	Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)							
	AY 2021-22							
			Course	Information				
Progra	amn	ne	M. Tech. (Mecha	nical Design Engir	neering)			
Class,	Sem	ester	First Year M. Te	ch., Sem I				
Cours	e Co	de	5DE501					
Cours	e Na	me	Advanced Solid	Mechanics				
Desire	ed Ro	equisites:	Strength of Mate	rials				
			-					
	Tea	ching Scheme		Examination S	cheme (Marks)			
Lectu	re	3 Hrs/week	T1	T2	ESE	,	Total	
Tutor	ial	-	20	20	60		100	
Practi	ical	-						
Intera	ictio	n -		Crea	lits: 3			
			Course	Objectives				
1	То	prepare the students to	succeed as design	er in industry/tech	nical professions.			
2	To Inc	provide students with lustry.	a sound foundation	n in solid mechanic	s required to solve	the pro	blems in	
3	To	train the students with	good design engir	neering breadth req	uired for safe and e	efficient	design,	
		nsu uction, instantation	, inspection and tes	sting of structural p	arts of the meenan			
		Course	Outcomes (CO) w	vith Bloom's Taxo	nomy Level			
At the	end	of the course, students	will be able to,					
CO1	Ve con	rify basic field equ	ations such as e	equilibrium equati	ons, compatibility	and /	Evaluate	
CO2	Stu	dy basic field equation	ns to torsion, bendin	ng and two-dimensi	ional elasticity prob	olems,	Analyze	
~~~	So	lve problems in unsy	mmetrical bendin	g and shear cent	re. contact stresse	s and	Apply	
<u>CO3</u>	pre	essurized cylinders and	rotating discs.					
	•			<b>C</b> + +			**	
Modu	ile		Modul	e Contents			Hours	
		Analysis of Stress	ts of Stress Equali	ty of cross shears	Cauchy's stress priv	ncinle		
Т		Direction cosines Sti	ess components o	n an arbitrary plan	e Stress transform	nation	7	
-		Principal stresses, Di	fferential equation	ns of equilibrium i	in rectangular and	polar	,	
		coordinates, Octahedr	al stresses, Plane s	tress and Plane stra	in, Airy's stress fu	nction		
		Strain and Stress-Str	rain Relations					
II Concept of st		Concept of strain,	Strain-Displacem	ent relations, Co	ompatibility cond	itions,	6	
Biharmonic equation,			, Strain measurem	ent, Construction of	of Mohr's Circle, S	Stress-	Ŭ	
		strain relationship, Iso	otropy,					
		Work done by forces	and elastic strain	energy Maxwell_R	etti-Ravleigh Reci	nrocal		
Ш		theorem. First and sec	ond theorem of Ca	stigliano, expressio	ns for strain energy	when	6	
		an elastic member is	subjected to axia	l force, Shear forc	e, Bending momen	nt and		
		Torsion. Theorem of	virtual work		-			

W	<b>Torsion</b> Torsion of general prismatic bars of solid section, Torsion of Circular and Elliptical	7			
IV	bars, Membrane analogy, Torsion of thin walled of open cross section and multiple cell closed sections				
	Axisymmetric Problems				
V	Stress in thick walled cylinder under internal and external pressure, stresses in	7			
V V	rotating flat solid disk, flat disk with central hole, rotating shafts and cylinders,	1			
	Thermal stresses in thin disc and long circular cylinder				
	Unsymmetrical Bending and Shear Centre				
	Concept of shear centre in symmetrical and unsymmetrical bending, stress and				
VI	deflections in beams subjected to unsymmetrical bending, shear centre for thin wall	6			
	beam cross section, open section with one axis of symmetry, general open section,				
	and closed section.	L			
1		-			
1	Sadd, Martin H., Elasticity: Theory, applications and Numeric, Academic Press, 2005	·			
2	Boresi, A.P. and K. P. Chong, Elasticity in Engineering Mechanics, Second Edition, & Sons, 2000	John Wiley			
3	Budynas, R. G. Advance strength and Applied Stress Analysis, Second Edition, WCB/McGraw Hill 1999				
	References				
1	Dally, J. W. and W.F. Riley, Experimental Stress Analysis, McGraw Hill Internat	ional, third			
1	Edition, 1991				
2	Theory of Elasticity – Timoshenko and Goodier, McGraw Hill				
3	Advanced Strength of Materials, Vol. 1,2 – Timoshenko, CBS				
4	Advanced Strength of Materials – Den Harteg				
	Useful Links				
1	https://nptel.ac.in/courses/112/101/112101095/				
2	https://nptel.ac.in/courses/112/102/112102284/				
3	https://freevideolectures.com/course/2361/strength-of-materials				
4	https://www.youtube.com/watch?v=4meZNc2wB4s&list=PLKZIPALGW-				
т	7TK51CrfZRyWcY8h2gaxVCy				

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

## 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 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 (Marks) For Theory Course

Bloc	om's Taxonomy Level	T1	T2	ESE	Total
1	Remember				
2	Understand				
3	Apply	6	6	18	30
4	Analyze	7	7	26	40
5	Evaluate	7	7	16	30
6	Create				
	Total	20	20	60	100

	Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)						
			AY2	2021-22			
			Course l	nformation			
Progr	amme		M. Tech. (Mecha	nical Design Engin	eering)		
Class,	Semester		First Year M. Teo	ch., Sem I			
Cours	e Code		5DE502				
Cours	e Name		Advanced Vibrat	ion and Acoustics			
Desire	ed Requisi	tes:					
	Teaching	Scheme		Examination S	cheme (Marks)		
Lectur	re	3 Hrs/week	T1	T2	ESE	L I	[otal
Tutori	ial	-	20	20	60		100
Practi	cal	-					
Intera	ction	-		Cred	its: 3		
			Course	Objectives			
1	To teach	the fundamenta	l concept of dynam	ic analysis of mach	nines.		
2	To train	students to prepa	are mathematical m	odel of discrete and	d continuous mass	system	and to
2	Tind resp	onse of models i	for different types (	of excitations	lite massurament		
5	10 111100	Course	Outcomes (CO) w	ith Bloom's Taxor	a ne measurement.		
At the	end of the	course students	s will be able to				
	Evaluate	response of a	SDOF system. da	mped or undampe	d. subjected to sin	mple	Evaluate
COI	arbitrary	base or force ex	citation.	1 1	ý <b>5</b>	1	
CO2	Apply te	chnique of deco	oupling and orthog	onal properties of	natural modes to s	solve	Apply
	different	ial equations of	motion for MDOF	system.			
	Explain	various terminol	ogies used in acous	tics and acoustic wa	ive transmission, d	erive	Analyze
03	from a di	d spherical wave	equations, and obt	ain sound pressure.	level at a given dist	ance	
	I ITOIII a S	imple sound sou	ice of known streng	gui.			
Modu	ıle		Module	Contents			Hours
	Tran	sient Vibrations	Response of a sin	gle degree of freed	lom system to ster	and	110015
I	any	arbitrary excita	tion, convolution	(Duhamel's) integ	gral, impulse resp	onse	7
	funct	ion.		` ´ ´			
	Mult	i degree of free	edom systems, Fre	e, damped and fo	rced vibrations of	two	
II	degre	ees of freedom s	ystems, Eigen val	ues and Eigen vect	ors, normal modes	s and	7
their properties, m			e summation meth	od, use of Lagrang	ge's equations to d	erive	

	the equations of motion.	
III	Continuous Systems, Natural Vibrations of beams–Differential equation of motion, solution by the method of separation of variables, frequency parameter, natural frequencies and mode shapes, forced vibration of simply supported beam subjected to concentrated harmonic force at a point, Mode summation method, discretized models of continuous systems and their solutions using Rayleigh–Ritz method	7
IV	Vibration Control, Methods of vibration control, principle of superposition, Numerical and computer methods in vibrations: Rayleigh, Rayleigh-Ritz and Dunkerley's methods, matrix iteration method for Eigen-value calculations, Holzer's method	6
V	Plane acoustic waves, Sound speed, characteristic acoustic impedance of elastic media, sound intensity, dB scale, Transmission Phenomena, transmission from one fluid medium to another, normal incidence, reflection at the surface of a solid, standing wave patterns, Symmetric Spherical waves, near and far fields, simple models of sound sources, sound power, determination of sound power and intensity levels at a point due to a simple source	7
VI	Psychoacoustics, Speech, mechanism of hearing, thresholds of the ear – sound intensity and frequency, loudness, equal loudness levels, loudness, pitch and timbre, beats, masking by pure tones, masking by noise.	6
	Text Books	
1	Thomson W.T., "Theory of Vibrations with applications", George Allen and U London, 1981.	Jnwin Ltd.
2	S.S. Rao, Addison, "Mechanical Vibrations", Wesley Publishing Co., 1990.	
3	Leonard Meirovitch, "Fundamentals of vibrations", McGraw Hill International Edition	ion
	References	
1	S. Timoshenko, "Vibration Problems in Engineering", Wiley, 1974.	
2	Lawrence E. Kinsler and Austin R.Frey, "Fundamentals of acoustics", Wiley Eastern	Ltd., 1987.
3	Michael Rettinger, "Acoustic Design and Noise Control", Vol. I & II., Chemical Publ New York, 1977	lishing Co.,
	Useful Links	
1	https://nptel.ac.in/courses/112/104/112104114/	
2	https://nptel.ac.in/courses/112/103/112103112/	
3	https://nptel.ac.in/courses/112/103/112103111/	
4	https://nptel.ac.in/courses/112/104/112104026/	

CO-PO Mapping									
		Programme Outcomes (PO)							
	1	2	3	4	5	6			
CO1			2	1	1	3			
CO2	1			1	2	3			
CO3	1		2			3			
The stren	oth of manning i	s to be written a	s 1 2 3· Where	1. I. ow 2. Mediu	n 3.High	-			

## **Assessment (for Theory Course)**

	Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course							
Blo	om's Taxonomy Level	T1	Т2	ESE	Total			
1	Remember							
2	Understand							
3	Apply	5	5	20	30			
4	Analyze	5	5	20	30			
5	Evaluate	10	10	20	40			
6	Create							
	Total		20	60	100			

	Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)						
			AY	2021-22			
			Course l	Information			
Progra	amme		M. Tech. (Mecha	nical Design Engin	eering)		
Class,	Semester		First Year M. Teo	ch., Sem I			
Cours	e Code		5DE560				
Cours	e Name		Research Method	lology			
Desire	d Requisi	tes:					
	Teaching	Scheme		Examination S	cheme (Marks)		
Lectur	re	-	LA1	LA2	ESE		Total
Tutori	al	-	30	30	40	100	
Practical -							
Intera	ction	2 Hrs/week	Credits: 2				
			Course	Objectives			
1	To prepa	re the students to	o identify and form	ulate the research p	oroblems		
2	To impai	t the Knowledge	e of planning and e	xecution of researc	h project, IPRs, Pat	tents e	tc
3	To devel	op the student to	prepare and write	papers for publicat	ions to Conference	s and J	Journals
		Course	Outcomes (CO) w	ith Bloom's Taxor	nomy Level		
At the	end of the	course, students	s will be able to,				
<u>CO1</u>	Classify	the research pro	blem and research	plan.			Apply
CO2	Analyze	the research pro	blem, literature and	d methodology.			Analyze
03	Interpret	the research pap	ers, reports, case st	tudies, patent inform	nation and database	, etc	Evaluate
N /]	1.		N/ - J]-	Contonto			TT
Modu	le Maar	·	Module	contents			Hours
Meaning of research p			oblem and Errora	in selecting a research	criteria, Characteri	sucs	
T	objec	tives of research	oblem, and Enois	oaches of investion	rent problem, scope	for	5
_ <b>1</b>	resea	rch problem	data collection	analysis inte	rpretation Neces	sarv	5
	instru	imentations.	and concerton	, analysis, me	-p	July	

II	Effective literature studies approaches, analysis. Plagiarism, Research ethics.	4				
	Effective technical writing, how to write report, Paper. Developing a Research					
III	Proposal, Format of research proposal, a presentation and assessment by a review	5				
	committee.					
	Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of					
TV I	Patenting and Development: technological research, innovation, patenting,	4				
1 V	development. International Scenario: International cooperation on Intellectual					
	Property. Procedure for grants of patents, Patenting under PCT					
V	Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent	1				
•	Information and databases. Geographical Indications.					
	New Developments in IPR: Administration of Patent System. New developments					
VI	in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge	4				
	Case Studies, IPR and IITs					
	Text Books					
1	C. R. Kothari, "Research Methodology", New Age international, 2nd edition, 2004.					
2	2 Deepak Chopra and NeenaSondhi, "Research Methodology: Concepts and cases", Vikas					
	Publishing House, New Delhi, 1998					
3	Stuart Melville and Wayne Goddard, "Research Methodology: An Introduction for S	Science &				
	Engineering Students", Tata MacGraw Hill, 2000					
	References	• •				
1	E. Philip and Derek Pugh, "How to get a Ph. D. – a handbook for students and their su	pervisors",				
	open university press, 2001.					
2	Kumar R., "Research Methodology- A step by step guide for beginners", SAGE, 3rd Edition,					
	G. Kamamurthy, "Research Methodology", Dream Tech Press, New Delhi, 2009					
1	Useful Links					
	https://youtu.be/ILINZI4GPIVM					
2	https://youtu.de/LIMMDIBENHNU					
3	nttps://youtu.be/UYBZc10rCGc					
4	https://nptei.ac.in/courses/12//105/12/105008/					

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

Assessment								
There are three	There are three components of lab assessment, LA1, LA2 and Lab ESE.							
IMP: Lab ES	E is a separate head of	passing. LAI, LA	A2 together is treated as In-Semester Evaluation	on.				
Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks				
та 1	Lab activities,	Lab Course	During Week 1 to Week 6	20				
LAI	attendance, journal	Faculty	Marks Submission at the end of Week 6	50				
T A O	Lab activities,	Lab Course	During Week 7 to Week 12	20				
	attendance, journal	Faculty	Marks Submission at the end of Week 12	50				

Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Wook 1 india	ates starting weak of a	competer The tyr	vicel schedule of lob assessments is shown	

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 Theory Course								
Bloom's Taxonomy Level		LA1	LA2	ESE	Total			
1	Remember							
2	Understand							
3	Apply	5	5	20	30			
4	Analyze	5	5	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							
Progra	amme		M. Tech. (Mecha	nical Design Engin	eering)			
Class,	Semester		First Year M. Teo	ch., Sem I				
Cours	e Code		5DE551					
Cours	e Name		Activity Based La	ab for Th course 1				
Desire	ed Requisi	tes:						
	- I							
Tea	aching Sch	eme (Hrs)		Examination S	cheme (Marks)			
Lectur	re	-	LA1	LA2	ESE	Total		
Tutori	al	-	30	30	40	100		
Practi	cal	2						
Intera	ction	-		Cred	its: 1			
			Course	Objectives				
	To provi	de an opportuni	ty to student to do	work independently	y on a topic/ problem			
1	experime	entation selected	l by him/her and er	courage him/her to	think independently	on his/her own		
	to bring of	out the conclusi	on under the given	circumstances and	limitations.			
2	To encou	rage creative th	inking process to h	elp student to get c	confidence by success	fully		
	completi	ng the mini, thr	ough observations,	discussions and de	cision making proces	<u>s.</u>		
	To enabl	e student for tec	chnical report writin	ng and effective pre	esentations.			
At the	and of the	Course	outcomes (CO) w	1111 BIOOM'S 1 8X0	nomy Level			
At the	Solve fie	d problems by	s will be able to,	niquas in mashani	al dagian anginagrin	a Apply		
$CO^{2}$	Design a	nd develop suit	able mechanical sy	stems	cai design engineern	g Appiy Create		
C02	Prenare a	and present a de	tailed technical ren	ort based on mini r	project work	Fyaluate		
0.05		ind present a de	tanea termiear tep		noject work	Evaluate		

Course Content									
Creation of prototype/ apparatus/ small equipment/experimental set up/ innovation of existing product/ analysis or simulation of a process/ experimental verification of principles in thrust areas of stress analysis, vibration, acoustics etc.									
	Text Books								
1	Suitable books based on the contents of the mini project selected.								
	References								
1	Suitable books based on the contents of the mini project selected and research papers from								
1	Reputed national and international journals and conferences.								
	Useful Links								
1	As per the need of the mini project.								

CO-PO Mapping										
	Programme Outcomes (PO)									
	1	2	3	4	5	6				
CO1	3			1						
CO2			3							
CO3					3	1				
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High										
Each CO	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 ES	IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.							
Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks				
ТАТ	Lab activities,	Lab Course	During Week 1 to Week 6	20				
LAI	attendance, journal	Faculty	Marks Submission at the end of Week 6	50				
1.4.2	Lab activities,	Lab Course	During Week 7 to Week 12	20				
LAZ	attendance, journal	Faculty	Marks Submission at the end of Week 12	30				
	Lab activities,	Lab Course	During Week 15 to Week 18	40				
Labese	attendance, journal	Faculty	Marks Submission at the end of Week 18	40				
Week 1 indica	ates starting week of a	semester. The typ	bical schedule of lab assessments is shown,					
considering a	26-week semester. Th	e actual schedule	shall be as per academic calendar. Lab activi	ties/Lab				
performance	shall include performing	ng experiments, n	nini-project, presentations, drawings, program	nming				
and other suit	able activities, as per t	the nature and req	uirement of the lab course. The experimental	lab				
shall have typically 8-10 experiments.								
	Assessment Plan b	ased on Bloom's	Taxonomy Level (Marks) (For lab Course	es)				

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									
Evaluate	10	10	10	30					

Create	10	10	20	40
Total Marks	30	30	40	100

Walchand College of Engineering, Sangli								
AY 2021-22								
Course Information								
Progr	amme		M. Tech. (Mecha	nical Design Engi	neering)			
Class,	Semester		First Year M. Teo	ch., Sem I				
Cours	e Code		5DE552	-				
Cours	e Name		Activity Based La	ab for Th course 2				
Desire	ed Requisi	tes:						
			1					
Теа	aching Sch	neme (Hrs)		Examination S	Scheme (Marks)			
Lectur	re	-	LA1	LA2	ESE	Total		
Tutori	ial	-	30	30	40	100		
Practi	cal	2			ł			
Intera	ction	-		Cre	dits: 1			
		·	Course	Objectives				
	To provi	de an opportuni	ty to student to do	work independent	ly on a topic/ problem			
1	experime	entation selected	l by him/her and er	ncourage him/her t	o think independently	on his/her own		
	to bring	out the conclusi	on under the given	circumstances and	l limitations.			
2	To encou	rage creative th	inking process to h	help student to get	confidence by success	fully		
	completi	ng the mini, thr	ough observations,	discussions and d	ecision making proces	<u>s.</u>		
	l o enabl	e student for tec	Outcomes (CO) w	ng and effective pr	resentations.			
At the	and of the	Course student	Suitomes (CO) w	ILII DIOOIII'S TAXO	Dhomy Level			
CO1	Solve fie	old problems by	using different tecl	hniques in mechan	ical design engineerin	g Apply		
CO2	Design a	nd develop suit	able mechanical sy	stems	ieur design engineerm	Create		
CO3	Prepare a	and present a de	tailed technical rep	ort based on mini	project work	Evaluate		
					1 5			
			Cours	e Content				
Creati	on of proto	otype/ apparatus	/ small equipment/	experimental set u	p/ innovation of existi	ng product/		
analys	is or simul	ation of a proce	ess/ experimental ve	erification of princ	iples in thrust areas of	Advanced		
Machi	ne Design/	Mathematical	Methods in Engine	ering/ Reliability I	Engineering/ Mechanic	es of		
Comp	osite Mate	rials/ Analysis a	and Synthesis of Mo	echanism/ Process	Equipment Design etc	с.		
The st	udents will	l select the thrus	st area depending u	pon his/her profes	sional elective 1 and 2			
4		11 1 1 1	Tex	t Books	1 4 1			
1	Suita	ble books based	t on the contents of	the mini project s	elected.			
	Cuito	bla books based	Kef	erences	alacted and research m	apore from		
1		ted national and	i on the contents of	als and conference	es	apers nom		
			. momunonai jouri		<b>~</b> 5.			
			Usef	ul Links				
1	As ne	er the need of th	e mini proiect.					
1	· · · · ·		1 5					

CO-PO Mapping											
Programme Outcomes (PO)											
	1	2		3		4		5		6	
CO1	3					1					
CO2				3							
CO3								3		1	
The streng	gth of mapping is	s to be wr	itten as	s 1,2,3; Wh	nere, 1	:Low, 2:Me	ediun	n, 3:High			
Each CO	of the course mu	st map to	at leas	t one PO.							
				Asses	smen	t					
There are	three componen	ts of lab a	issessm	nent, LA1,	LA2	and Lab ES	E.				
IMP: Lab	ESE is a separat	e head of	passin	g. LA1, LA	A2 tog	gether is trea	ated a	as In-Semester	Evaluat	ion.	
Assessme	nt Based	on	Cond	lucted by	T	ypical Sche	dule	(for 26-week S	Sem)	Marks	
τ Α 1	Lab activ	vities,	Lab	Course	Dur	ing Week 1	to W	eek 6		20	
LAI	attendance,	journal	Fa	aculty	Marks Submission at the end of Week 6			eek 6	50		
τ Δ 2	Lab activ	vities,	Lab	Course	Dur	ing Week 7	to W	eek 12		20	
LAZ	attendance,	journal	Fa	aculty	Maı	ks Submiss	ion a	t the end of We	eek 12	50	
I oh ESE	Lab activ	vities,	Lab	Course	Dur	ing Week 1	5 to V	Week 18		40	
	attendance,	journal	Fa	aculty	Marks Submission at the end of Week 18					40	
Week 1 in	dicates starting v	week of a	semes	ter. The typ	oical s	schedule of	lab a	ssessments is s	hown,		
considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab											
performan	ice shall include	performi	ng exp	eriments, n	nini-p	roject, pres	entati	ions, drawings,	program	nming	
and other	suitable activitie	s, as per t	the nati	ure and req	uiren	nent of the la	ab co	ourse. The expe	rimenta	l lab	

shall have typically 8-10 experiments.

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

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)							
AY 2021-22							
Course Information							
Programme		M. Tech. (Mecha	nical Design Engi	neering)			
Class, Semester		First Year M. Teo	ch., Sem I				
Course Code		5DE553					
Course Name		Presentation and	Technical Report	Writing			
Desired Requisi	tes:						
Teaching Scheme (Hrs)     Examination Scheme (Marks)							
Lecture	-	LA1	LA2	ESE	Total		

Tutori	al	-	30	30	40	100		
Praction	cal	-						
Intera	ction	1	Credits: 1					
	Course Objectives							
1	To provi	de an opportuni	ty to student to do	work independently	y on a topic.			
2	To encou	rage creative th	inking process in t	echnical report wri	ting			
3	To enabl	e student for go	od technical report	writing and effecti	ve presentations.			
		Course	Outcomes (CO) w	vith Bloom's Taxo	nomy Level			
At the	end of the	course, student	s will be able to,					
<u>CO1</u>	Demonst	rate the charact	eristics of technica	l and business writi	ng.	Apply		
CO2	Produce	documents relat	ed to technology a	nd writing in the w	orkplace and will h	ave Create		
	1mproved	their ability to	write clearly, conc	isely, and accurate	ly.			
CO3	Use a va	riety of materia	Is to produce appro	opriate visual prese	ntation for docume	its, Evaluate		
	such as i	nstructions, des	criptions, and resea	irch reports.				
			Corre	. Contont				
T1.:	• • • •	1				- f: 1		
	burse intro	uces students	to the discipline of	technical communi	cation. Preparation	of visuals to		
writing	reports a	re the major ton	ics included		ins, explanations of	processes, and		
This co	ourse is de	signed for stude	ents enrolled in tech	nical degree progr	ams for making the	m industry		
ready.		signed for stude		linear aegree progr	and for making the	in maastry		
			Tex	t Books				
1	Suita	ble books based	on the contents of	thetopic.				
			Ref	erences				
1	Suita	ble books base	d on the contents	of the selected top	ic and research pa	pers from reputed		
1	natio	nal and internat	ional journals and o	conferences.				
			Usef	ul Links				
1	As pe	er the need of th	e topic of report an	d presentation				

CO-PO Mapping										
		Programme Outcomes (PO)								
	1	2	3	4	5	6				
CO1		3								
CO2		2		1						
CO3		1				2				
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High										
Each CO	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.								
Assessment Based on Conducted by Typical Schedule (for 26-week Sem) Marks								
Τ.Α.1	Lab activities,	Lab Course	During Week 1 to Week 6	20				
LAI	attendance, journal	Faculty	Marks Submission at the end of Week 6	50				
T A C	Lab activities,	Lab Course	During Week 7 to Week 12	20				
LAZ	attendance, journal	Faculty	Marks Submission at the end of Week 12	50				

Lab ESE	Lab activities,	Lab Course	During Week 15 to Week 18	40				
	attendance, journal	Faculty	Marks Submission at the end of Week 18	40				
Week 1 indica	Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown,							
considering a	26-week semester. Th	e actual schedule	shall be as per academic calendar. Lab					
activities/Lab	performance shall inc	lude performing	experiments, mini-project, presentations, dra	awings,				
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							
Evaluate	10	10	10	30			
Create	10	10	20	40			
Total Marks	30	30	40	100			

	Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)						
			AY	2021-22			
			Course ]	Information			
Progra	amme		M. Tech. (Mecha	nical Design Engin	eering)		
Class,	Semester		First Year M. Teo	ch., Sem I			
Cours	e Code		5DE554				
Course	e Name		Professional Skill	ls 1			
Desire	d Requisi	tes:					
			1				
Теа	ching Sch	neme (Hrs)		Examination S	cheme (Marks)		
Lectur	e	-	LA1 LA2 ESE Total				
Tutori	al	-	30	30	40	100	
Practio	cal	-			·		
Intera	ction	1		Cred	its: 1		
		·	Course	Objectives			
1	To provi	de a hands on e	xperience of softwa	are in solving comp	lex mechanical eng	ineering	
1	problems	5.					
2	To enhar	nce the employa	bility of mechanica	al design engineerir	ng student.		
		Course	Outcomes (CO) w	rith Bloom's Taxo	nomy Level		
At the	end of the	course, student	s will be able to,				
CO1	Use of th	e software relat	ed to design of me	chanical system eff	ectively.	Evaluate	
<u>CO2</u>	Develop	the solution for	mechanical engine	ering problem usin	g software.	Create	
<u>CO3</u>	Explain	the process of p	roblem solving usin	ng computing tools	•	Understand	
			Cours	e Content			

This course is based on computing as a tool to design and analyse the mechanical system. In the modern day work environment, the Mechanical Design Engineer should be able to simulate and solve complex problems on computers. The Mechanical Design Engineer must be highly computer literate. The engineer with strong fundamentals in Design Engineering and computer software proficiency is highly in demand from industry. Employability of the student can be enhanced by providing software training of 2D modelling software in mechanical engineering.

