	Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)											
			(Government M	V 2021-22	шс)							
			Cour	se Information								
Progr	amme		B.Tech. (Mechani	cal Engineering)								
Class.	Semes	ter	Final Year B. Tech	n Sem VII								
Cours	e Code	· · · ·		,								
Cours	e Nam	e	Solid Mechanics									
Desire	ed Requ	ıisites:										
	-		1									
Т	eaching	g Scheme		Examination Sc	heme (Marks)							
Lectu	re	3Hrs/week	T1	T1 T2 ESE								
Tutor	ial	-	20	20	60	1(	00					
Practi	tical											
Intera	raction - Credits: 3											
			Cou	rse Objectives								
To provide students a sound knowledge in solid mechanics required to solve the problems in												
-	industry.											
2	To teach the mathematical and physical principles in understanding the linear continuum behavior											
	of sol	ıds										
		Can	ma Outcomag (CO	with Dloom's Tox	an amy I aval							
At the	end of	the course, the	students will be abl	e to.								
CO1	O1 Explain the concept of theory of elasticity Apply											
	Show basic relations between stress and strains from theory of elasticity perspective Analyze											
CO2	and u	se energy met	hods to solve structu	ral problems.			-					
CO2	Analy	se the deformation	ation behavior of sol	ids under different ty	pes of loading and obt	ain	Evaluate					
005	mathe	ematical solution	ons for simple geom	etries.								
Modu	ıle		Moo	lule Contents			Hours					
т	Co Dr	oncept of Stre	ss, Components of	stress, Principal s	tresses, Stress invarian	nts,	7					
1	eq	uilibrium. Foi	iations of equilibriu	m in cylindrical coor	dinates	01	/					
	Co	oncept of strain	n, Deformations in t	he neighborhood of	a point, Change in len	gth						
п	of	a linear elem	ent, The state of st	train at a point, Inte	rpretation of shear str	ain	7					
	co	mponents,Prin	cipal axes of strain	and principal strain	ns, Plane strains in po	olar	,					
		eneralized sta	tement of Hooke'	s. s law Stress-strair	relations for isotro	nic						
Ш	m	aterials, Relati	on between the ela	stic constants, Plane	e Stress and Plane stra	ain,	6					
	M	ohr's circles fo	or the 3-D state of st	ress, Strain Measurer	nent							
	En	nergy Methods	, Work done in de	formation, Reciproc	ity theorem, Castiglia	ano	_					
IV	the <b>P</b>	eorem, Princip	ple of virtual wor.	k, Principle of mi	nimum potential ener	gy,	7					
	Be	ending of Bea	ms. Straight beams	and asymmetrical	bending, shear center	or						
	ce	nter of flexure	, shear stresses in thi	in walled open section	ns		6					
VI	Ap	oplication to t ctions. Thermo	hick cylinders and o-elasticity, 2-D cont	rotating discs, torsi tact problems, Introd	on of non-circular croution to plasticity.	oss-	7					
Modu	le wise	Measurable S	Students Learning (	<b>Dutcomes :</b>	1 5	I						
After t	he com	pletion of the o	course the student sh	nould be able to:								
1.	Anal	yse state of st	resses 3-D continu	um.								
2.	Anal	yse state of st	rains in a 3-D cont	inuum.								
3.	Estab	olish stress-str	ain relations for de	eformable solids.								
4.	Analy	yse mechanic	al structures using	energy methods.								
5.	Evalu	late stresses i	n symmetrical and	asymmetrical bear	ns.							

6.	Evaluate the stresses in the different applications by using theory of elastcity concepts.
	Text Books
1	S.P. Timoshenko and J.N. Goodier, "Theory of Elasticity", McGraw-Hill Publishing Co. Ltd., 3rd Edition, 1970.
2	2. Beer and Johnston, "Mechanics of Materials", McGraw Hill, 6th Edition, 2012
3	3. L.S. Srinath, "Advanced Mechanics of Solids", Tata McGraw-Hill Publishing Co. Ltd, 3rd Edition 2009.
	References
1	Shames, I.H. and Pitarresi, J.M, "Introduction to solid Mechanics", PHI learning Pvt. Ltd, 3rd Edition, 2009
2	Hulse, R and Cain J, "Solid Mechanics", Palgrave publisher, 2nd Edition, 2004.
3	F.B Seely and Smith, "Advanced Mechanics of Materials", John Wiley & Sons, 2nd Edition, 1978
	Useful Links
1	
2	

	CO-PO Mapping															
	Programme Outcomes (PO)													PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	2												2			
CO2			2								3	3	2			
CO3	2		2									3	3			
The stren	gth of i	mappir	ng is to	be wr	itten as	\$ 1,2,3;	Where	e, 1:Lo	w, 2:N	<b>l</b> edium	, 3:Hig	gh				

	Assessment Plan based on	Bloom's Taxon	omy Level (Mai	ks) For Theory	Course
B	loom's Taxonomy Level	T1	T2	ESE	Total
1	Remember				
2	Understand				
3	Apply	7	8	20	35
4	Analyze	8	7	17	32
5	Evaluate	5	5	23	33
6	Create				
	Total	20	20	60	100

	Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)												
			A	Y 2021-22									
			Cours	se Information									
Progr	amme		B.Tech. (Mechani	cal Engineering)									
Class,	Semest	er	Final Year B.Tech	n., Sem VII									
Cours	e Code												
Cours	e Name	•	Project I and Sem	inar									
Desire	ed Requ	isites:											
			1										
Т	eaching	g Scheme		Examination S	cheme (Marks)								
Lectu	re	-	LA1	LA2	ESE	Total							
Tutor	ial	-	30	30	40	100							
Practi	ictical 6 Hrs/Week -												
Intera	raction - Credits: 3												
			Cour	rse Objectives									
1	To he	lp students to a	ddress real life chall	lenges and discuss p	project requirements								
2	To giv	ve technical sol	utions through lates	t design & developr	nent tools.	hay along in a good							
2	Encol	ng out the w	ork plan of the process	s to help them to siect and to success	sfully complete the	by planning and							
5	obser	vations discu	ssions and decisio	n making process	ssiuny complete u	ne same, unough							
	00501	valionis, aisea		in making process.									
		Cou	rse Outcomes (CO)	) with Bloom's Tax	conomy Level								
At the	end of t	the course, the	students will be able	e to,									
	Under	rstand the imp	portance of teamw	ork and will be ab	le to work in a tea	am for Understa							
CO1	achiev	ving group go	bals / will be prep	pared to assume a	a leadership role i	in any <sup>nd</sup>							
	team.												
CON	Expla	in various co	ncepts and tools u	used in their proje	ct and analyze and	d give Analyse							
	soluti	ons for a spec	ific problem state	ment related to the	eir project.								
CO3	Prepa	re and presen	nt a detailed repor	t based on projec	t work spread over	er two Creating							
	semes	sters.											
			List of Experi	iments / Lab Activi	ties								
Cour	a Can	tonta											
Cours		lents.											
1. Pi	roject I	Definition:-											
•	Creat	ion of produc	t, apparatus, small	equipment, test se	etup, experimental	setup.							
•	Proto	type based on	new ideas, innova	ation of existing pr	oducts.	-							
•	Energ	gy audit/ cons	ervation-studies of	f department/ section	ion / organization	/ plant / machine							
	etc.												
•	Maki	ng of machine	e and renovation of	f machine.									
•	Expe	rimental set up	p to verify and cor	ifirm scientific coi	ncepts.								
•	Expe	rimental verifi	cation of principle	es of mechanical e	ngineering.								
•	Indu	stry sponsored	i projects.										
Projec	et work	to be taken uj	p individually or ii	n group (a group s	hall not be more th	nan 5 students).							
The p	roject c	contents shoul	ld be such that it i	is to be carried ou	t over the entire a	cademic year by							
the gr	oup.												
2. <u>Syr</u>	nopsis:	<u>.</u>											
-													

Synopsis should contain:-

- a. Need of project- How you / your group inspired of particular project
- b. Aim and objective of project topic.
- c. Idea / ideas used in the project work.
- d. How will you or your group execute the proposed idea
- e. Various steps that will be followed (sequential) in the project work.
- f. Schedule to be followed for completion of project work (July to March).
- g. Cost estimate for the project including material / financial assistance expected from the department.
- h. Classification of the project such as In-house, Sponsored, Lab development, software based etc.

# 3. Work diary:

Each project group shall maintain the record about project work details containing following points:

- Searching suitable project work
- Brief report preferably on journals/ research or conference papers/ books or literature surveyed to select and bring out the project.
- Brief report of feasibility studies carried to implement the conclusion.
- Rough Sketches/ Design Calculations, etc.

# **Text Books**

1. Various printed and electronic resources available on the internet and institute library.

## References

All types of standard journals, conference proceedings etc. 1.

## **Useful Links**

Online resources in the selected domain areas. 1

	CO-PO Mapping															
	Programme Outcomes (PO)													PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1		2					3					2	3	3		
CO2					3						3		3	3		
CO3			3	3								2	3	3		
The stren	oth of	mannii	no is to	he wr	itten as	123.	Where	- 1·Lo	$w 2 \cdot N$	ledium	3.Hic	vh				

		Asses	sment									
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.												
AssessmenBased onConducted byTypical Schedule (for 26-week Sem)Ma												
t				s								
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								
LAC	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								
LauESE	attendance, journal	Faculty	Marks Submission at the end of Week 18	40								
Week 1 indic	ates the starting week	of a semester. The	e typical schedule of lab assessments is show	'n,								

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 o	n Bloom's Ta	xonomy Level	(Marks) (For la	b Courses)
Bloom's Taxonomy Level	LA1	LA2	Lab ESE	Total
Remember				
Understand	15	10	10	35
Apply				
Analyze	10	10	10	30
Evaluate				
Create	5	10	20	35
Total Marks	30	30	40	100

		W	alchand Colleg	ge of Engineeri	ng, Sangli						
			A	Y 2021-22							
			Cour	se Information							
Progr	amme		B.Tech. (Mechani	cal Engineering)							
Class.	Semes	ter	Final Year B. Tecl	h Sem VII							
Cours	e Code	<u>,</u>		,							
Cours	e Nam	e	Finite Element An	alysis							
Desire	ed Reg	uisites:									
			<u> </u>								
T	eaching	g Scheme		Examination S	cheme (Marks)						
Lectu	re	3Hrs/week	T1	T2	ESE	Т	otal				
Tutor	ial	-	20	20	60		100				
Practi	ical	-		1	-						
Intera	eraction - Credits: 3										
		1	1								
			Cou	rse Objectives							
1	To in	troduce the bas	sics and application	of Finite Element M	lethod						
2	To ex	plain the gener	al steps in finite ele	ment method.							
3	To sc	lve various fiel	d problems using fi	nite element method	1.						
4	To ill	ustrate the prin	ciple of mathematic	al modeling of engi	neering problems						
A 1	1 0	Cou	rse Outcomes (CO	) with Bloom's Ta	xonomy Level						
At the	end of	the course, the	students will be abl	e to,			Annly				
	CO1 Explain the use of mathematical modeling and FEM. Appl										
C02	Analy	vee structural a	nent problem	susing finite elemen	nt technique		Fyaluate				
0.05	Analy				n teeninque.		Evaluate				
Modu	ıle		Mo	dule Contents			Hours				
Wiout	III III	troduction to	FEM				Hours				
I	Bi ne lin	asic concepts of ed for approx nitations of FE	of FEM – Historical imation, application M.	background, relev as of FEM in vario	ance and scope for FI ous fields, advantages	EM – and	6				
II	G pi	overning equat oblems, Weigh	tions, discrete and control Residual Method	continuous models, ods, Variational forr	boundary and initial v nulation of boundary v	value value	7				
III	O el as	ements, deriva sembly of elerent transfer. for	a second order equation of shape fur mental matrices, solution	ation, discretization actions, Stiffness i lution of problems ation, transverse def	n, linear and higher of natrix and force vec from solid mechanics lections, continuity	order ctors, and	7				
IV	T fu to st el	wo dimensiona nctions, eleme rsion of non- resses and plar ements.	l equations, finite el ntal matrices and R circular shafts, qua le strain problems, l	ement formulation, HS vectors; applic adrilateral and high body forces and the	triangular elements- s ation to thermal probl her order elements. I ermal loads, plate and	hape ems, Plane shell	7				
v	In el N bo m	troduction, co ements, umerical integ oundary condit ethod, penalty	- ordinate transfor gration, assembly of tions, solution of t method	rmations, natural of element equation he equations, matrices	coordinates, isoparam ons, incorporation of ix operations, elimin	the ation	6				
VI	M re sc	odel validity a sult processin plution of dynar	and accuracy, mesh g, model checking mic problems	design and refine , longitudinal vib	ement, element distort pration and mode sh	ions, apes,	7				
Modu	le wise	Measurable S	tudents Learning	Outcomes :							
After t	the com	pletion of the o	course the student sh	nould be able to:							

- 1. Explain the use of mathematical modeling and FEM.
- 2. Apply the general steps of finite element method to solve engineering problems.
- 3. Use the discretization techniques to mesh the various geometries.
- 4. Solve the structural, thermal and fluid problems using variational formulation methods.
- 5. Describe the various boundary conditions.
- 6. Interpret the finite element model and its simulation results.

	Text Books
1	S. S. Rao, "Finite Element Method in Engineering", Elsevier Publication, 4th Edition, 2004
2	P. Seshu, "Textbook of Finite Element Analysis", 1st Edition. PHI publication. Ltd., 2008.
3	M. J Fagan, "Finite Element Analysis- Theory and Practice"; Longman Scientific & Technical, 1st

	References									
1	J. N. Reddy, "An Introduction to Finite Element Method", Tata McGraw Hill publication co. 2nd									
1	Edition, 1993									
2	2. Logan D. L. "A first course in Finite Element Method", Cengage learning, 4th Edition, 2008.									
2	3. O. C, Zienkiewicz "The Finite Element Method – Basic Concepts and Linear Applications",									
3	Tata McGraw Hill publication co., 5th Edition, 2000.									
	Useful Links									
1										
2										

	CO-PO Mapping																
		Programme Outcomes (PO)													PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
CO1	2											1					
CO2			3	2				2					2				
CO3		2						2				2	2				
T1	- 41 C			1		102	3371	1 T	<u> </u>	۲. ۱۰	2 11.	1					

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

	Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course						
B	loom's Taxonomy Level	<b>T1</b>	T2	ESE	Total		
1	Remember						
2	Understand						
3	Apply	7	8	20	35		
4	Analyze	8	7	17	32		
5	Evaluate	5	5	23	33		
6	Create						
	Total	20	20	60	100		

	Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)									
			A	Y 2021-22						
	Course Information									
Progr	amme		B.Tech. (Mechani	cal Engineering)						
Class.	Semes	ter	Final Year B. Tech	Final Year B. Tech., Sem VII						
Cours	e Code	<u>,                                     </u>		.,						
Cours	e Nam	e	Computational Flu	id Dynamics						
Desire	d Req	uisites:								
	-		1							
Т	eaching	g Scheme		Examination So	cheme (Marks)					
Lectu	re	3Hrs/week	T1	T2	ESE	[ ]	otal			
Tutor	ial	-	20	20	60		100			
Practi	cal	-		-						
Intera	ction	-		Cred	its: 3					
			1							
			Cou	rse Objectives						
1	To in	troduce various	s prediction methods	and CFD methodol	ogy					
2	To in	troduce govern	ing Equations of flu	id flow and its nume	rical modelling.					
	To en	able the studer	nts to understand the	various boundary co	onditions, discretiza	tion met	hods, and			
3	soluti	on procedures.								
4	To pr	epare the stude	ents to solve complex	x problems in the fie	ld of fluid flow and	heat tra	nsfer by			
4	using	high speed con	mputers.							
	· · · · · · · · · · · · · · · · · · ·									
A	1 0	Cou	rse Outcomes (CO	) with Bloom's Tax	onomy Level					
At the	At the end of the course, the students will be able to,						Apply			
CO1		cations	methods, CFD meth	ouology and its			Арріу			
<u> </u>	Deriv	e and explain t	he different forms o	f governing equation	10		Analyza			
$CO_2$	Apply	the numerical	techniques to solve	various engineering	nrohlems		Fyaluate			
	Appi.	y the numerical	i definiques to solve	various engineering	problems.		Lvaluate			
Modu	ıle		Moc	lule Contents			Hours			
	Ir	troduction								
I	Pı	rediction metho	od, experimental tech	6						
	ty	pical problems	/ Problem Solving w	vith CFD – Methodo	logy.					
		onservation la	ions of fluid flow ar	e <b>quations</b> ad heat transfer Fau	ations of the state N	Navier-				
II		okes equation	s for a Newtonian	fluid, Conservative	e form of the gov	verning	7			
	ec	uations of flu	id flow, Differentia	1 and integral form	s of the general tra	ansport				
	ec	luations, Classi	fication of physical	behaviour.						
		olution of the I	Navier-Stokes equa	tions and boundary	y conditions					
III		artial Different	ial Equations Grid	Generation Technic	lination of the Gov	litions:	6			
	In	troduction, typ	es of boundary cond	litions, Potential pitf	alls and final remar	ks				
	B	asic computat	ional techniques for	r simple grids						
	Fi	nite Difference	e Formulations: Intr	oductory remarks,	Taylor Series Expa	nsions,	_			
IV	Fi	Finite difference by Polynomials, Finite difference equations, Applications.								
		file volume N	schemes 1-D exami	n, Steady one-dimension	sional problem, Pro	perues				
<u> </u>		olution method	ds	2100						
		his chapter de	als with basic num	erical discretization	approaches discus	ssed in				
v	ea	rlier chapter ar	nd mold them into v	arious techniques that	at will allow the nur	nerical				
, v	sc	olution of flow	problems. Lax- W	Vendroff Technique	Maccormacks Tech	nnique,	7			
		rank-Nicolson	Technique ,Relaxa	ation Technique, A	ADI Technique, P	ressure				
			nque							

2								
1	U Strut Luiky							
	Useful Links							
3	1987.							
	Flectcher, C.A.J., "Computational Techniques for Different Flow Categories". Springe	er-Verlage						
2	Fletcher, C.A.J., "Computational Techniques for Fluid Dynamics 1" Fundamental an	d General						
1	Taylor, C and Hughes J.B. "Finite Element Programming of the Navier Stock I Pineridge Press Ltd., U.K.1981.	Equation",						
	References							
		-						
3	Subas V. Patankar"Numerical heat transfer fluid flow", Hemisphere Publishing Corpora	tion, 1980						
2	H.K.Versteeg and W Malalasekera, "Introduction to Computational Fluid Dynamics" Group Ltd 1995	Longman						
1	Anderson, J.D., "Computational Fluid Mechanics The Basics with applications", Me Publication 1995	cGrawHill						
	Text Books							
	results.							
6.	6. To select the appropriate post processing method, carry out and compare the various							
т. 5	Select the appropriate solution method, analyze and check the CFD study	•						
4	Analyze the FDM and FVM methods: carry out the solution using these methods	1						
3.	boundary conditions	iques and						
2	these equations.	iques and						
2.	Derive various governing equations in fluid mechanics and heat transfer, interpre-	etation of						
	applications of CFD							
1.	Describe and recall basics of fluid mechanics and mathematics, methods of predi	ction and						
After th	the completion of the course the student should be able to:							
Modul	e wise Measurable Students Learning Outcomes :							
	numerically. Graphically: Vector plots, Contours, Iso-surfaces, Flow lines, Animation Alpha numeric: Integral values, Drag, lift, torque calculations	6						
VI	Results are usually reviewed in one of two ways. Graphically and Alpha							
	Post processing							

	CO-PO Mapping														
		Programme Outcomes (PO) PSO													
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2											2	2	
CO2	3	2	1		3			3	3		3		2	2	
CO3	3	2	3		2	1			3				1		
The stren	oth of	mannir	ng is to	he wr	itten av	123.	Where	1.Lo	$\frac{1}{2}$ $2 \cdot N$	Iedium	3.Hic	vh			

