion/publication efforts, quality of presentation, quality of report, interaction during presentation and interaction with guide.

LA1,LA2 shall be conducted by Departmental Post-Graduate Committee (DPGC).

ESE for dissertation phase II shall be conducted at the end of semester by a duly constituted examination panel composed of Chairman, internal examiner (guide) and external examiner.

Assessment Plan based on Bloom's Taxonomy Level					
Bloom's Taxonomy Level	LA1	LA2	ESE	Total	
Remember					
Understand	10			10	
Apply	10	10		20	
Analyze	10	10	20	40	
Evaluate		10	10	20	
Create			10	10	
Total	30	30	40	100	

Walchand College of Engineering, Sangli							
	(Government Aided Autonomous Institute)						
	AY 2021-22						
Programme		МТ	Course Informa ech. (Control Syst				
Class, Semester	•		nd Year M. Tech.,				
Class, Semester		5CS6					
Course Name			no-Socio Activity				
Desired Requis	ites•		no boelo rienvity				
Teaching Sch	neme		Examin	ation Scheme (M	arks)		
(Hrs)							
Lecture	-	LA1	LA2	ESE	Total		
Tutorial	-	30	30	40	100		
Practical	-						
Interaction	1			Credits: 1			
			Course Object	ives			
1		ord student pe ars will be co		urricular and extr	a-curricular activities over		
2	To enco skills, t	ourage the stu	dents to participa		t help develop leadership nent, Communications		
3	-	-	ance of social resp	onsibility.			
	-		es (CO) with Blo		[eve]		
At the end of the			, ,	j -			
CO1	Notice		nent in his/her und	erstanding and	Apply		
CO2	Unders		lue the importance	of working in a	Analyze		
CO3		estrate the so al report writ	ft skills like prese ing etc.	ntation skills,	Evaluate		
Course Contents							
The guide will be mentoring a given student batch for the duration of two years. The students shall submit proof of their achievements in various extra and co-curricular activities related to technical, cultural and social causes from first year to second year. The faculty will evaluate the students' performance at the end of 4 th semester, based on the rubrics provided by the department from time to time.							
1	Not app	plicable	Text Books				
	1		References				
1	Not ap	plicable					

Useful Links						
1	1 Not applicable					

		CO-PO Mapping Programme Outcomes (PO)						
	1	2	3	4	5	6		
CO1	2				3			
CO2		1			2			
CO3			2		3			
The strength of ma	pping is to be w	ritten as 1,2	2,3; Where, 1:I	Low, 2:Mediu	m, 3:High			
Each CO of the cou	urse must map to	o at least on	e PO.					

Assessment There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation. Based on Assessment Conducted by **Typical Schedule (for** Marks 26-week Sem) During Week 1 to Lab activities, Lab Course Week 6 LA1 30 Marks Submission at attendance, journal Faculty the end of Week 6 During Week 7 to Lab Course Week 12 Lab activities. LA2 30 attendance, journal Faculty Marks Submission at the end of Week 12 During Week 15 to Lab activities, Lab Course Week 18 Lab ESE 40 attendance, journal Faculty Marks Submission at the end of Week 18 Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)						
Bloom's Taxonomy Level LA1 LA2 Lab ESE Total						
Remember						
Understand						

Apply	10	10	10	30
Analyze	10	10	15	35
Evaluate	10	10	15	35
Create				
Total Marks	30	30	40	100

		Wa	lchand College	of Engineering,	Sangli		
			(Government Aided	Autonomous Institute	•)		
				2021-22	,		
			Course I	nformation			
Progra	ımme	9	M.Tech. (Control S	System Engineerin	g)		
Class,	Seme	ster	Second Year M. To	ech., Sem II			
Course Code5CS621							
Course NameProfessional Elective 6: Robotics and AI							
Desire	d Rec	luisites:	Electrical Machine	s, Instrumentation	, Control System	Engine	ering
То	ochin	g Scheme		Examination Sch	omo (Marks)		
Lectur		3 Hrs/week	 T1	T2	ESE	То	tal
Tutori			20	20	60	10	
Practi		_	20	20	00	10	
Intera		-		Credits	• 3		
mer d		-			• J		
			Course	Objectives			
1	This	course provid	es the basics of robo	•			
2		-	hodology of modelli		robot.		
3	-		design of various ty				
	<u> </u>	-	Outcomes (CO) w	-			
At the	end o	f the course, th	e students will be ab	le to,			
CO1	Ana	lyze various m	odels of robots and	their dynamics.		An	alysin
cor						g	
CO2		• •	associated with ope	en loop and closed	l loop robot cont	rol An	alysin
	syst					g	
CO3	Des	i gn various cor	ventional and advar	nced controllers for	r robotics.	Cre	eating
74.1				<u> </u>			.
Modu			Niodule	Contents		L.	Iours
Ι]	orientation or Representation	brief history, types, f a rigid body of joints, link rej -H parameters and li	y, Homogeneous presentation using	transformatio	ns,	6
Examples of D-H parameters and link transforms.Elements of robots joints, links, actuators, and sensorsDifferent kinds of actuators – stepper, DC servo and brushless motors, model of a DC servo motor. Types of transmissions, Purpose of sensors, internal and external sensors, common sensors – encoders, tachometers, strain gauge based force-torque sensors, proximity and distance measuring sensors, and vision						6	
III]	Kinematics of		kinematics probl	ems, Examples	of	6