	Text Books						
1	Suitable books based on the software selected.						
References							
1	Suitable books based on the contents of software selcted						
Useful Links							
1	As per the need of the software training						

CO-PO Mapping										
		Programme Outcomes (PO)								
	1	1 2 3 4 5 6								
CO1	2									
CO2			2							
CO3		3				1				
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								
There are three	There are three components of lab assessment, LA1, LA2 and Lab ESE.							
IMP: Lab ES	E is a separate head of	passing. LA1, LA	A2 together is treated as In-Semester Evaluat	ion.				
Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks				
та 1	Lab activities,	Lab Course	During Week 1 to Week 6	20				
LAI	attendance, journal	Faculty	Marks Submission at the end of Week 6	50				
ТАЭ	Lab activities,	Lab Course	During Week 7 to Week 12	20				
LAZ	attendance, journal	Faculty	Marks Submission at the end of Week 12	50				
Lob ESE	Lab activities,	Lab Course	During Week 15 to Week 18	40				
	attendance, journal	Faculty	Marks Submission at the end of Week 18	40				
Week 1 indic	ates starting week of a	semester. The typ	vical schedule of lab assessments is shown,					
considering a	26-week semester. Th	e actual schedule	shall be as per academic calendar. Lab activit	ities/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 typ	bically 8-10 experiment	ts.						

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				

<b>Total Marks</b>	30	30	40	100
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Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)									
	AY 2021-22								
			Course l	Information					
Progra	amme		M. Tech. (Mecha	nical Design Engir	eering)				
Class,	Semester		First Year M. Te	ch., Sem I					
Cours	e Code		5DE511						
Cours	e Name		Advanced Machi	ne Design					
Desire	d Requisi	tes:	Industrial produc	t design, Machine	design				
	-		<b>^</b>						
,	Teaching	Scheme		Examination S	cheme (Marks)				
Lectur	e.	3 Hrs/week	T1	T2	ESE	,	Total		
Tutori	al	-	20	20	60		100		
Practio	cal	-		1	LI				
Intera	ction	-		Cred	its: 3				
		1	Course	Objectives					
1	To prepa	re the students to	o succeed as design	ner in industry /tecl	nnical profession.				
•	To provi	de students the k	nowledge of steps	involved in design	and developments	of indu	ustrial		
2	product.			-	-				
3	To prepa	re the students to	o use knowledge o	f ergonomics, aesth	netics for development	ent of i	industrial		
5	Product.								
4	To prepa	re the students to	o use knowledge o	f rapid prototyping	, value analysis, sta	ndardi	zation for		
	Develop	ment of industria	al Product.	th Disam'a Tarra					
At the	and of the	Course course	Juicomes (CO) w	ith Bloom's Taxo	nomy Level				
At the	Demonst	rate an ability to	s will be able to,	ed of society to des	an the products as	ner	Apply		
CO1	their real	irements	recognize the new	ed of society to de	sign the products as	, per	rippiy		
CO2	Recomm	end appropriate	changes to apply a	esthetic and ergono	mic concepts to pro	duct	Evaluate		
COA	Design a	and develop the	products by using	g principles of DF	MA, rapid prototyr	oing,	Create		
003	reliabilit	y and economy				0			
Modu	le		Module	e Contents			Hours		
	Prod	uct Developme	nt Process:						
T	Deve	Development processes and organizations, Product Planning Product development							
	mana	gement establish	ing the architectur	e, clustering geome	tric layout develop	ment			
	-Fun	-Fundamental and incidental interactions – related system level design issues							
п	Veed	Identification	and problem de	finition product	specification cor	cont	6		
a separation and select		on evaluation cre	eativity methods C	oncent testing	leept	0			
Frgonomics and A		nomics and Aes	sthetics:	utivity methods, e	oncept testing.				
III	Indus	trial design, De	sign for Emotion a	and experience, Intr	oduction to retrofit	and	6		
	Eco d	lesign, Human b	ehaviour in design	, ergonomics and a	esthetics				
	Robi	ıst Design:							
IV	Desig	gn for Reliability	, strength based re	liability, parallel ar	d series systems, ro	bust	7		
	desig	n, Integrate proc	ess design, Manag	ing costs, Robust d	esign, Integrating C	CAE,	,		
	CAD	, CAM tools, Si	mulating product	pertormance and n	nanutacturing proce	esses			

	electronically, Need for industrial design-impact.					
V	<b>Design for Manufacturing and Assembly:</b> Design for manufacture, assembly, maintenance, casting, forging, Estimation of Manufacturing cost, reducing the component costs and assembly costs, Minimize system complexity.	7				
VI	Rapid Prototyping: Rapid Prototyping Liquid based processes, Powder based processes and Solid based processes; Classes of RP systems: 3D Printers, Enterprise Prototyping centers, Direct digital tooling, Direct digital manufacturing, system classification, RP Applications	7				
	Text Books					
1	Ulrich K.T. and Eppinger S., Product Design and Development, McGraw-Hill Edu edition, 2011.	ucation; 5 th				
2	Dieter G.E., Engineering Design, McGraw-Hill Education 5 th edition, 2012.					
3	Prashant Kumar, Product Design, Creativity, Concepts and Usability, PHI New edition, 2011	Delhi, 1 st				
	Deferences					
1	Iohn I.C. Design Methods Wiley Inter science 2 nd edition 1970					
2	Law A. M. and Kelton W.D, Simulation, Modelling and Analysis, McGraw Hill Ededition, 2017	ucation, 4 th				
3	Pahl G. and W. Beitz, Engineering Design- a Systematic Approach, Springer, 2 nd edit	tion, 1996.				
	Useful Links					
1	https://nptel.ac.in/courses/112/107/112107217/					
2	https://nptel.ac.in/courses/107/103/107103084/					
3	https://youtu.be/hPrQXgQ-dY8					
4	https://nptel.ac.in/courses/112/104/112104265/					

CO-PO Mapping								
	Programme Outcomes (PO)							
	1	2	3	4	5	6		
CO1	3		2	3	1			
CO2	1		1	2				
CO3	3					2		
The stren	oth of manning i	s to be written a	c 1 2 2. Where	I.I. ow 2. Mediu	n 2.High	•		

## **Assessment (for Theory Course)**

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course								
	Bloom's Taxonomy Level	T1	Τ2	ESE	Total			
1	Remember							
2	Understand							
3	Apply	5	5	20	30			

4	Analyze				
5	Evaluate	5	5	20	30
6	Create	10	10	20	40
Total		20	20	60	100

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)								
	AY 2021-22							
			Course l	nformation				
Progra	amme		M. Tech. (Mecha	nical Design Engin	eering)			
Class,	Semester		First Year M. Teo	ch., Sem I				
Cours	e Code		5DE512					
Cours	e Name		Mathematical Me	thods in Engineering	ng			
Desire	d Requisi	tes:						
	Teaching	Scheme		Examination S	cheme (Marks)			
Lectur	re	3 Hrs/week	T1	T2	ESE	Total		
Tutori	ial	-	20	20	60	100		
Practi	cal	-						
Intera	ction	-		Cred	its: 3			
			Course	Objectives				
1	To make and their	students to orga use in practical	nize systems of eq applications.	uations, their algeb	raic and graphical re	presentations,		
2	To prepa	re students to ou	tline the physical s	ystems and formul	ate mathematical mo	dels for them.		
3	To make	students to solv	e differential equat	ions using numeric	al techniques and tra	nsform		
5	Techniqu	ie.						
	1 0 1	Course	Outcomes (CO) w	ith Bloom's Taxor	nomy Level			
At the	end of the	course, students	will be able to,					
COI	Apply sta	atistical techniqu	les to analyze mult	ivariate functions.	1 1 6 1	Apply		
CO2	partial di	fferential equation	ons	by applying the kno	wiedge of ordinary a	nd Evaluate		
CO3	Analyze	nature of a give	n wave equation a	nd obtain solution	from the perspective	of Analyze		
	D'Alemi	pert principle and	d/or by method of	separation of variat	bles.			
Modu			Madula	Contonta		Houng		
Muu	Intro	duction to Prol	ability Theory:	Contents		IIIIIIS		
I Probability Theory and examples.		d Sampling Distrib	outions. Basic proba	bility theory along w	vith 5			
II	Prob Stand Expo distri	<b>ability distribut</b> lard discrete and nential etc. Cen butions like $x^2$ , t	tions and theorem d continuous distr ntral Limit Theore , F.	s: ibutions like Bino: em and its signifi	mial, Poisson, Norn cance. Some sampl	nal, 5		

TIT	Testing of Statistical Hypothesis:	0				
	Testing a statistical hypothesis, tests on single sample and two samples concerning	8				
	means and variances. ANOVA: One – way, 1wo – way with/without interactions.					
IV/	Ordinary Differential equations colvable by direct colution methods, colvable	7				
1 V	nonlinear ODE"s	/				
	Portial Differential Equations and Concents in Solution to Boundary Value					
	Problems.					
v	Solution methods for wave equation D'Alembert solution potential equation	7				
	properties of harmonic functions, maximum principle, solution by variable	,				
	separation method.					
	Major Equation Types Encountered in Engineering and Physical Sciences:					
VI	Solution methods for wave equation, D'Alembert solution, potential equation,	0				
V1	properties of harmonic functions, maximum principle, solution by variable	8				
	separation method.					
	Text Books					
1	Ronald E, Walpole, Sharon L. Myers, Keying Ye, Probability and Statistics for Eng	ineers				
1	¹ And Scientists (8th Edition), Pearson Prentice Hall, 07.					
2	J. B. Doshi, Differential Equations for Scientists and Engineers, Narosa, New Delhi	, 10.				
	References					
1	Douglas C. Montgomery, Design and Analysis of Experiments (7th Edition), Wi	ley Student				
-	Edition, 09.					
2	S. P. Gupta, Statistical Methods, S. Chand & Sons, 37th revised edition, 08.					
3	William W. Hines, Douglas C. Montgomery, David M. Goldsman, Probability and					
	Statistics for Engineering, (4th Edition), Willey Student edition, 06.					
4	Advanced Engineering Mathematics (9th Edition), Erwin Kreyszig, Wiley India (13	).				
	Useful Links					
	https://www.ajronline.org/doi/10.2214/ajr.180.4.1800917					
2	https://www.healthknowledge.org.uk/public-health-textbook/research-methods/1b-s	tatistical-				
	methods/statistical-distributions					
3	https://nptel.ac.in/courses/111/106/111106100/					
4	https://www.math.upenn.edu/~deturck/m425/m425-dalembert.pdf					

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

### **Assessment (for Theory Course)**

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

Walchand College of Engineering, Sangli							
(Government Aldea Autonomous Institute)							
			Course	Information			
Progra	amme		M. Tech. (Mech	anical Design Engi	neering)		
Class,	Semester		First Year M. Te	ech., Sem I			
Cours	e Code		5DE513				
Cours	e Name		Reliability Engi	neering			
Desire	d Requisi	tes:	Concept knowle	dge of probability,	statistics and syste	m design	
	Teaching	Scheme		Examination S	Scheme (Marks)		
Lectu	re	3 Hrs/week	T1	T2	ESE	Total	
Tutor	ial	-	20	20	60	100	
Practi	cal	-					
Intera	ction	-		Cre	dits: 3		
	1		Course	e Objectives			
1	To prepar in mecha	re the students to nical devices.	o compute reliabili	ty engineering para	ameters and estima	tes for applications	
2	To provid	de knowledge of	reliability and mai	intainability of mac	chines and systems		
3	To train t	he students to ag	pply knowledge of	probability for reli	ability analysis of	machines and	
4	4 To teach use reliability theory for product life calculation and for maintenance of machines and mechanical systems						
		Course	Outcomes (CO) v	vith Bloom's Taxo	onomy Level		
At the	end of the	course, students	s will be able to,				
CO1	Apply va	rious probability	y distributions theo	ry for reliability an	alysis.	Apply	
CO2	Evaluate	reliability analy	sis of mixed and co	omplex systems.		Evaluate	
CO3	Design a	machine elemer	nt based on reliabil	ity theory		Create	
				<b>a</b>			
Modu	ile		Module	Contents		Hours	

	Evendomental Concenter	
I	Introduction to reliability, History, Reliability terminologies, Failure, Failure density, Failure Rate, Hazard Rate, Mean Time To Failure, MTBF, Maintainability, Availability, PDF, CDF, Safety and reliability, Quality, Cost and system effectiveness, Life characteristic phases, Modes of failure, Areas of reliability, Quality and reliability assurance rules, Product liability, Importance of reliability.	6
II	<b>Probability and Reliability:</b> Basic probability concepts, Laws of probability, Introduction to independence, mutually exclusive, conditional probability, Discrete and continuous probability distributions, Comparison of probability distributions - Binomial, Normal, Lognormal, Poisson, Weibull, Exponential. Standard deviation, Variance, Mean, Mode and Central limit theorem.	7
III	<b>System Reliability and Modelling:</b> Series, Parallel, Mixed configuration, k- out of n structure, Complex systems- enumeration method, Conditional probability method, Cut set and tie set method, Redundancy, Element redundancy, Unit redundancy, Standby redundancy and its types, Parallel components, Single redundancy, Multiple redundancy.	7
IV	Maintainability and Availability: Objectives of maintenance, Types of maintenance, Maintainability, Factors affecting maintainability, System down time, Availability - inherent, achieved and operational availability. Introduction to Reliability Centered Maintenance	6
V	Reliability in Design & Development:Failure mode effects analysis, Severity/Criticality analysis, FMECA examples,RPN, Ishikawa diagram for failure representation, Fault tree construction, Basicsymbols development of functional reliability Block diagram, Fault tree analysis,Fault tree evaluation techniques, Minimal cut set method, Delphi methods, MonteCarlo evaluation.	7
VI	<b>Reliability Testing:</b> Introduction to reliability testing, Stress strength interaction, Introduction to Markov model. Testing for Reliability and Durability- Accelerated Life Testing and Highly Accelerated Life Testing (HALT), Highly Accelerated Stress Screening (HASS).	7
	Text Books	
1	Balagurusmy E., "Reliability Engineering", Tata McGraw-Hill Publishing Co. Ltd	., 1984.
2	Birolini Alessandro, "Reliability Engineering", Springer, Seventh Edition, 2013	
3	Modarres M, Kaminskiy M, "Reliability Engineering and Risk Analysis-A Practical Press, Second Edition, 2010.	Guide", CRC
	<b>D</b> . 6	
	<b>Keterences</b>	W/ 1 1D
1	Editing Charles E., "Introduction to Reliability and Maintainability Engineering", Inc., Second edition, 2009.	waveland Pr
2	Kapoor K.C., Lamberson L.R., "Reliability in Engineering Design", John Wiley edition, 1977.	& Sons, First
3	Rao S.S., "Reliability Based Design", Tata McGraw Hills, 1st edition, 1980.	
	Useful Links	
1	https://www.tce.edu/sites/default/files/PDF/Reliability-Engg.pdf	
2	https://nptel.ac.in/courses/111/104/111104079/	
3	https://nptel.ac.in/courses/112/105/112105232/	
4	nttps://nptei.ac.in/content/storage2/courses/112101005/downloads/Module_5_Lect df	ture_3_final.p

CO-PO Mapping								
	Programme Outcomes (PO)							
	1	2	3	4	5	6		
CO1	2		2			2		
CO2	3		2			2		
CO3	3		2			3		
The stren	oth of manning i	s to be written a	s 1 2 3. Where 1	I ow 2. Mediu	n 3.High	-		

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

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)							
AY 2021-22							
			Course	Information			
Progra	amme		M. Tech. (Mech	anical Design En	gineering)		
Class,	Semester		First Year M. Te	ech., Sem I			
Cours	e Code		5DE513				
Cours	e Name		Reliability Engin	neering			
Desire	ed Requisit	tes:	Concept knowle	dge of probability	y, statistics and syste	em design	
	Teaching	Scheme	Examination Scheme (Marks)				
Lectur	re	3 Hrs/week	<b>T1</b>	T2	ESE	Total	
Tutor	ial	-	20	20	60	100	
Practi	cal	-					
Intera	ction	-	Credits: 3				
			Course	Objectives			
1	To prepar	re the students to	o compute reliabili	ty engineering pa	rameters and estima	tes for applications	
1	in mecha	nical devices.					
2	To provid	le knowledge of	reliability and mai	intainability of ma	achines and systems		
3	To train t mechanis	he students to ap ms.	pply knowledge of	probability for re	liability analysis of	machines and	

4	To teach use reliability theory for product life calculation and for maintenance of machines and mechanical systems						
	1	Course Outcomes (CO) with Bloom's Taxonomy Level					
At the	end	of the course, students will be able to,					
CO1	Ap	ply various probability distributions theory for reliability analysis.	Apply				
CO2	Ev	aluate reliability analysis of mixed and complex systems.	Evaluate				
<b>CO3</b>	De	sign a machine element based on reliability theory	Create				
Modu	ıle	Module Contents	Hours				
		Fundamental Concepts:					
		Introduction to reliability, History, Reliability terminologies, Failure, Failure					
		density, Failure Rate, Hazard Rate, Mean Time To Failure, MTBF,					
I		Maintainability, Availability, PDF, CDF, Safety and reliability, Quality, Cost and	6				
		system effectiveness, Life characteristic phases, Modes of failure, Areas of					
		reliability. Quality and reliability assurance rules. Product liability. Importance of					
		reliability.					
		Probability and Reliability:					
		Basic probability concepts Laws of probability Introduction to independence					
		mutually exclusive conditional probability Discrete and continuous probability					
II		distributions Comparison of probability distributions - Binomial Normal	7				
		Lognormal Poisson Weibull Exponential Standard deviation Variance Mean					
		Mode and Central limit theorem					
		System Deliphility and Modelling:					
		System Kenability and Modelling:					
		series, Faraner, Mixed configuration, k- out of it structure, Complex systems-	7				
111		enumeration method, Conditional probability method, Cut set and the set method,	/				
		Redundancy, Element redundancy, Unit redundancy, Standby redundancy and its					
		types, Parallel components, Single redundancy, Multiple redundancy.					
		Maintainability and Availability:					
IV		Objectives of maintenance, Types of maintenance, Maintainability, Factors	6				
		affecting maintainability, System down time, Availability - inherent, achieved and					
		operational availability. Introduction to Reliability Centered Maintenance					
		Reliability in Design & Development:					
		Failure mode effects analysis, Severity/Criticality analysis, FMECA examples,					
v		RPN, Ishikawa diagram for failure representation, Fault tree construction, Basic	7				
		symbols development of functional reliability Block diagram, Fault tree analysis,	,				
		Fault tree evaluation techniques, Minimal cut set method, Delphi methods, Monte					
		Carlo evaluation.					
		Reliability Testing:					
		Introduction to reliability testing, Stress strength interaction, Introduction to					
VI		Markov model. Testing for Reliability and Durability- Accelerated Life Testing	7				
		and Highly Accelerated Life Testing (HALT), Highly Accelerated Stress					
		Screening (HASS).					
		Text Books	1004				
		Balagurusmy E., "Reliability Engineering", Tata McGraw-Hill Publishing Co. Ltd.	., 1984.				
		Birolini Alessandro, "Reliability Engineering", Springer, Seventh Edition, 2013	<u>a 11 n an</u>				
3		Modarres M, Kaminskiy M, "Reliability Engineering and Risk Analysis-A Practical	Guide", CRC				
		Press, Second Edition, 2010.					
		Deferences					
		<b>References</b>	Wavaland Dr				
1		Editing Charles E., Introduction to Kenadility and Maintainability Engineering",	waveland Pr				
		Inc., Second edition, 2009.	& Come Final				
2		Kapoor K.C., Lamberson L.K., "Reliability in Engineering Design", John Wiley	& Sons, First				

	edition, 1977.
3	Rao S.S., "Reliability Based Design", Tata McGraw Hills, 1st edition, 1980.
	Useful Links
1	https://www.tce.edu/sites/default/files/PDF/Reliability-Engg.pdf
2	https://nptel.ac.in/courses/111/104/111104079/
3	https://nptel.ac.in/courses/112/105/112105232/
4	https://nptel.ac.in/content/storage2/courses/112101005/downloads/Module_5_Lecture_3_final.p
4	df

			CO-PO Mapp	ping		
			Programme (	<b>Dutcomes (PO)</b>		
	1	2	3	4	5	6
CO1	2		2			2
CO2	3		2			2
CO3	3		2			3
The stren	gth of mapping i	s to be written a	s 1,2,3; Where, 1	:Low, 2:Mediu	m, 3:High	

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

## **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 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 o	n Bloom's Taxo	onomy Level (M	larks) For Theor	y Course
	Bloom's Taxonomy Level	T1	T2	ESE	Total
1	Remember				
2	Understand				
3	Apply	5	5	20	30
4	Analyze				
5	Evaluate	5	5	20	30
6	Create	10	10	20	40
	Total	20	20	60	100

	Walc	hand College	of Engineerin	g, Sangli			
(Government Ataea Autonomous Institute)							
		Course	2021-22 Information				
Ducanommo		M Tash (Masha	nicol Docign Engi	nonring)			
Programme         M. Lecn. (Mechanical Design Engineering)							
Class, Semester	Class, Semester First Year M. Tech., Sem I						
Course Code		5DE514					
Course Name		Mechanics of Co	mposite Materials				
Desired Requisi	tes:						
Teaching	Scheme		Examination S	Scheme (Marks)			
Lecture	3 Hrs/week	T1	T2	ESE	Total		

Tutor	rial		-	20	20	60	1	100			
Practi	ical		-		1						
Intera	action		- Credits: 3								
				Course	Objectives						
	То	teach	students treat	ment of the class	sification and prop	perties of compos	site mat	erials of			
1	thed	liffere	rent ways composites can be laid up and how they can be analyzed with emphasis on								
-	nhvs	sical i	l understanding								
	Tor	perfor	m independent :	analysis of the com	nosite materials wh	ich is increasing us	sed in m	any fields			
2		in tra	ansportation (sea land air space) the oil industry civil engineering construction sports								
	equi	inmer	t biomechanics	a, fund, an, space),	the off madstry, e		instituetite	on, sports			
	Course Outcomes (CO) with Bloom's Taxonomy Level										
At the	end o	of the	course students	will be able to							
	Identify the properties of fiber and matrix materials used in commercial composites as Create										
CO1	well	l as so	ome common ma	anufacturing techn	iques	interetur composite	<i>7</i> 5, <b>u</b> 5	cieute			
	Ana	lvze	a laminated nla	ate in bending in	cluding finding la	ninate properties	from	Analyze			
CO2	lami	ina nr	operties and fin	d residual stresses	from curing and me	ninute properties		7 mary 20			
	Pred	lict th	e failure streng	th of a laminated	composite plate k	nowledge of issue	es in	Fvaluate			
<b>CO3</b>	fract	fure o	f composites an	d environmental d	-gradation of comp	osites		Lvaluate			
	Index		i compositos un		egradation of comp	05105.					
Modu	ıle			Module	Contents			Hours			
Mout		Intro	duction to com	nosite material:	contents			nours			
		rhara	teristics Over	view of advantage	and limitations of	of composite mate	rials				
I		Sionif	Ficance and obje	ctives of composite	materials Science	and technology cu	irrent	7			
		status and future prospectus									
		Rasic	Concepts and	Characteristics.							
		Struct	ural performation	ice of conventio	nal material Ge	ometric and phy	vsical				
П		defini	tion Material	response Classifi	cation of composi	te materials Scal	le of	7			
	2	analysis: Micromechanics Basic lamina properties Constituent materials and						,			
	r	prope	erties Properties of typical composite materials								
	1	Reinf	orcements:	or typical composi							
	I I	Prepa	ration-layup. cu	ring, properties and	l applications of gla	ass fibers, carbon fi	ibers.	rs			
III	H	Keylar fibers and Boron fibers. Properties and applications of whiskers, particle						7			
	r	reinfo	rcements. Mech	nanical Behaviour	of composites: Ru	le of mixtures. In	verse				
	r	rule of mixtures. Isostrain and Isostress conditions.									
	I	Manu	facturing of M	etal Matrix Com	posites:						
	(	Castir	ng-Solid State	diffusion techn	ique, Cladding–H	ot isostatic pres	sing.				
IV	I	Prope	rties and applica	ations. Manufactur	ing of Ceramic Ma	trix Composites: L	iquid	7			
	1	Metal	Infiltration-Li	quid phase sinte	ring. Manufacturi	ng of Ĉarbon–Ca	arbon				
	0	composites: Knitting, Braiding, Weaving. Properties and applications.									
	I	Manu	facturing of Po	olymer Matrix Co	mposites:	-					
V	I	Prepa	ration of Mould	ing compounds an	d prepregs-hand la	yup method Auto	clave	7			
v	r	metho	d – Filament w	inding method – C	ompression mouldi	ng – Reaction inje	ction	7			
	ľ	mould	ling. Properties	and applications.							
	5	Stren	gth:								
	I	Lamiı	nar Failure Crite	eria-strength ratio,	maximum stress c	riteria, maximum s	strain				
VI	0	criteri	a, interacting fai	ilure criteria, hygro	thermal failure. La	minate first play fai	ilure-	6			
	i	insight strength; Laminate strength-ply discount truncated maximum strain									
	0	criteri	on; strength des	ign using caplet pl	ots; stress concentr	ation					
				Tex	t Books						
1	1	WD (	Callister, Materia	als Science and En	gineering, An intro	duction., John Wile	ey & Soi	ns, NY,			
1	1	Indiar	edition, 2007.								

2	Bhagwan D. Agarwal, Lawrence J. Broutman, Analysis and Performance of fiber composites,
	John Wiley and Sons, Inc. 1990.
	References
1	Isaac M. Daniels, OriIshai, Engineering Mechanics of Composite Materials, Oxford University
1	Press, 1994.
2	Mazumdar S. K., Composite Manufacturing – Materials, Product and Processing Engineering,
	CRC Press, Boca Raton, 2002
3	Robert M. Jones, Mechanics of Composite Materials, Taylor and Francis, Inc., 1999
	Useful Links
1	https://compositesuk.co.uk/composite-materials/introduction
2	https://nptel.ac.in/content/storage2/courses/101104010/downloads/Lecture3.pdf
3	https://freevideolectures.com/course/4611/nptel-manufacturing-composites/21
4	https://nptel.ac.in/courses/112/104/112104221/

			CO-PO Map	ping					
		Programme Outcomes (PO)							
	1	2	3	4	5	6			
CO1	1		2	3		1			
CO2	1			3					
CO3	1		1	3					
The stren	gth of mapping i	s to be written a	s 1,2,3; Where, 1	l:Low, 2:Mediu	ım, 3:High				
Each CO of the course must map to at least one PO.									