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

	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	7	8	20	35		

4	Analyze	8	7	17	32
5	Evaluate	5	5	23	33
6	Create				
	Total	20	20	60	100

	Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)									
			A	Y 2021-22						
			Cour	se Information						
Progr	amme		B.Tech. (Mechani	cal Engineering)						
Class,	Semes	ter	Final Year B. Tecl	Final Year B. Tech., Sem VII						
Course Code										
Cours	e Nam	e	Foundry Technolo	ogy						
Desire	ed Requ	uisites:								
Т	eaching	g Scheme		Examination So	cheme (Marks)					
Lectu	re	3Hrs/week	T1	T2	ESE	L I	otal			
Tutor	ial	-	20	20	60		100			
Practi	cal	-		-						
Intera	ction	-		Cred	its: 3					
	-		Cou	rse Objectives	•••	<u> </u>				
1	To pr	ovide knowled	ge of various pheno:	mena observed in liq	uid metals and its e	effect on	casting			
	qualit	y also atradante fo		anto valotad to postin	a collidification to a					
2	and a	ake students ra	minar with the conc	epts related to castin	g solidification to g	get nomo	geneous			
2	To in	nart knowledg	e for design of gatin	a and feeding system	n					
	To de	monstrate the	melting practices an	d various equipment	s used in modern fo	undries				
	10 40		inering practices an	a various equipment						
		Cou	rse Outcomes (CO	) with Bloom's Tax	onomy Level					
At the	At the end of the course, the students will be able to,									
Summarize the foundry processes / equipments and metallurgical aspect of casting					Apply					
	proce	sses								
CO2	Calcu	late the dimen	sional aspects of gat	ing system, cooling	rate and furnace cha	arging	Analyze			
CO3	Inves	tigate the phen	omenon observed du	uring metal liquefact	ion, pouring,		Evaluate			
	sona	fication, and th	leir effects on castin	g quanty						
Modu			Mo	Jula Contants			Hours			
WIGUU	Inc	troduction	10100	iule Contents			110015			
I	Bi lic te	rief History, Fo quid metals, n sts, hot tearing	oundry Metallurgy: nethods of degassin , shrinkage of liquid	Oxidation of liquid g, fluidity, factors a metals.	metals, gas dissolu affecting fluidity, t	ition in fluidity	6			
II	So Cr gr str Cl	<b>Didification of</b> rystallization a owth, Indepen- ructure of ca <u>hvorinov's equ</u>	<b>Casting</b> nd development of ndent nucleation, stings, Concept of ation, heat flow ana	cast structure, Nucl Eutectic freezing, progressive and lysis	eation, Growth, De Peritectic reactions directional solidifi	endritic s, The ication,	7			
III	For Clark	eeding of Cast haracteristics, hills, padding a	<b>ings</b> gating technique, ca nd insulators, feedin	asting temperature a g and gating system	nd pouring speed, design	use of	7			
IV	M M W	elting of Ferr elting Practice orking of induc	ous Alloys es: cupola: charge tion furnace, crucibl	calculations, cons e furnace, and reverl	truction; other fu perate furnace.	rnaces:	6			
V	M No po ha re	odernization a eed for modern puring, shake andling equipt clamation of sa	and Mechanization nization, and mecha out equipment and nent for sand mou ands, Pollution contr	a <b>of Foundry</b> nization, moulding a d fettling, dust and olds and cores, mo rol.	and core making, n l fume control, n lten metal and ca	nelting, naterial astings,	7			
VI		ecently develo	pments oped processes, F	oundry Manageme	nt, Energy conse	rvation	6			

	methods, Casting simulation, DFM for cast components, Emerging techniques of
	Rapid prototyping and tooling, Simulations and analysis software's.
Modu	le wise Measurable Students Learning Outcomes :
After t	he completion of the course the student should be able to:
1.	1. Describe high temperature behavior of metals
2.	2. Articulate phases in casting solidification, related defects and remedial action to
	eliminate the defects
3.	3. Solve the problems related to gating and feeding system design
4.	4. Explain the melting practices and the equipment involved
5.	5. Discuss various modern equipment used in foundry
6.	6. Examine the design from casting production or yield point of view
	Text Books
1	P. L. Jain, "Principle of Foundry Technology",5th edition, Tata McGraw Hill publishing
1	Co.Ltd.,2017, ISBN:9780070151291.
2	.T V Ramana Rao, "Metal Casting: Principles and Practice", 2nd edition, New Age International
	(P) Ltd Publishers,2020,ISBN: 9789388818162
3	B. Ravi, "Metal Casting Computer Aided Design and Analysis" Prentice Hall of India, New
	Delhi, 2005.
	References
1	Richard Heine, Carl Loper & Philip Rosenthal, "Principles of Metal Casting", Tata McGraw Hill
-	publishing Co.Ltd,Indian edition, 2017,ISBN-10 : 0070278962; ISBN-13 : 9780070278967
2	P.Beelay, "Foundry Technology", Butterworth-Heinemann, 2001,ISBN:9780750645676(print
	book) 9/80080506890 (ebook)
3	D M Stetanescu, "ASM Handbook, Volume 15: Casting", 2001. ISBN-10
	: 9/808/1/00216,ISBN-13: 9/8-08/1/00216
1	Useful Lmks
2	

	CO-PO Mapping														
				Р	rograi	nme C	Outcon	nes (PC	))					PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2								1				1		
CO2			2									1	2		
CO3		3						2						2	
The stren	The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High														

	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	7	8	20	35		
4	Analyze	8	7	17	32		
5	Evaluate	5	5	23	33		
6	Create						
	Total	20	20	60	100		

	Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)								
	AY 2021-22								
	Course Information								
Progr	amme		B.Tech. (Mechani	cal Engineering)					
Class,	Seme	ster	Final Year B. Tech., Sem VII						
Cours	e Cod	e							
Cours	æ Nan	e	Industrial Engineer	ing					
Desire	ed Req	uisites:							
		-	1						
Teaching Scheme Examination Scheme (Marks)									
Lectu	re	3Hrs/week	T1	T2	ESE	Т	'otal		
Tutor	ial	-	20	20	60	1	100		
Practi	ical	-		- -					
Intera	ction	-		Cred	its: 3				
			Cou	rse Objectives					
1	Ton	nake the studer	nts perform in indus	stry for effective pla	nning, controlling,	and imp	lementing		
2	proje	cts.	las of saianaa taahna	low and anginaaring	for solving industry	rolovont	problems		
$\frac{2}{3}$	To de	evelop manageri	al skills relevant to the	ne industry.	Tor sorving mousery	Televalit	problems.		
	100	ererep managerr							
		Cou	rse Outcomes (CO	) with Bloom's Tax	onomy Level				
At the	At the end of the course, the students will be able to,								
CO1	CO1 Explain recent trends in industrial engineering. Apply								
CO2	CO2 Illustrate the basic concepts of modern industrial engineering in the manufacturing and Analyze								
<u> </u>	Examine various method study, work measurement and inventory management Evaluate						Evaluate		
0.05	techn	iques.	<b>•</b> •						
Modu	ile		Moo	lule Contents			Hours		
Ι		efinitions, funct ervice sector, P echniques, Value	ions and status of I.E roductivity – conce analysis. Production	E department in man pt and objectives, fa Planning and Contro	afacturing organization actors affecting, too bl – Elements and fu	on and ols and nctions	7		
II	P P te C lo	ant Layout:-Site lant layout:-Site chniques used, bjective, element oad concept, Ecc	d Material Handling e selection, principle maintenance, line b nts, functions, princip ponomics of material h	of Capacity requiren s alancing, layout plar ples, types of materia andling.	roduction types, too ning. Material hand l handling equipme	ols and lling: - nt, unit	7		
III	N D te	<b>lethod study</b> efinitions, obj cchniques, princi	ectives, various reples of motion econo	ecording techniques my, Therbligs, micro	, methods impro -motion study, MOS	vement ST	6		
IV	V D al	Vork Measuren Definitions, obje- llowances, group	<b>nent</b> ctives, activity and timing techniques, v	elements, performan work sampling, PMTS	ce rating, rating m	ethods,	6		
V		nventory Contr Different Models ecision.	ol s of Inventory Syste	ems, Economic orde	r quantity, Make o	or Buy	7		
VI	N C	etwork Techni PM and PERT,	ques Construction, Time c	ost trade off.			6		
			7	Cavt Baaks					
1	Khan	ina O.P., "Indus	strial Engineering an	nd Management", Dl	nanpat Rai Publicat	ions (P)	Ltd, New		
2	Mart Limi	and Telsang, " ted, N. Delhi, 3	Industrial Engineeri 3 <sup>rd</sup> revised edition 2	ng and Production 1 018	Management", S. C	hand &	Company		

3	M. Mahajan, "Industrial Engineering and Production Management", Dhanpat Rai & Co., Modified Edition, 2010					
	References					
1	Gavrial Salvendy" Handbook of Industrial engineering" John Wiley and sons, New York, 2007					
2	2 M. I. Khan "Industrial Engineering" New age international(P) Ltd, New Delhi, 2004					
3	International labour office, "Introduction to work study" Publisher International Labour office, 1969,					
5	Digitalized edition, 2008					
	Useful Links					
1	https://nptel.ac.in/courses/112/107/112107142/					
2	https://www.myklassroom.com/Engineering-branches/28/Industrial-Engineering					
3	https://www.youtube.com/watch?v=yhywrCChJBQ&feature=emb_imp_woyt					

	CO-PO Mapping														
	Programme Outcomes (PO)											PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1					2				3				3		
CO2				3	1	2							2	2	
CO3					2		2	3						3	
The stron	ath of	monni	an in to	haur	itton of	1 2 2.	Whore	1.Lo	<b>.</b>	1 dium	2.11	-h			

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

	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	7	8	20	35						
4	Analyze	8	7	17	32						
5	Evaluate	5	5	23	33						
6	Create										
	Total	20	20	60	100						

	Walchand College of Engineering, Sangli										
AY 2021-22											
	Course Information										
Progr	amme		B.Tech. (Mechani	cal Engineering)							
Class.	Semest	er	Final Year B.Tech	n Sem VII							
Cours	e Code										
Cours	e Name		Finite Element Me	ethod Lab							
Desire	ed Requ	isites:									
Т	eaching	Scheme		Examination So	cheme (Marks)						
Lectu	re	_	- LA1 LA2 ESE Total								
Tutor	ial	-	30	30	40		100				
Practi	cal	2Hrs/Week		-	, I						
Intera	ction	-		Cred	its: 1						
			Cour	rse Objectives							
1	To exp	plain the finite	element method, its	fundamentals and g	eneral steps.						
2	To de	scribe the unde	erlying theory, assur	mptions and modelin	g issues in FEM.						
3	To pr	ovide hands o	n experience using	g finite element sof	tware to model, an	alyze a	ind design				
	To pr	ovide hands or	a engineering.	finite element softw	vare to simulate str	uctural	fluid and				
4	therma	al	r experience using	Time clement sort	vare to simulate su	ucturui,	, maia ana				
	1										
		Cou	rse Outcomes (CO)	) with Bloom's Tax	onomy Level						
At the	At the end of the course, the students will be able to,										
COL	<b>CO1</b> Execute the structural, thermal and dynamic analysis using suitable software. Apply										
CO2	<b>CO2</b> Categorize the mathematical methods and finite element procedures for engineering Analyze applications.										
CO3	Select	the procedure	es for structural, th	ermal and fluid ana	llysis of 1D, 2D ar	nd 3D	Evaluate				
	proble	ms.									
			List of Evner	iments / I ah Activit	ins						
Listo	fFynor	imonts.									
LISU	Experi	unents.									
Term	work sh	all consist of m	inimum ten based o	on the topics given b	elow.						
The st	udents a	re expected to	solve (any 10) the p	problems by using an	y FEM software.						
1. A	nalvsis	of stepped bar									
2. T	hermal	analysis of con	nposite wall								
3. Т	orsiona	l analysis of sh	aft								
4. A	nalysis	of truss									
5. P	roblems	on shape func	tions								
$\begin{bmatrix} 0. \\ 7 \end{bmatrix}$	tructura	1 2D analysis									
8. N	7. Structural 5D analysis 8. Modal Analysis										
9. Т	9. Thermal 2D analysis										
10. T	10. Thermal 3D analysis										
	11. Geometrical nonlinear analysis										
12. C	12. Contact nonlinear analysis										
15. N 14 In	13. Material nonlinear analysis 14 Industrial Visit to Software Company										
	iul										
			Т	ext Books							
1	S. S. F	Rao, "Finite Ele	ement Method in En	igineering", Elsevier	Publication, 4th Ed	ition, 2	004				
2	P. Ses	hu, "Textbook	of Finite Element A	analysis", 1st Editior	, PHI publication, 2	2008.					

3	M. J Fagan, "Finite Element Analysis- Theory and Practice"; Longman Scientific & Technical, 1st
	References
1	J. N. Reddy, "An Introduction to Finite Element Method", Tata McGraw Hill publication co. 2nd
1	Edition, 1993
2	Logan D. L. "A first course in Finite Element Method", Cengage learning, 4th Edition, 2008.
2	O. C, Zienkiewicz "The Finite Element Method – Basic Concepts and Linear Applications", Tata
5	McGraw Hill publication co., 4th Edition.
	Useful Links
1	
2	

	CO-PO Mapping														
	Programme Outcomes (PO)										PSO				
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		2		3				3					2		
CO2		2		2				2					2		
CO3		2	2									1	3		
The strop	oth of	monni	na in to	how	itton of	1 2 2.	Whor	1.Lo	W 2.N	Andium	2.11	rh			

	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.											
Assessmen     Based on     Conducted by     Typical Schedule (for 26-week Sem)     M											
t				s							
LA1	Lab activities,	Lab Course	During Week 1 to Week 6	20							
	attendance, journal	Faculty	Marks Submission at the end of Week 6	50							
LAC	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							
LauESE	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	ne actual schedule	shall be as per academic calendar. Lab								
activities/Lab	performance shall inc	clude performing	experiments, mini-project, presentations, dra	wings,							

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

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)										
			A	Y 2021-22						
			Cours	se Information						
Progr	amme		B.Tech. (Mechani	cal Engineering)						
Class,	Semest	er	Final Year B.Tech	n., Sem VII						
Cours	e Code									
Cours	e Name		Computational Flu	uid Dynamics Lab						
Desire	d Requ	isites:								
		<u> </u>								
Т	eaching	Scheme	T A 1	Examination Sc	cheme (Marks)					
Lectu	re ial	-	20	20	<u>ESE</u>	<b>10tal</b>				
Procti	al col	- 2Hrs/Week	50	30	40	100				
Intera	ction	-		Cred	its• 1					
Intra				Citu	its. 1					
			Сош	rse Objectives						
1	To in	troduce the stu	udents about geom	etry creation, mesh	ing boundary con	ditions, numerical				
1	techni	ques.								
2	To pre	pare the studer	nts to use appropriat	e mesh, boundary co	onditions, and nume	erical technique.				
		elop the skill t	to use high speed dig	gital devices to solve	e CFD problems.					
		Cou	rse Outcomes (CO)	) with Bloom's Tax	onomy Level					
At the	end of t	he course, the	students will be able	e to,						
C01	O1 Interpret the methodology of CFD simulation Understand									
CO2	Explai genera	n FDM, FVN tion technique	1 techniques and t	heir significance, b	oundary condition	s, grid Understa nd				
CO3	Select proces	and apply the sing technique	e grids, boundary co	onditions, solver / r	iumerical technique	e, post Apply				
CO4	Analy: techni	ze and inter ques/methods i	pret the Preproc	essing, Processing	and Post Proc	cessing Analyz				
					•					
<b>T</b> • 4		·	List of Experi	iments / Lab Activit	ties					
List of	Experi	ments:								
1.	Metho	dology to sim	alate the problem wi	ith CFD.						
2.	Differ	ent types of gri	ids and grid generation	ion techniques.						
3.	Differ	ent types of bo	undary conditions.							
4.	Simul	ation of 1D cor	duction problem us	sing FDM.						
6.	Simul	ation of 1D con	nduction problem us	sing FVM.						
7.	Simul	ation of 2D con	nduction problem us	sing FVM						
8.	Simul	ation of mass d	liffusion problem us	sing FVM.						
9.	Simul	ation of flow the	rough pipe using -	commercial software	2.					
11	. Flow a	around Cylinde	er/Sphere/ Aerofoil.	venturmeter.						
12	. Simul	ation of flow th	rough duct.							
13	. Simul	ation of forced	convection heat tran	nsfer problem.						
14	. Simul	ation radiation	heat transfer proble	m.						
15	Simul	ation of Paralle	nu near transfer thro of flow heat exchange	ough porous media.						
17	. Simul	ation of Count	er flow heat exchange	ger.						
18	. Simul	ation of phase	change phenomenor	n.						
19	. Simul	ation of flow in	n Turbomachines.							
20	. Simul	ation of unstead	dy state heat transfe	r problem.						

	Text Books
1	Anderson, J.D., "Introduction to Computational fluid Dynamics", McGrawHill Publication 2008
2	Muralidhar K. and Sundararajan T., "Computational Fluid Flow and Heat Transfer", Narosa Publishing House, 2nd edition, New Delhi 2011.
3	H.K.Versteeg and W Malalasekera, "Introduction to Computational Fluid Dynamics" Longman group, 1998.
4	Hoffmann K.A " Computational fluid Dynamics" Publication of engineering education system 2000
	References
1	Anderson, J.D., "Introduction to Computational fluid Dynamics", McGrawHill Publication 2008
2	Muralidhar K. and Sundararajan T., "Computational Fluid Flow and Heat Transfer", Narosa Publishing House, 2nd edition, New Delhi 2011.
3	H.K.Versteeg and W Malalasekera, "Introduction to Computational Fluid Dynamics" Longman group, 1998.
	Useful Links
1	
2	

	CO-PO Mapping														
	Programme Outcomes (PO) PSO														
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2											1	2	
CO2	3	2	1		3			3	3		3		1	2	
CO3	3	2	3		2	1			3				1		
The stren	The strength of mapping is to be written as 1.2.3: Where, 1:Low, 2:Medium, 3:High														

	Assessment										
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.											
Assessmen Based on Conducted by Typical Schedule (for 26-week Sem) Max											
t				S							
ΤΑΊ	Lab activities,	Lab Course	During Week 1 to Week 6	20							
LAI	attendance, journal	Faculty	Marks Submission at the end of Week 6	50							
I 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							
Lob ESE	Lab activities,	Lab Course	During Week 15 to Week 18	40							
Lau ESE	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. Th	ne actual schedule	shall be as per academic calendar. Lab								
activities/Lab	performance shall inc	clude performing a	experiments mini-project presentations drav	wings							

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	15	35						
Apply	10	10	15	35						
Analyze	10	10	10	30						
Evaluate										
Create										

Total Marks	30	30	40	100

	(Government Aided Autonomous Institute)								
	AY 2021-22								
			Cours	se Information					
Progra	amme		B.Tech. (Mechani	cal Engineering)					
Class,	Semest	ter	Final Year B.Tech	., Sem VII					
Cours	e Code								
Cours	e Name	<u>e</u>	Foundry Technolo	ogy Lab					
Desire	d Requ	isites:							
Те	eaching	g Scheme		Examination Sc	heme (Marks)				
Lectur	e	-	LA1	LA2	ESE	]	Fotal		
Tutori	al	-	30	30	40		100		
Practi	cal	2Hrs/Week		-					
Intera	ction	-		Credi	its: 1				
		· · · · ·							
			Cour	rse Objectives					
1	To ma	ake students fan	niliar with importan	it sand properties and	l its effect on castin	g qualit	y		
2	To ava	ail hands on exp	perience with metal	casting/foundry prac	ctices				
3	To in	npart practical k	nowledge in design	of gating and feeding	ng system for cast c	ompone	ent		
4	To pro	ovide exposure	to computer applica	ations in found					
5	To giv	e students an e	exposure to various	equipment used in fo	undries.				
		Com	rea Autoomae (CA)	with Bloom's Tax	nomy Loval				
At the	end of t	the course the	students will be able	e to					
	Exami	ine the cast pr	oducts. Foundry Pr	rocesses, and comp	uter application in	volved	Understa		
CO1	therein	n		······	···· ··· ··· ··· ··· ··· ··· ···		nd		
CO2	Attrib	ute the Sand Pr	operties and investi	gate the Casting Def	ects		Understa		
02							nd		
CO3	Desig	n the gating, fee	eding system, patter	rns and furnace charg	ge		Apply		
	List of Experiments / Lab Activities								
List of	Exper	iments:							
I Sand	d tactin	a lah (8 hre)							
a. Com	n ressiv	e strength of m	olding sand (1 hrs)						
b. Tens	sile stre	ngth of molding	g sand (1 hrs)						
c. Shea	c. Shear strength of molding sand (2 hrs)								