	kinematics of common serial manipulators, workspace of a serial robot,	
	Inverse kinematics of constrained and redundant robots. Degrees-of- freedom of parallel mechanisms and manipulators, Active and passive	
	joints, Constraint and loop-closure equations, Direct kinematics problem,	
	Mobility of parallel manipulators, Closed-from and numerical solution,	
	Inverse kinematics of parallel manipulators and mechanisms.	
	Velocity and statics of robot manipulators	
IV	Linear and angular velocity of links, Velocity propagation, Manipulator Jacobians for serial and parallel manipulators, Velocity ellipse and ellipsoids, Singularity analysis for serial and parallel manipulators, Mass and inertia of links, Lagrangian formulation for equations of motion for serial and parallel manipulators.	6
	Motion planning and control	
V	Joint and Cartesian space trajectory planning and generation, Classical control concepts using the example of control of a single link, Independent joint PID control, Control of a multi-link manipulator, Non-linear model based control schemes, Simulation and experimental case studies on serial and parallel manipulators, Control of constrained manipulators, Cartesian control, Force control and hybrid position/force control, Advanced topics in non-linear control of manipulators.	6
	AI in Robotics	
VI	Models of flexible links and joints, Kinematic modeling of multi-link flexible robots, Dynamics and control of flexible link manipulators. Advanced control using AI techniques, Fuzzy control, Neural control, Adaptive control and implementation issues.	6
	Text Books	
1	Ashitava Ghosal,' <i>Robotics: Fundamental Concepts and Analysis</i> ', 2nd Editi University Press, 2008.	on, Oxford
2	Mittal R. and Nagrath I., 'Robotics and Control', McGraw-Hill publications, 2	2017.
	References	
1	Craig,,' Introduction to Robotics: Mechanics and Control', 3rd Edition, Oxford Press, 2008	l University
	Useful Links	
1	-	
L	1	

			O Mapping			
		Programm	e Outcomes	(PO)		
	1	2	3	4	5	6
CO1				2		
CO2				2		
CO3			2			1
The strength of ma	pping is to be	e written as 1	,2,3; Where,	1:Low, 2:M	ledium, 3:Hig	jh
The strength of ma	pping is to be	e written as 1	,2,3; Where,	1:Low, 2:M	ledium, 3:Hig	h
Each CO of the co	urse must ma	p to at least o	one PO.			

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3,4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level							
Bloom's Taxonomy Level	T1	T2	ESE	Total			
Remember							
Understand							
Apply							
Analyze	20	10	30	60			
Evaluate							
Create		10	30	40			
Total	20	20	60	100			

	Wa	alchand College of	f Engineering	, Sangli				
	(Government Aided Autonomous Institute)							
		AY 20)21-22					
		Course In	formation					
Program	ProgrammeM.Tech. (Control System Engineering)							
Class, S	emester	Second Year M. T	ech., Sem II					
Course Code5CS622								
Course		Professional Electi		11				
Desired	Requisites:	Microcontroller an	d Applications, I	Digital Signal Proc	essing			
		_						
	ching Scheme		Examination Sch	, ,				
Lecture			T2	ESE	Total			
Tutoria Dra atio		20	20	60	100			
Practic			C l'4	2				
Interac	tion -		Credit	s: 3				
		Course	Dbjectives					
1	The course inten	ds to introduce Embed		Control Application	me			
1								
2	and Simulink	at developing progra	ims using target	Microcontrollers	using Matlab			
		yze the performance of	of Electrical Syst	ems using advance	ed techniques			
3		loop simulation, Proc	•	•	a wonniques			
	Course	e Outcomes (CO) wit	h Bloom's Taxo					
At the e		he students will be ab						
CO1		grams to solve real ti	me control prot	olems in Electrica	l Applying			
	Engineering.	aufournance of real	time control or	ustom for variou	Evolucio			
CO2	applications.	erformance of real	time control sy	ystem for variou	s Evaluate			
	11	ne simulations and/or	hardware-in-loo	o simulations using	g Creating			
CO3		ike Arduino, dSpace,	-					
1	-				1			
Modul	e	Module	Contents		Hours			
	Introduction							
Ι		f System Simulation	1	e	6			
-		ta types, Matrix Comp			:			
		Conditional structures, Loop Structures, Accelerating Matlab functions,						
		ne and profiles	G. Correct 4.4'					
	MATLAB ap	oplications in Scienti	ne Computation	18				
II	Solutions to	Linear Algebra l	Problems: Matr	rix Analysis and	6			
		Matrix Equations, No		•				