### **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 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 (Marks) For Theory Course							
B	loom's Taxonomy Level	T1	T2	ESE	Total			
1	Remember							
2	Understand							
3	Apply							
4	Analyze	5	5	20	30			
5	Evaluate	5	5	20	30			
6	Create	10	10	20	40			
	Total	20	20	60	100			

Walchand College of Engineering, Sangli
(Government Aided Autonomous Institute)
AY 2021-22
Course Information

Progr	amme		M.Tech. (Mechanical Design Engineering)					
Class,	Semester		First Year M. Tech., Sem I					
Cours	se Code		5DE514					
Cours	se Name		Mechanics of Composite Materials					
Desire	ed Requisi	tes:		1				
	<u> </u>		1					
Teaching Scheme			Examination S	cheme (Marks)				
Lecture 3 Hrs/week		T1	T2	ESE		Total		
Tutor	ial	-	20	20	60		100	
Practi	ical	_						
Intera	iction	_		Cred	its: 3			
	.cuon	<u> </u>	Course	Objectives				
	To teach	students treat	ment of the class	vification and prop	perties of compos	ite m	aterials of	
1	thediffer	ent ways compo	osites can be laid	up and how they of	can be analyzed y	with en	mphasis on	
-	physical	understanding.	Sites cuir se fuid	up una novi incy	eun ee unurjzeu, t	vitin ei	inpituoio on	
	To perfor	rm independent	analysis of the com	posite materials wh	hich is increasing us	sed in 1	many fields	
2	e.g. in tra	ansportation (sea	a, land, air, space),	the oil industry, c	ivil engineering co	nstruc	tion, sports	
	equipme	nt, biomechanics	s and medicine.	-			_	
		Course	Outcomes (CO) w	ith Bloom's Taxor	nomy Level			
At the	end of the	course, students	s will be able to,					
CO1	Identify	he properties of	fiber and matrix m	aterials used in con	nmercial composite	es, as	Create	
	well as s	ome common m	anufacturing techniques.					
CO2	Analyze	a laminated pla	e in bending, including finding laminate properties from Analyz			Analyze		
	Dradiat f	roperties and fin	a residual stresses from curing and moisture.			a in	Evoluoto	
CO3	fracture	of composites an	th of a laminated composite plate Knowledge of issues in a environmental degradation of composites			Evaluate		
	fracture of composites and environmental degradation of composites.							
		or composites an	id environmental de	egradation of comp	osites.			
Modu	ıle		nd environmental de <b>Module</b>	egradation of comp	osites.		Hours	
Modu	ile Intro	duction to com	Module	egradation of comp	osites.		Hours	
Modu	ile Intro chara	duction to com	Module Module posite material: view of advantage	egradation of comp Contents e and limitations of	osites.	rials,	Hours	
Modu	Ile Intro chara Signi	duction to com cteristics, Over ficance and obje	Module Module posite material: view of advantage ctives of composite	egradation of comp Contents and limitations c materials, Science	of composite mate and technology, cu	rials, rrent	Hours 7	
Modu	ile Intro chara Signi status	duction to com cteristics, Over ficance and obje	Module Module posite material: view of advantage ctives of composite pectus	egradation of comp Contents and limitations of materials, Science	of composite mate and technology, cu	rials, rrent	Hours 7	
Modu	Ile Intro chara Signi status Basic	duction to com cteristics, Over ficance and obje and future pros Concepts and	Module Module posite material: view of advantage ctives of composite pectus Characteristics:	egradation of comp Contents and limitations of materials, Science	osites. of composite mate and technology, cu	rials, rrent	Hours 7	
Modu	ile Intro chara Signi status Basic Struc	duction to com cteristics, Over ficance and obje and future pros <b>Concepts and</b> tural performation	Module Module posite material: view of advantage ctives of composite pectus Characteristics: nce of conventio	egradation of comp Contents e and limitations of materials, Science mal material, Ge	of composite mate and technology, cu ometric and phy	rials, rrent	Hours 7	
Modu I II	Ile Intro chara Signi status Basic Struc defin	duction to com cteristics, Over ficance and obje and future pros <b>Concepts and</b> tural performan ition, Material	Module Module posite material: view of advantage ctives of composite pectus Characteristics: nce of conventio response, Classifi	contents contents and limitations of materials, Science nal material, Ge cation of composi	of composite mate and technology, cu ometric and phy ite materials, Scal	rials, rrent vsical le of	Hours 7 7	
Modu I II	Ile Intro chara Signi status Basic Struc defin analy	duction to com cteristics, Over ficance and obje and future pros <b>Concepts and</b> tural performani ition, Material sis; Micromech	Module Module posite material: view of advantage ctives of composite pectus Characteristics: nce of conventio response, Classifi aanics, Basic lami	egradation of comp Contents and limitations of materials, Science nal material, Ge cation of composi na properties, Con	osites. of composite mate and technology, cu ometric and phy ite materials, Scal astituent materials	rials, rrent vsical le of and	Hours 7 7	
Modu I II	Ile Intro chara Signi status Basic Struc defin analy prope	duction to com cteristics, Over ficance and obje and future pros <b>Concepts and</b> tural performani ition, Material sis; Micromech erties, Properties	Module Module posite material: view of advantage ctives of composite pectus Characteristics: nce of convention response, Classifin anics, Basic lamin of typical composition	egradation of comp Contents and limitations of materials, Science mal material, Ge cation of composi- na properties, Con- ite materials.	of composite mate and technology, cu ometric and phy ite materials, Scal nstituent materials	rials, rrent vsical le of and	Hours 7 7	
Modu I II	Ile Intro chara Signi status Basic Struc defin analy prope Reim	duction to com cteristics, Over ficance and obje and future pros <b>Concepts and</b> tural performan- ition, Material sis; Micromech erties, Properties forcements:	Module Module posite material: view of advantage ctives of composite pectus Characteristics: nce of conventio response, Classifi anics, Basic lami of typical composi- ring, properties and	egradation of comp Contents e and limitations of materials, Science mal material, Ge cation of composi na properties, Con ite materials.	osites. of composite mate and technology, cu ometric and phy ite materials, Scal astituent materials	rials, rrent vsical le of and	<b>Hours</b> 7 7	
Modu I II	Ile Intro chara Signi status Basic Struc defin analy prope Rein Prepa	duction to com cteristics, Over- ficance and obje and future pros <b>concepts and</b> tural performan- ition, Material sis; Micromech erties, Properties forcements: artion-layup, cu ar fibers and Bo	Module Module posite material: view of advantage ctives of composite pectus Characteristics: nce of convention response, Classifi anics, Basic lami of typical composi- ring, properties and properties and prope	egradation of comp Contents e and limitations of materials, Science mal material, Ge cation of composi- na properties, Con- ite materials. d applications of gla ties and application	osites. of composite mate and technology, cu ometric and phy ite materials, Scal astituent materials	rials, rrent vsical le of and bers, rticle	<b>Hours</b> 7 7 7	
Modu I II	Ile Intro chara Signi status Basic Struc defin analy prope Rein Prepa Kevla	duction to com cteristics, Over ficance and obje and future pros concepts and tural performan ition, Material sis; Micromech erties, Properties forcements: aration-layup, cu ar fibers and Bo	Module Module posite material: view of advantage ctives of composite pectus Characteristics: nce of convention response, Classifi anics, Basic lami of typical composi- ring, properties and pron fibers. Proper- hanical Behaviour	egradation of comp Contents e and limitations of materials, Science mal material, Ge cation of composi- na properties, Con- ite materials. d applications of gla ties and application of composites: Ru	osites. of composite mate and technology, cu ometric and phy ite materials, Scal ass fibers, carbon fi ass fibers, carbon fi as of whiskers, pai le of mixtures. In	rials, rrent vsical le of and bers, rticle	Hours           7           7           7           7	
Modu I II	Ile Intro chara Signi status Basic Struc defin analy prope Rein Prepa Kevla reinfo	duction to com cteristics, Over ficance and obje and future pros concepts and tural performan- ition, Material sis; Micromech erties, Properties forcements: mation-layup, cu ar fibers and Bo procements. Mech	Module Module posite material: view of advantage ctives of composite pectus Characteristics: nce of conventio response, Classifi anics, Basic lami of typical composi- ring, properties and pron fibers. Proper hanical Behaviour train and Isostress	egradation of comp Contents e and limitations of materials, Science nal material, Ge cation of composi na properties, Con ite materials. I applications of gla ties and application of composites: Ru conditions.	osites. of composite mate and technology, cu ometric and phy ite materials, Scal ass fibers, carbon fi as of whiskers, par le of mixtures, Inv	rials, rrent vsical le of and bers, rticle verse	Hours           7           7           7           7	
Modu I II III	Ile Intro chara Signi status Basic Struc defin analy prope Rein Prepa Kevla reinfo rule o	duction to com cteristics, Over- ficance and obje and future pros <b>concepts and</b> tural performan- ition, Material sis; Micromech erties, Properties forcements: artion-layup, cu ar fibers and Bo procements. Mech of mixtures. Isos	Module Module posite material: view of advantage ctives of composite pectus Characteristics: nce of convention response, Classifi anics, Basic lami of typical composi- ring, properties and pron fibers. Proper- hanical Behaviour train and Isostress Ietal Matrix Com	egradation of comp Contents and limitations of materials, Science mal material, Ge cation of composi- na properties, Con- ite materials. I applications of gla ties and application of composites: Ru conditions.	osites. of composite mate and technology, cu ometric and phy ite materials, Scal nstituent materials ass fibers, carbon fi ns of whiskers, par le of mixtures, Inv	rials, rrent vsical le of and bers, rticle verse	Hours           7           7           7           7	
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Modu I II III	Ile Intro chara Signi status Basic Struc defin analy prope Rein Prepa Kevla reinfo rule o Man Casti Prope	duction to com cteristics, Over ficance and obje and future pros concepts and tural performan- ition, Material sis; Micromech erties, Properties forcements: mation-layup, cu ar fibers and Bo procements. Mecl or mixtures. Isos ufacturing of M ng–Solid State erties and applica	Module posite material: view of advantage ctives of composite pectus Characteristics: nce of conventio response, Classifi anics, Basic lami of typical composi- ring, properties and pron fibers. Proper hanical Behaviour train and Isostress Ietal Matrix Comp diffusion techn ations. Manufactur	egradation of comp Contents e and limitations of e materials, Science nal material, Ge cation of composi na properties, Con ite materials. d applications of gla ties and application of composites: Ru conditions. posites: ique, Cladding–H ing of Ceramic Mat	osites. of composite mate and technology, cu ometric and phy ite materials, Scal ass fibers, carbon fi as of whiskers, par le of mixtures, Inv tot isostatic press trix Composites: Li	rials, rrent /sical le of and bers, rticle verse	Hours           7           7           7           7           7           7	
Modu I II III	Ile Intro chara Signi status Basic Struc defin analy prope Reim Prepa Kevla reinfo rule o Man Casti Prope	duction to com cteristics, Over- ficance and obje and future pros concepts and tural performan- ition, Material sis; Micromech erties, Properties forcements: aration-layup, cu ar fibers and Bo procements. Meel of mixtures. Isos ufacturing of M ng–Solid State erties and applica I Infiltration–L	Module posite material: view of advantage ctives of composite pectus Characteristics: nce of conventio response, Classifi anics, Basic lami of typical composi- ring, properties and oron fibers. Proper hanical Behaviour train and Isostress Ietal Matrix Comp diffusion techn ations. Manufactur iquid phase sinte	egradation of comp Contents and limitations of materials, Science mal material, Ge cation of composi- na properties, Con- ite materials. I applications of gla ties and application of composites: Ru conditions. posites: ique, Cladding–H ing of Ceramic Mat- ring. Manufacturin	osites. of composite mate and technology, cu ometric and phy ite materials, Scal nstituent materials ass fibers, carbon fi ns of whiskers, par le of mixtures, Inv fot isostatic press trix Composites: Li ng of Carbon–Ca	rials, rrent vsical le of and bers, rticle verse sing. iquid urbon	Hours         7         7         7         7         7         7         7         7	
Modu I II III	Ile Intro chara Signi status Basic Struc defin analy prope Rein Prepa Kevla reinfo rule o Man Casti Prope Meta comp	duction to com cteristics, Over ficance and obje and future pros concepts and tural performan ition, Material sis; Micromech erties, Properties forcements: ration-layup, cu ar fibers and Bo orcements. Mech of mixtures. Isos ufacturing of M ng–Solid State erties and applica Infiltration–Li ossites: Knitting,	Module posite material: view of advantage ctives of composite pectus Characteristics: nce of convention response, Classifi anics, Basic lami of typical composi- ring, properties and pron fibers. Proper hanical Behaviour train and Isostress letal Matrix Comp diffusion techn ations. Manufactur iquid phase sinte Braiding, Weavin	egradation of comp Contents e and limitations of materials, Science nal material, Ge cation of composi- na properties, Con- ite materials. d applications of gla- ties and application of composites: Ru conditions. posites: ique, Cladding–H ing of Ceramic Mai ring. Manufacturing g. Properties and ap	osites. of composite mate and technology, cu ometric and phy ite materials, Scal astituent materials ass fibers, carbon fi as of whiskers, par le of mixtures, Inv fot isostatic press trix Composites: Li ang of Carbon–Ca oplications.	rials, rrent vsical le of and bers, rticle verse sing. iquid urbon	Hours         7         7         7         7         7         7         7	
Modu I II III	Ile Intro chara Signi status Basic Struc defin analy prope Rein Prepa Kevla reinfo rule o Man Casti Prope Meta comp	duction to com cteristics, Over ficance and obje and future pros concepts and tural performan- ition, Material sis; Micromech erties, Properties forcements: mation-layup, cu ar fibers and Bo procements. Meel of mixtures. Isos ufacturing of M ng–Solid State erties and applica l Infiltration–Li osites: Knitting, ufacturing of P	Module posite material: view of advantage ctives of composite pectus Characteristics: nce of conventio response, Classifi anics, Basic lami of typical composi- ring, properties and oron fibers. Proper hanical Behaviour train and Isostress Ietal Matrix Comp diffusion techn ations. Manufactur iquid phase sinte Braiding, Weavin, olymer Matrix Com	Contents Contents and limitations of materials, Science anal material, Ge cation of composi- na properties, Con- ite materials. Applications of gla ties and application of composites: Ru conditions. posites: ique, Cladding–H ing of Ceramic Mat- ring. Manufacturing. Properties and ap- mposites:	osites. of composite mate and technology, cu ometric and phy ite materials, Scal ass fibers, carbon fi as of whiskers, par le of mixtures, Inv tot isostatic press trix Composites: Li applications.	rials, rrent vsical le of and bers, rticle verse ssing. iquid urbon	Hours         7         7         7         7         7         7	
Modu I II III IV	Ile Intro chara Signi status Basic Struc defin analy prope Reim Prepa Kevla reinfo rule o Man Casti Prope Meta comp	duction to com cteristics, Over ficance and obje and future pros concepts and tural performan- ition, Material sis; Micromech erties, Properties forcements: aration-layup, cu ar fibers and Bo procements. Meel of mixtures. Isos ufacturing of M ng–Solid State erties and applica Infiltration–Lio osites: Knitting, ufacturing of Po- aration of Mould	Module posite material: view of advantage ctives of composite pectus Characteristics: nce of convention response, Classifi anics, Basic lami of typical composi- ring, properties and oron fibers. Proper hanical Behaviour train and Isostress Ietal Matrix Comp diffusion techn ations. Manufactur iquid phase sinte Braiding, Weavin olymer Matrix Co	egradation of comp Contents and limitations of materials, Science mal material, Ge cation of composi- na properties, Con- ite materials. d applications of gla ties and application of composites: Ru conditions. posites: ique, Cladding–H ing of Ceramic Mat- ring. Manufacturing. Properties and ap- mposites: d prepregs–hand la	osites. of composite mate and technology, cu ometric and phy ite materials, Scal nstituent materials ass fibers, carbon fi ns of whiskers, par le of mixtures, Inv fot isostatic press trix Composites: Li ng of Carbon–Ca oplications.	rials, rrent vsical le of and bers, rticle verse sing. iquid urbon	Hours         7         7         7         7         7         7         7         7         7         7         7         7         7         7         7         7         7         7         7	
Modu I II III IV	Ile Intro chara Signi status Basic Struc defin analy prope Rein Prepa Kevla reinfo rule o Man Casti Propo Meta comp	duction to com cteristics, Over ficance and obje and future pros concepts and tural performan- ition, Material sis; Micromech erties, Properties forcements: ration-layup, cu ar fibers and Bo orcements. Mech of mixtures. Isos ufacturing of M ng–Solid State erties and applica l Infiltration–La osites: Knitting, ufacturing of Po- cration of Mould od – Filament w	Module posite material: view of advantage ctives of composite pectus Characteristics: nce of convention response, Classifi anics, Basic lami of typical composi- ring, properties and oron fibers. Proper hanical Behaviour train and Isostress <b>Ietal Matrix Comp</b> diffusion techn ations. Manufactur iquid phase sinte Braiding, Weavin, olymer Matrix Co ling compounds an inding method – C	Contents Contents and limitations of materials, Science anal material, Ge cation of composi- na properties, Con- ite materials. A applications of gla- ties and application of composites: Ru conditions. posites: ique, Cladding–H ing of Ceramic Mat- ring. Manufacturing g. Properties and ap- mposites: d prepregs–hand la ompression mouldi	osites. of composite mate and technology, cu ometric and phy ite materials, Scal ass fibers, carbon fi as of whiskers, par le of mixtures, Inv fot isostatic press trix Composites: Li ang of Carbon–Ca oplications. ayup method Autoo ing – Reaction inje	rials, rrent vsical le of and bers, rticle verse ssing. iquid urbon	Hours         7         7         7         7         7         7         7         7         7         7         7         7         7         7         7         7         7         7         7	

VI	Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure- insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentration	6
	Text Books	
1	WD Callister, Materials Science and Engineering, An introduction., John Wiley & So Indian edition, 2007.	ons, NY,
2	Bhagwan D. Agarwal, Lawrence J. Broutman, Analysis and Performance of fiber com John Wiley and Sons, Inc. 1990.	nposites,
	References	
1	Isaac M. Daniels, OriIshai, Engineering Mechanics of Composite Materials, Oxford U Press, 1994.	University
2	Mazumdar S. K., Composite Manufacturing – Materials, Product and Processing Eng CRC Press, Boca Raton, 2002	gineering,
3	Robert M. Jones, Mechanics of Composite Materials, Taylor and Francis, Inc., 1999	
	Useful Links	
1	https://compositesuk.co.uk/composite-materials/introduction	
2	https://nptel.ac.in/content/storage2/courses/101104010/downloads/Lecture3.pdf	
3	https://freevideolectures.com/course/4611/nptel-manufacturing-composites/21	
4	https://nptel.ac.in/courses/112/104/112104221/	

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

## **Assessment (for Theory Course)**

	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						
4	Analyze	5	5	20	30		
5	Evaluate	5	5	20	30		
6 Create		10	10	20	40		
	Total	20	20	60	100		

Walchand	College	of Engineering,	, Sangli

(Government Aided Autonomous Institute)

AY 2021-22				
Course Information				
Programme	M. Tech. (Mechanical Design Engineering)			
Class, Semester First Year M. Tech., Sem I				
Course Code	5DE515			
Course Name	Analysis and Synthesis of Mechanisms			
Desired Requisites:	Kinematics and theory of machines			

Teaching Scheme Examinat			Examination S	cheme (Marks)		
Lecture	3 Hrs/week	T1	T2	ESE	Total	
Tutorial	-	20	20	60	100	
Practical	-					
Interaction	-	Credits: 3				
Course Objectives						

1	To provide students with a sound foundation in kinematic and synthesis of machines an	d
I	mechanisms.	
2	To train the students to apply complex number, matrices and algebra for analysis of med	chanisms.
2	To prepare the students to use modern software for kinematic and dynamic analysis of t	he
3	mechanisms	
	Course Outcomes (CO) with Bloom's Taxonomy Level	
At the	end of the course, students will be able to,	
	Select, configure, and synthesize mechanical components into complete systems. Use	Evaluate
CO1	kinematic geometry to formulate and solve constraint equations to design linkages for	
	specified tasks.	
CO2	Formulate analytical equations describing the relative position, velocity and	Create
02	acceleration of all moving links.	
	Analyze and animate the movement of planar and spherical four-bar linkages. Students	Analyze
CO3	will be able to apply modern computer-based techniques in the selection, analysis, and	
	synthesis of components and their integration into complete mechanical systems.	

Module	Module Contents	Hours
I	Basic Concepts; Definitions and assumptions; planar and spatial mechanisms; kinematic pairs; degree of freedom; equivalent mechanisms; Kinematic Analysis of Planar Mechanisms. Review of graphical and analytical methods of velocity and acceleration analysis of kinematically simple mechanisms, velocity-acceleration, analysis of complex mechanisms by the normal acceleration and auxiliary-point methods.	7
II	Curvature Theory: Fixed and moving centrodes, inflection circle, Euler-Savary equation, Bobillier constructions, cubic of stationary curvature, Ball's point, Applications in dwell mechanisms.	7
III	Kinematic Synthesis of planar mechanisms, accuracy (precision) points, Chebesychev spacing, types of errors, Graphical synthesis for function generation and rigid body guidance with two, three and four accuracy points using pole method, centre and circle point curves, Analytical synthesis of four-bar and slider-	7

	crank mechanisms.	
IV	Freudenstein's equation, synthesis for four and five accuracy points, compatibility condition, synthesis of four-bar for prescribed angular velocities and accelerations using complex numbers, three accuracy point synthesis using complex numbers.	7
V	Coupler Curves: Equation of coupler curve, Robert-Chebychev theorem, double points and symmetry.	6
VI	Kinematic Analysis of Spatial Mechanisms, Denavit-Hartenberg parameters, matrix method of analysis of spatial mechanisms.	6
	Text Books	
1	R.S. Hartenberg and J. Denavit, "Kinematic Synthesis of Linkages", McGraw-Hill, 1980.	New York,
2	Robert L.Nortan, "Design of Machinery', Tata McGraw Hill Edition.	
3	Hamilton H.Mabie,"Mechanisms and Dynamics of Machinery", John Wiley and York.	sons New
	·	
	References	
1	A. Ghosh and A.K. Mallik, "Theory of Machines and Mechanisms", Affiliated East- New Delhi, 1988. Prentice Hall India, 1988.	West Press,
2	A.G. Erdman and G.N. Sandor, "Mechanism Design-Analysis and Synthesis", (Vol	. 1 and 2)
3	A.S. Hall, "Kinematics and Linkage Design", Prentice Hall of India	
4	J.E. Shigley and J.J. Uicker, "Theory of Machines and Mechanisms", 2nd Edition Hill,	, McGraw-
	Useful Links	
1	https://eg4.nic.in/govpoly/DFILES/EBOOKS/IR/ebook TOM_Mechanisms_and_Machines_83b6.pdf	
2	https://s.goessner.net/articles/CubicOfStationaryCurvature.html	
3	https://mech.iitm.ac.in/meiitm/wp-content/uploads/2016/08/Design-Stream-Course Contents.pdf	

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	2	3	4	5	6
CO1	1		2	3		1
CO2	1			3		
<b>CO3</b> 1 1 3						
The stren	gth of mapping i	s to be written a	s 1,2,3; Where,	Low, 2:Mediu	m, 3:High	

## **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 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 (Marks) For Theory Course						
E	Bloom's Taxonomy Level	T1	T2	ESE	Total	
1	Remember					
2	Understand					

3	Apply				
4	Analyze	5	5	20	30
5	Evaluate	5	5	20	30
6	Create	10	10	20	40
	Total	20	20	60	100

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)					
Y 2021-22					
se Information					
chanical Design Engi	neering)				
Tech., Sem I					
Synthesis of Mechania	sms				
d theory of machines					
Examination S	cheme (Marks)				
T2	ESE	Total			
20	60	100			
Crea	lits: 3				
rse Objectives					
tion in kinematic and	synthesis of machines	and			
mechanisms.					
umber, matrices and a	lgebra for analysis of 1	nechanisms.			
oftware for kinematic	and dynamic analysis	f the			
) with Bloom's Taxo	nomv Level				
nical components into	o complete systems. Us	e Evaluate			
nematic geometry to formulate and solve constraint equations to design linkages for					
ibing the relative	position, velocity an	d Create			
anar and spherical for	1r-har linkages Studen	s Analyze			
ased techniques in the	e selection. analysis. an	1			
nthesis of components and their integration into complete mechanical systems.					
1	2				
ule Contents		Hours			
sumptions; planar a	nd spatial mechanism	3;			
quivalent mechanism	s; Kinematic Analysis	f			
hical and analytical	methods of velocity ar	d 7			
ly simple mechanism	s, velocity-acceleratio	1,			
the normal accelera	tion and auxiliary-poi	it			
ng centrodes inflecti	ion circle Fuler-Sava	V			
cubic of stationary	curvature, Ball's poir	, 7			
	ided Autonomous Institut         Y 2021-22         se Information         chanical Design Engin         Tech., Sem I         Synthesis of Mechanical theory of machines         id theory of machines         Examination S         T2         20         Creation of the synthesis of Mechanical theory of machines         Examination S         T2         20         Creation of the synthesis of Mechanical S         ind theory of machines         Examination S         T2         20         Creation of the synthesis of the synthesis and a synthesynthesis and a synthesis and a synthesis and a	ided Autonomous Institute)         Y 2021-22         se Information         chanical Design Engineering)         Tech., Sem I         Synthesis of Mechanisms         id theory of machines         Examination Scheme (Marks)         T2       ESE         20       60         Credits: 3         rse Objectives         ation in kinematic and synthesis of machines         umber, matrices and algebra for analysis of mothematic and dynamic analysis of the of kinematic and dynamic analysis, and the of kinematic and dynamic analysis, and the of kinematic and the selection, analysis, and the selection, analysis, and the selection, analysis, and the analysis of the of the selection, analysis, and the selection, analysis, and the selection, analysis, and the selection and analytical methods of velocity and the selection and analytical methods of velocity and the selection and analytical methods of velocity and the of t			

	Applications in dwell mechanisms.	