- d. Permeability test for molding sand (2 hrs)
- e. Sieve shaker experiment to find GFN for molding sand (2 hrs)

#### II. Simple metal casting job (10 hrs)

- a. Design of feeder
- b. Design of gating system
- c. Pattern design and pattern manufacturing
- d. Mold preparation and pouring

## III. Study of Cupola furnace (2 hrs)

### IV. Demo on metallography of standard cast samples (2 hrs)

### V. Computer applications(6 hrs)

a. Computer program for foundry charge calculation (2 hrs)

b. Demo of casting design and analysis in simulation software (4 hrs)

# VI. Foundry(ferrous and non-ferrous) visits and reports

	Text Books
1	P. L. Jain, "Principle of Foundry Technology",5th edition, Tata McGraw Hill publishing Co.Ltd.,2017, ISBN:9780070151291
2	P.N.Rao, "Manufacturing Technology-Foundry, Forming and Welding, 5th edition (Volume I)", Tata McGraw Hill publishing Co.Ltd., 2018, ISBN: 9353160510, 9789353160517
3	B. Ravi, "Metal Casting Computer Aided Design and Analysis" Prentice Hall of India, New Delhi, 2005.
	References
1	P.Beelay, "Foundry Technology", Butterworth-Heinemann, 2001,ISBN:9780750645676(print book) 9780080506890 (ebook)
2	D M Stefanescu, "ASM Handbook, Volume 15: Casting", 2001. ISBN-10 : 9780871700216, ISBN-13 : 978-0871700216 3. Stimpson William C, Gray Burton Linwood, "Foundry Work: A Practical Handbook on Standard Foundry Practice, Including Hand and Machine Molding; Cast Iron, Malleable Iron, Steel, and Brass Castings; Foundry Management; Etc.", Creative Media Partners, LLC, 2018, ISBN: 0343313146, 9780343313142
3	P.Beelay, "Foundry Technology", Butterworth-Heinemann, 2001,ISBN:9780750645676(print book) 9780080506890 (ebook)
	Useful Links
1	
2	

CO-PO Mapping															
				Р	rograi	mme C	Outcon	nes (PC	<b>)</b> )					PSO	
	1	1 2 3 4 5 6 7 8 9 10 11 12 1 2 3													
CO1			2						1				2		
CO2			2						1					1	
CO3     2     1     2															
The stren	gth of	mappir	ng is to	be wr	itten as	\$ 1.2.3:	Where	e. 1:Lo	w. 2:N	ledium	. 3:Hig	zh	-		-

	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.									
Assessmen	ssessmen Based on Conducted by Typical Schedule (for 26-week Sem) Mark									
t				s						
ΤΑΙ	Lab activities,	Lab Course	During Week 1 to Week 6	20						
	attendance, journal	Faculty	Marks Submission at the end of Week 6	50						
L A 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	ce, journal Faculty Marks Submission at the end of Week 18		40						
West 1 india	atag starting weals of	approximentary The tru	nical achadula of lab accomments 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 LevelLA1LA2Lab ESETotal									
Remember									

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

Walchand College of Engineering, Sangli									
AY 2021-22									
Course Information									
Progr	amme		B.Tech. (Mechani	cal Engineering)					
Class,	Class, Semester Final Year B.Tech., Sem VII								
Cours	Course Code								
Cours	Course Name Industrial Engineering Lab								
Desire	d Requ	isites:							
T	eaching	Scheme		Examination S	cheme (Marks)				
Lectu	re	-	LA1	LA2	ESE	Total			
Tutor	ial	-	30	30	40	100			
Practi	cal	2Hrs/Week			-				
Intera	ction	-		Cred	lits: 1				
			~						
	-	1 .1 . 1 .	Cour	rse Objectives	• • • • • • • • • • • • • • • • • • • •	1 • 1 •			
1	project	ike the student s.	s perform in indus	try for effective pla	anning, controlling,	and implementing			
2	To util	ize the principle	es of science, techno	logy and engineering	for solving industry	relevant problems.			
3	To dev	elop manageria	l skills relevant to th	ne industry.					
		Cou	rea Autaamas (CA)	with Bloom's Tax	anomy Loval				
At the	At the end of the course, the students will be able to								
CO1	Explai	n recent trends	in industrial enginee	ring.		Apply			
CO2	Illustra service	te the basic co sector.	oncepts of modern in	ndustrial engineering	in the manufacturi	ng and Analyze			
CO3	Examin technic	ne various m jues.	ethod study, work	c measurement and	d inventory manag	gement Evaluate			
			List of Experi	iments / Lab Activi	ties				
Case s	tudies o	on:							
1. Cha	racterist	ics of manufac	turing organization						
2. Clas	sificatio	on of services a	ind service sectors						
3. Sale 4. Cap	acity rec	uirement plan	ning						
5. Typ	es of pla	ant layouts	8						
6. Mat	erial har	ndling system							
7. Tim	e study	and motion stu	dy						
8. WO1	rk measu	rement and pe	prormance rating	J					
10. Ne	twork te	chniques, CPN	A and PERT	y					
			Т	ext Books					
1	Khann Delhi.	a O.P., "Indus Year 2003	trial Engineering ar	nd Management", D	hanpat Rai Publicat	ions (P) Ltd, New			
2	Martaı Limite	nd Telsang, "In d, N. Delhi, 3	ndustrial Engineering revised edition 2	ng and Production 1 018	Management", S. C	Chand & Company			
3	E.S. E Edition	Buffa and R.K n, 2002	. Sarin, "Modern I	Production/ Operation	ons Management, V	Wiley & Sons, 8 <sup>th</sup>			
1	Carri	1 Column " IT	ndhook of Inderstal	References	Viloy and correctly	Vorte 2007			
$\frac{1}{2}$	Gavria MIV	han "Industrial	Engineering" New	age international(P) I	td New Delbi 200	1 OFK, 2007			
	Interna	tional labour of	ffice, "Introduction to	o work study" Publis	her International I al	oour office.1969.			
3	Digital	ized edition. 20	08		Lat				

	Useful Links
1	https://nptel.ac.in/courses/112/107/112107142/
2	https://www.myklassroom.com/Engineering-branches/28/Industrial-Engineering
3	https://www.youtube.com/watch?v=yhywrCChJBQ&feature=emb_imp_woyt

CO-PO Mapping															
	Programme Outcomes (PO) PSO														
	1 2 3 4 5 6 7 8 9 10 11 12 1 2 3														
CO1					2				3				3		
CO2				3	1	2							2	2	
CO3     2     2     3     3															
The stren	oth of 1	mannir	ng is to	be wr	itten as	1.2.3:	Where	e. 1:Lo	w. 2:N	Iedium	. 3:His	vh			

	Assessment								
There are thr	ee components of lab a	assessment, LA1,	LA2 and Lab ESE.						
IMP: Lab ES	E is a separate head of	f passing. LA1, LA	A2 together is treated as In-Semester Evaluat	ion.					
Assessmen	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Mark					
t				s					
Ι.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					
LAC	Lab activities,	Lab Course	During Week 7 to Week 12	20					
LAZ	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					
Lau ESE	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 Tota								
Remember								
Understand	10	10	15	35				
Apply	10	10	15	35				
Analyze	10	10	10	30				
Evaluate								
Create								
Total Marks	30	30	40	100				

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)												
			A	Y 2021-22								
			Cour	se Information								
Progra	amme		B.Tech. (Mechani	cal Engineering)								
Class,	Semes	ter	Final Year B. Tech	n., Sem VII								
Cours	e Code											
Cours	e Nam	9	Dynamics of Mach	nines								
Desire	ed Requ	isites:										
			1									
Te	eaching	s Scheme		Examination Sc	cheme (Marks)							
Lectu	re	3Hrs/week	T1	T2	ESE	Г	otal					
Tutor	ial	-	20	20 20 60								
Practi	cal	-										
Intera	ction	-		Cred	its: 3							
Course Objectives												
1 To make students aware about causes and effects of the vibration on mechanical systems.												
2	To di	scuss types of	vibrations namely u	n-damped, damped,	free and forced.							
3	To u	nderstand singl	e and two degree of	freedom systems of	vibrations.							
4	To le	arn about torsi	onal vibrations of 1,	2 and 3 rotor system	18.							
4 1	1.0	Cou	rse Outcomes (CO	) with Bloom's Tax	onomy Level							
At the	end of	the course, the	students will be abl	e to, nd hasis slamants on	d its massurament	,	Annly					
	Expla		the desire finding not		u its measurement		Apply					
CO2	Apply	of systems	anods in finding hat	ural frequency and c	orresponding mode		Analyze					
	Analy	s of systems	orgional systems wit	th single and two day	maa of freedom und	lor froo	Evoluoto					
CO3	Analy and fo	ze fillear allu t	orsional systems with single and two degree of freedom under free									
				equency and respons								
Modu	le		Mor	tule Contents			Hours					
littud	In	troduction					nours					
	In	portance and	scope, Concepts	and terms used, S	SHM, vector meth	nod of						
I	re	presenting har	nonic				7					
	m	otions, Comple	ex method of repres	enting vibration, Fo	urier series and ha	rmonic						
	an	alysis, stiffnes	s of springs in comb	inations.								
	<b>SI</b> (a)	) Undamped f	ree vibrations deri	vation: Damped and	<b>undamped</b> I equation with sc	olution						
	en	ergy method,			a equation what se	, iution,						
	ty	pes of dampin	g, free vibrations w	with viscous dampin	g, logarithmic deci	ement,						
	co	ulomb										
п	da	mping, and da	mping materials.	raitation formad and	vitation formed with	notions	7					
		) Forced Vibr	ations: Types of e	citation, forced exc	sitation, forced vib	rations	/					
	ha	rmonic excita	tion, steady state	vibration, excitation	on due to unbala	nce in						
	m	achines, suppo	rt									
	ex	citation, respo	onse due to above types of excitations, transmissibility, force									
		insmissibility	and motion transmissibility, vibration isolators, commercial									
	150 T	mation materia	and forced vibrat	ion								
	(a	) Free un-dan	ped vibrations – F	Principal modes and	l natural frequenci	es, co-						
тт	or	dinate coupling	g				7					
	an	d principal c	o-ordinates. (b) Fo	orced vibrations (U	n damped) – Ha	rmonic						
	ex	citation, vibrat	tion,		1 1 1 1 7 7 . 1							
	da	impers and abs	orders, dynamic vib	ration absorber – tun	ea and Un tuned ty	pe						

	Toroional Vibratian									
	Natural frequency of free torsional vibrations, effect of inertia of the constraint on									
IV	torsional vibrations, free torsional vibrations of a single rotor system, two rotor	7								
	system and three rotor system. Torsionally equivalent shaft, free torsional									
	vibrations of a geared system.									
	Vibration Measuring Instruments									
	Instruments for measurement of displacement, velocity, acceleration and frequency									
V	of vibration, introduction of $X-Y$ plotter, spectral analyzers, FFT analyzer.	C								
	Introduction to Numerical Methods in Vibration	6								
	Holzer method, Releigh's method, matrix iteration method, introduction to F. E.									
	M., Analysis techniques used in vibration (Eigen value analysis)									
хл	Critical speed of Shaft									
VI	Critical speed of a light shall having a single disc with and without damping,	5								
Modu	Critical speeds of a shaft having multiple discs, secondary critical speeds									
NIOUU	e wise Measurable Students Learning Outcomes:									
After t	ne completion of the course the student should be able to:									
1.	Understand the fundamental terms related to vibrations.									
2.	Explain different types of vibrations.									
3.	Analyze two degree of freedom system and forced vibrations.									
4.	Understand torsional vibrations of 1, 2 and 3 rotor systems.									
5.	Use mechanical vibration measuring instruments.									
6.	Analyze the rotor system for critical speed.									
	Text Books									
1	G. K. Grover, "Mechanical Vibration", Nemchand and Brothers, Roorkee, 3rd Edition, 2	2006								
2	Dr. V. P. Singh, "Mechanical Vibrations", S. Chand and Sons New Delhi, 2nd Edition, 2	2004								
3	J. S. Rao, "Introductory Course On Theory And Practice Of Mechanical Vibrations", Ne	ew Age								
	References									
1	Austin Church, "Mechanical Vibrations", Wiely Eastern, 1st Edition, 1963									
2	Cyril M. Harris, Charles E. Crede, "Shock and vibration handbook", McGraw-Hill, 1st 1	1976								
3	S. S. Rao, "Mechanical Vibrations", 4th Edition, 2006									
	Useful Links									
1										
2										

	CO-PO Mapping																
		Programme Outcomes (PO)													PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
C01	1											3	1				
CO2	3				3	2					1		3	2			
CO3	2	2			1						2	1	3				
The stren	gth of i	mappir	ng is to	be wr	itten as	\$ 1,2,3;	Where	e, 1:Lo	w, 2:N	ledium	, 3:Hig	gh					

	Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course											
B	loom's Taxonomy Level	<b>T1</b>	T2	ESE	Total							
1	Remember											
2	Understand											
3	Apply	7	8	20	35							