1					
	of Calculus Problems, Solutions of Ordinary Differential Equations,				
	Non-linear equation solution and optimization				
	Modeling and Simulation of Engineering systems				
ш	Physical system modeling with Simscape, Description of SimPowerSystems, Modeling and simulation of Electronics circuits, simulation of motors and electric drive systems	6			
	Microcontrollers for Real-time Control Applications				
IV	Selection of Microcontroller for Control Applications, Sampling frequency selection,	6			
	Features, Architecture and Specifications of Arduino Microcontrollers, Piccolo and Delfino Microcontrollers				
	Microcontroller Configuration for Real-time Applications				
V	Arduino, Delfino and Piccolo configuration in Matlab/Simulink				
	Introduction to Hardware-in-loop Simulations				
VI	 External mode simulations, Simulink and real-time workshop, VI Hardware-in-loop simulation techniques, code generation, Introduction to dSpace and its blocks, Hardware-in-loop simulations using Arduino, Processor-in-loop simulations, Applications of Arduino Control, dSpace Control, Case studies 				
	Text Books DingyuXue YangQuan Chen "System Simulation Techniques with M	atlah and			
1	DingyuXue, YangQuan Chen, "System Simulation Techniques with M	atlab and			
	DingyuXue, YangQuan Chen, "System Simulation Techniques with M Simulink", Wiley Publications, Edition I, 2014	atlab and			
1 2	DingyuXue, YangQuan Chen, "System Simulation Techniques with M	atlab and			
	DingyuXue, YangQuan Chen, "System Simulation Techniques with MSimulink", Wiley Publications, Edition I, 2014TI User Manuals TMS320C2x, TMS 28335	atlab and			
2	DingyuXue, YangQuan Chen, "System Simulation Techniques with M Simulink", Wiley Publications, Edition I, 2014TI User Manuals TMS320C2x, TMS 28335References				
2	DingyuXue, YangQuan Chen, "System Simulation Techniques with M Simulink", Wiley Publications, Edition I, 2014 TI User Manuals TMS320C2x, TMS 28335 References Website www.ti.com and www.DSPguide.com. Harold Klee, Randal Allen,"Simulation of Dynamic Systems with MATI Simulink", CRC Press, Third Edition, 2011. KatalinPopovici, Pieter J. Mosterman , "Real-time Simulation Techniques	AB® and			
2 1 2	DingyuXue, YangQuan Chen, "System Simulation Techniques with M Simulink", Wiley Publications, Edition I, 2014 TI User Manuals TMS320C2x, TMS 28335 References Website www.ti.com and www.DSPguide.com. Harold Klee, Randal Allen,"Simulation of Dynamic Systems with MATL Simulink", CRC Press, Third Edition, 2011.	AB® and			
2 1 2	DingyuXue, YangQuan Chen, "System Simulation Techniques with M Simulink", Wiley Publications, Edition I, 2014 TI User Manuals TMS320C2x, TMS 28335 References Website www.ti.com and www.DSPguide.com. Harold Klee, Randal Allen,"Simulation of Dynamic Systems with MATL Simulink", CRC Press, Third Edition, 2011. KatalinPopovici, Pieter J. Mosterman , "Real-time Simulation Techniques Principles, Methodologies, and Applications", CRC Press, 2012.	AB® and			
2 1 2	DingyuXue, YangQuan Chen, "System Simulation Techniques with M Simulink", Wiley Publications, Edition I, 2014 TI User Manuals TMS320C2x, TMS 28335 References Website www.ti.com and www.DSPguide.com. Harold Klee, Randal Allen,"Simulation of Dynamic Systems with MATL Simulink", CRC Press, Third Edition, 2011. KatalinPopovici, Pieter J. Mosterman , "Real-time Simulation Techniques, Methodologies, and Applications", CRC Press, 2012. CO-PO Mapping	AB® and			
2 1 2	DingyuXue, YangQuan Chen, "System Simulation Techniques with M Simulink", Wiley Publications, Edition I, 2014 TI User Manuals TMS320C2x, TMS 28335 References Website www.ti.com and www.DSPguide.com. Harold Klee, Randal Allen,"Simulation of Dynamic Systems with MATI Simulink", CRC Press, Third Edition, 2011. KatalinPopovici, Pieter J. Mosterman , "Real-time Simulation Techniques, Methodologies, and Applications", CRC Press, 2012. CO-PO Mapping Programme Outcomes (PO)	AB® and			
2 1 2 3	DingyuXue, YangQuan Chen, "System Simulation Techniques with M Simulink", Wiley Publications, Edition I, 2014TI User Manuals TMS320C2x, TMS 28335ReferencesWebsite www.ti.com and www.DSPguide.com.Harold Klee, Randal Allen,"Simulation of Dynamic Systems with MATL Simulink", CRC Press, Third Edition, 2011.KatalinPopovici, Pieter J. Mosterman Principles, Methodologies, and Applications", CRC Press, 2012.CO-PO MappingProgramme Outcomes (PO)123456	AB® and			

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 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3,4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level							
Bloom's Taxonomy Level	T1	T2	ESE	Total			
Remember							
Understand							
Apply	10	10	30	50			
Analyze							
Evaluate	10	10	20	40			
Create			10	10			
Total	20	20	60	100			