III	Kinematic Synthesis of planar mechanisms, accuracy (precision) points, Chebesychev spacing, types of errors, Graphical synthesis for function generation and rigid body guidance with two, three and four accuracy points using pole method, centre and circle point curves, Analytical synthesis of four-bar and slider- crank mechanisms.	7
IV	Freudenstein's equation, synthesis for four and five accuracy points, compatibility condition, synthesis of four-bar for prescribed angular velocities and accelerations using complex numbers, three accuracy point synthesis using complex numbers.	7
V	Coupler Curves: Equation of coupler curve, Robert-Chebychev theorem, double points and symmetry.	6
VI	Kinematic Analysis of Spatial Mechanisms, Denavit-Hartenberg parameters, matrix method of analysis of spatial mechanisms.	6
	Text Books	
1	R.S. Hartenberg and J. Denavit, "Kinematic Synthesis of Linkages", McGraw-Hill, 1980.	New York,
2	Robert L.Nortan, "Design of Machinery', Tata McGraw Hill Edition.	
3	Hamilton H.Mabie,"Mechanisms and Dynamics of Machinery", John Wiley and York.	sons New
	References	
1	A. Ghosh and A.K. Mallik, "Theory of Machines and Mechanisms", Affiliated East-V New Delhi, 1988. Prentice Hall India, 1988.	West Press,
2	A.G. Erdman and G.N. Sandor, "Mechanism Design-Analysis and Synthesis", (Vol.	1 and 2)
3	A.S. Hall, "Kinematics and Linkage Design", Prentice Hall of India	
4	J.E. Shigley and J.J. Uicker, "Theory of Machines and Mechanisms", 2nd Edition, Hill,	McGraw-
	Useful Links	
1	https://eg4.nic.in/govpoly/DFILES/EBOOKS/IR/ebook TOM Mechanisms and Machines 83b6.pdf	
2	https://s.goessner.net/articles/CubicOfStationaryCurvature.html	
3	https://mech.iitm.ac.in/meiitm/wp-content/uploads/2016/08/Design-Stream-Course Contents.pdf	

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

# **Assessment (for Theory Course)**

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

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)							
	AY 2021-22						
			Course l	Information			
Progra	amme		M. Tech. (Mecha	nical Design Engin	eering)		
Class,	Semester		First Year M. Tee	ch., Sem I			
Cours	e Code		5DE516				
Cours	e Name		Process Equipme	ent Design			
Desire	d Requisi	tes:					
	Teaching	Scheme		Examination So	cheme (Marks)		
Lectur	re	3 Hrs/week	T1	T2	ESE	Total	
Tutori	al	-	20	20	60	100	
Practi	cal	-					
Intera	ction	-		Credi	its: 3		
Course Objectives							
1	To prepa	re the students to	o succeed as design	ner in the process in	dustry/technical pro	ofession.	
2	To provid	de students with in the process i	a sound foundation ndustry.	n in process equipn	ent design required	to solve the	
3	To train t construct	he students with ion, installation.	n good design enging, inspection, testing	neering breadth req g and certification o	uired for safe and ef f unfired pressure v	fficient design, essels.	
4	To aware equipment	the students ab	out rules and regul	ations related to the	operational safety	of process	
		Course	Outcomes (CO) w	ith Bloom's Taxor	omy Level		
At the	end of the	course, students	s will be able to,				
C01	Distingui of design	ish types of equip.	pment used in the p	rocess industry and	their general procee	lure Analyze	
CO2	Recomm and safet	end the appropr y measures.	iate equipment for	a process by consi	dering process haza	ards Evaluate	
CO3	Design p of pressu	ressure vessels a re vessels.	nd its correspondin	ng components usin	g BIS and ASME co	odes Create	
Modu	ıle		Module	e Contents		Hours	
Ι	Intro Introc classi	duction to Prod luction, Basic fication of equi	cess Equipments: process requirem pments used in pr	ent of plants and ocess industry, Ger	projects, Types neral design proced	and 6 ure,	

	Materials of construction and corrosion prevention. Design codes required in	
	process equipment design.	
	Pressure Vessels:	
II	Design parameters, Design criteria, Design of pressure vessel components – Shell, Head, Nozzle, flanged joint, Thermal stresses in cylindrical shell, Cylindrical pressure vessels under combined loading, Fabrication process, Inspection and testing of pressure vessels.	7
	High Pressure Vessels:	
III	Constructional features, Stresses in thick walled shells, Multi-shell construction, Shrink fit construction, Stresses in shrink fit construction, Supports for pressure vessels.	7
	Discontinuity stresses in pressure vessel.	
IV	Storage Vessels: Storage vessels and its type, Fixed roof storage tanks, Variable volume tanks-vapor lift type and floating roof type, Accessories of storage tanks, column supported storage tanks, Design of rectangular tanks. Reaction vessel - Heating systems of reaction vessels, Design and construction of jackets	7
	Heat Exchangers:	
V	Types of heat exchangers and constructional features, Design of shell and tube heat exchangers, Arrangements of tubes, baffles, Expansion provisions for heat exchangers.	6
	Evaporators and crystallizers – Types and its constructional features	
VI	Process Equipments: Agitators, Centrifugal machines, Filters and dryers used in process industries. Process hazards and safety in the process industry	7
		1
	Text Books	
1	Mahajani V.V. and Umbrani S.B., "Process Equipment Design", Macmillan Publi Ltd., Fourth edition, 2009.	shing India
2	Bieuro of Indian standard "Code for unfired pressure vessels IS:2825", Indian Institution, Revised Edition	n Standard
	References	
1	Brownell L. E and Young H, "Process Equipment Design", John Willey Public Edition, 2004.	ation, First
2	Harvey J. F., "Theory and Design of Pressure Vessel" CBS Publisher, Third Edition	, 2004.
	Useful Links	
1	https://www.nptel.ac.in/courses/103/107/103107143/	
2	https://nptel.ac.in/courses/103/107/103107207/	
3	https://youtu.be/WG418jpYXKc	
4	https://nptel.ac.in/courses/112/105/112105248/	

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

## 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 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 (Marks) For Theory Course							
Blo	oom's Taxonomy Level	T1	T2	ESE	Total		
1	Remember						
2	Understand						
3	Apply						
4	Analyze	5	5	20	30		
5	Evaluate	5	5	20	30		
6	Create	10	10	20	40		
	Total	20	20	60	100		

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)						
			AY	2021-22		
			Course l	nformation		
Progra	amme		M. Tech. (Mecha	nical Design Engin	eering)	
Class,	Semester		First Year M. Teo	ch., Sem I		
Cours	e Code		5DE516			
Cours	e Name		Process Equipme	nt Design		
Desire	ed Requisi	tes:				
	Teaching SchemeExamination Scheme (Marks)					
Lectur	re	3 Hrs/week	T1 T2 ESE Total			
Tutori	ial	-	20	20	60	100
Practi	cal	-				
Intera	ction	-		Cred	its: 3	
			Course	Objectives		
1	To prepa	re the students to	o succeed as design	ner in the process in	ndustry/technical pr	ofession.
2	To provi	de students with	a sound foundation	n in process equipn	nent design required	d to solve the
	problems	in the process i	ndustry.	• 1 1.1	. 10 0 1	<u> </u>
3	To train t	the students with	i good design engin	neering breadth req	ured for safe and e	efficient design,
	To aware	the students ab	out rules and regul	ations related to the	on unified pressure v	of process
4	equipme	nt	out rules and regul		e operational safety	of process
Course Outcomes (CO) with Bloom's Taxonomy Level						
At the end of the course, students will be able to,						
COL	Distingui	ish types of equi	pment used in the p	rocess industry and	their general proce	dure Analyze
	of design	·				
CO2	Recomm	end the appropr	iate equipment for	a process by cons	idering process haz	ards Evaluate

	and safety measures.					
CO3	Design pressure vessels and its corresponding components using BIS and ASME codes	Create				
	of pressure vessels.					
Modu	le Module Contents	Hours				
Ι	Introduction to Process Equipments: Introduction, Basic process requirement of plants and projects, Types and classification of equipments used in process industry, General design procedure, Materials of construction and corrosion prevention, Design codes required in process equipment design.	6				
II	Pressure Vessels:Design parameters, Design criteria, Design of pressure vessel components – Shell,Head, Nozzle, flanged joint, Thermal stresses in cylindrical shell, Cylindricalpressure vessels under combined loading, Fabrication process, Inspection andtesting of pressure vessels.	7				
Ш	High Pressure Vessels:           Constructional features, Stresses in thick walled shells, Multi-shell construction,           III         Shrink fit construction, Stresses in shrink fit construction, Supports for pressure vessels.           Discontinuity stresses in pressure vessel.					
IV	<ul> <li>Storage Vessels:</li> <li>Storage vessels and its type, Fixed roof storage tanks, Variable volume tanks-vapor lift type and floating roof type, Accessories of storage tanks, column supported storage tanks, Design of rectangular tanks.</li> <li>Reaction vessel - Heating systems of reaction vessels, Design and construction of jackets</li> </ul>	7				
V	Heat Exchangers:           Types of heat exchangers and constructional features, Design of shell and tube heat exchangers, Arrangements of tubes, baffles, Expansion provisions for heat exchangers.           Evaporators and crystallizers – Types and its constructional features.					
VI	Process Equipments:Agitators, Centrifugal machines, Filters and dryers used in process industries.Process hazards and safety in the process industry	7				
	Text Books					
1	Mahajani V.V. and Umbrani S.B., "Process Equipment Design", Macmillan Publi Ltd., Fourth edition, 2009.	shing India				
2	Bieuro of Indian standard "Code for unfired pressure vessels IS:2825", India Institution, Revised Edition	n Standard				
	References					
1	Brownell L. E and Young H, "Process Equipment Design", John Willey Public Edition, 2004.	ation, First				
2	Harvey J. F., "Theory and Design of Pressure Vessel" CBS Publisher, Third Edition	, 2004.				
	Useful Links					
1	https://www.nptel.ac.in/courses/103/107/103107143/					
$\frac{2}{2}$	nups://nptei.ac.in/courses/103/10//10310/20//					
	https://youtu.de/w0418jp1AKC					
4	m.ps.//mp.et.ac.m/courses/112/103/112103240/					

**CO-PO** Mapping

	Programme Outcomes (PO)						
	1	2	3	4	5	6	
CO1	1					2	
CO2			2				
CO3	3		2			3	
The strength of manning is to be written as 1.2.3: Where 1.1 ow 2: Medium 3: High							

## **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 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 (Marks) For Theory Course							
Blo	oom's Taxonomy Level	T1	T2	ESE	Total		
1	Remember						
2	Understand						
3	Apply						
4	Analyze	5	5	20	30		
5	Evaluate	5	5	20	30		
6	Create	10	10	20	40		
	Total	20	20	60	100		

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)							
AY 2021-22							
Course Information							
Programme			M. Tech. (Mechanical Design Engineering)				
Class, Semester			First Year M. Tech., Sem I				
Course Code			5IC501				
Course Name			Value Education				
Desired Requisites:							
Teaching Scheme		Examination Scheme (Marks)					
Lecture 2 Hrs		2 Hrs/week	T1	<b>T2</b>	ESE	Total	
Tutorial		-	20	20	60	100	
Practical		-					
Interaction -		Credits: 0					
Course Objectives							
1	To impar	t knowledge on	value of education and self- development.				
2	To imbib	e good values in	n students.				
3	To highlight importance of character.						
Course Outcomes (CO) with Bloom's Taxonomy Level							

At the	nd of the course, students will be able to,						
CO1	Explain value of education and self- development.						
CO2	Summarize importance of good character, and Behaviour development.	Evaluate					
Modu	Module Module Contents						
Ι	Values and self-development –Social values and individual attitudes. Work ethic I Indian vision of humanism, Moral and non- moral valuation. Standards and principles, Value judgments.						
II	Importance of cultivation of values, Sense of duty. Devotion, Self-reliance, confidence, Concentration. Truthfulness, Cleanliness, Honesty, Humanity, Power of faith, National Unity, Patriotism, Love for nature, Discipline.	6					
III	Personality and Behaviour Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline, Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labour universal brotherhood and religious tolerance, True friendship, Happiness vs. suffering, love for truth, Aware of self- destructive habits, Association and Cooperation, Doing best for saving nature	7					
IV	Character and Competence –Holy books vs. Blind faith, Self-management and Good health, science of reincarnation, Equality, Nonviolence, Humility, Role of Women, All religions and same message, Mind your Mind, Self-control. Honesty, Studying effectively						
Text Books							
1	Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University						
	riess, new Delli						
	References						
1							
Liseful Links							
1	https://nimsuniversity.org/wp-content/uploads/2018/02/Value-Education-Human-Rights-and- Legislative-Procedures.pdf						
2	http://cbseacademic.nic.in/web_material/ValueEdu/Value%20Education%20Kits.pdf						
3	https://www.verywellmind.com/personality-development-2795425						
4	https://trudreadz.com/2019/09/10/blind-faith-in-religion-destroys-our-ability-to-critically- think-for-ourselves/						

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

### **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 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 (Marks) For Theory Course					
Bloom's Taxonomy Level	T1	T2	ESE	Total	
1	Remember				
---	------------	----	----	----	-----
2	Understand	10	10	30	50
3	Apply				
4	Analyze				
5	Evaluate	10	10	30	50
6	Create				
	Total	20	20	60	100

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)								
	AY 2021-22							
			Cou	irse Information				
Progra	amme		M. Tech. (Med	chanical Design Eng	gineering)			
Class,	Semester		First Year M.	Tech., Sem II				
Cours	e Code		5DE521					
Cours	e Name		Finite Element	t Method				
Desire	d Requisi	tes:						
		~ .			~ ~ ~ ~ ~ ~			
<b>.</b> .	Teaching	Scheme		Examinati	on Scheme (Marks	)		
Lectur	re	3 Hrs/week	<u> </u>		ESE		Total	
Tutor		-	20	20	60		100	
Practi		-			0 14 2			
Intera	ction	-	C		Credits: 3			
	Tataah	the free demonster	Co	urse Objectives	anima an tha an daular			
1	and mode	eling issues	s of finite element	method with emph	asize on the underly	ing theor	y, assumption,	
2	To provid systems	de hands on expe	erience using finite	e element software	to model, analyze an	d design	mechanical	
		Cou	irse Outcomes (C	O) with Bloom's 7	<b>Saxonomy Level</b>			
At the	end of the	course, students	will be able to,					
CO1	Classify depender	a given problen nce as Static or I	1 on the basis of i Dynamic, Linear or	its dimensionality a Non-linear.	as 1-D, 2-D, or 3-D	, time-	Understand	
CO2	Construc	t system level n the Galerkin w	natrix equations from	om a given mathen	natical model of a p	roblem	Apply	
	Estimate	three sources of	errors in impleme	enting FEM and sug	gest remedies to mi	nimize	Evaluate	
CO3	the same	for a given prob	olem, viz. Modelin	g errors, Approxim	ation errors, and nur	merical		
	errors.							
	-							
Modu	le	<u> </u>	Modu	le Contents	1 D 1	X 7 1	Hours	
I	Classi	fication of pro	blems – Dimensi	ionality, time dep	endence, Boundary	Value	3	
	Differ	ential equation	e problems, Linear	int for FEM steps	in finite element r	nethod		
	discre	tization types c	of elements used	Shape functions I	inear Elements Lo	cal and		
II	Globa	1 coordinates,	Coordinate trans	formation and G	auss-Legendre sche	eme of	9	
	numer	rical integration,	Nodal degrees of	freedom	C			
III	Finite	element formula	ation, variational, v	weighted residual a	nd virtual work meth	nods.	9	
IV	1-D ai	nd 2-D problems	s from Structural N	Aechanics – Bar, B	eam, Plane stress an	d plane	9	
	Strain problems, Axisymmetric problems – Axi-symmetric forces and geometry         9							
	V         Computer implementation, higher order elements, iso-parametric formulation.         6							
VI	VI Eigen-value problems, Natural vibration of bars and beams, Methods to find eigen- values and eigen-vectors.							
1	Text Books							
	Klaus	Jurgen Bathe, "	Finite Element Pro	cedures" Print ice	Hall of India Pvt. Lto	$\frac{1}{1+1}$	Print,2008	
		ientiewicz "Th	LIOII IO FINILE Elem	Aethod" Tata McGraw	raw Hill Publishing Co	$\frac{1}{2}$ 1 to $\frac{1}{2}$	o th revised edition	
3	3 O.C. Zienkiewicz, "The Finite Element Method", Tata McGraw Hill Publishing Co. Ltd, 5th revised edition ,2000							

	References
1	T.R. Chandrupatla. "Introduction to Finite Element in Engineering", Prentice Hall, New Delhi, 2nd
1	Edition-1997
n	David V. Hutton, Fundamentals of finite element analysis, Tata McGraw Hill Publishing Co. Ltd Second
L	edition 2005
3	S. S. Rao. "Introduction to Finite Element in Engineering", Elsevier, 5th edition, 2012.
4	Cook R.D. "Concepts and applications of finite element analysis" Wiley, New York, 4th Ed. 02.
5	Logan Deryl L., "A First Course in Finite Element Method", Thomson Brook/Cole,5th Ed.
	Useful Links
1	https://www.youtube.com/watch?v=KR74TQesUoQ&list=PLbMVogVj5nJRjnZA9oryBmDdUNe7lbnB0
2	https://www.youtube.com/watch?v=qwQcGruUGwI
3	https://www.youtube.com/results?search_query=+Boundary+Value+problems+in+fea+nptel
4	https://www.youtube.com/watch?v=oz0bUB44LDg

# **CO-PO Mapping**

	11 8								
	Programme Outcomes (PO)								
	1	2	3	4	5	6			
CO1	3								
CO2				3	2	2			
CO3		2	2			3			
The str	ength of mapping	g is to be written	as 1,2,3; Where,	1:Low, 2:Mediu	ım, 3:High				

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

### **Assessment (for Theory Course)**

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course							
B	Bloom's Taxonomy Level	T1	T2	ESE	Total		
1	Remember						
2	Understand	10	10	30	50		
3	Apply	05	05	15	25		
4	Analyze						
5	Evaluate	05	05	15	25		
6	Create						
Total		20	20	60	100		

	Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)								
	AY 2021-22								
			Cou	rse Information					
Progr	amme		M. Tech. (Mec	hanical Design Eng	gineering)				
Class,	Semester		First Year M.	Fech., Sem II					
Cours	e Code		5DE521						
Cours	e Name		Finite Element	Method					
Desire	ed Requisi	tes:							
			1						
	Teaching	Scheme		Examinati	on Scheme (Mark	(s)			
Lectu	re	3 Hrs/week	T1	T2	ESE		Total		
Tutor	ial	-	20	20	60		100		
Practi	cal	-				1			
Intera	ction	-			Credits: 3				
		<u> </u>	Со	urse Objectives					
1	To teach	the fundamentals	s of finite element	method with emph	asize on the under	lying theor	ry, assumption,		
	To provi	de hands on expe	rience using finite	element software t	to model analyze a	nd design	mechanical		
2	systems	de hunds on expe	fielde using fille	element sortware t	to model, unaryze t	ina acoign	meenumeur		
		Cou	rse Outcomes (C	O) with Bloom's T	<b>Faxonomy Level</b>				
At the	end of the	course, students	will be able to,	,					
CO1	Classify depender	a given problem	on the basis of i vnamic. Linear or	ts dimensionality a Non-linear	as 1-D, 2-D, or 3-	D, time-	Understand		
GOA	Construc	t system level ma	atrix equations from	om a given mathem	natical model of a	problem	Apply		
CO2	following	g the Galerkin we	residual m	ethod or principle of	of stationary potent	ial.	11.7		
	Estimate	three sources of	errors in impleme	nting FEM and sug	ggest remedies to n	ninimize	Evaluate		
CO3	the same	for a given probl	lem, viz. Modeling	g errors, Approxim	ation errors, and m	umerical			
	errors.								
	•						**		
Modu		<u> </u>		le Contents	1 D 1	X7 1	Hours		
I	proble	ems, Initial value	problems – Dimensi	Non-linear, etc,	endence, Boundar	y value	3		
	Differ	ential equation a	is the starting poi	int for FEM, steps	in finite element	method,			
II	discre	tization, types of	f elements used, s	Shape functions, L	inear Elements, L	ocal and	9		
	Globa	l coordinates, (	Coordinate trans	formation and Ga	auss-Legendre sch	neme of			
	numer	alament formula	tion variational v	reedom	nd virtual work ma	thoda	0		
		nd 2-D problems	from Structural N	Vergineu residuar ar	eam Plane stress a	nd plane	7		
IV	Strain	problems Axisy	mmetric problems	s = Axi-symmetric	forces and geometr	v	9		
V	Computer implementation higher order elements iso-parametric formulation 6								
	Eigen	-value problems.	Natural vibration	n of bars and bean	ns, Methods to fin	d eigen-			
VI values and eigen-vectors. 4									
	· · · · ·								
				Text Books					
1	Klaus Jurgen Bathe, "Finite Element Procedures" Print ice Hall of India Pvt. Ltd. Fourth Print,2008								
2	J.N. R	eddy. "Introducti	ion to Finite Elem	ent", Tata McGraw	Hill Publishing C	o. Ltd,199	98		
3	0.C. 2 ,2000	Zienkiewicz, "The	e Finite Element N	Iethod", Tata McGı	raw Hill Publishing	, Co. Ltd, 5	5th revised edition		

	References
1	T.R. Chandrupatla. "Introduction to Finite Element in Engineering", Prentice Hall, New Delhi, 2nd
1	Edition-1997
n	David V. Hutton, Fundamentals of finite element analysis, Tata McGraw Hill Publishing Co. Ltd Second
Z	edition 2005
3	S. S. Rao. "Introduction to Finite Element in Engineering", Elsevier, 5th edition, 2012.
4	Cook R.D. "Concepts and applications of finite element analysis" Wiley, New York, 4th Ed. 02.
5	Logan Deryl L., "A First Course in Finite Element Method", Thomson Brook/Cole,5th Ed.
	Useful Links
1	https://www.youtube.com/watch?v=KR74TQesUoQ&list=PLbMVogVj5nJRjnZA9oryBmDdUNe7lbnB0
2	https://www.youtube.com/watch?v=qwQcGruUGwI
3	https://www.youtube.com/results?search_query=+Boundary+Value+problems+in+fea+nptel
4	https://www.youtube.com/watch?v=oz0bUB44LDg

# **CO-PO Mapping**

	· · · · · · · · · · · · · · · · · · ·							
	Programme Outcomes (PO)							
	1	2	3	4	5	6		
CO1	3							
CO2				3	2	2		
CO3		2	2			3		
The str	ength of mapping	g is to be written	as 1,2,3; Where,	, 1:Low, 2:Mediu	m, 3:High			

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

### **Assessment (for Theory Course)**

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course							
B	Bloom's Taxonomy Level	T1	T2	ESE	Total		
1	Remember						
2	Understand	10	10	30	50		
3	Apply	05	05	15	25		
4	Analyze						
5	Evaluate	05	05	15	25		
6	Create						
Total		20	20	60	100		

	Walchand College of Engineering, Sangli						
AY 2021-22							
			Course	Information			
Progr	Programme M. Tech. (Mechanical Design Engineering)						
Class.	Semester		First Year M Te	ch Sem II			
Cours	e Code		5DE522				
Cours	e Name		Computer Aided	Design			
Desire	d Requisi	ites:					
	<u> </u>		1				
1	Teaching	Scheme		Examination S	cheme (Marks)		
Lectur	e.	3 Hrs/week	T1	T2	ESE	Total	
Tutori	al	-	20	20	60	100	
Practi	cal	-		1			
Intera	ction	-		Cred	its: 3		
			Course	Objectives			
1	To intro	duce the students	application of Ge	ometric Dimension	ing and Tolerancing		
2	To impa	rt the students m	odern CAD operat	ions.			
3	To prepa	are the students f	or use of modern F	FEA system			
		Course	Outcomes (CO) w	ith Bloom's Taxo	nomy Level		
At the	end of the	course, students	s will be able to,				
<u>CO1</u>	Demons	trate various app	roaches of geomet	ric modeling		Apply	
CO2	CO2 Analyse geometric dimensioning and tolerancing based on ASME standard in design Analyze						
<u>CO3</u>	Design r	varts using a more	lern parametric CA	AD system		Create	
	Design	arts using a mot				Create	
Modu	le		Module	e Contents		Hours	
I	CAD and Softv	Hardware and output devices, ware modules	Software, Types of hardware integr	f systems and syste ation and networl	m considerations, inj king, hardware tren	ls, 6	
II	Com netw syste	puter Communi ork wring, meth ms	cations, Principle ods, transmission	of networking, of media and interfa	classification network classification network operation	rs, ng 7	
III	Com scalin trans mapp trans	puter Graphics, 1 ng, reflection, formations; map ping, general ma formations and r	Introduction, transf rotation, hom pings of geometri apping, mappings napping	formation of geome ogeneous represe c models, translatio as changes of coo	tric models: translatio entation, concatenat onal mapping rotation rdinate system; invest	on, ed aal 6 se	
IV	Proje curve repre	ections of geome representation sentation of sym	etric models, ortho Parametric repre- thetic curves, curves	ographic projection esentation of anal e manipulations. Su	s, Geometric Modelin ytic curves, paramet rface representation	ic 7	
V	Fundamentals of solid modeling, boundary representation (B-rep), Constructive         Solid Geometry (CSF), sweep representation, Analytic Solid Modeling (ASM),         other representations; solid manipulations, solid modeling based applications: mass         properties calculations, mechanical tolerancing etc						
VI	Finit mode autor of si	e Element Mode eling, mesh ger natic methods, d mulation, areas	eling and Analysis heration mesh req esign and engineer of applications, v	s, Finite Element A juirements, semiau ring applications, S when simulation is	Analysis, finite eleme tomatic methods, fu ystem Simulation, Ne appropriate tool / 1	nt ly ed ot 7	

	Text Books					
1	Zeid Ebrahim, CAD/CAM Theory and Practice, Tata Mc.Graw Hills, 3 rd edition, 2009.					
2	Radhakrishnan P., Subramanyan S., Raju V., CAD/CAM/CIM, , New Age International, 2nd					
	edition, 2010.					
	References					
1	Lee Kunwoo, Principles of CAD/CAM/CAE systems, , Addison Wesley, 2nd edition, 1999					
2	Machover Carl ,The C4 handbook: CAD, CAM, CAE, CIM, Tab Professional and Reference					
Z	Books, 3rdedition, 1998					
2	Taraman Khalil ,CAD-CAM: Meeting Today's Productivity Challenge, University of Michigan,					
5	6th edition, 2012					
	Useful Links					
1	https://www.youtube.com/watch?v=EgKc9L7cbKc					
2	https://www.youtube.com/watch?v=swtH_okidQc&list=PLUtfVcb-iqn8dG1-					
	Cn7NTEdILR3hRVgcN&index=1					
3	https://www.youtube.com/watch?v=0IgOapAtauM					
4	https://www.youtube.com/watch?v=0IgOapAtauM&list=PLC3EE33F27CF14A06&index=43					

	CO-PO Mapping							
		Programme Outcomes (PO)						
	1	2	3	4	5	6		
CO1	3		3		2			
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							
Each CO of the	course must n	nap to at least	one PO.					