4	Analyze	8	7	17	32
5	Evaluate	5	5	23	33
6	Create				
	Total	20	20	60	100

AY 2021-22   Course Information   Programme B. Tech. (Mechanical Engineering)   Class, Semester Final Year B. Tech., Sem VII   Course Code Engineering												
Course Information   Programme B.Tech. (Mechanical Engineering)   Class, Semester Final Year B. Tech., Sem VII   Course Code Image: Code Semester												
Programme   B.Tech. (Mechanical Engineering)     Class, Semester   Final Year B. Tech., Sem VII     Course Code   Image: Code Semester												
Class, Semester Final Year B. Tech., Sem VII   Course Code Image: Code												
Course Code												
<b>Course Name</b> Gas Dynamics and Jet Propulsion												
Desired Requisites:												
Teaching Scheme     Examination Scheme (Marks)												
Lecture 3Hrs/week T1 T2 ESE	Total											
<b>Tutorial</b> - 20 20 60	100											
Practical												
Interaction - Credits: 3												
Course Objectives												
1 To understand the basic difference between incompressible and compressible flow.												
2 To understand the phenomenon of shock waves and its effect on flow.												
3 To gain some basic knowledge about jet propulsion and Rocket Propulsion.												
Course Outcomes (CO) with Bloom's Tayonomy Level												
At the end of the course, the students will be able to.												
At the end of the course, the students will be able to,												
At the end of the course, the students will be able to,CO1Understand the basic difference between incompressible and compressible flow.	Apply											
At the end of the course, the students will be able to,CO1Understand the basic difference between incompressible and compressible flow.CO2Recognize phenomenon of shock waves and its effect on flow.	Apply Analyze											
At the end of the course, the students will be able to,CO1Understand the basic difference between incompressible and compressible flow.CO2Recognize phenomenon of shock waves and its effect on flow.CO3apply gas dynamics principles in the Jet and Space Propulsion	Apply Analyze Evaluate											
At the end of the course, the students will be able to,     CO1   Understand the basic difference between incompressible and compressible flow.     CO2   Recognize phenomenon of shock waves and its effect on flow.     CO3   apply gas dynamics principles in the Jet and Space Propulsion     Module   Module Contents	Apply Analyze Evaluate											
At the end of the course, the students will be able to,     CO1   Understand the basic difference between incompressible and compressible flow.     CO2   Recognize phenomenon of shock waves and its effect on flow.     CO3   apply gas dynamics principles in the Jet and Space Propulsion     Module   Module Contents     BASIC CONCEPTS AND ISENTROPIC FLOWS	Apply Analyze Evaluate Hours											
At the end of the course, the students will be able to,     CO1   Understand the basic difference between incompressible and compressible flow.     CO2   Recognize phenomenon of shock waves and its effect on flow.     CO3   apply gas dynamics principles in the Jet and Space Propulsion     Module   Module Contents     Energy and momentum equations of compressible fluid flows – Stagnation states,	Apply Analyze Evaluate Hours											
At the end of the course, the students will be able to,     CO1   Understand the basic difference between incompressible and compressible flow.     CO2   Recognize phenomenon of shock waves and its effect on flow.     CO3   apply gas dynamics principles in the Jet and Space Propulsion     Module   Module Contents     I   BASIC CONCEPTS AND ISENTROPIC FLOWS     Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility –	Apply Analyze Evaluate Hours 6											
At the end of the course, the students will be able to,     CO1   Understand the basic difference between incompressible and compressible flow.     CO2   Recognize phenomenon of shock waves and its effect on flow.     CO3   apply gas dynamics principles in the Jet and Space Propulsion     Module   Module Contents     I   BASIC CONCEPTS AND ISENTROPIC FLOWS     Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts – Nozzle and Diffusers.	Apply Analyze Evaluate Hours 6											
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Course of course (CCO) with Diobit's Taxonomy Level     At the end of the course, the students will be able to,   CO1   Understand the basic difference between incompressible and compressible flow.     CO2   Recognize phenomenon of shock waves and its effect on flow.     CO3   apply gas dynamics principles in the Jet and Space Propulsion     Module   Module Contents     BASIC CONCEPTS AND ISENTROPIC FLOWS     Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts – Nozzle and Diffusers.     II   FLOW THROUGH DUCTS Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) variation of flow properties	Apply Analyze Evaluate Hours 6 9											
Course outcomes (Co) with bloom's Factoring feeter     At the end of the course, the students will be able to,     CO1   Understand the basic difference between incompressible and compressible flow.     CO2   Recognize phenomenon of shock waves and its effect on flow.     CO3   apply gas dynamics principles in the Jet and Space Propulsion     Module   Module Contents     BASIC CONCEPTS AND ISENTROPIC FLOWS   Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts – Nozzle and Diffusers.     II   FLOW THROUGH DUCTS     Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties     NORMAL AND OBLIQUE SHOCKS	Apply Analyze Evaluate Hours 6 9											
Course Outcomes (Co) with Disord S Taxonomy Devel     At the end of the course, the students will be able to,     CO1   Understand the basic difference between incompressible and compressible flow.     CO2   Recognize phenomenon of shock waves and its effect on flow.     CO3   apply gas dynamics principles in the Jet and Space Propulsion     Module   Module Contents     BASIC CONCEPTS AND ISENTROPIC FLOWS     Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts – Nozzle and Diffusers.     II   FLOW THROUGH DUCTS Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties     NORMAL AND OBLIQUE SHOCKS Governing equations – Variation of flow parameters across the normal and oblique	Apply Analyze Evaluate Hours 6 9 9											
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Course outcomes (co) with bitoin's functionly level     At the end of the course, the students will be able to,   CO1   Understand the basic difference between incompressible and compressible flow.     CO2   Recognize phenomenon of shock waves and its effect on flow.     CO3   apply gas dynamics principles in the Jet and Space Propulsion     Module   Module Contents     BASIC CONCEPTS AND ISENTROPIC FLOWS     Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts – Nozzle and Diffusers.     II   FLOW THROUGH DUCTS     III   Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties     III   NORMAL AND OBLIQUE SHOCKS     III   Governing equations – Variation of flow parameters across the normal and oblique shocks – Prandtl – Meyer relations – Applications     IV   JET PROPULSION Theory of jet propulsion – Thrust equation – Thrust power and propulsive to be the propulsion – Thrust equation – Thrust power and propulsive	Apply Analyze Evaluate Hours 6 9 9 4											
Control of the course, the students will be able to,     CO1   Understand the basic difference between incompressible and compressible flow.     CO2   Recognize phenomenon of shock waves and its effect on flow.     CO3   apply gas dynamics principles in the Jet and Space Propulsion     Module   Module Contents     BASIC CONCEPTS AND ISENTROPIC FLOWS     Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts – Nozzle and Diffusers.     II   FLOW THROUGH DUCTS Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties     III   Soverning equations – Variation of flow parameters across the normal and oblique shocks – Prandtl – Meyer relations – Applications     IV   IFT PROPULSION Theory of jet propulsion – Thrust equation – Thrust power and propulsive efficiency – Operating principle, cycle analysis and use of stagnation state preferemence of rom int turboint turboint and turbo properiors	Apply Analyze Evaluate Hours 6 9 9 4 7											
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At the end of the course, the students will be able to,     CO1   Understand the basic difference between incompressible and compressible flow.     CO2   Recognize phenomenon of shock waves and its effect on flow.     CO3   apply gas dynamics principles in the Jet and Space Propulsion     Module   Module Contents     BASIC CONCEPTS AND ISENTROPIC FLOWS     Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts – Nozzle and Diffusers.     II   Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties     III   Governing equations – Variation of flow parameters across the normal and oblique shocks – Prandtl – Meyer relations – Applications     IV   Theory of jet propulsion – Thrust equation – Thrust power and propulsive efficiency – Operating principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines     V   Types of rocket engines – Propellants-feeding systems – Ignition and combustion – Theory of rocket propulsion.	Apply Analyze Evaluate Hours 6 9 4 7 7											
At the end of the course, the students will be able to,     CO1   Understand the basic difference between incompressible and compressible flow.     CO2   Recognize phenomenon of shock waves and its effect on flow.     CO3   apply gas dynamics principles in the Jet and Space Propulsion     Module   Module Contents     BASIC CONCEPTS AND ISENTROPIC FLOWS   Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts – Nozzle and Diffusers.     II   FLOW THROUGH DUCTS     II   Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties     NORMAL AND OBLIQUE SHOCKS   Governing equations – Variation of flow parameters across the normal and oblique shocks – Prandtl – Meyer relations – Applications     IV   Theory of jet propulsion – Thrust equation – Thrust power and propulsive efficiency – Operating principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines     SPACE PROPULSION GAS DYNAMICS AND JET PROPULSION     V   Types of rocket engines – Propellants-feeding systems – Ignition and combustion – Theory of rocket propulsion.     VI   Performance study – Staging – Terminal and characteristic velocity – Applications	Apply Analyze Evaluate Hours 6 9 4 4 7 7 7											
At the end of the course, the students will be able to,     CO1   Understand the basic difference between incompressible and compressible flow.     CO2   Recognize phenomenon of shock waves and its effect on flow.     CO3   apply gas dynamics principles in the Jet and Space Propulsion     Module   Module Contents     BASIC CONCEPTS AND ISENTROPIC FLOWS     Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts – Nozzle and Diffusers.     II   FLOW THROUGH DUCTS     III   Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties     III   Governing equations – Variation of flow parameters across the normal and oblique shocks – Prandtl – Meyer relations – Applications     IV   JET PROPULSION Theory of jet propulsion – Thrust equation – Thrust power and propulsive efficiency – Operating principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines     SPACE PROPULSION GAS DYNAMICS AND JET PROPULSION Types of rocket engines – Propellants-feeding systems – Ignition and combustion – Theory of rocket propulsion.     VI   PERFORMANCE STUDY Performance study – Staging – Terminal and characteristic velocity – Applications - space flights.	Apply Analyze Evaluate Hours 6 9 4 4 7 7 7 6											
At the end of the course, the students will be able to,     CO1   Understand the basic difference between incompressible and compressible flow.     CO2   Recognize phenomenon of shock waves and its effect on flow.     CO3   apply gas dynamics principles in the Jet and Space Propulsion     Module   Module Contents     BASIC CONCEPTS AND ISENTROPIC FLOWS     Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts – Nozzle and Diffusers.     FLOW THROUGH DUCTS     II   Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties     NORMAL AND OBLIQUE SHOCKS     III   Governing equations – Variation of flow parameters across the normal and oblique shocks – Prandtl – Meyer relations – Applications     JET PROPULSION   Theory of jet propulsion – Thrust equation – Thrust power and propulsive efficiency – Operating principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines     SPACE PROPULSION GAS DYNAMICS AND JET PROPULSION     V   Types of rocket engines – Propellants-feeding systems – Ignition and combustion – Theory of rocket propulsion.     VI   PERFORMANCE STUDY     VI   Performance study – Staging – Terminal and characteristic velocity – Applications – space	Apply Analyze Evaluate Hours 6 9 4 4 7 7 7 6											
At the end of the course, the students will be able to,     CO1   Understand the basic difference between incompressible and compressible flow.     CO2   Recognize phenomenon of shock waves and its effect on flow.     CO3   apply gas dynamics principles in the Jet and Space Propulsion     Module   Module Contents     BASIC CONCEPTS AND ISENTROPIC FLOWS     Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts – Nozzle and Diffusers.     FLOW THROUGH DUCTS     II   Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties     III   Governing equations – Variation of flow parameters across the normal and oblique shocks – Prandtl – Meyer relations – Applications     JET PROPULSION   Theory of jet propulsion – Thrust equation – Thrust power and propulsive efficiency – Operating principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines     SPACE PROPULSION GAS DYNAMICS AND JET PROPULSION Types of rocket propulsion.   PERFORMANCE STUDY     VI   Performance study – Staging – Terminal and characteristic velocity – Applications – space flights.     Module wise Measurable Students Learning Outcomes : After the completion of the course the student should be able to: 1   Understrand havis concoarts and isontropic flows	Apply Analyze Evaluate Hours 6 9 4 4 7 7 7 6											
At the end of the course, the students will be able to,     CO1   Understand the basic difference between incompressible and compressible flow.     CO2   Recognize phenomenon of shock waves and its effect on flow.     CO3   apply gas dynamics principles in the Jet and Space Propulsion     Module   Module Contents     BASIC CONCEPTS AND ISENTROPIC FLOWS   Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts – Nozzle and Diffusers.     II   FLOW THROUGH DUCTS     III   Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties     III   Soverning equations – Variation of flow parameters across the normal and oblique shocks – Prandtl – Meyer relations – Applications – More and propulsive efficiency – Operating principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbojet, and turbo prop engines     V   Types of rocket engines – Propellants-feeding systems – Ignition and combustion – Theory of rocket propulsion.     VI   PERFORMANCE STUDY     VI   Performance study – Staging – Terminal and characteristic velocity – Applications – space flights.     Module wise Measurable Students Learning Outcomes :   After the completion of the course the student should be able to:     1.   Understand basic concepts and	Apply Analyze Evaluate Hours 6 9 4 4 7 7 7 6											
At the end of the course, the students will be able to,     CO1   Understand the basic difference between incompressible and compressible flow.     CO2   Recognize phenomenon of shock waves and its effect on flow.     CO3   apply gas dynamics principles in the Jet and Space Propulsion     Module   Module Contents     BASIC CONCEPTS AND ISENTROPIC FLOWS   Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts – Nozzle and Diffusers.     II   FLOW THROUGH DUCTS     Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties     NORMAL AND OBLIQUE SHOCKS   Governing equations – Variation of flow parameters across the normal and oblique shocks – Prandtl – Meyer relations – Applications     JET PROPULSION   Theory of jet propulsion – Thrust equation – Thrust power and propulsive efficiency – Operating principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines     V   Types of rocket engines – Propellants-feeding systems – Ignition and combustion – Theory of rocket propulsion.     VI   PERFORMANCE STUDY     PERFORMANCE Study – Staging – Terminal and characteristic velocity – Applications – space flights.     Module wise Measurable Students Learning Outcomes :     After the completion of the c	Apply     Analyze     Evaluate     Hours     6     9     4     7     6											
At the end of the course, the students will be able to,     CO1   Understand the basic difference between incompressible and compressible flow.     CO2   Recognize phenomenon of shock waves and its effect on flow.     CO3   apply gas dynamics principles in the Jet and Space Propulsion     Module   Module Contents     BASIC CONCEPTS AND ISENTROPIC FLOWS   Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts – Nozzle and Diffusers.     FLOW THROUGH DUCTS   Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties     NORMAL AND OBLIQUE SHOCKS   Governing equations – Variation of flow parameters across the normal and oblique shocks – Prandtl – Meyer relations – Applications     JET PROPULSION   Theory of jet propulsion – Thrust equation – Thrust power and propulsive efficiency – Operating principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines     V   Types of rocket engines – Propellants-feeding systems – Ignition and combustion – Theory of rocket propulsion.     V   Types of rocket regines – Propellants-feeding systems – Ignition and combustion – Theory of rocket propulsion.     V   Types of rocket regines – Propellants-feeding systems – Ignition and combustion – Theory of rocket propulsion.     PERFORMANCE STUDY <t< td=""><td>Apply     Analyze     Evaluate     Hours     6     9     4     7     6</td></t<>	Apply     Analyze     Evaluate     Hours     6     9     4     7     6											

6.	Analyze the performance of the rocket engines.
	Text Books
1	Anderson, J.D., "Modern Compressible flow", 3rd Edition, McGraw Hill, 2003.
2	Yahya, S.M. "Fundamentals of Compressible Flow", New Age International (P) Limited, New
2	Delhi, 1996
	References
1	Anderson, J.D., "Modern Compressible flow", 3rd Edition, McGraw Hill, 2003.
2	Yahya, S.M. "Fundamentals of Compressible Flow", New Age International (P) Limited, New
2	Delhi, 1996.
	Useful Links
1	
2	

CO-PO Mapping																
	Programme Outcomes (PO)													PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	3	2											2	2		
CO2	3	2	1		3			3	3		3		2	2		
CO3	3	2	3		2	1			3				1			
The stren	oth of	mannir	o is to	he wr	itten as	123.	Where	1.Lo	w 2.N	Iedium	3.Hic	vh				

#### Assessment (for Theory Course)

	Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course												
B	loom's Taxonomy Level	<b>T1</b>	T2	ESE	Total								
1	Remember												
2	Understand												
3	Apply	7	8	20	35								
4	Analyze	8	7	17	32								
5	Evaluate	5	5	23	33								
6	Create												
	Total	20	20	60	100								

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)												
			A	Y 2021-22								
			Cour	se Information								
Progr	amme		B.Tech. (Mechani	cal Engineering)								
Class.	Semes	ter	Final Year B. Tecl	n Sem VII								
Cours	e Code	2		.,								
Cours	e Nam	e	Computer Integrat	ed Manufacturing								
Desire	ed Rea	uisites:		8								
Т	eaching	g Scheme		Examination So	cheme (Marks)							
Lectu	re	3Hrs/week	T1	T2	ESE	1	[otal					
Tutor	ial	-	20	20	60		100					
Practi	cal	-		-		I						
Intera	ction	-		Cred	its: 3							
		1	1									
			Cou	rse Objectives								
1	To ex	pose the stude	nt to the various fun	damentals of comput	er assisted manufac	cturing s	ystems.					
	To m	ake the student	s familiar with crite	ria for implementing	systems associated	with so	ftware					
2	and C	CAD/CAM data	base for design and	manufacturing.	-							
		Cou	rse Outcomes (CO	) with Bloom's Tax	onomy Level							
At the	end of	the course, the	students will be abl	e to,								
CO1	Appl	y concepts of C	CIM using robotics a	nd automation.			Apply					
CO2	Anal	ze the fundam	ental concepts of Au	itomation and			Analyze					
	Produ	ict Developme	nt through CIM moc	lels								
CO3	Inter	pret CIM conce	pts in flexible manu	facturing system.			Evaluate					
	-											
Modu			Moo	lule Contents			Hours					
		omputer Integ	grated Manufacturi	ing	motion and avalue	tion of						
T		Infoduction, de IM Advantage	s limitations scon	e, components, auto e and globalization	view Product desi	on and	6					
1		AD/CAM, role	of computers in des	sign and manufacturi	ng, Role of CAD/C	AM in	0					
	C	IM.	1	6	<i>C</i> ,							
	P	roduct Develo	pment through CI	N								
II	Ir	troduction, pr	oduct developmen	t cycle, sequential	engineering, con-	current	7					
	ei	igineering, con	totyping characteri	E and CE, implement	of CE applications	of CE						
	A	utomated Oua	lity Control	sues of CL, success (	or CL, applications	UI CL						
	Ir	-process and p	ost process method	ologies, integrations	of CNC machines	, robot						
III	in	CIM enviro	nment. Communic	ation, software/ Ha	ardware: Availabil	lity of	6					
	so	oftware, netwo	rk topologies for l	LAN, network inter	face card and pro	otocols,						
		etwork operating	ng systems.									
IV		<b>IVI models</b>	PRIT- CIM OSA m	odel the NIST- AM	RF hierarchical mo	del the	7					
	S	iemens model,	digital equipment co	orporation model, IB	M concept of CIM.							
	R	obotics in CIN	1		~							
	H	istorical develo	opment, various terr	ninologies, classific	ation, degrees of fr	eedom						
	aı	nd degrees of	motion, manipulation	on of robot compon	ents, joints and sy	mbols,	6					
		ork volume, we	ork envelope, accura	icy and repeatability,	configuration, Nul	nerical						
		lexible Manuf	acturing Systems in									
VI	F	lexible Manufa	cturing Systems: C	oncept, difference b	etween rigid and f	lexible	7					

	manufacturing, concept of cellular manufacturing, structure of FMS, components
	of FMS.
	Computer Aided Quality Control: Objectives, contact & non-contact inspection,
	types of contact and non-contact inspection, scope in CIMS, coordinate measuring
	machine :types, construction, working principle, working, applications, scope of
	CMM in CIMS, flexible inspection system.
Modu	le wise Measurable Students Learning Outcomes :
After t	he completion of the course the student should be able to:
1.	Explain advancement in manufacturing systems.
2.	Introduce the idea of CIM and its implementation.
3.	Use appropriate software and related hardware.
4.	Understand various CIM models and idea of IBM concept.
5.	Use of robotics in CIM environment.
6.	Implement CIM for flexible manufacturing systems.
	Text Books
1	Automation, Production systems and Computer Integrated Manufacturing by M.P.Groover, 1987.
2	Computer Integrated Design and Manufacturing by Bedworth, Henderson Wolfe (McGraw Hill),
	1991
3	Performance Modeling of Automated Production System by Narhari and Vishvanandhan, 2015
	References
1	Urich Rembold, "Computer Integrated Manufacturing Technology and System," 1995.
2	Yorem koren, "Computer Integrated Manufacturing System", McGraw-Hill, 1983.
3	S. Kant Vajpayee, "Principles of Computer Integrated Manufacturing" (PHI), 2015
	Useful Links
1	
2	

	CO-PO Mapping															
	Programme Outcomes (PO)													PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1		3	2										3			
CO2	2	3											2			
CO3				3	2									1		
The stren	gth of 1	mappii	ng is to	be wr	itten as	\$ 1,2,3;	Where	e, 1:Lo	w, 2:N	ledium	, 3:Hig	gh				

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	7	8	20	35				
4	Analyze	8	7	17	32				
5	Evaluate	5	5	23	33				
6	Create								
	Total	20	20	60	100				

Walchand College of Engineering, Sangli										
AV 2021-22										
Course Information										
Progr	Programme     B.Tech. (Mechanical Engineering)									
Class.	Semest	er	Final Year B.Tech., Sem VII							
Cours	e Code									
Cours	e Name	;	Dynamics of Mac	hines Lab						
Desire	ed Requ	isites:								
			1							
Т	eaching	Scheme		Examination So	cheme (Marks)					
Lectu	re	-	LA1	LA2	ESE	r.	Fotal			
Tutor	ial	-	30	30	40		100			
Practi	cal	2Hrs/Week		-						
Intera	ction	-		Cred	its: 1					
			1							
			Cou	rse Objectives						
1	To ma	ke students aw	are about causes an	d effects of the vibra	tion on mechanical	l system	s.			
2	To der	monstrate mecl	nanical vibration me	easuring instruments						
3	To dev	velop the stude	nt's skills in un-dan	nped, damped, free a	ind forced vibration	IS.				
		Com	rsa Autoomas (CA)	with Bloom's Tax	onomy Laval					
At the	end of t	he course, the	students will be able	e to.						
	Demo	nstrate the co	oncept of vibratio	n, its causes and	basic elements a	nd its	Understa			
	measu	rement.	•				nd			
CO2	Detern system	nine the natura n.	al frequency, damp	ing coefficient and	other characteristic	es of a	Apply			
CO3	Measu	re transmissib	ility characteristics	of a system.			Analyz			
			List of Experi	iments / Lab Activit	ties					
List of	f Experi	iments:	*							
-										
List of	f experi	ments (study f	type) waray of two dograd	a of freedom enring	magagy					
$\frac{1}{2}$	Study	of natural freq	uency of double per	ndulum system	nass system.					
3.	Study	of critical spee	ed of shaft.	iaaiaiii systemi						
List of	f experi	ments (Trial /	Demonstration typ	pe)						
1.	Deterr	nination of stif	fness of spring from	n static deflection.						
2.	Deterr	nination of nat	ural frequency of si	ngle degree of freed	om spring mass sys	tem.				
5. 4	Measu	rement of tors	ional vibrations	Sinpound pendunum						
5.	Deterr	nination of tor	sional vibrations of	single/two rotor syst	em.					
6.	Demo	nstration of plo	ot response curve of	system under forced	l vibration.					
7.	Deterr	nination of dar	nping effect on a sy	stem under forced vi	ibration with viscou	ıs damp	ing.			
8.	Deterr	nination of opt	imal frequency for	dynamic vibration at	osorber.					
9.	Measu	rement of vari	ous parameters of v	ibrations.						
10.	Deterr	vation of Dunk	de shapes of beam y	rse vibrations.	ry conditions					
11.	Duil		ac shupes of beam							
			Т	ext Books						
1	G. K.	Grover, "Mech	anical Vibration", I	Nemchand and Broth	ers, Roorkee, 3rd H	Edition,	2006			
2	Dr. V.	P. Singh, "Me	chanical Vibrations	", S. Chand and Son	s New Delhi, 2nd H	Edition,	2004			
3	J. S. R	ao, "Introducto	ory Course on Theo	ry And Practice of M	lechanical Vibratio	ns", Ne	w Age			
			T							
			ŀ	kererences						

1	Austin Church, "Mechanical Vibrations", Wiely Eastern, 1st Edition, 1963					
2	Cyril M. Harris, Charles E. Crede, "Shock and vibration handbook", McGraw-Hill, 1st 1976					
3	S. S. Rao, "Mechanical Vibrations", 4th Edition, 2006					
Useful Links						
1						
2						

CO-PO Mapping															
		Programme Outcomes (PO) PSO													
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3						1			1			2		
CO2	3			2					1				3		
CO3	2	3	3		3							1	1	2	
The stren	The strong of a function of the providence of 1.2.2. Wheney 1.1 our 2. Madings 2. High														

Assessment								
There are three components of lab assessment, LA1, LA2 and Lab ESE.								
IMP: Lab ES	E is a separate head of	f passing. LA1, LA	A2 together is treated as In-Semester Evaluat	ion.				
Assessmen	Assessmen Based on Conducted by Typical Schedule (for 26-week Sem)							
t				s				
ТАТ	Lab activities,	Lab Course	During Week 1 to Week 6	30				
LAI	attendance, journal	Faculty	Marks Submission at the end of Week 6					
L A 2	Lab activities,	Lab Course	During Week 7 to Week 12	30				
LA2	attendance, journal	Faculty	Marks Submission at the end of Week 12					
Lob 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 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	Lab ESE	Total						
Remember									
Understand	10	10	15	35					
Apply	10	10	15	35					
Analyze	10	10	10	30					
Evaluate									
Create									
Total Marks	30	30	40	100					

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)												
AY 2021-22												
Course Information												
Progra	amme		B.Tech. (Mechanical Engineering)									
Class.	Semest	er	Final Year B.Tech., Sem VII									
Cours	e Code											
Cours	e Name		Gas Dynamics and	l Jet Propulsion Lab								
Desire	d Requ	isites:		•								
	-		I									
Т	eaching	Scheme		Examination Scheme (Marks)								
Lectur	re	-	LA1	LA2	ESE	Total						
Tutori	ial	-	30	30	40	100						
Practi	cal	2Hrs/Week		-		1						
Intera	ction	-		Cred	its: 1							
			Cour	rse Objectives								
1	To un	derstand the ba	sic difference betwe	en incompressible a	nd compressible flo	DW.						
2	To un	derstand the ph	enomenon of shock	waves and its effect	t on flow.							
3	To gai	n some basic k	nowledge about jet	propulsion and Roc	ket Propulsion.							
		Cour	rse Outcomes (CO)	with Bloom's Tax	onomy Level							
At the	end of t	he course, the	students will be able	e to,								
CO1	Under	stand the basic	difference between	incompressible and	compressible flow.	Unde nd	rsta					
CO2	Recog	nize phenomer	non of shock waves	and its effect on flow	<i>W</i> .	Appl	у					
CO3	apply	gas dynamics p	principles in the Jet	and Space Propulsio	n	Analy	yz					
			List of Evnori	monts / Lob Activi	tios							
List of	Fyner	iments.		ments / Lab Activi								
	плреп	incitis.										
List of	f experi	ments (study t	(ype)									
1.	Study	of isentropic fl	lows and numerical	on stagnation prope	rties.							
$\begin{vmatrix} 2.\\ 2 \end{vmatrix}$	Study	of flow throug	h ducts and numeric	cal on Rayleigh and	Fanno flow.							
5. 4	Study	of jet propulsic	on and numerical	numericai.								
 5.	Study	of performance	e of rocket engines.									
6.	Visit t	o gas turbine p	ower plant.									
			Т	'ext Books								
1	P. K. 1	Nag "Engineeri	ing Thermodynamic	s", Tata McGraw H	ill Publication, 2017	7, 6th Edition						
2	R. Ya	dav, "Fundam	entals of Thermod	ynamics", Central	Publication house,	Allahabad, 20	011,					
	Revise	ed /th Edition										
			R	References								
1	Cenge Revise	l and Boles, "T ed 9th Edition,	Thermodynamics an 2019	Engineering Appro	oach", Tata McGrav	w-Hill publicat	tion,					
2	Sonnta Wiley	ag, R. E, Borgr and Sons, 7th	nakke, C. and Van Edition, 2009	Wylen, G. J., "Fund	lamentals of Therm	nodynamics", J	John					
3	Moran and So	, M. J. and Shons, 8th Edition	apiro, H. N., "Func 1, 1999	lamentals of Engine	ering Thermodyna	mics", John W	liley					
			U	seful Links								
1												
---	--											
2												

	CO-PO Mapping															
		Programme Outcomes (PO)													PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	3	2											1	2		
CO2	3	2	1		3			3	3		3		1	2		
CO3	3	2	3		2	1			3				1			
The stren	gth of	mappir	ng is to	be wr	itten as	\$ 1,2,3;	Where	e, 1:Lo	w, 2:N	<i>l</i> edium	, 3:Hig	gh				

 Assessment

 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.