#### **Assessment (for Theory Course)**

	Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course								
<b>Bloom's Taxonomy Level</b>		T1	T2	ESE	Total				
1	Remember								
2	Understand								
3	Apply	05	05	15	25				
4	Analyze	05	05	15	25				
5	Evaluate								
6	Create	10	10	30	50				
	Total	20	20	60	100				

Walchand College of Engineering, Sangli									
AY 2021-22									
Course Information									
Progr	amme		M. Tech. (Mechar	nical Design Engi	neering)				
Class,	, Semester		First Year M. Tec	h., Sem II					
Cours	se Code		5DE571						
Cours	se Name		Activity Based La	ab for Th course 3					
Desire	ed Requisi	ites:							
Te	aching Scl	heme (Hrs)		Examination S	Scheme (Marks)				
Lectu	re	-	LA1	LA2	ESE	Total			
Tutor	rial	-	30	30	40	100			
Practi	ical	2		~					
Intera	action	-	~~~~~	Cree	lits: 1				
	<b>—</b> •	1	Course	Objectives					
1	To provi experime own to b	de an opportuni entation selected ring out the cor	ity to student to do d by him/her and en aclusion under the g	work independentl acourage him/her t given circumstance	y on a topic/ problem o think independently o and limitations.	n his/her			
2	To encou completi	arage creative th ng the mini, thr	ninking process to h rough observations,	elp student to get discussions and de	confidence by successfe ecision making process.	ully			
3	To enabl	e student for te	chnical report writin	ng and effective pr	esentations.				
A ( 1) -		Course	Outcomes (CO) w	ith Bloom's Taxo	onomy Level				
At the	$\frac{1}{2}$ Solve field	d problems by	using different tech	niques in mechan	ical design engineering	Apply			
C01	Design a	nd develop suit	able mechanical sy	stems	ical design engineering	Create			
CO3	Prepare a	and present a de	etailed technical rep	ort based on mini	project work	Evaluate			
	· •	1	<b>t</b>		1 J	1			
			Cours	e Content					
Creati verific	on of proto cation of pr	otype/ innovatio rinciples in thru	on of existing produ st areas of Finite El	ct/ analysis or sim ement Method.	ulation of a process/ ex	perimental			
1	Quita	hla haalta haas	Tex	t Books	alastad				
	Suita	ble books based	1 on the contents of	the mini project s	elected.				
			Pof	erences					
1       Suitable books based on the contents of the mini project selected and research papers from Reputed national and international journals and conferences.									
Useful Links									
	As pe	er the need of th	e mini project.						
			CO-PO	) Mapping					

		CO-PO Map	ping					
	Programme Outcomes (PO)							
1	2	3	4	5	6			

CO1	3			1					
CO2			3						
CO3					3	1			
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High									
Each CO	of the course mu	ist map to at leas	st one PO.						

Assessment										
There are three components of lab assessment, LA1, LA2 and Lab ESE.										
IMP: Lab ES	E is a separate head of	passing. LA1, LA	A2 together is treated as In-Semester Evaluat	ion.						
Assessment Based on Conducted by Typical Schedule (for 26-week Sem) Mark										
т. а. 1	Lab activities,	Lab Course	During Week 1 to Week 6	20						
LAI	attendance, journal	Faculty	Marks Submission at the end of Week 6	50						
1.4.2	Lab activities,	Lab Course	During Week 7 to Week 12	20						
	attendance, journal	Faculty	Marks Submission at the end of Week 12	50						
Lob ESE	Lab activities,	Lab Course	During Week 15 to Week 18	40						
Lab ESE	attendance, journal	Faculty	Marks Submission at the end of Week 18	40						
Week 1 indic	ates starting week of a	semester. The tyr	pical schedule of lab assessments is shown.							

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

	Walchand College of Engineering, Sangli						
		(Government Aided	l Autonomous Institu	te)			
	AY 2021-22						
	Course Information						
Programme	M. Tech. (Mechanical Design Engineering)						
Class, Semester	Class, Semester First Year M. Tech., Sem II						
Course Code		5DE572					
Course Name		Activity Based La	ab for Th course 4				
Desired Requisi	tes:						
Teaching Sch	neme (Hrs)	Examination Scheme (Marks)					
Lecture	-	LA1	LA2	ESE	Total		

Tutor	ial	-	30	30	40	100	
Practi	Practical 2						
Intera	Interaction - Credits: 1						
			Course	Objectives			
	To provide an opportunity to student to do work independently on a topic/ problem						
1	1 experimentation selected by him/her and encourage him/her to think independently on his/her						
	own to b	ring out the con	clusion under the g	given circumstances	s and limitations.		
2	To encou	rage creative th	inking process to h	elp student to get c	confidence by succe	ssfully	
	completi	ng the mini, thr	ough observations,	discussions and de	cision making proce	:SS.	
3	To enabl	e student for tec	chnical report write	ng and effective pre	esentations.		
<b>A</b> 4 4 h a	and of the	Course	Outcomes (CO) w	ith Bloom's Taxo	nomy Level		
At the	Solve fie	course, student	s will be able to,	niquas in machani	al dagign anginagri	Apply	
C01	Design a	nd develop suit	able mechanical sy	stoms	cai design engineen	Ig Apply Create	
C02	Design and develop suitable mechanical systems     Create     Design and present a datailed technical report based on mini-present work     Eveluate						
		and present a de				Lvaluate	
			Cours	e Content			
Creatio	on of prote	otype/ apparatus	/ innovation of exi	sting product/ analy	vsis or simulation of	a process/	
experi	mental ver	ification of prin	ciples in thrust are	as of Computer Aid	led Design.	a process,	
· ·		······································	I I I I I I I I I I I I I I I I I I I	I I I I	6		
			Tox	t Dooles			
1	Suita	hle books based	on the contents of	the mini project se	lected		
1	Juita	DIC DOOKS Dased	on the contents of	the min project se			
			Ref	erences			
	Suita	ble books based	on the contents of	the mini project se	lected and research	napers from	
1	Repu	ted national and	international jour	als and conference	es.	pupers nom	
	<b>P</b>		j~				
			Usef	ul Links			
1	As pe	er the need of th	e mini project.				

CO-PO Mapping										
	Programme Outcomes (PO)									
	1	2	3	4	5	6				
CO1	2			1						
CO2			2							
CO3					3	1				
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High										
Each CO	of the course mu	ist map to at leas	st one 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.									
Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks					
TA1	Lab activities,	Lab Course	During Week 1 to Week 6	20					
LAI	attendance, journal	Faculty	Marks Submission at the end of Week 6	50					
1.4.2	Lab activities,	Lab Course	During Week 7 to Week 12	20					
LAZ	attendance, journal	Faculty	Marks Submission at the end of Week 12	50					

Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 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. 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								
Evaluate	10	10	15	35				
Create	10	10	15	35				
Total Marks	30	30	40	100				

	Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)					
			AY	2021-22		
			Course	Information		
Progra	amme		M. Tech. (Mecha	nical Design Engin	eering)	
Class,	Semester		First Year M. Teo	ch., Sem II		
Cours	e Code		5DE573			
Cours	e Name		Industrial Project			
Desire	d Requisi	tes:	Domain knowled	ge of mechanical en	ngineering	
Tea	ching Sch	neme (Hrs)		Examination S	cheme (Marks)	
Lectur	·e	-	LA1	LA2	ESE	Total
Tutori	itorial - 30 30 40 100					100
Practio	cal	-		· · · · · ·		
Intera	ction	2		Cred	its: 2	
		·	Course	Objectives		
1	To Revie	ew and increase	students' understar	nding of the specifi	c topics	
2	To induc	e Learning man	agement of values			
3	To teach	how research p	apers are written a	nd read such papers	critically and effic	iently and to
	summari	ze and review the	nem to gain an und	erstanding of a new	field, in the absen	ce of a textbook
4	To teach	how to judge th	ne value of differen	t contributions and	identify promising	new directions
_	in specifi	ied area			<b>T</b> 1	
A1	1 6 1	Course	Outcomes (CO) w	ith Bloom's Taxo	nomy Level	
At the	end of the	course, student	s will be able to,	1.1		A 1
	Apply th	e existing know	ledge on real life p	roblems		Apply
C02	Investiga	ite the selected	topic/ system	1 (1	1.1	Analyze
003	verify th	e outcomes of t	ne work have solve	ed the specified pro	biems	Evaluate
			C	<b>C</b> + +		
Course Content						

The industrial project work will start in semester II and should be an industrial problem with research potential and should involve scientific research review, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution. Students should undergo industrial projects a registered company/organization after consulting with the faculty guide assigned by the department. Industrial projects should be based preferably in the area in which the candidate is interested to undertake the dissertation work. The student has to be in regular contact with the guide and the topic of the industrial project must be mutually decided. The examination shall consist of the preparation of a report consisting literature review, detailed problem statement, methodology, etc, according to the type of work carried out. The work has to be presented in front of the examiners panel formed by DPGC for evaluation.

	Text Books					
1	As per topic Selected and Journal papers, Conference papers, Handbooks					
	References					
1	As per topic Selected and Journal papers, Conference papers, Handbook					
Useful Links						
1	https://www.entrepreneurindia.co/complete-project-list					
2	https://medium.com/@ThePensters/how-to-write-an-industrial-visit-report-4be6fdbbd1f7					

CO-PO Mapping							
	Programme Outcomes (PO)						
	1	2	3	4	5	6	
CO1	2	2	1				
CO2	3				1		
<b>CO3</b> 3 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 map to at least one PO.

Assessment							
There are three	ee components of lab a	ssessment, LA1,	LA2 and Lab ESE.				
IMP: Lab ES	E is a separate head of	passing. LA1, LA	A2 together is treated as In-Semester Evaluat	ion.			
Assessment	Assessment Based on Conducted by Typical Schedule (for 26-week Sem) Marks						
ТАТ	Lab activities,	Lab Course	During Week 1 to Week 6	20			
LAI	attendance, journal	Faculty	Marks Submission at the end of Week 6	50			
T A D	Lab activities,	Lab Course	During Week 7 to Week 12	20			
LAZ	attendance, journal	Faculty	Marks Submission at the end of Week 12	50			
I oh ESE	Lab activities,	Lab Course	During Week 15 to Week 18	40			
Lauese	attendance, journal	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	ng experiments, n	nini-project, presentations, drawings, program	nming			
and other suit	table activities, as per t	the nature and req	uirement 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		

Walchand College of Engineering, Sangli				
AY 2021-22				
Course Information				
Programme	M. Tech. (Mechanical Design Engineering)			
Class, Semester First Year M. Tech., Sem II				
Course Code	5DE574			
Course Name	Course Name Professional Skills 2			
Desired Requisites:				

Teaching Scheme		Examination Scheme (Marks)				
Lecture	-	LA1	LA2	ESE	Total	
Tutorial	-	30	30	40	100	
Practical	-		· · · · ·		·	
Interaction	1 Hr/Week		Credits: 1			

	Course Objectives					
1	To provide a hands on experience of software in solving complex mechanical engine	eering				
	problems.					
2	To enhance the employability of mechanical design engineering student.					
Course Outcomes (CO) with Bloom's Taxonomy Level						
At the	At the end of the course, students will be able to,					
CO1	Use of the software related to design of mechanical system effectively.	Evaluate				
CO2	Develop the solution for mechanical engineering problem using software.	Create				
CO3	Explain the process of problem solving using computing tools.	Understand				

#### **Course Content**

This course is based on computing as a tool to design and analyse the mechanical system. In the modern day work environment, the Mechanical Design Engineer should be able to simulate and solve complex problems on computers. The Mechanical Design Engineer must be highly computer literate. The engineer with strong fundamentals in Design Engineering and computer software proficiency is highly in demand from industry. Employability of the student can be enhanced by providing software training of 3D modelling software in mechanical engineering.

1

**Text Books** 

Suitable books based on the software selected.

References

1	Suitable books based on the contents of software selected			
Useful Links				
1 As per the need of the software training				

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

Assessment								
There are three components of lab assessment, LA1, LA2 and Lab ESE.								
IMP: Lab ES	E is a separate head of	passing. LA1, LA	A2 together is treated as In-Semester Evaluation	ion.				
Assessment Based on Conducted by Typical Schedule (for 26-week Sem) Marks								
т а 1	Lab activities,	Lab Course	During Week 1 to Week 6	30				
LAI	attendance, journal	Faculty	Marks Submission at the end of Week 6	50				
τ Δ 2	Lab activities,	Lab Course	During Week 7 to Week 12	20				
LAZ	attendance, journal	Faculty	Marks Submission at the end of Week 12	50				
Lob ESE	Lab activities,	Lab Course	During Week 15 to Week 18	40				
Lab ESEattendance, journalFacultyMarks Submission at the end of Week 18								
Week 1 indica	ates starting week of a	semester. The typ	vical 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	10	10	10	30		
Apply						
Analyze						
Evaluate	10	10	15	35		
Create	10	10	15	35		
Total Marks	30	30	40	100		

Walchand College of Engineering, Sangli
(Government Aided Autonomous Institute)
AY 2021-22

	Course Information							
Progr	amme		M. Tech. (Mechanical Design Engineering)					
Class,	Semester		First Year M. Tech., Sem II					
Cours	se Code		5DE523					
Cours	se Name		Tribology in Des	ign				
Desire	ed Requisi	tes:		-0				
	Teaching	Scheme		Examination S	cheme (Marks)			
Lectur	ro	2 Hrs/week	T1	T?	FSF	т	atal	
Lecture         2 ms/week         11         12         ESE           Tutorial         20         20         60			<b>ESE</b>	1	01a1			
Due of		-	20	20	00	1	100	
Ргаси		-		<u> </u>	•			
Intera	ction	-		Crea	its: 2			
ļ			~	~ ~ ~				
	1		Course	Objectives				
1	To create	an awareness o	of the importance of	t tribology in desig	n.			
2	To descr	be the material	selection for minin	nizing friction and	wear in machinery.			
3	To select	bearing and bea	aring arrangement	in machines				
		Course	Outcomes (CO) w	ith Bloom's Taxor	nomy Level			
At the	end of the	course, students	s will be able to,					
CO1	Apply th	e basic theorie	s of friction, wear	and lubrication to	predictions about	the	Apply	
	frictiona	behavior of con	nmonly encountere	ed sliding interface	S.	1 1		
CO2	Select n	naterials and lu	bricants to sugges	st a tribological s	olution to a particu	ilar I	Evaluate	
Situation.							Create	
	COS Design a hydrodynamic bearing using various bearing charts.							
Modu	ıle		Module	Contents			Hours	
Modu	ıle Lubr	ication Theory	Module	e Contents			Hours	
Modu	ile Lubr Intro Beari	<b>ication Theory</b> luction to Tribo ng construction	<b>Module</b> logy, Tribology in a, Tribology in in-	e <b>Contents</b> design – bearing n dustry, Lubrication	naterials - its propert n – introduction, b	ies, asic	Hours	
Modu	Ile Lubr Intro Beari mode	<b>ication Theory</b> duction to Tribo ng construction s of lubricatio	<b>Module</b> logy, Tribology in a, Tribology in in n, Lubricants pro	e Contents design – bearing n dustry, Lubrication perties, Lubricant	naterials - its propert n – introduction, b s standards, Types	ies, asic of	Hours 4	
Modu	Ile Lubr Intro Beari mode addit	<b>ication Theory</b> luction to Tribo ng construction is of lubricatio ives, Bearing T	<b>Module</b> logy, Tribology in a, Tribology in in n, Lubricants pro erminology - Slid	e <b>Contents</b> design – bearing n dustry, Lubrication operties, Lubricant ing contact bearin	naterials - its propert n – introduction, bas s standards, Types gs and Rolling con	ies, asic of tact	Hours 4	
Modu	Ile Lubr Intro Beari mode addit beari	<b>ication Theory</b> duction to Tribo ng construction s of lubricatio ives, Bearing T ngs, Comparison	Module logy, Tribology in a, Tribology in in n, Lubricants pro erminology - Slid n between sliding a	e <b>Contents</b> design – bearing n dustry, Lubrication operties, Lubricant ing contact bearin nd rolling contact b	naterials - its propert n – introduction, b s standards, Types gs and Rolling con pearings.	ies, asic of tact	<b>Hours</b> 4	
Modu	lle Lubr Intro Beari mode addit beari	ication Theory duction to Tribo ng construction is of lubricatio ives, Bearing T ngs, Comparison ion and Wear	<b>Module</b> logy, Tribology in a, Tribology in in- n, Lubricants pro erminology - Slid n between sliding a	e <b>Contents</b> design – bearing n dustry, Lubrication operties, Lubricant ing contact bearin nd rolling contact b	naterials - its propert 1 – introduction, back 1 s standards, Types 1 gs and Rolling con 1 pearings.	ies, asic of tact	Hours 4	
Modu	lle Lubr Intro Beari mode addit beari Frict	ication Theory duction to Tribo ng construction s of lubricatio ives, Bearing T ngs, Comparison ion and Wear on - Laws of fr	Module logy, Tribology in a, Tribology in in n, Lubricants pro erminology - Slid n between sliding a iction, Friction cla	e <b>Contents</b> design – bearing n dustry, Lubrication operties, Lubricant ing contact bearin nd rolling contact be ssification, Causes	naterials - its propert n – introduction, bass s standards, Types gs and Rolling con pearings. of friction, Theorie	ies, asic of tact	Hours 4	
Modu I II	Ile Lubr Introd Beari mode addit beari Frict dry f	ication Theory duction to Tribo ng construction s of lubricatio ives, Bearing T ngs, Comparison ion and Wear on - Laws of fr riction, Friction	Module logy, Tribology in a, Tribology in in n, Lubricants pro erminology - Slid n between sliding a iction, Friction cla n measurement, St	e Contents design – bearing n dustry, Lubrication operties, Lubricant ing contact bearin nd rolling contact b ssification, Causes ick-Slip motion an	naterials - its propert n – introduction, basis s standards, Types gs and Rolling con pearings. of friction, Theories and friction instability	ies, asic of tact s of ies.	<b>Hours</b> 4 4	
Modu I II	Ile Lubr Intro Beari mode addit beari Frict dry f Wear	ication Theory duction to Tribo ng construction is of lubricatio ives, Bearing T ngs, Comparison ion and Wear on - Laws of fr riction, Friction	Module logy, Tribology in a, Tribology in in- n, Lubricants pro erminology - Slid <u>a between sliding a</u> iction, Friction cla <u>a measurement, St</u> cation, Wear between	e Contents design – bearing n dustry, Lubrication operties, Lubricant ing contact bearin nd rolling contact b ssification, Causes ick-Slip motion an een solids, Wear be	naterials - its propert n – introduction, back s standards, Types gs and Rolling con- bearings. of friction, Theories nd friction instability etween solid and lique	ies, asic of tact s of ies. uid,	<b>Hours</b> 4 4	
Modu I II	Ile Lubr Intro Beari mode addit beari Frict dry f Wear Facto	ication Theory luction to Tribo ng construction is of lubricatio ives, Bearing T ngs, Comparison ion and Wear on - Laws of fr riction, Friction - Wear classifi- rs affecting wea	Module logy, Tribology in n, Tribology in in n, Lubricants pro erminology - Slid n between sliding a iction, Friction cla n measurement, St cation, Wear betwee ur, Measurement of	e Contents design – bearing n dustry, Lubrication operties, Lubricant ing contact bearin nd rolling contact bearin ssification, Causes ick-Slip motion an een solids, Wear bear wear, Theories of	naterials - its propert n – introduction, back s standards, Types gs and Rolling con bearings. of friction, Theories nd friction instability etween solid and lique Wear.	ies, asic of tact s of ies. uid,	<b>Hours</b> 4 4	
Modu I II	Ile Lubr Introd Bearin mode addit bearin Frict dry f Wear Facto	ication Theory duction to Tribo ng construction is of lubrication ives, Bearing T ngs, Comparison ion and Wear on - Laws of fr riction, Friction - Wear classifi- rrs affecting wear ication of Bear	Module logy, Tribology in n, Tribology in in n, Lubricants pro- erminology - Slid n between sliding a iction, Friction cla n measurement, St cation, Wear betwee r, Measurement of ings	e Contents design – bearing n dustry, Lubrication operties, Lubricant ing contact bearin nd rolling contact be ssification, Causes ick-Slip motion an een solids, Wear be wear, Theories of	naterials - its propert n – introduction, bass s standards, Types gs and Rolling con- bearings. of friction, Theories nd friction instability etween solid and liq- Wear.	ies, asic of tact s of ies. uid,	<b>Hours</b> 4 4	
Modu I II	Ile Lubr Introd Beari mode addit beari Fricti dry f Wear Facto Lubr	ication Theory duction to Tribo ng construction is of lubricatio ives, Bearing T ngs, Comparison ion and Wear on - Laws of fr riction, Friction - Wear classifi- rs affecting wea ication of Bear ry of hydrodyna	Module logy, Tribology in a, Tribology in in- n, Lubricants pro- derminology - Slid a between sliding a iction, Friction cla a measurement, St cation, Wear between r, Measurement of ings amic lubrication, M	e Contents design – bearing n dustry, Lubrication operties, Lubricant ing contact bearin nd rolling contact be ssification, Causes ick-Slip motion an een solids, Wear be wear, Theories of Mechanism of press	naterials - its propert n – introduction, be s standards, Types gs and Rolling con bearings. of friction, Theories nd friction instability etween solid and liq Wear. sure development in pitations Designing	ies, asic of tact s of ies. uid, oil	<b>Hours</b> 4 4	
Modu I II	Ile Lubr Intro Beari mode addit beari Frict Gry f Wear Facto Lubr Theo film,	ication Theory duction to Tribo ng construction is of lubricatio ives, Bearing T ngs, Comparison ion and Wear on - Laws of fr riction, Friction - Wear classifi- rs affecting wea ication of Bear ry of hydrodyna Two dimensio	Module logy, Tribology in a, Tribology in in- a, Tribology in in- an, Lubricants pro- derminology - Slid a between sliding a iction, Friction cla a measurement, St cation, Wear betwee ar, Measurement of ings amic lubrication, M nal Reynolds"s ec- using Paimondi	e Contents design – bearing n dustry, Lubrication operties, Lubricant ing contact bearin nd rolling contact bearin nd rolling contact bearin ssification, Causes ick-Slip motion an een solids, Wear be wear, Theories of Mechanism of press quation and its lin	naterials - its propert n – introduction, bass s standards, Types gs and Rolling con- bearings. of friction, Theories and friction instability etween solid and lique Wear. sure development in nitations, Designing and Petroff's Soluty	ies, asic of tact s of ies. uid, oil	<b>Hours</b> 4 4 5	
Modu I II	Ile Lubr Intro Beari mode addit beari Frict Gry f Wear Facto Lubr Theo film, journ Parar	ication Theory luction to Tribo ng construction s of lubricatio ives, Bearing T ngs, Comparison ion and Wear on - Laws of fr riction, Friction - Wear classifi- rs affecting weat ication of Bear ry of hydrodyna Two dimensio al bearing by	Module logy, Tribology in n, Tribology in in- n, Lubricants pro- erminology - Slid n between sliding a iction, Friction cla n measurement, St cation, Wear between r, Measurement of ings amic lubrication, M nal Reynolds ^{**} s ec- using Raimondi	e Contents design – bearing n dustry, Lubrication operties, Lubricant ing contact bearin nd rolling contact be ssification, Causes ick-Slip motion ar een solids, Wear be wear, Theories of Mechanism of press quation and its lin and Boyd metho	naterials - its propert n – introduction, be s standards, Types gs and Rolling con bearings. of friction, Theories nd friction instabilit etween solid and liq Wear. sure development in nitations, Designing od, Petroff''s Solut	ies, asic of tact s of ies. uid, oil of ion,	Hours           4           4           5	
Modu I II III	Ile Lubr Introd Beari mode addit beari Fricti dry f Wear Facto ILubr Theo film, journ Parar diam	ication Theory duction to Tribo ng construction is of lubrication ives, Bearing T ngs, Comparison ion and Wear on - Laws of fr riction, Friction - Wear classifi- ris affecting wear ication of Bear ry of hydrodyna Two dimensio al bearing by neters of bearing	Module logy, Tribology in a, Tribology in in a, Tribology in in a, Lubricants pro- erminology - Slid a between sliding a iction, Friction cla a measurement, St cation, Wear betwee ar, Measurement of ings amic lubrication, M nal Reynolds"s ec- using Raimondi g design - Unit bea	e Contents design – bearing n dustry, Lubrication operties, Lubricant ing contact bearin nd rolling contact be ssification, Causes ick-Slip motion an een solids, Wear be wear, Theories of Mechanism of press quation and its lin and Boyd methor ring pressure, Tem	naterials - its propert n – introduction, be s standards, Types gs and Rolling con bearings. of friction, Theories of friction instability etween solid and liq Wear. sure development in nitations, Designing od, Petroff's Soluty apperature rise, Length	ies, asic of tact s of ies. uid, oil of ion, h to	Hours           4           4           5	
Modu I II	Ile Lubr Intro Beari mode addit beari Frict Gry f Wear Facto Lubr Theo film, journ Parar diam	ication Theory duction to Tribo ng construction is of lubrication ives, Bearing T ngs, Comparison ion and Wear on - Laws of fr riction, Friction - Wear classifiers affecting weat ication of Bear ry of hydrodyna Two dimension al bearing by neters of bearing eter ratio, Radia	Module logy, Tribology in a, Tribology in in- n, Lubricants pro- derminology - Slid a between sliding a iction, Friction cla a measurement, St cation, Wear between r, Measurement of ings amic lubrication, M nal Reynolds ^{es} ec- using Raimondi g design - Unit bea l clearance, Minime ust Bearing	e Contents design – bearing n dustry, Lubrication operties, Lubricant ing contact bearin nd rolling contact be ssification, Causes ick-Slip motion an een solids, Wear be wear, Theories of Mechanism of press quation and its lin and Boyd methor ring pressure, Tem um oil-film thickne	naterials - its propert n – introduction, be s standards, Types gs and Rolling con pearings. of friction, Theorie nd friction instabilit etween solid and liq Wear. sure development in nitations, Designing od, Petroff''s Solut perature rise, Lengtl ess.	ies, asic of tact s of ies. uid, of ion, h to	Hours           4           4           5	
Modu I II III	Ile Lubr Intro Beari mode addit beari Frict Gry f Wear Facto Lubr Theo film, journ Parar diam	ication Theory luction to Tribo ng construction is of lubricatio ives, Bearing T ngs, Comparison ion and Wear on - Laws of fr riction, Friction - Wear classifi- ris affecting wea ication of Bear ry of hydrodyna Two dimensio al bearing by neters of bearing eter ratio, Radia rodynamic Thre	Module logy, Tribology in a, Tribology in in- n, Lubricants pro- erminology - Slid a between sliding a iction, Friction cla a measurement, St cation, Wear between r, Measurement of ings amic lubrication, M nal Reynolds"s eco using Raimondi g design - Unit bea l clearance, Minimu ust Bearing of hydrodynamic fl	e Contents design – bearing n dustry, Lubrication operties, Lubricant ing contact bearin nd rolling contact be ssification, Causes ick-Slip motion an een solids, Wear be wear, Theories of Mechanism of press quation and its lin and Boyd methor ring pressure, Tem um oil-film thickne	naterials - its propert n – introduction, bass s standards, Types gs and Rolling con- bearings. of friction, Theories nd friction instabilite tetween solid and lique Wear. sure development in nitations, Designing od, Petroff's Solution perature rise, Lengthess.	ies, asic of tact s of ies. uid, oil g of ion, h to	Hours         4         4         5         4	