 Assessmen
 Based on
 Conducted by
 Typical Schedule (for 26-week Sem)
 Mark

 t
 Lab activities,
 Lab Course
 During Week 1 to Week 6
 30

LAI	attendance, journal	Faculty	FacultyMarks Submission at the end of Week 6							
I A 2	Lab activities,	Lab Course	During Week 7 to Week 12	30						
LAZ	attendance, journal	Faculty	Marks Submission at the end of Week 12							
	Lab activities,	Lab Course	During Week 15 to Week 18	40						
Lao ese	attendance, journal	Faculty	Marks Submission at the end of Week 18	40						
Weak 1 indicates starting weak of a semaster. The typical 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	10	10	15	35								
Apply	10	10	15	35								
Analyze	10	10	10	30								
Evaluate												
Create												
Total Marks	30	30	40	100								

Walchand College of Engineering, Sangli											
			(Government Ald	V 2021-22	uie)						
			Cours	e Information							
Progr	amme		B.Tech. (Mechani	cal Engineering)							
Class.	Semest	er	Final Year B.Tech	Sem VII							
Cours	e Code			.,							
Cours	e Name		Computer Integrated Manufacturing Lab								
Desire	ed Reau	isites:		<u> </u>							
Т	eaching	Scheme		Examination So	heme (Marks)						
Lectu	re	-	LA1	LA2	ESE	r	Fotal				
Tutor	ial	-	30	30	40		100				
Practi	cal	2Hrs/Week		-		1					
Intera	ction	_		Cred	its: 1						
			1								
			Cour	se Objectives							
1	To exp	oose the studen	t to the various fund	lamentals of comput	er assisted manufac	cturing s	systems.				
2	To ma	ake the studen	ts familiar with crit	eria for implementi	ng systems associa	ated wit	h software				
	and C.	AD/CAM data	base for design and	manufacturing.							
3	To exp	plain students	about Robotics and	its allied interdiscip	plinary approach, c e	compon	ent design,				
To evolve prominent component of Automated Manufacturing Systems and controllers to perform											
4	a prog	rammed tasks.	_								
		Сош	rse Autcomes (CA)	with Bloom's Tay	nomy I aval						
At the	end of t	the course, the	students will be able	e to,							
CO1	Demo day-to	nstrate how Cl -day life.	M knowledge is use	eful in engineering a	and consumer prod	ucts in	Understa nd				
CO2	Exami and re	ne continuous cording of data	-time control using	software for the ma	anipulation, transm	ission,	Apply				
CO3	Decide system	e suitable actu 18	ators and sensors	and integrate them	with embedded of	control	Analyz				
					•						
<b>T</b> • 4	e <b>T</b>	•	List of Experi	ments / Lab Activit	les						
List of Experiments: 1. Introduction to various CIM models with case study 2. To demonstrate Robot anatomy and related attributes for different types of joints, links, configurations, drive and control systems, end effectors and sensors 3. Demonstration on fluid mixer in manufacturing 4. Study of software and hardware interfacing requirements in CIMS 5. Demonstration on automated belt conveyer system 6. To study and use of CIM for Flexible manufacturing systems 7. Demonstration on automatic bottle filling plant 8. Pick and place operation in industrial application 9. Demonstration on pneumatic operated resistance spot welding machine 10. Water level controller for industrial environment 12. Use of stepper motor in industrial environment 12. Use of HMI for CIM 13. Demonstration on automatic spray painting machine 14. To study and demonstration on CMM 15. Generation of any one simple solid model using CAD software.											
			Т	ext Books							
1	Groov	er M. P. "Au	tomation, Producti	on Systems and C	omputer Integrated	i Manu	facturing",				

	Prentice Hall International publication, 2004.									
r	Groover M. P., Nagel R.N., Ordey N.G. "Industrial Robotics- Technology, Programming and									
2	Applications," McGraw Hill International, 2012.									
3	Pradeep Chaturvedi, N.K. Tewari, P.V. Rao, G.S. Yadav, "Modern Trends in Manufacturing									
References										
1	Richard M. Murrai, Zexiang Li, S Shankar Sasrty, "Robotic Manipulation," CRC Press, 2001									
2	S. R. Deb, "Robotics Technology and Flexible Automation," Tata McGraw Hill, 2000									
3	Urich Rembold, "Computer Integrated Manufacturing Technology and System," 1995									
	Useful Links									
1										
2										

	CO-PO Mapping														
		Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C01	2	3											2		
CO2		3	2										2		
CO3				3	2									3	
The stren	gth of a	mappii	ng is to	be wr	itten as	5 1,2,3;	Where	e, 1:Lo	w, 2:N	ledium	, 3:Hig	gh			

		Asses	sment							
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.										
Assessmen	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Mark						
t				S						
ΤΑΙ	Lab activities,	Lab Course	During Week 1 to Week 6	20						
LAI	attendance, journal	Faculty	Marks Submission at the end of Week 6	50						
LAC	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						
	attendance, journal	Faculty	Marks Submission at the end of Week 18	40						
Week 1 indic	ates starting week of a	semester. The typ	pical schedule of lab assessments is shown,							
considering a	26-week semester. Th	ne actual schedule	shall be as per academic calendar. Lab							
activities/Lab	performance shall inc	clude performing	experiments, mini-project, presentations, drav	wings,						
programming	g and other suitable act	ivities, as per the	nature and requirement of the lab course. The	e						
experimental	lab shall have typicall	y 8-10 experimen	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	15	35								
Apply	10	10	15	35								
Analyze	10	10	10	30								
Evaluate												
Create												
Total Marks	30	30	40	100								

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)											
			A	Y 2021-22							
			Cour	se Information							
Progr	amme		B.Tech. (Mechani	cal Engineering)							
Class	Semes	ter	Final Year B Tecl	n Sem VII							
Cours	e Code										
Cours	e Nam	2	Computer Aided I	Design (CAD)							
Desire	d Rea	isites:	I I I I I I I I I I I I I I I I I I I								
	1										
Т	eaching	Scheme		Examination Sc	cheme (Marks)						
Lectu	re	3Hrs/week	T1	T2	ESE	Г	otal				
Tutor	ial	-	20	20	60		100				
Practi	cal	-		-	I						
Intera	ction	-		Cred	its: 3						
			Cou	rse Objectives							
1	To fa	miliarize the st	udent with different	modeling techniues	used for component	design.					
•	To de	velop the stude	ents to use mathema	tical representation of	of geometries and dif	fferent t	olerance				
2	techni	iques.									
3	To ma	ake students av	vare of use of comp	iter for data exchang	e formats and tools.						
A 1	1 0	Cou	rse Outcomes (CO	) with Bloom's Tax	onomy Level						
At the	end of	the course, the	students will be abl	e to,			A				
	Expla	in different mo	defing techniques.	41			Apply				
<u>CO2</u>	Apply	mathematical	model to transform	the geometries.	· · · · · · · · · · · · · · · · · · ·	~	Analyze				
03	Const	ruct 3D CAD	wodels and Assemb	nes using concept of	geometric modeling	g	Evaluate				
Modu			Mo	Jula Contants			Hours				
WIOUU	In	troduction	10100				110015				
I	A C Di es Sy C C Li ex	typical produc AM system eva splays: Refres timation of gra ystems: Work bordinate System ne and Curve change standa	et cycle, CAD tools i aluation criteria, Inp sh display, DVST, i aphical memory, LC ing Coordinate S em. generation algorith rds and Database ma	for the design proces ut / Output devices; ( Raster display, pixe D, LED fundamenta ystem, Model Coo um: DDA, Bresenha unagement systems.	s of product cycle, Graphics I value and lookup Is. Concept of Coor ordinate System, S m's algorithms. Gr	CAD / table, rdinate Screen aphics	6				
П	Cu Pa pe Pa Sy bla Sp Va	urves and sur arametric repre- propendicular lir arametric repre- anthetic Curve ending. Bezier plines and NUF arious types of	faces esentation of lines: es, distance of a poi sentation of circle, H s: Concept of conti Curve: equations, RBS. surfaces along with	Locating a point nt, Intersection of lir Ellipse, parabola and nuity, Cubic Spline: properties; Properti their typical applica	on a line, parallel nes. hyperbola. equation, propertion es and advantages tions.	lines, es and of B-	6				
III	Green	eometry and aces, Boolean imitive instance	Fopology, Comparis id model, properties operations. Scheme sing, Cell Decompose sformation	son of wireframe, s s of representation s es: B-rep, CSG, Sw sition and Octree enc	urface and solid m chemes, Concept of eep representation, oding	nodels, f Half- ASM,	8				
IV	Ho in tra	2D and 3D; 0 ansformation.	epresentation; Trans Orthographic and p	lation, Scaling, Refle erspective projection	ection, Rotation, Sh ns. Window to View	earing w-port	6				

	Finite Element Analysis										
V	Review of stress-strain relation and generalized Hooke's Law, Plane stress and										
v	Plane strain conditions; Concept of Total Potential Energy; Basic procedure for	6									
	solving a problem using Finite Element Analysis.										
	Computer Aplication in Design										
VI	Collaborative Design, Principles, Approaches, Tools, Design Systems. Product	7									
	Data Management (PDM), concurrent engineering, PLM concept.	,									
Modu	e wise Measurable Students Learning Outcomes :										
After the	ne completion of the course the student should be able to:										
1.	Explain the CAD and its advantages and disadvantages.										
2.	Explain types of curves and its applications in surface modeling.										
3.	Summarise geometric modeling techniques.										
4.	Perform the different transformations using mathematical / matrix relations.										
5	5 Apply tolerancing and mathematical models										
6	Handle product data enchange format in CAD/Computer based system										
0.	Thandie product data enchange format in Critic computer based system.										
	Toyt Books										
	P N Rao "CAD/CAM: Principles and Applications" Mc Graw Hill Education Thir	d Edition									
1	2010	u Luiuoli,									
	2010. Mikell P. Groover Emory W. Zimmers "CAD/CAM: Computer Aided De	sion and									
2	Manufacturing" Prentice-Hall 108/	sign and									
	Manufacturing, 11chuce-fian, 1964.										
	Deferences										
	Ibrahim Zeid "Mastering CAD/CAM" Tata McGraw Hill Education Pyt I td. N	ew Delhi									
1	Special Indian Edition 2007 Ninth Reprint 2010	ew Denn,									
	Ibrahim Zeid R Siyasubramanian "CAD/CAM: Theory and Practice" Tata Mc	Graw Hill									
2	Companies Special Indian Edition 2009										
	Companies, special Indian Edition, 2007.										
	Usoful Links										
1	U SCI UI LIIIKS										
2											
4											

	CO-PO Mapping														
		Programme Outcomes (PO) PSO													
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		3			2										
CO2			3	1											
CO3					3								2		
The stren	gth of :	mappii	ng is to	be wr	itten as	s 1,2,3;	Where	e, 1:Lo	w, 2:N	ledium	n, 3:Hig	gh			

	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	7	8	20	35	
4	Analyze	8	7	17	32	
5	Evaluate	5	5	23	33	
6	Create					
	Total	20	20	60	100	

Walchand College of Engineering, Sangli									
	AV 2021-22								
			Cour	se Information					
Progr	amme		B.Tech. (Mechani	cal Engineering)					
Class,	Semes	ter	Final Year B. Tecl	Final Year B. Tech., Sem VII					
Cours	æ Code	2							
Cours	æ Nam	e	Non-Conventiona	l Machining					
Desire	ed Req	uisites:							
T	eaching	g Scheme		Examination So	cheme (Marks)				
Lectu	re	3Hrs/week	<u>T1</u>	<u>T2</u>	ESE		<b>fotal</b>		
Tutor		-	20	20	60		100		
Practi		-		- 	4a. 2				
Intera	iction	-		Crea	us: 5				
			Cou	rsa Ohiactivas					
		earn about y	various nonconvent	tional machining r	processes with va	rious t	echniques		
1	perfo	rmance charac	teristics and their ap	plications.		11005 0	coninques,		
2	To ir	troduce studer	nts with various ma	chine tools and thei	r peculiars used fo	r nonco	nventional		
	mach	ining.		. 1.1			1.		
3	To tr	ain the student	s to identify main v	ariables of nonconv	entional machining	g proces	ses and to		
	To m	otivate the stud	lents to pursue adva	nced studies, researc	h and industrial pro	oduct de	velopment		
4	4 in the field of mechanical engineering.								
At the	and of	Cou	irse Outcomes (CO	) with Bloom's Tax	onomy Level				
At the	Expl	in various no	onconventional ma	chining processes	tooling and equin	ment's	Apply		
CO1	requi	red for various	manufacturing appl	ications.	tooming and equip	ment s	rippiy		
CO2	Explo	oit the capabilit	ies and applications	of nonconventional	machining processe	ès.	Analyze		
CO3	Anal	yze effect of	different parameters	Evaluate					
	proce	esses and comp	are with other techn	ique applications.					
Modu	ıle		Mo	dule Contents			Hours		
litioud	Ir	troduction to	nontraditional mac	chining methods -N	leed for non -trac	litional	Hours		
I	m	achining -Sour	ces of metal remova	6					
	-F	Parameters influ	encing selection of	process.					
		brasive Jet Ma	chining – Water Jet	Machining – Abrasi	ve Water Jet Machi	ining –	7		
11		uipment used	nining.(AJM, WJM – Process parameter						
	E	lectric Dischar	ge Machining (EI	M)- working Prin	ciple-equipment's-I	Process			
ш	P	arameters-Surf	ace Finish and MI	RR- electrode / To	ol – Power and	control	6		
	C	ircuits-Tool W	/ear – Dielectric –	Flushing – Wire c	ut EDM – Applic	ations-	0		
		licro-EDM, Mi	cro-WEDM.	i 1					
		Maskant -tech	ning and Electro-Cl	naskants - Process P	arameters – Surface	- finish			
IV	ar	nd MRR-Appli	cations.			2 1111511	7		
	P	Principles of ECM- equipments-Surface Roughness and MRR, Electrical circuit-							
	P	rocess Paramet	ers- ECG and ECH-	- Applications.					
		aser Beam Ma	achining: Material	removal mechanism	h, types of Lasers,	LBM Basic			
	e	uipment and	metal removal med	hanism, process ch	aracteristics. annlic	ations			
	P	lasma Beam M	achining: Machining	g systems, material r	emoval rate, accura	cy and	7		
	รเ	rface quality,	applications. Ion Be	am Machining: Intro	duction, material re	emoval			
	ra	te, accuracy an	d surface effects, ap	plications.					
VI	– ⊢ B	asics and de	ermitions: Principle	e of laver-based	technology, adva	ntages.			

classification. Rapid Prototyping Process Chain: 3D Modeling, Data Conversion 7
and Transmission, Checking and Preparing, model building, post processing.
Rapid prototyping techniques: Stereo lithography, Solid Ground Curing (SGC),
Fused Deposition Modeling (FDM), Selective Laser Sintering (SLS), Three-
dimensional printing, Laminated Object Modeling (LOM). Rapid manufacturing
and Rapid tooling.
Module wise Measurable Students Learning Outcomes :
After the completion of the course the student should be able to:
1. Describe the nonconventional machining processes, machining aspects, and their importance.
<ol> <li>Explain various mechanical energy based processes, main variables, equipment's and applications.</li> </ol>
<ol> <li>Figure out capabilities of electrical energy based processes their working principle, tooling's and applications</li> </ol>
<ul> <li>4. Discuss types of chemical machining processes their equipment's, different techniques and process parameters with applications</li> </ul>
5 Explore the laser beam machining different techniques, process characteristics, equipmen
3. Explore the laser beam machining unrerent techniques, process characteristics, equipment
and applications.
6. Articulate the different additive manufacturing techniques, their principles and
Toxt Dools
Mishra P. K. Non Conventional Machining. The Institution of Engineers (India). Text Bool
1 Series, New Delhi, 1997
2 Garry F. Benedict, Unconventional Machining Process, Marcel Dekker Publication, New York 1987.
3 Vijay.K. Jain "Advanced Machining Processes" Allied Publishers Pvt. Ltd, New Delhi, 2007.
References
1         Hassan El-Hofy, "Advanced Machining Processes: Nontraditional and Hybrid Machining Processes", McGraw-Hill Co, New York (2005).
2 Benedict, Gary F., "Non-Traditional Manufacturing Processes", Marcel Dekker Inc., New York (1987).
3 Chua C. K. and Leong, Lim, "Rapid Prototyping Principles and Applications", 2nd edition, John Wiley and Sons, 1989.
Useful Links

CO-PO Mapping															
		Programme Outcomes (PO) PSO													
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			3					2					2		
CO2			3	2				3				3	2	2	
CO3		2		3		1		3					1	2	
The stren	oth of	monnir	na is to	howr	itton or	123.	Whore	1.Lo		adium	2.Hi	rh			

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

## **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	7	8	20	35
4	Analyze	8	7	17	32
5	Evaluate	5	5	23	33
6	Create				
	Total	20	20	60	100

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)									
AY 2021-22									
Course Information									
Progr	amm	e	B.Tech. (Mechanie	cal Engineering)					
Class, Semester Final Year B. Tech., Sem VII									
Course Code									
Cours	æ Na	me	Refrigeration and	Air Conditioning					
Desired Requisites:									
T	eachi	ng Scheme		Examination Second	cheme (Marks)				
Lectu	re	3Hrs/week	T1	T2	ESE	Г	<b>`otal</b>		
Tutor	ial	-	20	20	60		100		
Practi	ical	-							
Intera	nctior	ı –		Cred	its: 3				
			Cou	rse Objectives					
	То	enable the studen	ts to analyze and so	lve refrigeration rela	ited problems by ap	plying p	rinciples		
1	of 1	nathematics, scie	nce and engineering	5					
	Ta	nnon oro otradonto	to use modern tools	tachniquas					
2		prepare sudents	communication ski	leciniques.	rigoration / air cond	itioning	theories		
3		develop skills in	the analysis of refri	aration / air condition	ning/gryogenics sy	stome in	research		
4 or design and industrial needs.						research			
5	To Con	develop a profess ditioning/cryoger	sional approach to li	felong learning in th wareness of social a	e refrigeration / air	ies.			
		Cou	rse Outcomes (CO	) with Bloom's Tax	onomy Level				
At the	end	of the course, the	students will be abl	e to,					
CO1	Ap	ply knowledge of	mathematics, scien	ce, and engineering	for the needs in		Apply		
	refr An:	igeration, air con	ditioning and cryog	enic	ic systems with the	ir	Analyze		
CO2	app	lications.	ingeration, an cond	7 mary 20					
CO3	Eva	lluate refrigeratio	n and air-conditioni	ng systems under di	fferent conditions.		Evaluate		
	•						TT		
Modu	lle			fule Contents			Hours		
I	Review of TherLaws, General eof refrigeration.Basic RefrigerationICarnot cycle, Resub cooling, sucCalculations andBell Coleman -Treatment)		anodynamics: quations, Processes, on Cycles: eversed Carnot cycle tion vapor superhea performance of ab Reversed Bryton	fect of nanger, cycle, criptive	7				
п		Multi pressure S Multi pressure S Multistage, Multi Refrigerants: Classification, D Comparison amo on Ozone deple refrigerants.	System and Refrige ystem: Removal of i-evaporator and Ca esirable Properties ong commonly used tion and global w	erants: flash gas, Flash inte scade System. like Thermodynami refrigerants, Selecti arming, Alternative	er-cooling, Water-c ic, physical and che on of Refrigerants, Refrigerants. Sec	ooling, emical. Effect ondary	6		
III		Cryogenics and Cryogenics:	Vapor Absorption	System			7		

Vapor Absorption System:         Aqua Ammonia system, Enthalpy-Concentration chart, analysis of system. Lithiun         Bromide -water vapor absorption system, Coefficient of Performance, Comparison         with Vapor Compression cycle. (Descriptive treatment only).         Refrigeration Equipments:	
Aqua Ammonia system, Enthalpy-Concentration chart, analysis of system. Lithiun         Bromide -water vapor absorption system, Coefficient of Performance, Comparison         with Vapor Compression cycle. (Descriptive treatment only).         Refrigeration Equipments:	
Bromide -water vapor absorption system, Coefficient of Performance, Comparison with Vapor Compression cycle. (Descriptive treatment only). Refrigeration Equipments:	t 🔤
With Vapor Compression cycle. (Descriptive treatment only).         Refrigeration Equipments:	Ĺ
Kerrigeration Equipments:	
U. IV. I Tymog of Compressor, Condensor, Evenerator, Expansion devises, and selection	6
Types of Compressor, Condenser, Evaporator, Expansion devices, and selection	, 0
Desce being and applications	
Moist air as a working substance Psychrometric properties of air use o	2
Psychrometric tables and charts processes combinations and calculations ADP	
Coil condition line, sensible heat factor, bypass factor, air washer and it'	
V applications.	7
Comfort:	
Thermal exchange between human body and environment, factors affecting	r
comfort, effective temperature, comfort chart, ventilation requirements.	
Heating and Cooling Load Calculation	
Representation of actual air conditioning process by layouts and on Psychrometric	;
VI charts, load analysis, RSHF, GSHF, ESHF, Enumeration and brief explanation or	
the factors forming the load on refrigeration and air conditioning systems, Energy	6
requirements of different types of air conditioning systems, Energy conservation in	L
air conditioning.	
Module wise Measurable Students Learning Outcomes :	
After the completion of the course the student should be able to:	
1. Describe and recall basics of thermodynamics and study and analyze VCC.	
2. Carry out performance study of multistage VCC. Classify the refrigerants; expl	ain the
physical, chemical properties of refrigerants.	
3. Study the applications and cryogenic systems. Analyze vapor absorption system	1.
4. Select different equipment used in refrigeration and become familiar with appli	cation of
refrigeration.	
5. Describe and recall basics of thermodynamics and air conditioning.	
6. Calculate heating and cooling load for air conditioning systems.	
Text Books	
C. P. Arora , "Refrigeration and Air conditioning", Tata McGraw Hill Education Priva	te Limited,
<sup>1</sup> third edition,2008	
2 Roy J. Dossat "Principles of Refrigeration", Pearson, fourth edition, 2020	
References	Professional
References           Wilbert F. Stoecker, Industrial refrigeration handbook, 1st edn., McGraw-Hill	
References       1     Wilbert F. Stoecker, Industrial refrigeration handbook, 1st edn., McGraw-Hill Publishing,1998	
References         Number of the state o	IcGraw-Hill
References         1       Wilbert F. Stoecker, Industrial refrigeration handbook, 1st edn., McGraw-Hill Publishing,1998         2       Wilbert F. Stoecker, Jerold W. Jones, "Refrigeration and Air Conditioning", N Publishing, 2nd ed.,2008         2       Publishing, 2nd ed.,2008	IcGraw-Hill
References         1       Wilbert F. Stoecker, Industrial refrigeration handbook, 1st edn., McGraw-Hill Publishing,1998         2       Wilbert F. Stoecker, Jerold W. Jones, "Refrigeration and Air Conditioning", M Publishing, 2nd ed.,2008         3       Shan K. Wang, "Handbook of air conditioning and refrigeration" McGraw-Hill is a divisor proved divisor	IcGraw-Hill nternational
References         1       Wilbert F. Stoecker, Industrial refrigeration handbook, 1st edn., McGraw-Hill Publishing,1998         2       Wilbert F. Stoecker, Jerold W. Jones, "Refrigeration and Air Conditioning", N Publishing , 2nd ed. ,2008         3       Shan K. Wang, "Handbook of air conditioning and refrigeration" McGraw-Hill edition, second edition.	IcGraw-Hill nternational
References         1       Wilbert F. Stoecker, Industrial refrigeration handbook, 1st edn., McGraw-Hill Publishing,1998         2       Wilbert F. Stoecker, Jerold W. Jones, "Refrigeration and Air Conditioning", M Publishing , 2nd ed. ,2008         3       Shan K. Wang, "Handbook of air conditioning and refrigeration" McGraw-Hill edition, second edition.	IcGraw-Hill nternational
References         1       Wilbert F. Stoecker, Industrial refrigeration handbook, 1st edn., McGraw-Hill Publishing,1998         2       Wilbert F. Stoecker, Jerold W. Jones, "Refrigeration and Air Conditioning", M Publishing , 2nd ed. ,2008         3       Shan K. Wang, "Handbook of air conditioning and refrigeration" McGraw-Hill edition, second edition.         Useful Links	IcGraw-Hill nternational
References         1       Wilbert F. Stoecker, Industrial refrigeration handbook, 1st edn., McGraw-Hill Publishing,1998         2       Wilbert F. Stoecker, Jerold W. Jones, "Refrigeration and Air Conditioning", N Publishing , 2nd ed. ,2008         3       Shan K. Wang, "Handbook of air conditioning and refrigeration" McGraw-Hill edition, second edition.         Useful Links	IcGraw-Hill nternational

	CO-PO Mapping														
		Programme Outcomes (PO)								PSO					
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2														
CO2	2	2													
CO3	2			2								1			
The stren	gth of	mappii	ng is to	be wr	itten as	\$ 1,2,3;	Where	e, 1:Lo	w, 2:N	<i>l</i> edium	, 3:Hig	gh			-

	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					
3	Apply	7	8	20	35	
4	Analyze	8	7	17	32	
5	Evaluate	5	5	23	33	
6	Create					
	Total	20	20	60	100	

Walchand College of Engineering, Sangli									
AY 2021-22									
	Course Information								
Progra	amme		B.Tech. (Mechanical Engineering)						
Class,	Semest	er	Final Year B.Tech	Final Year B.Tech., Sem VII					
Cours	e Code								
Cours	e Name	<u>!</u>	Computer Aided I	Design (CAD) Lab					
Desire	d Requ	isites:							
			1						
T	eaching	Scheme		Examination So	cheme (Marks)				
Lectur	re	-			ESE	Total			
Tutor Dragti		-	30	30	40	100			
Practi	cal	2Hrs/week		-	4a. 1				
пиега	ction	-		Crea	us: 1				
			Сош	rse Ohiectives					
1	To far	niliarize the stu	dent with different	modeling techniques	used for component	t design			
1	To de	velop the stude	ents to use mathema	atical representation	of geometries and	different tolerance			
2	techni	ques.		L.	0				
3	To ma	ke students aw	are of use of compu	ter for data exchang	e formats and tools				
		Cou	rse Outcomes (CO)	) with Bloom's Tax	onomy Level				
At the	end of t	he course, the	students will be able	e to,					
<b>CO1</b> Explain different modeling techniques and optimization technique. Underst					Understa				
	A	duaftin a ta alan				nd			
C02	Apply Const	drafting techn	Iques to generate dif	lies using concept of	ponents.	Apply Apply			
000	Consu			nes using concept of	geometric modelin				
	1					I			
			List of Experi	iments / Lab Activit	ties				
List of	f Experi	iments:							
1 Evn	loin diff	Forant modaling	tachniques (1 Urs)						
2. Crea	ate simp	le 3D compone	ent. (2 Hrs)	)					
3. Crea	ate comp	plicated 2D and	1 3D components. (4	4 Hrs)					
4. Mak	te any tw	vo assemblies	of minimum 5 comp	ponents. (4 Hrs)					
5. Mak	te any ty	vo assemblies	of minimum 10 con	nponents. (4 Hrs)					
o. Crea 7 Use	of FEA	technique for	optimization of desi	nrs) on (6 Hrs)					
1. 050				.Sm (0 mb)					
			T	ext Books					
1	PNR	Rao, "CAD/CA	M: Principles and	Applications", Mc	Graw Hill Education	on, Third Edition,			
-	2010.	D Croover	r Emory W 7	mmarg 40 A D/C A	M: Computer A:	dad Dasign and			
2	Manut	facturing" Prei	r, Emory w. Zi ntice-Hall 1984	uniners, CAD/CA	avi. Computer-Al	ucu Desigli alla			
<u> </u>	1,14114								
			R	References					
1	Ibrahi	m Zeid, "Ma	stering CAD/CAM	", Tata McGraw H	lill Education Pvt	Ltd., New Delhi,			
	Specia Ibrahi	m Zeid R $\varsigma$	ii, 2007, INININ Kep iyasubramanian "'	THIL 2010. CAD/CAM· Theory	and Practice" T	ata McGraw Hill			
2	Comp	anies, Special I	Indian Edition, 2009	).					
		_							

	Useful Links
1	
2	

	CO-PO Mapping															
		Programme Outcomes (PO)													PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
C01		3			2											
CO2			3	1												
CO3					3								2			
The stren	The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High															

	Assessment											
There are three components of lab assessment, LA1, LA2 and Lab ESE.												
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.												
Assessmen Based on Conducted by Typical Schedule (for 26-week Sem) Mari												
t				s								
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								
L A 2	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,	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 ty	pical schedule of lab assessments is shown,									
considering a	1 26-week semester. Th	ne actual schedule	shall be as per academic calendar. Lab									
activities/Lab	performance shall inc	olude performing	avperiments mini project presentations dra	winge								

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

	Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)										
			A	Y 2021-22							
			Cours	se Information							
Progr	amme		B.Tech. (Mechani	cal Engineering)							
Class,	Semest	er	Final Year B.Tech	n., Sem VII							
Cours	e Code										
Cours	e Name		Non-Conventiona	l Machining Lab							
Desire	ed Requ	isites:									
			·								
Т	eaching	Scheme		Examination So	cheme (Marks)						
Lectu	re	-	LA1	LA2	ESE	Total					
Tutor	ial	-	30	30	40	100					
Practi	cal	2Hrs/Week		-							
Intera	ction	-		Cred	its: 1						
			1								
			Cour	rse Objectives							
1	To ma	ke students far	niliar with different	non-conventional m	achining technique	s.					
2	To pro	ovide a hands o	n experience with d	lifferent non-convent	tional machining se	etups.					
3	To im	part practical k	nowledge about var	ious parameters and	their effect on mac	chining materials.					
4	To pro	ovide exposure	to different tooling	's and machining cap	babilities.						
		Cou	rse Autcomes (CA)	with Bloom's Tay	nomy Level						
At the	end of t	he course, the	students will be able	e to.							
CO1	Classi	fy different t	spes of non con	ventional machinin	g techniques and	their Applyin					
	Study	the effects of v	arious process para	meters on the proper	rties of different ma	aterials Analyzin					
002	in non	conventional t	techniques.	* *		g					
CO3	Discus non co	ss the toolings onventional tech	and equipments reaching hniques.	quired for machinng	of different mater	ials by Evaluati ng					
			List of Experi	iments / Lab Activit	ties						
List of	f Experi	ments:									
List of	f Experi	ments on Non	-Conventional Ma	chining: (Each Exp	eriment of 2 hrs)						
1. Intro	oductior	to the differer	nt nonconventional	machining setups.							
2. Han	ds on ex	experiment on A	brasive Jet Machini	ing. Jaching (EDM)							
$\int 3. \text{ Han}$	eriment	on Micro-FDN	M	Machine (EDM)							
5. Exp	periment	t on Micro-WE	DM.								
6. Han	ds on ex	periment on pl	hoto chemical mach	ining techniques.							
7. Mac	hining /	deposition of	metals using fiber la	aser machine.							
8. Stud	ly and d	emonstration o	of fused deposition r	nodeling.							
9. Indi	ustrial vi	sit and report v	writting.								
			7	lowt Docha							
	Mishr	PK Non-	Conventional Mac	ext DUOKS hining The Instituti	on of Engineers (	India) Text Book					
1	Series	, New Delhi. 1	997.	ining, the monut	on of Lighters (	manu, ion book					
2	Garry 1987.	F. Benedict, U	Inconventional Ma	chining Process, Ma	rcel Dekker Public	cation, New York,					
3	Vijay.	K. Jain "Advar	nced Machining Pro	cesses" Allied Publi	shers Pvt. Ltd, New	v Delhi, 2007.					
4	Pande (2007)	y P.C. and Sh	an H.S. "Modern N	Machining Processes	s", Tata McGraw -	- Hill, New Delhi					
			R	References	. 11.1 4 4 -						
1	Hassa	n El-Hofy, "A	Advanced Machini	ing Processes: Nor	ntraditional and H	Hybrid Machining					

	Processes", McGraw-Hill Co, New York (2005).
2	Benedict, Gary F., "Non-Traditional Manufacturing Processes", Marcel Dekker Inc., New York (1987).
3	Chua C. K. and Leong, Lim, "Rapid Prototyping Principles and Applications", 2nd edition, John Wiley and Sons, 1989.
	Useful Links
1	
2	

	CO-PO Mapping															
		Programme Outcomes (PO)													PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
C01		3	3										2			
CO2				2								3	2	2		
CO3			2	3				3					2	2		
The stren	The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High															

		Asses	sment									
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.											
Assessmen	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Mark								
t				s								
L A 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								
L A 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								
	attendance, journal	Faculty	Marks Submission at the end of Week 18	40								
Week 1 indic	ates starting week of a	semester. The typ	pical schedule of lab assessments is shown,	<u></u>								
considering a	26-week semester. Th	ne actual schedule	shall be as per academic calendar. Lab									
activities/Lab	performance shall inc	clude performing	experiments, mini-project, presentations, drav	wings,								
programming	g and other suitable act	ivities, as per the	nature and requirement of the lab course. The	e								
experimental	lab shall have typicall	y 8-10 experimen	ts.									

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

Walchand College of Engineering, Sangli												
			(Government Ald	<b>V 2021-22</b>	uie)							
			Cours	se Information								
Progr	amme		B.Tech. (Mechani	cal Engineering)								
Class	Semest	er	Final Year B Tech	Sem VII								
Cours	e Code		· · · · · · · · · · · · · · · · · · ·									
Cours	e Name		Refrigeration and Air Conditioning Lab									
Desire	ed Reau	isites:	8		-							
2 00110												
Т	eaching	Scheme	Examination Scheme (Marks)									
Lectu	re	_	LA1	LA2	ESE		<b>Fotal</b>					
Tutor	ial	_	30	30	40		100					
Practi	cal	2Hrs/Week		II		1						
Intera	ction	-		Cred	its: 1							
			1									
			Cour	se Objectives								
1	To en	able the stude	nts to perform the	experiment and an	alyze results based	d on pr	inciples of					
1	mathe	matics, science	and engineering.		-							
2	To pre	pare students t	o use modern tools	and techniques.								
3	To tra	in students wit	h effective commun	nication skill to dem	onstrate refrigeration	on/air co	onditioning					
4	To dev	velop skills to f	fulfill industrial need	ds.								
5	To de	velop a profe	ssional approach to	lifelong learning i	n the refrigeration	/ air co	onditioning					
3	/cryog	enics.										
		Com	nso Autoomos (CA)	with Plaam's Tax	nomy Loval							
At the	end of t	the course the	students will be able	to	Dhomy Level							
CO1	Perfor	m the experime	ents in refrigeration	and air conditioning	as per given object	tives.	Applyin o					
CO2	Analy: applic	ze different re	efrigeration, air con	ditioning and cryo	genic systems with	n their	Analyzin g					
CO3	Measu	re the perform	ance of different sys	stems under differen	t conditions		Evaluati ng					
			List of Experi	ments / Lab Activit	ies							
List of	f Experi	iments:										
	Trial C	on vapour comj on Heat Pump	pression refrigeratio	n system.								
3.	Trial c	on ice plant.										
4.	Trial o	on Cascade sys	tem.									
5.	Trial o	on air condition	ning system.									
Demo	nstratio	n / Study (any	v six)									
1.	Study	and demonstr	ation of refrigeration	on system for house	e hold refrigerator,	water	cooler, ice					
2.	Study	and demonstra	tion of controls in r	efrigeration.								
3.	Study	and demonstra	tion on window, spl	lit and central air con	nditioner.							
4.	Study	of dehydration	, charging, leak test	ing and testing of re	frigeration system.							
5.	Study	and demonstra	tion of absorption s	ystem.								
6.	Study	of method for	star rating and EER	tor domestic applia	ices like house hok	t refrige	rator.					
/. Q	Study/	trial on wortex	stage compression r	refrigeration system								
0. 9	Study	trial on air wa	stage compression i isher.	emgeration system								
10	. Study	/trial on multi-e	evaporator refrigerat	tion system.								
				-								
			Т	'ext Books								

1	C. P. Arora , "Refrigeration and Air conditioning", Tata McGraw Hill Education Private Limited , third edition,
2	Roy J. Dossat "Principles of Refrigeration", Pearson, fourth edition, 2020.
	References
1	Wilbert F. Stoecker, Industrial refrigeration handbook, 1st edn., McGraw-Hill Professional Publishing,1998Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., "Fundamentals of Thermodynamics", John Wiley and Sons, 7th Edition, 2009
2	Wilbert F. Stoecker, Jerold W. Jones, "Refrigeration and Air Conditioning", McGraw-Hill Publishing, 2nd ed., 2008
3	Shan K. Wang, "Handbook of air conditioning and refrigeration" McGraw-Hill international edition, second edition
	Useful Links
1	
2	

CO-PO Mapping															
	Programme Outcomes (PO)PSO														
	1	1 2 3 4 5 6 7 8 9 10 11 12									1	2	3		
CO1	2							2		1					
CO2	2	2			1										
CO3	2									1	1				
The stren	gth of 1	mappir	ng is to	be wr	itten as	1,2,3;	Where	e, 1:Lo	w, 2:N	ledium	, 3:Hi	zh		-	

	Assessment											
There are three	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.												
AssessmenBased onConducted byTypical Schedule (for 26-week Sem)Mark												
t				s								
T A 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								
I A 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								
Lauese	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	ne actual schedule	shall be as per academic calendar. Lab									
activities/Lab	performance shall inc	clude performing a	experiments mini-project presentations drav	wings								

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	Lab ESE	Total									
Remember												
Understand												
Apply	10	10	15	35								
Analyze	10	10	15	35								
Evaluate	10	10	10	30								
Create												
Total Marks	30	30	40	100								