Modu I II III	Ile Lubr Introd Beari mode addit beari Frict Gry f Wear Facto Lubr Theo film, journ Parar diame Hydu Introd	ication Theory duction to Tribo ng construction is of lubrication ives, Bearing T ngs, Comparison ion and Wear on - Laws of fr riction, Friction - Wear classifi- ris affecting wear ication of Bear ry of hydrodyna Two dimensio al bearing by neters of bearing eter ratio, Radia rodynamic Thru luction, Types on ng, Tilting pad f	Module logy, Tribology in a, Tribology in in a, Tribology in in a, Lubricants pro- erminology - Slid a between sliding a iction, Friction cla a measurement, St cation, Wear betwee ar, Measurement of ings amic lubrication, M nal Reynolds"s ec- using Raimondi g design - Unit bea l clearance, Minima ust Bearing of hydrodynamic th hrust bearing and F	e Contents design – bearing n dustry, Lubrication operties, Lubricant ing contact bearin nd rolling contact be ssification, Causes ick-Slip motion and een solids, Wear be wear, Theories of Mechanism of press quation and its lin and Boyd methor ring pressure, Tem um oil-film thicknet hrust bearing, Ana Rayleigh step bearing	naterials - its propert a – introduction, be s standards, Types gs and Rolling con- bearings. of friction, Theories and friction instabilite tetween solid and lique Wear. sure development in nitations, Designing od, Petroff's Solute perature rise, Lengthess. lysis of flat plate thang.	ies, asic of tact s of ies. uid, oil oil of ion, h to	Hours       4       4       5       4	
Modu I II III	Ile       Ile     Lubr       Introd     Beari       mode     addit       beari     beari       Frict     Frict       Frict     Frict       Vear     Facto       Lubr     Theo       film,     journ       Parar     diamo       Hydu     Introd       beari     Hydu	ication Theory duction to Tribo ng construction is of lubricatio ives, Bearing T ngs, Comparison ion and Wear on - Laws of fr riction, Friction - Wear classifi- riction, Friction - Wear classifi- riction of Bear ry of hydrodyna Two dimensio al bearing by neters of bearing eter ratio, Radia rodynamic Thre duction, Types on ng, Tilting pad t	Module logy, Tribology in a, Tribology in in- n, Lubricants pro- erminology - Slid a between sliding a iction, Friction cla a measurement, St cation, Wear between r, Measurement of ings amic lubrication, M nal Reynolds"s ec- using Raimondi g design - Unit bea l clearance, Minimu ust Bearing of hydrodynamic th hrust bearing and F ueeze Film Lubric	e Contents design – bearing n dustry, Lubrication operties, Lubricant ing contact bearin nd rolling contact be ssification, Causes ick-Slip motion an een solids, Wear be wear, Theories of Mechanism of press puation and its lin and Boyd methor ring pressure, Tem um oil-film thicknee hrust bearing, Ana Rayleigh step bearin <b>ation</b>	naterials - its propert n – introduction, be s standards, Types gs and Rolling con- bearings. of friction, Theories and friction instabilite tetween solid and liqs Wear. sure development in nitations, Designing od, Petroff [*] s Solution perature rise, Lengthess. lysis of flat plate thang.	ies, asic of tact s of ies. uid, oil g of ion, h to	Hours         4         4         5         4	
Modu I II III	Ile Lubr Intro Beari mode addit beari Frict Fricti dry f Wear Facto Iubr Theo film, journ Parar diam <b>Hydn</b> Intro beari	ication Theory duction to Tribo ng construction is of lubricatio ives, Bearing T ngs, Comparison ion and Wear on - Laws of fr riction, Friction - Wear classifi- ris affecting wea ication of Bear ry of hydrodyna Two dimensio al bearing by neters of bearing eter ratio, Radia rodynamic Thru- duction, Types on ng, Tilting pad to rostatic and Squostatic Lubrication	Module logy, Tribology in a, Tribology in in- a, Tribology in in- a, Lubricants pro- derminology - Slid a between sliding a iction, Friction cla a measurement, St cation, Wear betwee ar, Measurement of ings amic lubrication, M nal Reynolds"s ec- using Raimondi g design - Unit bea l clearance, Minimu ust Bearing of hydrodynamic th hrust bearing and F ueeze Film Lubric on – Basic concept	e Contents design – bearing n dustry, Lubrication perties, Lubricant ing contact bearin nd rolling contact bearin nd rolling contact bearin sification, Causes ick-Slip motion an een solids, Wear be wear, Theories of dechanism of press quation and its lin and Boyd metho ring pressure, Tem um oil-film thicknee hrust bearing, Ana Rayleigh step bearin ation , Advantages and li	naterials - its propert n – introduction, bass s standards, Types gs and Rolling con- bearings. of friction, Theories and friction instabilite etween solid and lique Wear. sure development in nitations, Designing od, Petroff [*] s Solution perature rise, Lengthess. lysis of flat plate thang.	ies, asic of tact s of ies. uid, oil g of ion, h to rust	Hours         4         4         5         4	
Modu I II III IV	Ile Lubr Intro Beari mode addit beari Frict Gry f Wear Facto Iubr Theo film, journ Parar diam Aydu Intro beari Hydu	ication Theory luction to Tribo ng construction is of lubricatio ives, Bearing T ngs, Comparison ion and Wear on - Laws of fr riction, Friction - Wear classifi- ris affecting weat ication of Bear ry of hydrodyna Two dimensio al bearing by neters of bearing eter ratio, Radia rodynamic Thru duction, Types on ng, Tilting pad t rostatic and Squ ostatic Lubricati gh rectangular	Module logy, Tribology in in- n, Tribology in in- n, Lubricants pro- erminology - Slid n between sliding a iction, Friction cla n measurement, St cation, Wear betwee r, Measurement of ings amic lubrication, M nal Reynolds"s ec- using Raimondi g design - Unit bea l clearance, Minimu ust Bearing of hydrodynamic th hrust bearing and F ueeze Film Lubric on – Basic concept slot, Load carrving	e Contents design – bearing n dustry, Lubrication operties, Lubricant ing contact bearin nd rolling contact be ssification, Causes ick-Slip motion ar een solids, Wear be wear, Theories of Mechanism of press juation and its lin and Boyd methor ring pressure, Tem um oil-film thicknee hrust bearing, Ana Rayleigh step bearin <b>ation</b> , Advantages and ling capacity and flo	naterials - its propert n – introduction, be s standards, Types gs and Rolling con- bearings. of friction, Theories and friction instabilite etween solid and lique Wear. sure development in nitations, Designing od, Petroff's Solute perature rise, Length ess. lysis of flat plate that ng. imitations, Viscous f w requirement, Ene	ies, asic of tact s of ies. uid, oil oil of ion, h to rust	Hours         4         4         5         4	
Modu I II III IV V	Ile Lubr Introd Beari mode addit beari Frict Gry f Wear Facto Iubr Theo film, journ Parar diam diam Hydu Introd bearir Hydu	ication Theory duction to Tribo ng construction is of lubrication ives, Bearing T ngs, Comparison ion and Wear on - Laws of fr riction, Friction - Wear classifi- ris affecting weat ication of Bear ry of hydrodyna Two dimension al bearing by neters of bearing eter ratio, Radia rodynamic Thru duction, Types on ng, Tilting pad t rostatic and Squ ostatic Lubricati gh rectangular s, Optimum desi	Module logy, Tribology in a, Tribology in in a, Tribology in in a, Lubricants pro- erminology - Slid a between sliding a iction, Friction cla a measurement, St cation, Wear betwee ar, Measurement of ings amic lubrication, M nal Reynolds"s ec- using Raimondi g design - Unit bea l clearance, Minima ust Bearing of hydrodynamic th hrust bearing and F ueeze Film Lubric on – Basic cocept slot, Load carrying ign. Hydrostatic co	e Contents design – bearing n dustry, Lubrication operties, Lubricant ing contact bearin nd rolling contact be ssification, Causes ick-Slip motion an een solids, Wear be wear, Theories of Mechanism of press quation and its lin and Boyd methor ring pressure, Tem um oil-film thicknet hrust bearing, Ana Rayleigh step bearin ation , Advantages and li g capacity and flo nical thrust bearing	naterials - its propert n – introduction, be s standards, Types gs and Rolling con- bearings. of friction, Theories of friction instabilite tetween solid and lique Wear. sure development in nitations, Designing od, Petroff's Solute apperature rise, Length ess. lysis of flat plate that ng. amitations, Viscous f w requirement, Energy	ies, asic of tact s of ies. uid, oil j of ion, h to rust	Hours         4         4         5         4         5         4         5         5         5         5         5         5         5	
Modu I II III IV V	Ile Lubr Intro Beari mode addit beari Frict Fricti dry f Wear Facto Iubr Theo film, journ Parar diam Barar diam Hydr Hydr Hydr throu losse Sque	ication Theory duction to Tribo ng construction is of lubricatio ives, Bearing T ngs, Comparison ion and Wear on - Laws of fr riction, Friction - Wear classifier riction, Friction - Wear classifier is affecting weat ication of Bear ry of hydrodyna Two dimension al bearing by neters of bearing eter ratio, Radia rodynamic Thre duction, Types of ng, Tilting pad t rostatic Lubricati gh rectangular s, Optimum desi peze Film Lubricati	Module logy, Tribology in a, Tribology in in- a, Tribology in in- a, Lubricants pro- derminology - Slid a between sliding a iction, Friction cla a measurement, St cation, Wear betwee ar, Measurement of ings amic lubrication, M nal Reynolds"s ec- using Raimondi g design - Unit bea l clearance, Minimust Bearing of hydrodynamic th hrust bearing and F ueeze Film Lubric on – Basic concept slot, Load carrying gn. Hydrostatic co- cation - Basic cond	e Contents design – bearing n dustry, Lubrication operties, Lubricant ing contact bearin nd rolling contact be ssification, Causes ick-Slip motion an een solids, Wear be wear, Theories of Mechanism of press juation and its lin and Boyd methor ring pressure, Tem um oil-film thicknee hrust bearing, Ana Rayleigh step bearin <b>ation</b> , Advantages and ling g capacity and flo nical thrust bearing cept, Squeeze action	naterials - its propert n – introduction, be s standards, Types gs and Rolling con- bearings. of friction, Theories and friction instability etween solid and liq Wear. sure development in nitations, Designing od, Petroff's Soluty perature rise, Lengthess. lysis of flat plate the ng. imitations, Viscous f w requirement, Energy on between circular	ies, asic of tact s of ies. uid, oil g of ion, h to rust low orgy and	Hours         4         4         5         4         5         5         5	

VI	<b>Elasto-Hydrodynamic Lubrication</b> Principles and Applications, Pressure viscosity term in Reynolds"s equation, Hertz" theory, Ertel - Grubin equation, lubrication of spheres, gear teeth and rolling element bearings, Gas (Air-) Lubricated Bearings: Introduction, Merits, Demerits and Applications.	4
	Text Books	
1	Basu, Sengupta and Ahuja, "Fundamentals of Tribology", PHI Learning, First edition	on, 2011.
2	Sushil Kumar Srivatsava, "Tribology in Industry", S. Chand Publisher, Revised edit	ion, 2001
	References	
1	Majumdar B.C., "Introduction to Tribology of Bearings", S. Chand and Company Edition, 2010.	Ltd., First
2	Bharat Bhushan, "Handbook of Tribology", Krieger Publishing Company, First Edit	tion, 1997.
3	Mervin H. Jones and Douglas Scott, "Industrial Tribology - The Practical Aspects of Lubrication and Wear", Elsevier Scientific Publishing Company Amsterdam-O York, 1991.	of Friction, xford-New
4	PrasannaSahoo, "Engineering Tribology", PHI Learning Pvt. Ltd., First Edition, 20	11.
	Useful Links	
1	https://nptel.ac.in/courses/112/102/112102015/	
2	https://nptel.ac.in/courses/112/102/112102014/	
3	https://nptel.ac.in/courses/112/106/112106137/	
4	https://nptel.ac.in/courses/113/108/113108083/	

CO-PO Mapping								
	Programme Outcomes (PO)							
	1 2 3 4 5 6							
CO1	2		1			2		
CO2 2 2								
CO3	1	2	2			3		
The streng	th of mapping is	to be written as	1.2.3: Where 1	Low 2. Mediun	n 3:High			

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

## **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 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 (Marks) For Theory Course						
Blo	om's Taxonomy Level	T1	T2	ESE	Total	
1	Remember					
2	Understand					
3	Apply	05	05	20	30	
4	Analyze					
5	Evaluate	05	05	20	30	
6	Create	10	10	20	40	
	Total	20	20	60	100	

	Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)							
	AY 2021-22							
			Course	Information				
Progr	Programme M. Tech. (Mechanical Design Engineering)							
Class.	Semester		First Year M. Tech	Sem II				
Cours	Course Code 5DE524							
Cours	Course Name Robotics							
Desire	d Requisites.		Robolies					
Desire	a Requisites.							
	Teaching Sc	heme		Fyaminatia	n Scheme (Marks)			
Lectur	·	2 Hrs/week	T1	T?	FSF	Total		
Tutori		2 1115/ WCCK	20	20	60	100		
Drooti		-	20	20	00	100		
Fracu		-		(	Nan J:4an D			
Intera	cuon	-			realts: 2			
	T : / 1	. 1			• • • •			
1	To introduce	students to func	lamentals of robot v	vorking, programn	ning and integration in a	manufacturing		
2	To male stud	lante understand	having working com	nonants of an indu	astrial robot			
2	To make stuc	recent technolo	av as machina visio					
5	To muoduce	Cours	gy as machine visio	11 vith Plaam's Tav	onomy Loval			
At the	end of the cou	rse students wi	ll be able to					
	Understand b	asic terminolog	ies and concepts as	sociated with Robo	tics and Automation	Understand		
$\frac{CO1}{CO2}$	Demonstrate	comprehension	of various Robotic	sub-systems		Apply		
C02	Analyse kine	matics and dyna	mics to explain examises	oct working pattern	of robots	Analyze		
	7 maryse kine	maties and dyna	unies to explain ext	et working pattern	101100003	7 maryze		
Modu	le		Module C	ontents		Hours		
112040	Introduct	ion						
	Basic Con	Basic Concepts such as Definition, three laws, DOF, Misunderstood devices etc., Robot						
	anatomy,	anatomy, Classification, Associated parameters i.e. resolution, accuracy, repeatability.						
1	dexterity,	dexterity, compliance, etc. Automation - Concept, Need, Principles and Strategies of						
	Automatic	Automation, Basic Elements of an Automated System, Advanced Automation Functions,						
	Levels of	Automations, in	troduction to autom	ation productivity				
	Robot Gr	ippers						
П	Types of	Types of Grippers, Design aspect for gripper, Sensors for Robots- Characteristics of						
	sensing de	vices, Selectior	ns of sensors, Class	ification and appli	cations of sensors. Need			
	for sensor	s and vision sys	tem in the working	and control of a ro	bot.			
	Drives an	d control syste	ms	1.1 1	1			
	Types of	Drives, Actuato	rs and its selection	while designing a	robot system. Types of	4		
111	control C	on systems, Cor	agios in Automati	s of Controllers, In	uroduction to closed loop	4		
	Industries Discrete Control							
	Kinomoti		01.					
	Transform	ustion matrices	and their arithmet	ic link and join	description Denavit			
IV	Hartenber	g narameters	frame assignment	to links direct	kinematics kinematics	4		
	redundanc	v. kinematics	calibration invers	e kinematics so	lyability, algebraic and	т		
	geometric	al methods. Vel	ocities and Static for	rces in manipulate	rs			
L	Marking	geometrical methods. Velocities and Static forces in manipulators						
	Machine	Vision System				_		

	Processing Techniques, Noise reduction methods, Edge detection, Segmentation, motion			
	types such as <b>PAI</b> and <b>VAI</b> . If etc. Features of type and development of languages for			
	recent robot systems			
	Modeling and Simulation for manufacturing Plant Automation			
VI	Introduction, need for system Modeling, Building Mathematical Model of a manufacturing Plant, robots and application of robots for automation. Introduction to Artificial Intelligence, AI techniques, Need and application of AI	4		
	Text Books			
1	John J. Craig, Introduction to Robotics (Mechanics and Control), Addison-Wesley, 2nd E	dition, 04		
2	Mikell P. Groover et. Al., Industrial Robotics: Technology, Programming and Applications			
	² International, 1986.			
3	Shimon Y. Nof, Handbook of Industrial Robotics, John Wiley Co, 01.			
	References			
1	Richard D. Klafter, Thomas A. Chemielewski, Michael Negin, Robotic Engineer Approach, Prentice Hall India, 02.	ing: AnIntegrated		
2	Handbook of design, manufacturing & Automation: R.C. Dorf, John Wiley and Sons.			
	Useful Links			
1	https://nptel.ac.in/courses/112/104/112104298/			
2	https://nptel.ac.in/courses/107/106/107106090/			
3	https://nptel.ac.in/courses/112/107/112107289/			
4	https://nptel.ac.in/courses/112/105/112105249/			

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

**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 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 (Marks) For Theory Course						
	Bloom's Taxonomy Level	T1	Т2	ESE	Total	
1	Remember					
2	Understand	05	05	15	25	
3	Apply	10	10	30	50	
4	Analyze	05	05	15	25	
5	Evaluate					
6	Create					
	Total	20	20	60	100	

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)						
			ZUZI-ZZ			
Drogrommo		M Tech (Me	chanical Design I	Engineering)		
Class Somester		First Vear M	Tech Sem II	Singineering)		
Course Code		5DF525	. Teen., Seni n			
Course Name		Fracture Mec	hanics			
Desired Requisites:						
Teaching	Scheme		Examinatio	n Scheme (Marks)		
Lecture	2 Hrs/week	T1	T2	ESE	Total	
Tutorial	_	20	20	60	100	
		20		00		
Practical	-					
Interaction	-		C	credits: 2		
	· · ·	Course	e Objectives			
1 To des	cribe the near field	l equations to det	ermine the stress-	strain and load-displa	cement fields around	
a crack	tip for linear elas	tic cases.				
2 To rec	ognize and formul	ate the stress inte	ensity factor ((K) f	for typical crack config	gurations.	
3 To ide	ntify and formulat	e the strain energ	y release rate (G)			
At the end of the co	Course Co	be able to	with Bloom's Tax	konomy Level		
CO1 Relate	the basic concepts	regarding solid	materials		Apply	
CO2 Check	the procedures to	carryout analysis	of failure		Evaluate	
CO3 Design	of Failure analys	sis template			Create	
					1	
Module		Modul	le Contents		Hours	
I In de	troduction to Mate formation	erial Behavior, o	verview of disloc	cation theory and plas	tic 4	
II O as	verview of Engin pects, Fracture, Fa	eering Fracture tigue, Creep, Mo	Mechanics: Kind des of fracture fai	s of failures, Historic	cal 4	
III Su re re Ch	irface energy, Grif lease rate of DC sistance stable an itical energy relea	ffith's realization and analysis, Energy release rate, Energy CB specimen, inelastic deformation at crack tip, Crack ad unstable crack growth, R curve, thin and thick plate, provide the stress intensity factor relation between GL and KL			gy ck 5 II	
IV         Anelastic deformation at the crack tip, modelling of Plastic Deformation, effective crack length, effect of plate thickness.         4				on, 4		
V El in	astic plastic analy tegral, applications	vsis, J-integral, d s. Fracture Tough	efinition and eng	ineering approach of	J- 5	
VI Ci	ack tip opening c nall scale yielding.	lisplacement, rela Failure analysis-	ationship betweer	n CTOD, KI and GI tures case studies.	eor 4	

Text Books								
1	Prashant Kumar, "Elements of Fracture Mechanics", Tata McGraw Hill, New Delhi, India, 2009.							
2	K. Ramesh, e-Book on Engineering Fracture Mechanics, IIT Madras, 2007. URL:							
Z	http://apm.iitm.ac.in/smlab/kramesh/book_4.htm							
3	K. R.Y. Simha, "Fracture Mechanics for Modern Engineering Design", Universities Press (India)							
	Limited, 2001.							
	References							
1	D. Broek, "Elementary Engineering Fracture Mechanics", Kluwer Academic Publishers, Dordrecht,							
1	1986.							
2	T.L. Anderson, "Fracture Mechanics - Fundamentals and Applications", 3rd Edition, Taylor and							
	Francis Group, 2005.							
	Useful Links							
1	https://www.youtube.com/watch?v=hnkFR5J_Ifw&list=PLfIFNJ1DPG4nwAQAY8aEi2-							
1	1JPwCRj9Gq							
2	https://www.youtube.com/watch?v=9lwnE77utoo							
3	https://www.youtube.com/watch?v=rKi6_ibjVPA							
4	https://www.youtube.com/watch?v=eGwqCwgFBlw							

CO-PO Mapping									
		Programme Outcomes (PO)							
	1 2 3 4 5 6								
CO1		1	3	2	1	2			
CO2 2 1 3 2									
CO3	1	2	1		1	2			
The strength of r	The strength of manning is to be written as 1.2.2; Where 1:Low 2: Medium 2: High								

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 (for Theory Course)**

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course					
	<b>Bloom's Taxonomy Level</b>	T1	T2	ESE	Total
1	Remember				
2	Understand				
3	Apply	05	05	15	25
4	Analyze				
5	Evaluate	05	05	15	25
6	Create	10	10	30	50
	Total	20	20	60	100

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)						
	AY 2021-22					
	Course Information					
Progra	amme		M.Tech. (	Mechanical Des	ign Engineering)	
Class,	Semester		First Year	M. Tech., Sem	II	
Cours	e Code		5DE526			
Cours	e Name		Advanced	Metallurgy		
Desire	d Requisites					
	Teach	ing Scheme		Examinat	tion Scheme (Marl	(S)
Lectur	e	2 Hrs/week	<b>T1</b>	T2	ESE	Total
Tutori	al	-	20	20	60	100
Practi	cal	-				
Intera	ction	-			Credits: 2	
			Course Ob	jectives		
		Course Outcon	nes (CO) with	Bloom's Taxon	omy Level	
At the	end of the co	ourse, students will be able	to,			1
C01	Apply varie acquisition	ous aspects of crystal and of knowledge of composite	lattice structure es, ceramics, or	e and their impe thodontal and bi	erfection, and also omaterials	Apply
CO2	Discuss im	portance of equilibrium dia	grams and their	r uses in develop	oing materials	Evaluate
CO3	Explain the decide a he	process of heat treatment at treatment to acquire their	of different no r desired proper	nferrous alloys rties	and tool steel and	Understand
Module         Module Contents         Hours						
Mouu	le		Module Collie	2015		Hours
Ι	Crystal s ordinatio	structure, systems, Indexin on Number, Density calcula	g of lattice pla tions and imper	nes, Indexing or rfections in crys	f lattice directions, tals	Co- 4
I	Crystal s ordinatic Study of	structure, systems, Indexin on Number, Density calcula Equilibrium diagrams for	g of lattice pla tions and imper	nes, Indexing o rfections in crys , Cu - Bronze a	f lattice directions, tals lloys, Developmen	Hours       Co-       4       ts in
I	Crystal s ordinatic Study of metallic	structure, systems, Indexin on Number, Density calcula Equilibrium diagrams for materials like HSLA state,	g of lattice pla ations and imper Fe-C systems, dual phased sto	nes, Indexing o rfections in crys , Cu - Bronze a cels, creep resist	f lattice directions, tals lloys, Developmen ing steels, material	HoursCo-4ts ins for5
I	Crystal s ordinatic Study of metallic high and	structure, systems, Indexin on Number, Density calcula Equilibrium diagrams for materials like HSLA state, low temperature applicatio	g of lattice pla tions and imper Fe-C systems, dual phased sto	nes, Indexing o rfections in crys , Cu - Bronze a cels, creep resist	f lattice directions, tals lloys, Developmen ing steels, material	Hours       Co-       4       ts in s for       5
I II III	Crystal s ordination Study of metallic high and Heat Tre	structure, systems, Indexin on Number, Density calcula Equilibrium diagrams for materials like HSLA state, low temperature application atment of Nonferrous alloy	g of lattice pla tions and imper Fe-C systems, dual phased sto ons gs, Heat Treatm	nes, Indexing o rfections in crys , Cu - Bronze a eels, creep resist ent of Tool steel	f lattice directions, tals lloys, Developmen ing steels, material	Hours       Co-       4       ts in s for       5       4
I II III IV	Crystal s ordinatic Study of metallic high and Heat Tre Orthoden materials	structure, systems, Indexin on Number, Density calcula Equilibrium diagrams for materials like HSLA state, low temperature application atment of Nonferrous alloy ntal materials, Bio material, s.	g of lattice pla ations and imper Fe-C systems, dual phased sto ons /s, Heat Treatm Prosthetic mate	nes, Indexing o rfections in crys , Cu - Bronze a cels, creep resist ent of Tool steel erials, Nano mat	f lattice directions, tals lloys, Developmen ing steels, material s erials, super conduc	HoursCo-4ts in s for544cting5
I II III IV V	Crystal s ordinatic Study of metallic high and Heat Tre Orthoden materials Composi advantag	structure, systems, Indexin, on Number, Density calcula Equilibrium diagrams for materials like HSLA state, low temperature application atment of Nonferrous alloy that materials, Bio material, s. tes, ceramics, cermets, shows and limitations.	g of lattice pla ations and imper Fe-C systems, dual phased sto ons <u>7s</u> , Heat Treatm Prosthetic mate	nes, Indexing o rfections in crys , Cu - Bronze a eels, creep resist ent of Tool steel erials, Nano mat alloys their man	f lattice directions, tals lloys, Developmen ing steels, material s erials, super conduc	HoursCo-4ts in s for544cting5jues,4
IIIIIIIV V VI	Crystal s ordination Study of metallic high and Heat Tre Orthoder materials Composi advantag	structure, systems, Indexin, on Number, Density calcula Equilibrium diagrams for materials like HSLA state, low temperature application atment of Nonferrous alloy ntal materials, Bio material, s. tes, ceramics, cermets, shores and limitations. coatings and their tribologic	g of lattice pla itions and imper Fe-C systems, dual phased sto ons vs, Heat Treatm Prosthetic mate hape memory a cal aspects. PV	nes, Indexing o rfections in crys , Cu - Bronze a eels, creep resist ent of Tool steel erials, Nano mat alloys their man	f lattice directions, tals lloys, Developmen ing steels, material s erials, super conduc nufacturing technic on implantation met	HoursCo-4ts in s for544cting5jues,4hod.4
I II III IV V VI	Crystal s ordinatic Study of metallic high and Heat Tre Orthoden materials Composi advantag	structure, systems, Indexin, on Number, Density calcula Equilibrium diagrams for materials like HSLA state, low temperature application atment of Nonferrous alloy ntal materials, Bio material, s. tes, ceramics, cermets, sh ges and limitations. coatings and their tribologic	g of lattice pla ations and imper Fe-C systems, dual phased strons rs, Heat Treatm Prosthetic mate hape memory a cal aspects. PV	nes, Indexing o rfections in crys , Cu - Bronze a cels, creep resist ent of Tool steel erials, Nano mat alloys their man D, CVD, IVD ic	f lattice directions, tals lloys, Developmen ing steels, material s erials, super conduc nufacturing technic on implantation met	HoursCo-4ts in s for544cting5jues, hod.4
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III III IV V VI 1 2 3	Crystal s ordination Study of metallic high and Heat Tre Orthoder materials Composi advantag Surface of V. Raghy V. Raghy William Edition,	structure, systems, Indexin, on Number, Density calcula Equilibrium diagrams for materials like HSLA state, low temperature application atment of Nonferrous alloy ntal materials, Bio material, s. tes, ceramics, cermets, shares and limitations. coatings and their tribologic van, "Solid State Phase Tra van, "Physical Metallurgy: D. Callister, "Fundamenta 2009.	g of lattice pla tions and imper Fe-C systems, dual phased sto ons /s, Heat Treatm Prosthetic mate nape memory a cal aspects. PV <u>Text Bo</u> nsformations", Principles and als of Material	nes, Indexing o rfections in crys , Cu - Bronze a eels, creep resist ent of Tool steel erials, Nano mat alloys their man D, CVD, IVD ic <b>poks</b> PHI Publication Practice", PHI F s Science and T	f lattice directions, tals lloys, Developmen ing steels, material s erials, super conduct nufacturing technic on implantation met , 1st Edition, 2004. Publication, 3rd Edi Engineering", Wile	HoursCo-4ts in s for544ting5jues,4hod.4tion, 2015.ty India Pvt. Ltd, 7th
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3	Biomaterials and Bioengineering Handbook, Donald L. Wise, Marcel Dekker Inc.			
4	Smithells Metals Reference Book, E. A. Brandes and G. B. Brook, Butterworth Heinemann.			
Useful Links				
1	https://www.youtube.com/watch?v=KMcsjCXfLQw&list=PLyAZSyX8Qy5Am_2StOOQ5vCUE3VIcAenE			
2	https://www.youtube.com/watch?v=748_ME0p0Ag			
3	https://www.youtube.com/watch?v=TuP9de_SK1A			
4	https://www.youtube.com/watch?v=2bDf7JSRvf8			

CO-PO Mapping							
		Programme Outcomes (PO)					
	1	2	3	4	5	6	
CO1	2	3	1	2	1	2	
CO2		2	1	3	2		
CO3		2	2		3	1	
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 (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 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 (Marks) For Theory Course					
Bloom's Taxonomy Level		T1	T2	ESE	Total
1	Remember				
2	Understand	05	05	15	25
3	Apply	10	10	30	50
4	Analyze				
5	Evaluate	05	05	15	25
6	Create				
	Total	20	20	60	100

Walchand College of Engineering, Sangli			
(Government Aided Autonomous Institute)			
AY 2021-22			
Course Information			
Programme         M. Tech. (Mechanical Design Engineering)			
Class, Semester First Year M. Tech., Sem II			

Course Code			5DE527				
Cours	e Name		Condition Based Monitoring				
Desire	ed Requisi	tes:					
	Teaching	Scheme	I	Examination Scheme (Marks)			
Lectur	re	2 Hrs/week	T1	T2	T2 ESE		
Tutor	ial	-	20	20	60	100	
Practi	cal	-					
Intera	ction	-	~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~	Cre	dits: 2		
	Course Objectives						
1	<b>1</b> To make students aware of some methods and procedures applied for general Condition Monitoring.						
2	To make	students apprec	ate and understand the	e basic idea be	hind vibration-based	structural health	
	To monitori	ng and vibration	based condition monit	toring, know ti	ne general stages of C		
3	10 prepa	are students capa	ible to apply some ba	asic techniques	s for analysis of rand	om and periodic	
	To prepa	re students awar	of some basic instrum	nentation used	for machinery and str	uctural vibration-	
4	based m	onitoring	of some busic instrum	lientation used	for machinery and su	deturar vioration	
	1	Course	Outcomes (CO) with	Bloom's Tax	onomy Level		
At the	end of the	course, students	will be able to,		V		
CO1	Calculat	e the characterist	ic of problems related	to vibrations		Evaluate	
CO2	Apply k	nowledge for pre	ventive maintenance			Apply	
CO3	Investiga	te the data for	troubleshooting vib	ration problem	ns in the mechanic	al Analyse	
	machine	S					
	-						
Modu	ile		Module Co	ntents		Hours	
т	Type	es of Maintenan	ce basic idea of baalth	monitoring on	d condition monitori	5	
1	of st	of structures and machines. Critical speed of shafts. Some basic techniques					
	Sign		innes. Critical speed o	of structures and machines. Critical speed of shafts, Some basic techniques.			
		al Processing	Signal Processing Study of periodic and random signals probability distribution statistical				
	Sign	v of periodic	and random signals.	probability	distribution, statistic	al .	
II	Sign Stud prop	al <b>Processing</b> y of periodic erties, power spe	and random signals, ctral density functions	, probability of commonly	distribution, statistic found systems, spect	cal 4	
II	Sign Stud prop analy	y of periodic erties, power spe vsis	and random signals, ctral density functions	, probability of commonly	distribution, statistic found systems, spect	al 4	
II	Sign Stud prop analy	al Processing y of periodic erties, power spe zsis ier Transform	and random signals, ctral density functions	probability of commonly	distribution, statistic found systems, spect	al 4	
	Sign Stud prop analy Four	y of periodic erties, power spe vsis rier Transform ier transform: t	and random signals, etral density functions he basic idea of Fo	, probability of commonly ourier transfo	distribution, statistic found systems, spect rm, interpretation a	al 4 al 4	
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3	Mohanty A. R., Machinery Condition Monitoring-Principles and Practices, CRC Press, 1st
	References
1	William J. H., Davis N., Drake P. R., Condition Based Maintenance and Machine Diagnostics,
1	Springer Netherlands, 2nd edition, 1994
2	L.L. Faulkner, Handbook of Industrial Noise Control, Industrial press, 1st edition 1976
3	Rao S. S., Mechanical Vibrations, Pearson education, 5th edition, 2010
	Useful Links
1	https://www.youtube.com/watch?v=aKcDBg8c4hk
2	https://www.youtube.com/watch?v=6dFnpz_AEyA
3	https://nptel.ac.in/courses/112/105/112105232/
4	https://nptel.ac.in/courses/112/105/112105048/

			CO-PO Mapp	ing			
		Programme Outcomes (PO)					
	1	2	3	4	5	6	
CO1			3		2	3	
CO2	2					1	
CO3				2	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 mu	st man to at leas	t one PO				

### **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 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 (Marks) For Theory Course					
Bloom's Taxonomy Level		T1	Τ2	ESE	Total	
1	Remember					
2	Understand					
3	Apply	05	05	15	25	
4	Analyze	10	10	30	50	
5	Evaluate	05	05	15	25	
6	Create					
	Total	20	20	60	100	

# Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

				AY 2021-22				
			Cou	rse Information				
Progr	amme		M. Tech. (Me	chanical Design En	gineering)			
Class,	Semester		First Year M.	First Year M. Tech., Sem II				
Cours	e Code		5DE528					
Cours	e Name		Optimization '	Techniques in Desi	gn			
Desire	d Requisi	tes:						
			I					
	Teaching	Scheme		Examinati	on Scheme (Mark	s)		
Lectu	re	2 Hrs/week	T1	T2	ESE	r.	Fotal	
Tutor	ial	-	20	20	60		100	
Practi	cal	-						
Intera	ction	-			Credits: 2			
			Co	urse Objectives				
1	To design	n a system, com	ponent, or process	to meet desired nee	ds within realistic	constraints s	such as	
	economic	e, environmental	, social, ethical, he	alth and safety, ma	nufacturability, an	d sustainabi	lity.	
2	To use th	e operations res	earch techniques a	nd tools for necessa	ry engineering pra	ctice.		
3	To use m	athematical met	hods and computer	rs to make rational	decisions in solvin	g a variety c	of optimization	
	problems		was Autoomas (Cl	)) with Dloom's T	avonomy Loval			
At the	and of the	Course students	will be able to	J) with bloom's 1	axonomy Level			
CO1	Develop	algorithms for d	esign optimization				Apply	
CO1	Evaluate	and interpret so	lution of an optimi	zation problem			Evaluate	
	Formulat	e and construct	t the optimum s	solution of the pr	oblems using op	timization	Create	
CO3	technique	es.	I	r in the second s	6 T			
Modu	le Modu	le Contents					Hours	
I	Introd optimi	uction to opti- ization technique	mization, classifi	I Introduction to optimization, classification of optimization problems, classical 4				
II Linear programming, simplex method and Duality in linear programming, sensitivity or 4					4			
	post-o	r programming, ptimality analys	simplex method ar	nd Duality in linear	· programming, ser	nsitivity or	4	
III	post-o One d indire	r programming, ptimality analys imensional mini- ct methods.	simplex method ar is mization, unconstr	nd Duality in linear	programming, ser ned minimization,	nsitivity or direct and	4	
III IV	post-o One d indired Geom gears,	r programming, ptimality analys imensional mini- ct methods. etric programmi shafts, etc.	simplex method ar is mization, unconstr ng, Optimum desig	nd Duality in linear rained and constrai gn of mechanical el	programming, ser ned minimization, ements like beams	nsitivity or direct and , columns,	4 5 5	
III IV V	post-o One d indired Geom gears, Introd Proble	r programming, ptimality analys imensional mini- ct methods. etric programmi shafts, etc. uction to Geneti- ems.	simplex method ar is mization, unconstr ng, Optimum desiş c Algorithms, Ope	nd Duality in linear rained and constrai gn of mechanical el erators, applications	r programming, ser ned minimization, ements like beams s to engineering op	nsitivity or direct and , columns, timization	4 5 5 4	
III IV V VI	post-o One d indired Geom gears, Introd Proble Optim selecti	r programming, ptimality analys imensional mini- ct methods. etric programmi shafts, etc. uction to Geneti- ems. um selection of on charts and op	simplex method ar is mization, unconstr ng, Optimum desig c Algorithms, Ope f material and protimization.	nd Duality in linear rained and constrai gn of mechanical el erators, applications rocesses in mecha	programming, ser ned minimization, ements like beams s to engineering op nical design using	nsitivity or direct and , columns, timization g material	4 5 5 4 4	
III IV V VI	post-o One d indired Geom gears, Introd Proble Optim selecti	r programming, ptimality analys imensional mini- ct methods. etric programmi shafts, etc. uction to Geneti- ems. um selection co on charts and op	simplex method ar is mization, unconstr ng, Optimum desig c Algorithms, Ope f material and pr otimization.	nd Duality in linear rained and constrai gn of mechanical el erators, applications rocesses in mecha	programming, ser ned minimization, ements like beams s to engineering op nical design using	nsitivity or direct and , columns, otimization g material	4 4 5 5 4 4 4	
III IV V VI	post-o One d indirec Geom gears, Introd Proble Optim selecti	r programming, ptimality analys imensional mini- ct methods. etric programmi shafts, etc. uction to Geneti- ems. um selection co on charts and op	simplex method ar is mization, unconstr ng, Optimum desig c Algorithms, Ope f material and pr otimization.	nd Duality in linear rained and constrai gn of mechanical el erators, applications rocesses in mecha	programming, ser ned minimization, ements like beams s to engineering op nical design using	nsitivity or direct and , columns, timization g material	4 5 5 4 4	
III IV V VI	post-o         One d         indired         Geom         gears,         Introd         Proble         Optime         selection	r programming, ptimality analys imensional mini- ct methods. etric programmi shafts, etc. uction to Geneti- ems. um selection co on charts and op	simplex method ar is mization, unconstr ng, Optimum desig c Algorithms, Ope f material and pr ptimization.	nd Duality in linear rained and constrai gn of mechanical el erators, applications rocesses in mecha <b>Text Books</b> of energy systems"	programming, ser ned minimization, ements like beams s to engineering op nical design using Battelle Press, Ne	nsitivity or direct and , columns, otimization g material	4 5 5 4 4 5.	
III IV V VI 1 2	post-o One d indired Geom gears, Introd Proble Optim selecti	r programming, ptimality analys imensional mini- ct methods. etric programmi shafts, etc. uction to Geneti- ems. um selection co on charts and op Stricker, "Optim ohnson, "Optim	simplex method ar is mization, unconstr ng, Optimum desig c Algorithms, Ope f material and pr otimization.	nd Duality in linear rained and constrai gn of mechanical el erators, applications cocesses in mecha <b>Text Books</b> of energy systems" hanical Elements",	Programming, ser ned minimization, ements like beams s to engineering op nical design using Battelle Press, Ne Willey, New York	nsitivity or direct and , columns, otimization g material w York,198 c, 1980.	4 5 5 4 4 5.	
III IV V VI 1 2 3	post-o One d indired Geom gears, Introd Proble Optim selecti S. S. S R.C. J J. S. A	e programming, ptimality analys imensional mini- et methods. etric programmi shafts, etc. uction to Geneti- ems. um selection of on charts and op Stricker, "Optim ohnson, "Optim arora, "Introduct	simplex method ar is mization, unconstr ng, Optimum desig c Algorithms, Ope f material and pr otimization. ising performance um Design of Mec ion to Optimum D	nd Duality in linear rained and constrai gn of mechanical el erators, applications rocesses in mecha <b>Text Books</b> of energy systems" hanical Elements", esign", McGraw H	Programming, ser ned minimization, ements like beams s to engineering op nical design using Battelle Press, Ne Willey, New York ill, New York, 198	nsitivity or direct and , columns, timization g material w York,198 c, 1980. 9.	4 5 5 4 4 5.	
III           IV           V           VI           1           2           3           4	post-o One d indired Geom gears, Introd Proble Optim selecti S. S. S R.C. J J. S. A Kalya	r programming, ptimality analys imensional mini- ct methods. etric programmi shafts, etc. uction to Geneti- ems. uum selection co on charts and op Stricker, "Optim ohnson, "Optim arora, "Introduct	simplex method ar is mization, unconstr ng, Optimum desig c Algorithms, Ope f material and pr otimization.	nd Duality in linear rained and constrai gn of mechanical el erators, applications rocesses in mecha <b>Text Books</b> of energy systems" hanical Elements", esign", McGraw H neering Design", P	Programming, ser ned minimization, ements like beams s to engineering op nical design using Battelle Press, Ne Willey, New York ill, New York, 198 rentice Hall of Ind	nsitivity or direct and , columns, timization g material w York,198 c, 1980. 9. ia, New Del	4 5 5 4 4 5. 5. hi, 05	
III IV V VI 1 2 3 4	post-o One d indired Geom gears, Introd Proble Optim selecti S. S. S R.C. J J. S. A Kalya	r programming, ptimality analys imensional mini- ct methods. etric programmi shafts, etc. uction to Geneti- ems. um selection co on charts and op Stricker, "Optim ohnson, "Optim arora, "Introduct nmoy Deb, "Optim	simplex method ar is mization, unconstr ng, Optimum desig c Algorithms, Ope f material and pr otimization. ising performance um Design of Mec ion to Optimum D cimization for Engi	nd Duality in linear rained and constrai gn of mechanical el erators, applications cocesses in mecha <b>Text Books</b> of energy systems" hanical Elements", esign", McGraw H neering Design", P	Programming, ser ned minimization, ements like beams s to engineering op nical design using Battelle Press, Ne Willey, New York ill, New York, 198 rentice Hall of Ind	nsitivity or direct and , columns, timization g material w York,198 c, 1980. 9. ia, New Del	4 5 5 4 4 5. hi, 05	
III IV V VI 1 2 3 4	post-o One d indired Geom gears, Introd Proble Optim selecti S. S. S R.C. J J. S. A Kalya	r programming, ptimality analys imensional mini- ct methods. etric programmi shafts, etc. uction to Geneti- ems. um selection of on charts and op Stricker, "Optim ohnson, "Optim rora, "Introduct nmoy Deb, "Op	simplex method ar is mization, unconstr ng, Optimum desig c Algorithms, Ope f material and pr otimization. ising performance um Design of Mec ion to Optimum D cimization for Engi	nd Duality in linear rained and constrai gn of mechanical el erators, applications rocesses in mecha of energy systems" hanical Elements", esign", McGraw H neering Design", P <b>References</b> ry and Practice. New	Programming, ser ned minimization, ements like beams s to engineering op nical design using Battelle Press, Ne Willey, New York ill, New York, 198 rentice Hall of Ind	nsitivity or direct and , columns, timization g material w York,198 c, 1980. 9. ia, New Del	4 5 5 4 4 5. hi, 05	
III IV V VI 1 2 3 4 1 2	post-o One d indired Geom gears, Introd Proble Optim selecti S. S. S R.C. J J. S. A Kalya Rao S R.J. D	r programming, ptimality analys imensional mini- ct methods. etric programmi shafts, etc. uction to Geneti- ems. um selection co on charts and op Stricker, "Optim ohnson, "Optim arora, "Introduct nmoy Deb, "Op , "Engineering co uffin, E.L. Peter 1967	simplex method ar is mization, unconstr ng, Optimum desig c Algorithms, Ope f material and pr otimization. ising performance um Design of Mec ion to Optimum De timization for Engi	nd Duality in linear rained and constrai gn of mechanical el erators, applications cocesses in mecha <b>Text Books</b> of energy systems" hanical Elements", esign", McGraw H neering Design", P <b>References</b> cy and Practice, Ner Geometric Program	<ul> <li>programming, ser</li> <li>ned minimization,</li> <li>ements like beams</li> <li>s to engineering op</li> <li>nical design using</li> <li>Battelle Press, Ne</li> <li>Willey, New York</li> <li>ill, New York, 198</li> <li>rentice Hall of Ind</li> <li>w Age Internationa</li> <li>ming-Theory and A</li> </ul>	nsitivity or direct and , columns, timization g material w York,198 c, 1980. 9. ia, New Del il Publishers Applications	4 4 5 5 4 4 5	

Useful Links				
1	https://www.youtube.com/watch?v=_awAywLKuEQ&list=PLvfKBrFuxD065AT7q1Z0rDAj9kBnPnL01			
2	https://www.youtube.com/watch?v=wIAOApE0Q3o			
3	https://www.youtube.com/watch?v=GBheyaICuGQ			
4	https://www.youtube.com/watch?v=Z_8MpZeMdD4			

CO-PO Mapping							
	Programme Outcomes (PO)						
	1	2	3	4	5	6	
CO1	2		2	1	1	3	
CO2	3		1		3		
CO3	2	1	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 course must map to at least one PO.

#### **Assessment (for Theory Course)**

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	05	05	15	25		
4	Analyze	05	05	15	25		
5	Evaluate						
6	Create	10	10	30	50		
	Total	20	20	60	100		

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)				
AY 2021-22				
Course Information				
Programme	M. Tech. (Mechanical Design Engineering)			
Class, Semester	First Year M. Tech., Sem II			
Course Code	5DE575			
Course Name	A B Elective Lab 1: Tribology in Design Lab			
Desired Requisites:				

Tea	aching Sch	eme (Hrs)	e (Hrs) Examination Scheme (Marks)					
Lectur	re	-	LA1	LA2	ESE	Total		
Tutori	ial	-	30	30	40	100		
Practi	cal	2						
Intera	ction	-		Cred	its: 1			
			Course	Objectives				
1	To provide an opportunity to student to do work independently on a topic/ problem experimentation selected by him/her and encourage him/her to think independently on his/her own to bring out the conclusion under the given circumstances and limitations.							
2	To encou completi	rage creative th	inking process to hough observations,	elp student to get c discussions and de	onfidence by succe cision making proc	ssfully ess.		
3	To enabl	e student for tec	chnical report writin	ng and effective pre	esentations.			
	1 6 1	Course	Outcomes (CO) w	ith Bloom's Taxo	nomy Level			
At the	end of the	course, student	s will be able to,		1 . 1	· · · · · · · · · · · · · · · · · · ·		
	Solve fie	nd develop avit	using different tech	nniques in mechani	cal design engineer	Ing Apply Create		
C02	Design a	nd present a da	toiled technical sy	stellis	roject work	Evoluoto		
	Flepale a	and present a de				Evaluate		
			Cours	e Content				
Creation analys Design	on of proto is or simul 1.	type/ apparatus ation of a proce	/ small equipment/ ss/ experimental ve	experimental set up prification of princi	/ innovation of exisples in thrust areas	ting product/ of Tribology in		
			Τ	4 D L				
1	Suito	ble books based	l ex	the mini project so	lected			
1	Sulta	DIE DOOKS Dased		the min project se				
References								
1	1       Suitable books based on the contents of the mini project selected and research papers from Reputed national and international journals and conferences.							
			Usef	ul Links				
1	As ne	er the need of th	e mini proiect.					
	F -		r J					

CO-PO Mapping							
	Programme Outcomes (PO)						
	1	2	3	4	5	6	
CO1	3			1			
CO2			3				
CO3					3	1	
The strength of manning is to be written as 1.2.3. Where 1.Low 2.Medium 3.High							

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							
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.							
Assessment Based on Conducted by Typical Schedule		Typical Schedule (for 26-week Sem)	Marks				
LA1	Lab activities,	Lab Course	During Week 1 to Week 6	20			
	attendance, journal	Faculty	Marks Submission at the end of Week 6	50			

T A 2	Lab activities,	Lab activities, Lab Course During Week 7 to		20				
	attendance, journal	Faculty	Marks Submission at the end of Week 12	30				
Lob ESE	Lab activities,	Lab Course	During Week 15 to Week 18	40				
	attendance, journal	Faculty	Marks Submission at the end of Week 18	40				
Week 1 indic	Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown,							
considering a	26-week semester. Th	e actual schedule	shall be as per academic calendar. Lab activi	ties/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	05	05	10	20		
Analyze						
Evaluate	10	10	15	35		
Create	15	15	15	45		
Total Marks	30	30	40	100		

	Walchand College of Engineering, Sangli					
			(Government Aided	d Autonomous Institu	te)	
			AY	2021-22		
			Course	Information		
Progra	amme		M. Tech. (Mecha	nical Design Engin	eering)	
Class,	Semester		First Year M. Teo	ch., Sem II		
Cours	e Code		5DE576			
Cours	e Name		A B Elective Lab	1: Robotics Lab		
Desire	d Requisi	tes:				
	1		1			
Tea	Teaching Scheme (Hrs) Examination Scheme (Marks)					
Lectur	e.	-	LA1	LA2	ESE	Total
Tutori	al	-	30	30	40	100
Practio	cal	2		1		
Intera	ction	-		Cred	its: 1	
		<u>.</u>	Course	Objectives		
	To provi	de an opportuni	ty to student to do	work independently	y on a topic/ problem	
1	experime	entation selected	by him/her and er	ncourage him/her to	think independently	on his/her own
	to bring	out the conclusi	on under the given	circumstances and	limitations.	
2	To encou	arage creative th	inking process to h	help student to get c	confidence by success	fully
	completi	ng the mini, thr	ough observations,	discussions and de	cision making proces	3.
3	To enabl	e student for tec	chnical report writi	ng and effective pre	esentations.	
Course Outcomes (CO) with Bloom's Taxonomy Level						
At the	end of the	course, student	s will be able to,			
CO1	Solve fie	ld problems by	using different tech	hniques in mechani	cal design engineerin	g Apply
CO2	Design a	nd develop suit	able mechanical sy	stems		Create
CO3	Prepare a	and present a de	tailed technical rer	ort based on mini r	project work	Evaluate

	Course Content					
Creation of prototype/ apparatus/ small equipment/experimental set up/ innovation of existing product/ analysis or simulation of a process/ experimental verification of principles in thrust areas of Robotics.						
	Text Books					
1	Suitable books based on the contents of the mini project selected.					
	References					
1	Suitable books based on the contents of the mini project selected and research papers from					
1	Reputed national and international journals and conferences.					
	Useful Links					
1	As per the need of the mini project					

CO-PO Mapping							
	Programme Outcomes (PO)						
	1	2	3	4	5	6	
CO1	3			1			
CO2			3				
CO3					3	1	
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								
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.								
Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks				
LA1	Lab activities,	Lab Course	During Week 1 to Week 6	20				
	attendance, journal	Faculty	Marks Submission at the end of Week 6	30				
T A O	Lab activities,	Lab Course	During Week 7 to Week 12	20				
LAZ	attendance, journal	Faculty	Marks Submission at the end of Week 12	50				
Lob ESE	Lab activities,	Lab Course	During Week 15 to Week 18	40				
Labese	attendance, journal	Faculty	Marks Submission at the end of Week 18	40				
Week 1 indic	Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown,							
considering a	26-week semester. Th	e actual schedule	shall be as per academic calendar. Lab activit	ties/Lab				

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	05	05	10	20			
Analyze							
Evaluate	10	10	15	35			
Create	15	15	15	45			

Total Marks	30	30	40	100
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	Walchand College of Engineering, Sangli					
			AY	2021-22		
			Course	Information		
Progr	amme		M. Tech. (Mecha	nical Design Engir	neering)	
Class,	Semester		First Year M. Teo	ch., Sem II	6,	
Cours	e Code		5DE577	,		
Cours	e Name		A B Elective Lab	1: Fracture Mecha	anics Lab	
Desire	ed Requisi	ites:				
Tea	aching Sch	neme (Hrs)		Examination S	cheme (Marks)	
Lectur	re	-	LA1	LA2	ESE	Total
Tutori	ial	-	30	30	40	100
Practi	cal	2				
Intera	ction	-		Crea	lits: 1	
			Course	Objectives		
1	To provi experime to bring	de an opportuni entation selected out the conclusi	ty to student to do d by him/her and er on under the given	work independentl acourage him/her to circumstances and	y on a topic/ problem o think independently o l limitations.	on his/her own
2	completi	ng the mini, thr	ough observations,	discussions and de	ecision making process	ully
3	To enabl	e student for tec	Chnical report writin	ng and effective pr	esentations.	
At the	and of the	Course student	<b>Outcomes</b> (CO) w	Ith Bloom's Taxo	nomy Level	
CO1	Solve fie	eld problems by	using different tecl	hniques in mechan	ical design engineering	Apply
CO2	Design a	and develop suit	able mechanical sy	stems		Create
CO3	Prepare	and present a de	tailed technical rep	ort based on mini	project work	Evaluate
						·
			Cours	se Content		
Creation analys Mecha	Creation of prototype/ apparatus/ small equipment/experimental set up/ innovation of existing product/ analysis or simulation of a process/ experimental verification of principles in thrust areas of Fracture Mechanics.					