		W	alchand Colleg	e of Engineerin	<b>ig, Sangli</b>									
	(Government Aided Autonomous Institute) AY 2021-22													
AY 2021-22 Course Information Programme R Tach (Machanical Engineering)														
Progra	amme		B.Tech. (Mechani	cal Engineering)										
Class.	Semes	ter	Final Year B. Tecl	n Sem VII										
Cours	e Code	· · · ·												
Cours	e Nam	e	Aerospace Engine	ering										
Desire	d Reg	isites:												
Те	eaching	Scheme		Examination Sc	heme (Marks)									
Lectur	re	3Hrs/week	T1	T2	ESE	Г	otal							
Tutori	ial	-	20	20	60		100							
Practi	cal	-		-										
Intera	ction	-		Cred	its: 3									
		1	1											
	Course Objectives													
1	To learn about the nomenclature of Aerospace engineering and aircraft components.													
2	To learn about basics of fluid mechanics and aerodynamics.													
3	To learn about aero propulsion systems and thermodynamic cycles.													
4	To understand about the performance parameters, aircraft stability and control													
5	To learn about the launch vehicles and basics of satellite.													
6	To ur	derstand airpo	rts and aircraft mana	igement.										
Course Outcomes (CO) with Bloom's Taxonomy Level														
At the	end of	the course, the	students will be abl	e to,			A							
	Apple	mber basics ar	in understanding nr	in similar of vahiala	, propulsion system	s.	Apply							
CO2	Appr	basic physics	in understanding pr	incipies of venicle.	ah mahialaa		Analyze							
<u>CO3</u>	Expla	in different per	formance, stability	and control and laun	ch venicles.		Evaluate							
Modu	le		Μο	tule Contents			Hours							
litouu	Ir	troduction	11100				110015							
	H	story of Aeros	pace, Atmosphere a	nd its properties, Cla	ssification of Aeros	space								
I	ve	hicles, basic co	omponents of aircrat	fts and spacecraft, ve	hicle control surfac	es and	7							
	sy	stems, introdu	ction to Indian Aero	space sector, major A	Aerospace industry a	and								
	m	anufacturers, a	erospace material te	chnology.										
	F	ight Principle												
	F	uid mechanics	: Streamlines + Ste	ady flow + Incomp	ressible flow, Bern	oulli's								
	E	juation + Coai	nda Effect + Mach	No, Significance of	speed of sound, st	andard								
II		erodynamic <sup>.</sup> A	erodynamic forces	acting on aircrafts	and spacecraft a	erofoil	9							
		menclature. p	ressure and velocity	distribution. aerody	vnamic forces, gen	eration								
	of	lift and drag,	supersonic effects,	aerodynamic center,	center of pressure,	aspect								
	ra	tio		•		•								
	P	ropulsion Syst	em	C 1	1	. 1 . 0								
III	P	opulsion syste	ms, classifications of simon	of propulsion system	, location and princ	iple of	7							
		cle and Humpl	hrev cycle iet engin	es propeller engines	rocket engines	ayton								
		ircraft Perfor	mance, Stability an	d control	, isoner onghios									
	Pe	erformance: p	ower curves, maxi	mum and minimum	speed of aircraft	during								
IV	st	eady state, effe	cts of altitude on en	gine performance, es	cape velocity.		8							
		ability and o	control :Static and	d Dynamic stabilit	y, Steady level	flight,	Ŭ							
		ngitudinal, late	eral and directional	stability, Ceilings,	Steady Climbing	Flight,	,							
V		aunch vohieles	and Satellites	nuary control surface	ts, manoeuvres.									
· · ·		A G I I I I I I I I I I I I I I I I I I	ana satunto			1								

	Rockets and satellite materials, launch vehicle dynamics, basic orbital mechanics,	5
	satellite applications and orbits, future challenges in aerospace engineering.	
VI	<b>Steam Turbines</b> NVH and crashworthiness of vehicles, Emission norms and control, automotive electronics, Automotive manufacturing and assembly, material and vendor management, Testing and certification of vehicles Alternative energy sources, natural gas, LPG, biodiesel, bio-ethanol, gasohol and hydrogen fuels in automobiles, modifications needed, performance, combustion & emission characteristics of alternative fuels in SI and CI engines, Electric and Hybrid vehicles, Application of Fuel Cells	4
Modu	e wise Measurable Students Learning Outcomes :	
After the	he completion of the course the student should be able to:	
1.	Remember the current trends of Aerospace engineering	
2.	Understand and explain different types of propulsion systems	
3.	Apply the fluid mechanics concepts to understand the Aerodynamics	
4.	Understand the working of aerospace vehicle and satellite	
5.	Understand the application of aircraft and aerospace vehicles	
	Text Books	
1	John D Anderson, "Introduction to flight", McGraw-Hill Publishing Co., 2017.	
2	Turner, M. J. L., "Rocket and Spacecraft Propulsion: Principle, Practice and No opments", 3rd Edition, Springer (2016).	ew-Devel-
	References	
1	Sutton G. P., "Rocket Propulsion Elements", John Wiley, New York, 8th Ed., 2011.	
2	Anderson, D. F. and Eberhardt, S., "Understanding Flight, 2nd Ed. McGraw Hill (2009).	
	Useful Links	
1		

CO-PO Mapping																
	Programme Outcomes (PO)													PSO		
	1	1     2     3     4     5     6     7     8     9     10     11     12     1     2     3														
CO1		2	2					3					2	1		
CO2		3	3	2		2			2				2	2		
CO3	3	1	3		2		2				2		3			
The strop	oth of	monnir	a in to	hour	itton of	1 2 2.	Whore	1.Lo		ladium	2.11.	rh				

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

**Assessment (for Theory Course)** 

	Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course												
В	loom's Taxonomy Level	<b>T1</b>	T2	ESE	Total								
1	Remember												
2	Understand												
3	Apply	7	8	20	35								
4	Analyze	8	7	17	32								
5	Evaluate	5	5	23	33								
6	Create												
	Total	20	20	60	100								

		W	alchand Colleg	ge of Engineerin	<b>ig, Sangli</b>								
AY 2021-22													
			Cour	se Information									
Progr	amme		B.Tech. (Mechani	cal Engineering)									
Class	Semes	ter	Final Year B Tech	n Sem VII									
Class,	o Code		Tillar Tear D. Teel										
Cours	o Nom	<u>a</u>	Automobile Engin	eering									
Desine	d Door		Automobile Eligin	lecting									
Desire	ea Kequ	lisites:											
T	1. 2	C.L.		EC	h								
	eaching	3 Scheme		Examination SC	ESE								
Lectu	re	3Hrs/week	11	12	ESE								
Tutor		-	20	20	60		100						
Practi	cal												
Intera	raction - Credits: 3												
			Cou	rse Objectives									
1	To un	derstand the co	onstruction and worl	king principle of vari	ous parts and syste	ms of a	n						
1	auton	nobile											
2	To pe	rform basic cal	lculations required f	or vehicle performan	ice and for some of	importa	nt						
	syster	ns such as Tra	nsmission (Gear Rat	ios), steering system	, and brake system.								
2	To make student aware of latest trends in transportation towards a safe, pollution free and fully												
3	auton	natic vehicle.											
		Cou	rse Outcomes (CO	) with Bloom's Tax	onomy Level								
At the	end of	the course, the	students will be abl	e to,									
CO1	Under	rstand various	types of Engine & A	utomotive systems			Apply						
CO2	Analy	ze vehicle per	formance related to	engine, brake and ste	ering systems.		Analyze						
CO3	Select	t proper engine	, gear ratios, and oth	ner systems for given	vehicle application	ı with	Evaluate						
	refere	nce to safety a	nd pollution norms.										
Modu	ıle		Moo	lule Contents			Hours						
	In	troduction, cl	assification and Au	itomotive power pla	ints								
	In	troduction, Bi	oad classification	of Engines, Basic	components of H	Engine,							
	Pe	erformance of	Engine. Automobi	les. Major compon	ents and their fun	ctions.							
I	1 <u>1</u>	pes of venici	e layouts, Types of	onsiderations Elec	tric and Hybrid ve	power	6						
		ants, Comparis	ges and limitations	New engine techno	logies i e turbo cl	hargers							
		VGT, VGT), d	engine emission Co	ontrol by 3-way ca	talytic converter s	system,							
	Ē	nission norms	(Euro & BS).		•	-							
	V	ehicle Perforn	nance										
	Re	esistance to ve	hicle motion, Air, I	Rolling and Gradien	t resistance, Accele	ration,	-						
	G	ve effort, Distribut	tion of										
		tio	equired for venicle	propulsion, Selectio	li ol gear ratio, Re	ar axie							
		ransmission S	vstem										
	A	utomobile clut	ch requirements, T	ypes & functions,	Single plate, Multi	plate,							
	C	entrifugal and l	Fluid clutches.	• •									
III	R	equirements of	gear box, Types of	gear box, Types of gearboxes, construction and Working									
	Pr	Principle of operation of automatic transmission, Torque converter, Epicyclic gear											
	tra	un, Constructi	on and working of										
		interential, Rea	r axles.	ing & Flootman	toma								
IV		ispension requ	urements Sprung	and Un sprung ma	ss Types of auto	motive	7						
1,1		spension syste	ems. Conventional	and Independent. S	hock absorber. Tv	pes of	,						

	springs, Hotch- kiss and Torque tube drive, Reaction members-Radius rods,	
	Stabilizer bar, Air suspension system.	
	Function of steering, Steering system layout, Automotive steering mechanism,	
	Types of steering gear boxes, Condition for true rolling, Steering geometry-	
	Camber, Caster, King pin inclination, Toe-in and Toe-out, Wheel alignment, Slip	
	angle, Under steer & over steer conditions, Introduction of power steering,	
	Braking and Electrical System	
	Function of automotive brake system, Types of braking mechanism, internal	
	expanding & Disc brake, Mechanical, Hydraulic & Air brake system, Servo and	
	power brakes, Calculation of braking force required, stopping distance and dynamia weight transfer	
V	Automotive batteries Automotive lighting system Starting system Charging	7
	system Voltage and current regulator. Electric horn, Dash board gauges. Winer &	/
	side indicator circuit Engine electronic control modules. Safety devices braking	
	systems, antilock braking system (ABS), electronic brake force distribution (EBD)	
	and traction control.	
	Recent trends in Automotive Development	
	NVH and crashworthiness of vehicles, Emission norms and control, automotive	
	electronics, Automotive manufacturing and assembly, material and vendor	
VI	management, Testing and certification of vehicles Alternative energy sources,	
¥1	natural gas, LPG, biodiesel, bio-ethanol, gasohol and hydrogen fuels in	6
	automobiles, modifications needed, performance, combustion & emission	
	characteristics of alternative fuels in SI and CI engines, Electric and Hybrid	
	vehicles, Application of Fuel Cells	
Modu	e wise Measurable Students Learning Outcomes :	
After t	ne completion of the course the student should be able to:	
1.	To select proper engine for given vehicular application	
2.	To analyze vehicle performance	
3.	To understand various types of transmission systems	
4.	To relate concepts of vehicle dynamics with daily experiences	
5.	To calculate braking performance of the vehicle in different conditions	
6.	To comprehend recent trends in automobile development	
	Text Books	
1	Kripal Singh, Automobile Engineering Vol II, Standard Publishers Distributors, Tenth 2007	n Edition,
2	P S Gill, Automobile Engineering II, S K Kataria and Sons, Second Edition, 2012	
3	R K Rajput, Automobile Engineering, Laxmi Publications, First Edition, 2007	
4	Jain K.K. and Asthana R.B., Automobile Engineering, Tata McGraw Hill, New Delhi, 2	002.
1	References	
1	P. w. Kett., Motor Venicle Science Part 2, Chapman and Hall, 1st Edition, 1982	th Edition
2	1989	th Edition,
3	Crouse and Anglin, Automotive Mechanics, McGrawhill Publication, Tenth Edition, 200	07
1	Useful Links	
1		
2		

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

	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												
3	Apply	7	8	20	35								
4	Analyze	8	7	17	32								
5	Evaluate	5	5	23	33								
6	Create												
	Total	20	20	60	100								

	Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)													
	AY 2021-22													
			Cour	se Information										
Progr	amme		B.Tech. (Mechanie	cal Engineering)										
Class.	Seme	ster	Final Year B. Tech	n., Sem VII										
Cours	e Cod	e		,										
Cours	e Nan	e	Industrial Automa	tion										
Desire	ed Req	uisites:												
	-		1											
Т	eachin	g Scheme		Examination Sc	heme (Marks)									
Lectu	re	3Hrs/week	T1	T2	ESE	Г	otal							
Tutor	ial	-	20	20	60		100							
Practi	tical													
Intera	eraction - Credits: 3													
			Cou	rse Objectives										
1	To tr	ain the students	s in the area of instru	mentation, automation	on and control.									
2	To g	et the basic kno	wledge and practical	l experience in instru	mentation, automat	tion and	control							
	area	and to work mo	ore effectively in mai	nufacturing, process	and automation ind	ustries.								
3	To g	et the knowledg	ge of various elemen	ts of industrial auton	nation – CAD/CAN	l, sensor	·s,							
	pneu Ta u	matics, nydraul	ics and CNC.	an and the nale of in	duraterial automation									
4	10 u		asies of product desi	gh and the role of m										
		Cou	urse Outcomes (CO	) with Bloom's Tax	onomy Level									
At the	end of	the course, the	students will be abl	e to,										
COL	Iden	tify different typ	pes automation, tech	nological and econor	nic		Apply							
COI	issue	s involved in au	utomatic manufactur	ing of products										
CO2	Class	sify the major c	omponents used in a	utomation such as co	ommonly used sense	ors	Analyze							
	and a	analyze commo	n techniques for sens	sor interfacing and p	rotection circuits									
CO3	Inter	pret basic conce	epts of sensors and the	cansducers into real v	world applications.		Evaluate							
	-													
Modu			Moc	lule Contents	· (*)		Hours							
I		atroduction: Re atomation, App atomation, Lov atomation, Iss atomation	ason of automation plication of automa v cost automation, ( ues for automation	tion, Goals of auto Current emphases in in factory opera	assification and ty mation, Social iss automation, Reaso tion, Ten strategi	ues of ons for es for	6							
II	R cu C fi	igid automation ontrol of Machi NC-Adaptive xturing.	n: Part handling, M ine Tools and Mach Control, Automate	achine tools. Flexib ining Centers, NC ar ed Material handli	le automation: Con nd NC part program ng. Assembly, F	mputer nming, lexible	7							
III	C C a te	Computer Aidec Graphics.Softwa pplications an echnology, CNC	l Design: Fundamer re and Data Bas d analysis method C Adaptive Control.	ntals of CAD - Har se, Geometric mo ls; Computer Aide	dware in CAD-Co deling for down d Manufacturing:	mputer stream CNC	6							
IV		ow cost automa lydraulics, Illus	ation: Mechanical & trative Examples and	Electro mechanical d case studies.	Systems, Pneumati	ics and	7							
v	<ul> <li>Introduction, Sensor and transducers, Sensor technology, Selection of Transducers,</li> <li>Classification of sensors and transducers, History of Microprocessor,</li> <li>Programmable logic controller, Working of PLC.</li> </ul>													
VI	II C	ntroduction to Note of the other of the other of the other o	Modeling and Simula hniques, Case studie	ation: Product designers & industrial applic	n, process route mo ations.	deling,	6							
Modu After t	le wise the con	e <b>Measurable S</b> npletion of the o	Students Learning ( course the student sh	<b>Jutcomes :</b> ould be able to:										

- 1. Become familiar with the different types automations involved in manufacturing of products.
- 2. Use various machine tools and machining centers.
- 3. Get a comprehensive picture of computer based automation of manufacturing operations.
- 4. Utilize Hydraulic and Pneumatic system in Automation.
- 5. Understand the major components like sensors, their interfacing and protection circuits.
- 6. Implement automation knowledge in real world problems

	Text Books									
1	M. P. Groover, "Automation, Production Systems and Computer Integrated Manufacturing"									
1	Pearson Education, 2016.									
2	Andrew Parr, (HB), "Hydraulic and Pneumatics ", Jaico Publishing House, 1999.									
3	Industrial automation and robotics by A. K. Gupta & S. K. Sharma, Laxmi publication, 2013									
	References									
1	Industrial Instrumentation, Control and Automation, S. Mukhopadhyay, S. Sen and A. K. Deb,									
1	Jaico Publishing House, 2013.									
2	Hydraulic Control Systems, Herbert E. Merritt, Wiley, 1991.									
3	Electric Motor Drives, Modelling, Analysis and Control, R. Krishnan, Prentice Hall India, 2002.									
	Useful Links									
1	NPTEL and MOOC links									

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

	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	7	8	20	35				
3	Apply	8	7	17	32				
4	Analyze	5	5	23	33				
5	Evaluate								
6	Create								
	Total	20	20	60	100				

	Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)								
			A	Y 2021-22					
			Cours	se Information					
Progra	amme		B.Tech. (Mechanical Engineering)						
Class,	Semest	ter	Final Year B.Tech., Sem VIII						
Cours	e Code								
Cours	e Name	e.	Project II						
Desire	d Requ	isites:							
			1						
Т	eaching	g Scheme		Examination Sc	heme (Marks)				
Lectur	re	-	LA1	LA2	ESE	Tot	al		
Tutori	ial	-	30	30	40	100	)		
Practi	cal	16 Hrs/Week		-					
Intera	ction	-		Credi	its: 8				
			Cour	rse Objectives					
1	To he	lp students to a	ddress real life chall	lenges and discuss pi	oject requirements	•			
2	To giv	ve technical sol	utions through lates	t design & developm	ent tools.				
	Encou	urage creative	thinking process	s to help them to	get confidence	by plannii	ng and		
3	carry	ng out the wo	ork plan of the pro	bject and to succes	stully complete the	ne same, tl	hrough		
	obser	vations, discus	ssions and decision	n making process.					
		Сош	rse Outcomes (CO)	with Bloom's Tax	nomv Level				
At the	end of t	the course, the	students will be able	e to.					
	Unde	rstand the imp	ortance of teamw	ork and will be abl	e to work in a tea	um for U	ndersta		
CO1	achie	ving group go	bals / will be prep	pared to assume a	leadership role i	n any no	1 E		
	team.		1 1	L	1				
cor	Analy	ze and give	solutions for a sp	pecific problem sta	tement related to	their A	nalyse		
02	projec	ct.							
C03	Prepa	re and presen	t a detailed repor	t based on project	work spread over	er two C	reating		
000	semes	sters.							
			List of Experi	iments / Lab Activit	ies				
Cours	e Conte	ents:							
	1	<b>C C C</b>	. , .	11 /	1 6 4	. 1	1 6 4		
1) Con	npletio	n of manufact	uring / processing	g-assembly / testing	g work of the proj	ect by end	of the		
semes	ter.								
ii) Tee									
(1) res	sting, re	esun analysis e	etc.						
iii) Re	ctificat	tions/ correction	on if required.						
iv) Fir	nal repo	ort presentatio	n.						
			Т	ext Books					
1.	Vario	us printed and	l electronic resour	ces available on the	e internet and inst	itute librai	ry.		
		1							
			R	References					
1.	All typ	pes of standard	journals, conferenc	e proceedings etc.					
			U	seful Links					
1	Online	e resources in the	he selected domain	areas.					