			Tex	t Books		
1	Suita	ble books based	l on the contents of	the mini project se	elected.	
References						
1 Suitable books based on the contents of the mini project selected and research papers from Reputed national and international journals and conferences.						
Useful Links						
	As pe	er the need of th	e mm project.			
				) Manning		
			Drogro	mme Outcomes (	PO)	
			r rogra	mine Outcomes (	10)	

CO-PO Mapping
Programme Outcomes (PO)

	1	2	3	4	5	6		
CO1	3			1				
CO2			3					
CO3					3	1		
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							
There are three	ee components of lab a	ssessment, LA1,	LA2 and Lab ESE.				
IMP: Lab ES	E is a separate head of	passing. LA1, LA	A2 together is treated as In-Semester Evaluat	ion.			
Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks			
т. а. 1	Lab activities,	Lab Course	During Week 1 to Week 6	20			
LAI	attendance, journal	Faculty	Marks Submission at the end of Week 6	50			
1 4 2	Lab activities,	Lab Course	During Week 7 to Week 12	20			
LAZ	attendance, journal	Faculty	Marks Submission at the end of Week 12	50			
	Lab activities,	Lab Course	During Week 15 to Week 18	40			
	attendance, journal	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. 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	05	05	10	20			
Analyze							
Evaluate	10	10	15	35			
Create	15	15	15	45			
Total Marks	30	30	40	100			

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)							
		AY	2021-22				
		Course ]	Information				
Programme		M. Tech. (Mecha	nical Design Engin	eering)			
Class, Semester		First Year M. Tec	ch., Sem II				
Course Code		5DE578					
Course Name		A B Elective Lab	1: Advanced Meta	llurgy Lab			
Desired Requisi	tes:						
		·					
Teaching Sch	eme (Hrs)		Examination S	cheme (Marks)			
Lecture	-	LA1	LA1 LA2 ESE Total				
Tutorial	-	30	30	40	100		

Praction	Practical 2				
Intera	Interaction - Credits: 1				
			Course Objectives		
1	To provide experiments to bring of the bring	de an opportuni entation selected out the conclusi	ty to student to do work independently on a topic/ problem l by him/her and encourage him/her to think independently on on under the given circumstances and limitations.	his/her own	
2	To encou completi	rage creative th	inking process to help student to get confidence by successful ough observations, discussions and decision making process.	ly	
3	To enabl	e student for tec	chnical report writing and effective presentations.		
		Course	Outcomes (CO) with Bloom's Taxonomy Level		
At the	end of the	course, student	s will be able to,		
CO1	Solve fie	ld problems by	using different techniques in mechanical design engineering	Apply	
CO2	Design a	nd develop suit	able mechanical systems	Create	
CO3	Prepare a	and present a de	tailed technical report based on mini project work	Evaluate	
			Course Content		
Creation of prototype/ apparatus/ small equipment/experimental set up/ innovation of existing product/ analysis or simulation of a process/ experimental verification of principles in thrust areas of Advanced Metallurgy.					
			Text Books		
1	Suita	ble books based	on the contents of the mini project selected.		
References					
1	1 Suitable books based on the contents of the mini project selected and research papers from Reputed national and international journals and conferences.				
			Useful Links		
1	As pe	er the need of th	e mini project.		

CO-PO Mapping									
	Programme Outcomes (PO)								
	1	1 2 3 4 5 6							
CO1	3			1					
CO2			3						
CO3					3	1			
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 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. Assessment Typical Schedule (for 26-week Sem) Based on Conducted by Marks Lab activities, Lab Course During Week 1 to Week 6 LA1 30 attendance, journal Faculty Marks Submission at the end of Week 6 Lab activities, Lab Course During Week 7 to Week 12 LA2 30 Marks Submission at the end of Week 12 attendance, journal Faculty Lab Course During Week 15 to Week 18 Lab activities, 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)							
<b>Bloom's Taxonomy Level</b>	LA1	LA2	Lab ESE	Total			
Remember							
Understand							
Apply	05	05	10	20			
Analyze							
Evaluate	10	10	15	35			
Create	15	15	15	45			
Total Marks	30	30	40	100			

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)						
			AY	2021-22	,	
			Course 2	Information		
Progra	amme		M. Tech. (Mecha	nical Design Engin	eering)	
Class,	Semester		First Year M. Teo	ch., Sem II		
Cours	e Code		5DE579			
Cours	e Name		A B Elective Lab	1: Condition Base	d Monitoring Lab	
Desire	d Requisi	tes:				
Tea	ching Sch	neme (Hrs)		Examination S	cheme (Marks)	
Lectur	e	-	LA1	LA2	ESE	Total
Tutori	al	-	30	30	40	100
Praction	Practical 2					
Intera	ction	-		Cred	its: 1	
			Course	Objectives		
1	To provi experime	de an opportuni entation selected	ty to student to do l by him/her and er	work independently acourage him/her to	y on a topic/ problem think independently	on his/her own
	to bring	out the conclusi	on under the given	circumstances and	limitations.	
2	To encou	urage creative th	inking process to h	help student to get o	confidence by succes	sfully
	completi	ng the mini, thr	ough observations,	discussions and de	cision making proce	ss.
3	To enabl	e student for tec	chnical report writin	ng and effective pro	esentations.	
A 4 4 h a	and of the	Course	Outcomes (CO) w	ith Bloom's Taxo	nomy Level	
At the	Solve fie	d problems by	s will be able to,	hniquas in machani	al dasign anginagri	A pply
$\frac{CO1}{CO2}$	1         Solve held problems by using different techniques in mechanical design engineering         Apply           2         Design and develop suitable mechanical systems         Create					
C02	CO3 Prepare and present a detailed technical report based on mini project work Evaluate					
		and present a de	tuned teennedi tep	or oused on mining	noject work	Dvardate
			Cours	e Content		
			Cours	Content		

Creation of prototype/ apparatus/ small equipment/experimental set up/ innovation of existing product/ analysis or simulation of a process/ experimental verification of principles in thrust areas of Condition Based Monitoring.

	Text Books					
1	Suitable books based on the contents of the mini project selected.					
	References					
1	Suitable books based on the contents of the mini project selected and research papers from					
1	Reputed national and international journals and conferences.					
Useful Links						
1	As per the need of the mini project.					

CO-PO Mapping								
	Programme Outcomes (PO)							
	1	2	3	4	5	6		
CO1	3			1				
CO2			3					
<b>CO3</b> 3 1								
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								
There are thre IMP: Lab ES	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.							
Assessment Based on Conducted by Typical Schedule (for 26-week Sem) Marks								
т а 1	Lab activities,	Lab Course	During Week 1 to Week 6	20				
LAI	attendance, journal	Faculty	Marks Submission at the end of Week 6	50				
Lab activities, Lab Course During Week 7 to Week 12				20				
LAZ	attendance, journal	Faculty	Marks Submission at the end of Week 12	50				
Lab ESE	Lab activities,	Lab Course	During Week 15 to Week 18	40				
	attendance, journal	Faculty	Marks Submission at the end of Week 18	40				
Wealt 1 india	atag starting wash of a	compostor The tru	ical achadula of lab accounts is shown					

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	05	05	10	20		
Analyze						
Evaluate	10	10	15	35		
Create	15	15	15	45		
Total Marks	30	30	40	100		

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)							
	AY 2021-22						
			Course ]	Information			
Progra	amme		M. Tech. (Mecha	nical Design Engin	eering)		
Class,	Semester		First Year M. Teo	ch., Sem II			
Cours	se Code		5DE580				
Cours	e Name		A B Elective Lab	1: Optimization To	echniques in Design L	ab	
Desire	ed Requisi	tes:					
			1				
Tea	Teaching Scheme (Hrs)     Examination Scheme (Marks)						
Lecture -			LA1	LA2	ESE	Total	
Tutori	ial	-	30	30	40	100	
Practi	cal	2			· · ·		
Intera	ction	-		Cred	lits: 1		
			Course	Objectives			
	To provi	de an opportuni	ty to student to do	work independently	y on a topic/ problem		
1	experime	entation selected	l by him/her and er	courage him/her to	think independently of	on his/her own	
	to bring	out the conclusi	on under the given	circumstances and	limitations.		
2	To encou	rage creative th	inking process to h	elp student to get o	confidence by successf	ully	
	completi	ng the mini, thr	ough observations,	discussions and de	cision making process	•	
3	To enabl	e student for teo	chnical report writin	ng and effective pro	esentations.		
A ( 1		Course	Outcomes (CO) w	ith Bloom's Taxo	nomy Level		
At the	end of the	course, student	s will be able to,			A	
	Solve fie	and develop mil	using different tech	nniques in mechani	cai design engineering	Apply	
C02	Design a	na develop suit	able mechanical sy	stems	• , 1	Create	
CO3	Prepare and present a detailed technical report based on mini project work						

### **Course Content**

Creation of prototype/ apparatus/ small equipment/experimental set up/ innovation of existing product/ analysis or simulation of a process/ experimental verification of principles in thrust areas of Optimization Techniques in Design.

	Text Books
1	Suitable books based on the contents of the mini project selected.
	References
1	Suitable books based on the contents of the mini project selected and research papers from
1	Reputed national and international journals and conferences.
	Useful Links
1	As per the need of the mini project.

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

CO2			3				
CO3					3	1	
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								
There are thre IMP: Lab ES	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.							
Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks				
т а 1	Lab activities,	Lab Course	During Week 1 to Week 6	20				
LAI	attendance, journal	Faculty	Marks Submission at the end of Week 6	50				
1.4.2	Lab activities,	Lab Course	During Week 7 to Week 12	20				
LAZ	attendance, journal	Faculty	Marks Submission at the end of Week 12	50				
Lab ESE	Lab activities,	Lab Course	During Week 15 to Week 18	40				
	attendance, journal	Faculty	Marks Submission at the end of Week 18	40				
Weak 1 india	ator starting weak of a	compostor The tur	vicel schodule of leb assessments is shown					

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	05	05	10	20		
Analyze						
Evaluate	10	10	15	35		
Create	15	15	15	45		
Total Marks	30	30	40	100		

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)								
	AY 2021-22							
		Course	Information					
Programme	ProgrammeM. Tech. (Mechanical Design Engineering)							
Class, Semester		First Year M. Te	ch., Sem II					
Course Code 50E105								
Course Name		Industrial Produc	xt Design					
Desired Requisit	tes:							
Teaching	Scheme		Examination S	cheme (Marks)				
Lecture	2 Hrs/week	T1	T2	ESE	Total			
Tutorial	-	20 20 60 100						
Practical	-							
Interaction	-	Credits: 2						
Course Objectives								
1	To prepare the students to succeed as designer in industry /technical profession.							
---------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------	--	--	--	--	--	--
2	To provide students the knowledge of steps involved in design and developments of industrial Product							
	Product.         To train the students to generate the idea for new product development based on the needs of							
3	To train the students to generate the idea for new product development based on the need Society	s of						
	To prepare the students to use knowledge of ergonomics aesthetics for development of i	ndustrial						
4	Product.	ndubtriur						
5	5 To prepare the students to use knowledge of materials, economics, value analysis, standardization							
	Course Outcomes (CO) with Bloom's Taxonomy Level							
At the	end of the course students will be able to							
	Demonstrate an ability to recognize the need of society to design the products as per	Apply						
CO1	their requirements.	Аррту						
CO2	Recommend appropriate process to apply aesthetical concepts to product.	Evaluate						
CO3	Design and develop the products by using standardization.	Create						
	I							
Modu	le Module Contents	Hours						
	Approach to industrial product based on idea generation and innovations to meet the							
	creative process involved in idea marketing, designers, mind-criticism, design							
T	process, creation needs of the developing society. Design and development process	8						
1	of industrial products, various steps such as Ergonomics and aesthetic requirements	0						
	of product design, quality and maintainability consideration in product design, Use							
	of modelling technique, prototype designs, conceptual design.							
	General design situations, setting specifications, requirements and ratings, their							
	importance in the design, Study of market requirements and manufacturing aspects	0						
	of industrial designs. Aspects of ergonomic design of machine tools, testing	9						
	equipment's, instruments, automobiles, process equipment etc. Convention of style,							
	Trom and colour of industrial design.							
	bedy dimensions. Ergenemic considerations interpretation of information	6						
	conversions for style forms, colours	0						
	A asthetic Concepts Concept of units and and and a with units and and a state of the second of the s							
	Aesthetic Concept of unity and order with variety, concept of purpose, style							
	and environment, Aesthetic expressions of symmetry, balance, contrast and							
IV	line and from mechanics of seeing' neychology of seeing influence of line and	7						
	form Components of style Basic factors. Effect of colour on product appearance							
	colour composition, conversion of colours of engineering products							
	Economic Considerations Selection of material Design for production use of							
	standardization, value analysis and cost reduction, maintenance aspects in design.	5						
	Design Organization Structure. Designer position Drawing office procedure							
VI	Standardization, record keeping, legal procedure of Design patents.	5						
	Text Books							
	W. H. Mayall, "Industrial Design for Engineers", Illife, 1967.	10/2						
$\frac{2}{2}$	Hearn Buck. "Problems of Product Design and Development", Pergamon press, Jan 1	, 1963.						
3	Charles H. Flueriche, "Industrial Designs in Engineering", Design council, 1983.							
	References							
	Ezia Manzim "Material of Invention", Cambridge Mass: MIT press, 1989.							
2	Percy H. Hill "The Science of Engineering Design". Holt McDougal, 19/0							

Course Contents for M. Tech. (Design) Programme, Department of Mechanical Engineering, AY2021-22

Useful Links					
1	https://www.youtube.com/watch?v=ANBqFUrUfOY				
2	https://www.youtube.com/watch?v=0W_wGUf59UU				
2	https://www.youtube.com/watch?v=HN9GtL21rb4&list=PLSGws_74K018yZOnbSaqWJZ837				
3	QyBB7vu				
4	https://youtu.be/oUeK6ZsCo8I				

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

## **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 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 (Marks) For Theory Course						
Blo	oom's Taxonomy Level	T1	T2	ESE	Total	
1	Remember					
2	Understand					
3	Apply	05	05	15	25	
4	Analyze					
5	Evaluate	05	05	15	25	
6	Create	10	10	30	50	
	Total	20	20	60	100	

Walchand College of Engineering, Sangli					
(Government Aided Autonomous Institute)					
	AY 2021-22				
	Course Information				
Programme         M. Tech. (Mechanical Design Engineering)					
Class, Semester	First Year M. Tech., Sem II				
Course Code	Course Code 50E105				
Course Name	Industrial Product Design				

Course Contents for M. Tech. (Design) Programme, Department of Mechanical Engineering, AY2021-22

Desire	ed Requis	ites:					
	Teaching	Scheme		Examination S	cheme (Marks)		
Lectu	re	2 Hrs/week	T1	T2	ESE	T	otal
Tutor	ial	-	20	20	60		100
Practi	ical	-		1	1	1	
Intera	ction	-		Cred	lits: 2		
			Course	e Objectives			
1	To prep	are the students to	o succeed as design	ner in industry /tecl	nnical profession.		
2	To prov Product	ide students the k	nowledge of steps	involved in design	and developments	of indu	strial
3	To train Society.	the students to g	enerate the idea for	r new product deve	lopment based on t	he need	s of
4	To prep Product	are the students to	o use knowledge o	f ergonomics, aest	hetics for developn	nent of i	ndustrial
5	To prep For dev	are the students to elopment of indu	o use knowledge o strial Product.	f materials, econon	nics, value analysis	, standa	rdization
		Course	Outcomes (CO) v	vith Bloom's Taxo	onomy_Level		
At the	end of the	e course, students	will be able to,				
CO1	Demons	strate an ability t	o recognize the ne	ed of society to de	esign the products	as per	Apply
CO2	Recom	nend appropriate	process to apply a	esthetical concepts	to product.		Evaluate
CO3	Design	and develop the p	products by using s	tandardization.			Create
Modu	ıle		Modul	e Contents			Hours
Mout	App	roach to industria	l product based on	idea generation an	d innovations to m	eet the	IIUIIS
Ι	crea proc of ir of p of m	tive process inv ess, creation need adustrial products roduct design, qu odelling techniqu	olved in idea ma ds of the developin , various steps suc ality and maintain ae, prototype desig	arketing, designers ng society. Design h as Ergonomics a ability consideration ns, conceptual desi	, mind-criticism, and development p nd aesthetic require on in product desig gn.	design process ements n, Use	8
II	Gen impo of i equi fron	eral design situa ortance in the des ndustrial designs pment's, instrum and colour of in	tions, setting spea sign, Study of mar s. Aspects of erg ents, automobiles, dustrial design.	cifications, require ket requirements and gonomic design of process equipment	ments and ratings nd manufacturing a f machine tools, etc. Convention of	, their aspects testing f style,	9
III	Des body conv	gn of Consumer dimensions. versions for style,	Product, Functior Ergonomic consi forms, colours.	ns and use standard derations, interpr	l and legal require etation of inform	ments, nation,	6
IV	Aesthetic Concepts Concept of unity and order with variety, concept of purpose, style and environment, Aesthetic expressions of symmetry, balance, contrast and continuity, proportion, rhythm, radiation. From and style of product: visual effect of line and from, mechanics of seeing', psychology of seeing, influence of line and form, Components of style, Basic factors, Effect of colour on product appearance, colour composition, conversion of colours of engineering products.						
v	Eco stan	nomic Considera dardization, value	tions Selection o e analysis and cost	f material, Design reduction, mainten	for production, ance aspects in des	use of ign.	5
VI	Desi Stan	gn Organization dardization, reco	Structure, Designd Keeping, legal p	gner position, Dra rocedure of Design	awing office proc patents.	cedure,	5

	Text Books
1	W. H. Mayall, "Industrial Design for Engineers", Illife, 1967.
2	Hearn Buck. "Problems of Product Design and Development", Pergamon press, Jan 1, 1963.
3	Charles H. Flueriche, "Industrial Designs in Engineering", Design council, 1983.
	References
1	Ezia Manzim "Material of Invention", Cambridge Mass: MIT press, 1989.
2	Percy H. Hill "The Science of Engineering Design", Holt McDougal, 1970
	Useful Links
1	https://www.youtube.com/watch?v=ANBqFUrUfOY
2	https://www.youtube.com/watch?v=0W_wGUf59UU
2	https://www.youtube.com/watch?v=HN9GtL21rb4&list=PLSGws_74K018yZOnbSaqWJZ837
3	QyBB7vu
4	https://youtu.be/oUeK6ZsCo8I

CO-PO Mapping								
	Programme Outcomes (PO)							
	1	2	3	4	5	6		
CO1	3							
CO2	3			1				
CO3	3		2		2			
The streng	gth of mapping i	s to be written a	s 1,2,3; Where, 1	:Low, 2:Mediu	ım, 3:High			

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

## **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 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 (Marks) For Theory Course						
Blo	oom's Taxonomy Level	T1	Τ2	ESE	Total	
1	Remember					
2	Understand					
3	Apply	05	05	15	25	
4	4 Analyze					
5	Evaluate	05	05	15	25	
6	Create	10	10	30	50	
	Total	20	20	60	100	

	Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)									
	AY 2021-22									
Course Information										
Progra	amme		M. Tech. (Mecha	nical Design Engin	eering)					
Class,	Semester		First Year M. Tech., Sem II							
Cours	e Code		5IC502							
Cours	e Name		Constitution of In	Idia						
Desire	d Requisi	tes:								
	1									
	Teaching	Scheme		Examination S	cheme (Marks)					
Lectur	re	2 Hrs/week	T1	T2	ESE	Т	[otal			
Tutori	ial	_	20	20	60	1	100			
Practi	cal			1	I I					
Intera	ction			Cre	dits:					
			Course	Objectives						
1	To review	v and create awa	areness on various	provisions in the co	onstitution of India.					
-	101010	Course (	Outcomes (CO) w	ith Bloom's Taxor	nomv Level					
At the	end of the	course, students	s will be able to.		10111 <i>y</i> 120,01					
001	Explain t	he premises inf	orming the twin th	emes of liberty and	l freedom from a c	ivil ur	nderstand			
COI	rights per	spective.	0	5						
	Address	the growth of	f Indian opinion	regarding moderr	n Indian intellectu	ials ur	nderstand			
CO2 constitutional role and entitlement to civil and economic rights as well as the					the					
emergence of nationhood in the early years of Indian nationalism										
Address the role of socialism in India after the commencement of the Bolshevik						vik   ur	nderstand			
Revolution in 1917 and its impact on the initial drafting of the Indian Constitution										
	Revolution	on in 1917 and i	ts impact on the in	itial drafting of the	Indian Constitution	L				
		on in 1917 and i	ts impact on the in	itial drafting of the	Indian Constitution	ı				
Modu	Revolution	on in 1917 and i	ts impact on the initial <b>Module</b>	Contents	Indian Constitution		Hours			
Modu	Revolution	on in 1917 and i ry of Making of orking	ts impact on the in <b>Module</b> T the Indian Consti	itial drafting of the Contents tution Drafting Cor	Indian Constitution	tion	Hours 4			
Modu I	le Histo & We Philo	on in 1917 and i ry of Making of orking sophy of the In	ts impact on the in Module The Indian Consti dian Constitution	itial drafting of the Contents tution Drafting Cor	Indian Constitution	tion	Hours 4			
Modu I II	le Histo & Wo Philo Pream	on in 1917 and i ry of Making of orking sophy of the In able, Salient Fea	ts impact on the inf Module The Indian Consti dian Constitution ature	itial drafting of the Contents tution Drafting Cor	Indian Constitution	tion	Hours 4 4			
Modu I II	le Histo & Wo Philo Prean Cont	ry of Making of orking sophy of the In able, Salient Fea ours of Constitu	ts impact on the in Module The Indian Constitution ature utional Rights:	itial drafting of the Contents tution Drafting Cor	Indian Constitution	tion	Hours 4 4			
Modu I II	Revolution	ry of Making of orking sophy of the In able, Salient Fea ours of Constitut amental Rights	ts impact on the in Module The Indian Constitution ature utional Rights: ; Right to Equal	itial drafting of the Contents tution Drafting Cor : lity; Right to Free	Indian Constitution nmittee, (Composi- eedom; Right aga	tion	Hours 4 4			
Modu I II III	Revolution le Histo & Wo Philo Pream Cont Funda Explo Bight	ry of Making of orking sophy of the In able, Salient Fea ours of Constitu amental Rights itation; Right t	ts impact on the in Module The Indian Constitution ature utional Rights: ; Right to Equal to Freedom of Re-	tution Drafting of the Contents tution Drafting Cor : lity; Right to Free ligion; Cultural an Directive Principal	Indian Constitution mmittee, (Composite eedom; Right aga d Educational Rig	tion inst hts;	Hours           4           4           5			
Modu I II III	lle Histo & Wo Philo Pream Cont Funda Explo Right	ry of Making of orking sophy of the In able, Salient Fea ours of Constitu- amental Rights itation; Right to constituti- amental Duties	ts impact on the in Module The Indian Constitution ature utional Rights: ; Right to Equal to Freedom of Re onal Remedies;	itial drafting of the Contents tution Drafting Cor : lity; Right to Fre ligion; Cultural an Directive Principl	Indian Constitution mmittee, (Composite eedom; Right aga d Educational Rig les of State Pol	tion inst hts; icy;	Hours           4           4           5			
Modu I II III	le Histo & Wo Philo Prean Cont Funda Explo Right Funda	ry of Making of orking sophy of the In able, Salient Fea ours of Constitu amental Rights bitation; Right t to Constituti amental Duties.	ts impact on the im Module The Indian Constitution ature utional Rights: ; Right to Equal to Freedom of Re- onal Remedies; MCP:	itial drafting of the Contents tution Drafting Cor : lity; Right to Free ligion; Cultural an Directive Principl	Indian Constitution nmittee, (Composite eedom; Right aga d Educational Rig les of State Pol	tion inst hts; icy;	Hours           4           4           5			
Modu I II III	Revolution le Histo & Wo Philo Pream Conte Funda Explo Right Funda Orga Parlia	on in 1917 and i ry of Making of orking sophy of the In able, Salient Fea ours of Constitu- amental Rights itation; Right t to Constituti- amental Duties. ns of Governar ment Compos	ts impact on the in Module The Indian Constitution ature utional Rights: ; Right to Equal to Freedom of Re onal Remedies; mce: ition Qualification	itial drafting of the Contents tution Drafting Cor : lity; Right to Free ligion; Cultural an Directive Principl	Indian Constitution mmittee, (Composi- eedom; Right aga d Educational Rig les of State Pol	tion inst hts; icy; and	<b>Hours</b> 4 4 5			
Modu I II III IV	Revolution le Histo & Wo Pream Pream Cont Funda Explo Right Funda Orga Parlia Funct	ry of Making of orking sophy of the In able, Salient Fea ours of Constitut amental Rights bitation; Right t to Constituti amental Duties. ns of Governar ment, Compos ions, Executive	ts impact on the in Module Module The Indian Constitution ature utional Rights: ; Right to Equal to Freedom of Re onal Remedies; ition, Qualification e. President, Gov	itial drafting of the Contents tution Drafting Cor : lity; Right to Free ligion; Cultural an Directive Principl ons and Disqualifi- remor. Council of	Indian Constitution mmittee, (Composite eedom; Right aga d Educational Rig les of State Pol ications, Powers Ministers Judici	tion inst hts; icy; and ary.	Hours       4       4       5       5			
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Text Books						
1	Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.					
2	M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014					
3	D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015					
	References					
1	The Constitution of India, 1950 (Bare Act), Government Publication					
	Useful Links					
1	https://en.wikipedia.org/wiki/Constituent_Assembly_of_India					
2	https://nptel.ac.in/courses/129/106/129106003/					
3	https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-1w02/					
4	https://eci.gov.in/about/about-eci/the-functions-electoral-system-of-india-r2/					

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

## **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 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 (Marks) For Theory Course					
<b>Bloom's Taxonomy Level</b>		T1	T2	ESE	Total
1	Remember				
2	Understand	20	20	60	100
3	Apply				
4	Analyze				
5	Evaluate				
6	Create				
Total		20	20	60	100