	CO-PO Mapping														
				Р	rograi	nme C	Outcon	nes (PC	<b>)</b> )					PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		2					3					2	3	3	
CO2					3						3		3	3	
CO3			3	3								2	3	3	
The stren	gth of 1	mappii	ng is to	be wr	itten as	5 1,2,3;	Where	e, 1:Lo	w, 2:N	ledium	, 3:Hig	gh			

	Assessment								
There are thr 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.								
Assessmen	AssessmenBased onConducted byTypical Schedule (for 26-week Sem)								
t				s					
I A1	Lab activities,	Lab Course	During Week 1 to Week 6	30					
	attendance, journal	Faculty	Marks Submission at the end of Week 6	50					
L A 2	Lab activities,	Lab Course	During Week 7 to Week 12	20					
LA2	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 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	10	5	10	25			
Apply							
Analyze	10	10	10	30			
Evaluate							
Create	10	15	20	45			
Total Marks	30	30	40	100			

	Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)									
			A	Y 2021-22						
			Cours	se Information						
Progr	amme		B.Tech. (Mechanical Engineering)							
Class,	Semest	er	Final Year B.Tech	., Sem VIII						
Cours	se Code									
Cours	se Name		Skill Based Learn	ing						
Desire	ed Requ	isites:								
Т	eaching	Scheme		Examination	Scheme (Marks)					
Lectu	re	-	LA1	LA2	ESE	Fotal				
Tutor	ial	-	30	30	40	100				
Practi	ical	2Hrs/Week			-					
Intera	iction	-		Cre	edits: 1					
			Cour	rse Objectives	· · · · ·					
1	In this years	s course the stud will be conside	dent performance in red.	co-curricular and	extra-curricular activities ov	er four				
2	<ul> <li>The common activities are like technical events, Sports, Cultural, Social, and Students Club etc.</li> <li>These activities help the students to develop leadership skills, team integrity, coordination skills,</li> <li>Time management, Communications skills, Interviewing skills etc. These activities help the students to know his or her intelligence. The evaluation will be done by the mentor who is mentoring the student during graduation period.</li> </ul>									
		Сош	rse Outcomes (CO)	with Bloom's Ta	avonomy Level					
At the	end of t	the course, the	students will be able	e to,						
C01	Preparetc.)	re for Co Curric	ular and Extracurri	icular activities ( T	echnical/Non. Tech/Social	Apply				
CO2	Devel	op the ability fo	or working in a dive	ersified team.		Analyze				
CO3	Judge	his/her ability	in various events.			Evaluate				
			List of Experi	iments / Lab Acti	vities					
			T	ext Books						
	NA									
	N A		R	References						
	<u> </u>									
			U	seful Links						
1										
2										

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

	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.							
Assessmen Based on Conducted by Typical Schedule (for 26-week Sem) M				Mark				
t				s				
τ. Α. 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				
L A 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				
LauESE	attendance, journal Faculty Marks Submission at the e		Marks Submission at the end of Week 18	40				
Week 1 indic	Week 1 indicates the starting week of a semester. The typical schedule of lab assessments is shown,							
considering a	26-week semester. Th	ne 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	15	35				
Analyze	10	10	15	35				
Evaluate	10	10	10	30				
Create								
Total Marks	30	30	40	100				

Event	Details	1 <sup>st</sup> Prize	2 <sup>nd</sup> Prize	3 <sup>rd</sup> Prize	Participation
Technical events Sports	National	30	25	20	15
Cultural,	State	25	20	15	10
Social	Inter College/Dist./ City	10	08	06	04
Students club	President, Vice President, Treasurer, Secretary	10			
	Member/Volu nteer	05			

		W	alchand Colleg (Government A	ge of Engineerin ided Autonomous Insti	<b>ng, Sangli</b>					
	AY 2021-22									
	Course Information									
Progr	amme		B.Tech. (Mechani	B.Tech. (Mechanical Engineering)						
Class,	Semest	er	Final Year B. Tec	h., Sem VIII						
Cours	se Code									
Cours	se Name		Summer Internshi	ip						
Desired Requisites:										
T	eaching	Scheme		Examination S	cheme (Marks)					
Lectu	re	-	LA1	LA2	ESE	Total				
Tutor	ial	-	30	30	40	100				
Practi	ical	-		-	-					
Intera	action	1Hrs/week		Cred	lits: 1					
			Cou	rse Objectives						
	Follow	ving are the in	tended objectives of	f internship training:						
	•	Will expose	Technical students	to the industrial env	ironment, which can	not be simulated				
	in the	classroom and	l hence creating con	npetent professionals	s for the industry.					
	•	Provide pos	sible opportunities t	o learn, understand a	and sharpen the real	time technical /				
	manag	gerial skills rec	juired at the job.							
• Exposure to the current technological developments relevant to the subject area of										
	trainir	training. • Experience gained from the 'Industrial Internship' in the classroom will be used in								
	classro	oom discussion	ns.							
	•	Create cond	itions conducive to	quest for knowledge	and its applicability	on the job.				
1	•	Learn to app	oly the Technical kn	owledge in real indu	strial situations.					
L	•	Gain experie	ence in writing Tech	nnical reports/project	ts.					
	•	Expose stud	ents to the engineer	's responsibilities an	d ethics.					
	•	Familiarize	various materials, p	rocesses, products a	nd their applications	along with				
	releva	nt aspects of q	uality control.							
	•	Promote aca	demic, professional	l and/or personal dev	velopment.					
	•	Expose the s	students to future en	nployers.						
	•	Understand	the social, economi	c and administrative	considerations that i	influence the				
	worki	ng environmen	nt of industrial organ	nizations						
	•	Understand	the psychology of the	he workers and their	habits, attitudes and	approach to				
	proble	em solving.								
		Com	man Autoomaa (CO	) with Plaam's T						
At the	end of	the course the	students will be abl	<b>) with Bloom's Tax</b> le to	konomy Level					
CO1	Notice	an improvem	ent in his/her under	standing and practic	al skills.	Apply				
$CO^2$	Under	stand and valu	e the importance of	working in a divers	ified field.	Analyze				
CO3	Demo	nstrate the sof	t skills like presenta	tion skills, technical	report writing etc.	Evaluate				
005	Demo		t skills like presenta	dion skins, teenneur	report writing etc.	Livalaute				
Modu	ıle		Mo	dule Contents		Hours				
Asses	sments	<u> </u>				ilouis				
Intern	ships ca	rried out by the	e student will be eva	aluated based on ove	erall knowledge gain	ed from the				
concer	rned ind	ustry. This eva	aluation will be carr	ied out by the concer	rn mentor allocated t	to individual				
studen	its by th	e department h	before LA4/ISE-2							
1.	The of	verall assessm	ent is for 100 marks	s and minimum 40 m	arks should be score	ed by student for				
	passin	g				-				

	Text Books					
	Not applicable.					
	References					
	Not applicable.					
	Useful Links					
1						

	CO-PO Mapping														
		Programme Outcomes (PO) PSO													
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1													1	1	
CO2														2	
CO3													2		
The stren	oth of	mannii	na is to	he wr	itten a	123.	Where	- 1·Lo	$\mathbf{w} \cdot 2 \cdot \mathbf{N}$	Iedium	3.Hi	rh			

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

	Assessment										
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.											
Assessmen	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Mark							
t				S							
ΤΑΙ	Lab activities,	Lab Course	During Week 1 to Week 6	20							
LAI	attendance, journal	Faculty	Marks Submission at the end of Week 6	50							
1.42	Lab activities,	Lab Course	During Week 7 to Week 12	30							
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 ty	pical schedule of lab assessments is shown,								
considering a	26-week semester. Th	ne actual schedule	shall be as per academic calendar. Lab								
activities/Lab	activities/Lab performance shall include performing experiments, mini-project, presentations, drawings,										
programming	g and other suitable act	ivities, as per the	nature and requirement of the lab course. The	e							
experimental	lab shall have typicall	y 8-10 experimen	ts.								

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

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)										
			A	Y 2021-22	uic)					
			Cour	se Information						
Progr	amme		B.Tech. (Mechani	echanical Engineering)						
Class.	Semes	ter	Final Year B. Tech., Sem VIII							
Cours	e Code	;		,						
Course Name Product Lifecycle Management										
Desire	d Requ	uisites:								
			1							
Т	eaching	g Scheme		Examination So	cheme (Marks)					
Lectu	re	3Hrs/week	T1	T2	ESE	Т	'otal			
Tutor	ial	-	20	20	60		100			
Practi	cal	-		-	·					
Intera	ction	-		Cred	its: 3					
			Cou	rse Objectives						
1	To pr	ovide the know	vledge of different in	formation systems u	sed in an engineerin	ng enter	prises			
2	2 To impart the recent knowledge in the broader field of product development and various lifecycle aspects involved									
3 To provide exposure to application of software tools for addressing problems in product design and development										
	1									
Course Outcomes (CO) with Bloom's Taxonomy Level										
At the	At the end of the course, the students will be able to,									
CO1 Understand various phases in product lifecycle and its considerations in product Aj							Арріу			
$CO^{2}$	Under	rstanding PI M	backend technolog	ies and its implemen	tation		Analyze			
C02	Comr	pare functionali	ities of various com	nercial PLM system	S S		Evaluate			
	com				, 		L'uluute			
Modu	le		Moo	lule Contents			Hours			
	In	troduction To	Product Lifecycle	Management						
Ι	Pr Li ch Si pr gr O Co Lif	Introduction To Product Lifecycle Management Product lifecycle – Introduction, growth, maturity & decline, Product LifecycleManagement- Definition & Overview, Background for PLM-corporate challenges,Need of PLM, Components/Elements of PLM, Emergence of PLM, Significanceof PLM - lifecycle problems to be resolved, product development problems to beresolved, Customer Involvement. Product lifecycle – Introduction, growth, maturity & decline, Product Lifecycle Management Definition & Overview, Background for PLM-corporate challenges, Need of PLM, Components/Elements of PLM, Emergence of PLM, Significance of PLM - lifecycle problems to be resolved, product development problems to be resolved,								
п	Constructing Product Lifecycle Management & Driving EnvironmentPLM Lifecycle model- plan, design, build, support & dispose. Threads of PLMcomputer aided design (CAD), engineering data management (EDM), Productdatamanagement (PDM), computer integrated manufacturing (CIM). Weavingthethreads into PLM, comparison of PLM to Engineering resource planning(ERP).PLM characteristics - singularity, cohesion, traceability, reflectiveness,InformationMirroring Model. External drivers- scale, complexity, cycle times,globalization &regulation. Internal drivers - productivity, innovation,collaboration & quality.Board room drivers - income, revenues & costsDigital Lifecycle									
III	Co Nu M	ollaborative Pro umbering, Er anagement, B	oduct Development, ngineering Vaultin Sill of Material ar	Mapping Requirem g, Product reuse nd Process Consist	ents to specification , Engineering C ency. Digital Mo	is. Part Change ck up	6			

	andPrototype development. Virtual testing and collateral. Introduction to Digital						
	Manufacturing.						
	Product Lifecycle Management System						
	Product lifecycle management system- system architecture, Informationmodels and						
13.7	product structure, Information model, the product information data model, the						
10	product model, functioning of the system. Reasons for the deployment of PLM	0					
	systems.						
	Product Lifecycle Environment						
	Product Data issues - Access, applications, Archiving, Availability, Change,						
	Confidentiality. Product Workflow, The Link between Product Data and Product						
	Workflow, Key Management Issues around Product Data and Product Workflow, Company's PI M vicion The PI M Strategy Principles for PI M strategy						
	Preparing for the PLM strategy, Developing a PLM strategy, Strategy						
	identification and selection, Change Management for PLM.						
	Components of Product Lifecycle Management						
	Different phases of product lifecycle and corresponding technologies, Foundation						
VI	technologies and standards e.g. visualization, collaboration and enterprise						
V I	management workflow and program management Functional applications e.g.	7					
	configuration management. Human resources in product lifecycle. PLM Case						
	Study.						
Modu	e wise Measurable Students Learning Outcomes :						
After t	he completion of the course the student should be able to:						
1.	Work on any PLM tool.	C					
2.	Implement different phases of design in PLM and integrate the different element.	stor					
3	Identify the various requirements in product development process in consideration	n to					
5.	digital manufacturing.	11 10					
4.	Compare various commercial PLM systems						
5.	Associate the role of database management systems in PLM						
6.	Evaluate the different phases of product lifecycle technologies through case stud	ies					
	Text Books						
1	Antti Saaksvuori, Anselmi Immonen, Product Lifecycle Management - Springer, I (Nov.5, 2003)	st Edition					
2	Stark John, Product Lifecycle Management - 21st Century Paradigm for Product R Springer, 2005.	ealization,					
3	Hoffer J, Prescott M, McFadden F, Modern Database Management, Prentice Hall, 2007.						
	References						
1	Grieves Michael, Product Lifecycle Management- Driving the Next Generation of Lean McGraw-Hill 2006 ISBN 0071452303	Thinking,					
	Stark, John. Product Lifecycle Management: 21st Century Paradigm for Product R	ealization,					
2	Springer-Verlag, 2004. ISBN 1852338105.						
3	Magrab E, Gupta S, McClusky P, Sandborn P, Integrated Product and Process D	esign and					
-	Development: The Product Realization Process, CRC Press, 2010.						
	Useful Linke						
1	Userui Liiks						
2							

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

CO1	3		1		2						1	2	2	
CO2		3	2		2						1	2	2	
CO3		3	2	2	2	1	1				2	1	3	
The strength of mapping is to be written as 1.2.3; Where, 1:Low, 2:Medium, 3:High														

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								
3	Apply	7	8	20	35				
4	Analyze	8	7	17	32				
5	Evaluate	5	5	23	33				
6	Create								
	Total	20	20	60	100				

		W	alchand Colleg	e of Engineerin	<b>g, Sangli</b>					
			(Government M	V 2021-22	uic)					
			Cour	se Information						
Progr	amme		B.Tech. (Mechani	cal Engineering)						
Class.	Semes	ter	Final Year B. Tech., Sem VIII							
Course Code										
Cours	e Nam	e	Robotics	Robotics						
Desired Requisites:										
Те	eaching	g Scheme		Examination Sc	heme (Marks)					
Lectu	re	3Hrs/week	T1	T2	ESE	Т	otal			
Tutor	ial	-	20	20	60		100			
Practi	cal	-		-						
Intera	ction	-		Credi	ts: 3					
			Cou	rse Objectives						
1	To ex	pose the stude	nt to the various fun	damentals of robotics	s systems.					
2	To m	ake the student	s familiar with criter	ria for implementing	robotic systems.					
3	To ex	plain students	about Robotics and	its allied interdiscipli	nary approach, com	ponent	design			
	and sensor technology.									
4	4 a Programmed tasks									
	a Pro	grammed tasks	•							
		Cou	rse Outcomes (CO	) with Bloom's Tax	nomy Level					
At the	end of	the course, the	students will be abl	e to,						
CO1	Deter	mine the funda	mental concepts of	Automation and Rol	ootics		Apply			
CO2	Choo	se sensors, actu	ators and motion co	onversion devices			Analyze			
CO3	Defer	d the working	of Robot software/	nardware			Evaluate			
Modu	le		Moo	lule Contents			Hours			
I	In Cr Do m PV Br	troduction, A reation of Rob C Motor, Dyna odulation (PW WM amplifiers rushless DC M	ctuators and Drive otics, Manipulation amics of single axis 'M), PWM switchin , Robot Controls an otors.	Systems and Dexterity, Loc drive system, Powen og characteristics, T ad PWM Amplifiers	omotion and Navia r Electronics, Pulse he H-bridge and b , Optical Shaft Enc	gation, width pipolar coders,	7			
II	R Jo Se Pa	bot Mechanis int Primitives prial Link Mech rallel Link Me	s <b>ms</b> and Serial Linkag aanisms, Inverse Kir chanisms, Redundar	es, Parallel Linkage nematics of Planar M nt mechanisms.	es, Planar Kinemat echanisms, Kinema	ics of ttics of	6			
III	Di Di Di	ifferential Mo fferential Rel fferential Moti	tion ationship, Propertie on, Singularity and	es of the Jacobian, Redundancy	Inverse Kinemat	ics of	6			
IV	St Fr Di Ad	atics ee Body Diag fferential Kin ctuated System	ram, Energy Metho ematics and Stations, Newton-Euler Fo	od and Equivalent J cs, Closed-Loop K rmulation of Equation	oint Torques, Dua inematic Chains, ons of Motion.	lity of Over-	7			
v	D Ba In D Ge	ynamics asic Dynamic terpretation of ynamics, Lag eneralized Force	c Equations, Clo f the Dynamic Eq grangian Dynamics, ces.	osed-Form Dynami uations, Lagrangiar Planar Robot Dy	c Equations, Ph Formulation of namics, Inertia M	nysical Robot ⁄Iatrix,	7			
VI	F	orce and Com	pliance Controls							
	Hybrid Position/Force Control, Principle, Architecture, Compliance Control,     6       Task strategy Compliance control synthesis     6									
---------	--									
Modu	le wise Measurable Students Learning Outcomes ·									
Δfter t	he completion of the course the student should be able to:									
1	1. Explain advanced manufacturing systems									
1.	1. Explain advanced manufacturing systems									
2.	2. Introduce the idea of implementation of robotics									
5.	3. Use of robot in Chvi environment									
4.	4. Apply the fundamentals of robotics on real life problems.									
5.	5. Observe anatomy parameters of robot									
6.	6. Describe new trends in robotics									
	Text Books									
1	Antti Saaksvuori, Anselmi Immonen, Product Lifecycle Management - Springer, 1st Edition (Nov.5, 2003)									
2	Stark John, Product Lifecycle Management - 21st Century Paradigm for Product Realization, Springer, 2005.									
3	Hoffer J, Prescott M, McFadden F, Modern Database Management, Prentice Hall, 2007.									
	References									
1	Grieves Michael, Product Lifecycle Management- Driving the Next Generation of Lean Thinking, McGraw-Hill, 2006. ISBN 0071452303									
2	Stark, John. Product Lifecycle Management: 21st Century Paradigm for Product Realization, Springer-Verlag, 2004. ISBN 1852338105.									
2	Magrab E, Gupta S, McClusky P, Sandborn P, Integrated Product and Process Design and									
3	Development: The Product Realization Process, CRC Press, 2010.									
	Useful Links									
1										
2										

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

	Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course										
В	loom's Taxonomy Level	T1	T2	ESE	Total						
1	Remember										
2	Understand										
3	Apply	7	8	20	35						
4	Analyze	8	7	17	32						
5	Evaluate	5	5	23	33						
6	Create										
	Total	20	20	60	100						

	Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)									
			A	Y 2021-22						
			Cour	se Information						
Progr	rogramme     B.Tech. (Mechanical Engineering)									
Class.	Elass, Semester Final Year B. Tech., Sem VIII									
Cours	Course Code									
Cours	æ Nar	ne	Total Quality Man	agement						
Desire	ed Red	uisites:								
		-	1							
Т	eachir	g Scheme		Examination Sc	heme (Marks)					
Lectu	re	3Hrs/week	T1	T2	ESE	Г	otal			
Tutor	ial	-	20	20	60		100			
Practi	ical	-		-	I					
Intera	ction	-		Cred	its: 3					
			Cou	rse Objectives						
1	To r	nake the student	s to understand prin	ciples and elements of	of total quality mana	agement	•			
2	Top	repare the stude	nts for the analysis	and use of various to	tal quality managen	nent too	ls.			
3	Top	repare the stude	ents to analyze imple	ementation of modern	n quality tools.					
	1									
		Cou	rse Outcomes (CO	) with Bloom's Tax	onomy Level					
At the	end o	f the course, the	students will be abl	e to,			A 1			
COI	Und	erstand quality r	nanagement philoso	ophies and frameworl	<u>KS</u>		Apply			
<u>CO2</u>	App	ly the knowledg	e on various tools a	nd techniques of qua	ity management	1	Analyze			
CO3	Ana	lyze the implement	entation of quality to	bols and techniques i	n both manufacturi	ng and	Evaluate			
	serv									
Modu	ıla		Mo	dula Contants			Hours			
Wibut		ntroduction nee	d for quality evolu	tion of quality: Defu	nitions of quality n	roduct	110015			
		uality and se	rvice quality; Bas	sic concepts of T	QM, TQM frame	ework,				
I	c	ontributions of	Deming, Juran and	Crosby. Barriers to '	FQM; Quality state	ments,	6			
	C	ustomer focus	, customer orienta	ation & satisfaction	n, customer comp	olaints,				
	C	ustomer retentio	on; costs to quality							
	i	QM principles;	leadership, strategic	c quality planning; Q	amwork: Quality of	ployee				
П	r	ecognition and	reward, performance	e appraisal: Continue	ous process improv	ement:	7			
	I	PDCE cycle, 55	S, Kaizen; Supplie	r partnership, Partn	ering, Supplier rat	ing &				
	s	election				_				
	] ]	The seven trad	itional tools of qu	ality; New manage	ement tools; Six	sigma-				
ш		oncepts, methors	odology, application	ns to manufacturing	, service sector inc	luding	7			
	1		ing process, rivieA-	stages, types.			,			
	]   T	QM tools and	techniques, control	l charts, process cap	ability, Quality Fu	inction	7			
10	Development (QFD), Taguchi quality loss function; TPM- concepts, improvement /									
	(	Duality systems,	need for ISO 9000,	ISO 9001-9008; Oua	ality system- elemer	nts.				
v	documentation,; Quality auditing, QS 9000, ISO 14000- concepts, requirements									
	and benefits;									
VI	]	QM implement	ation in manufactur	ring and service sect	ors, case studies of	TQM				
Mode		mplementation	tudonta Logunina 4	Outcomes .			6			
Δfter f	the cor	nnletion of the	course the student of	ould be able to:						
				iouiu oc abie io.	f anality Cuma					
1	I Inc	erstand having	concente of 17 M/ c	m/1 ///mirining.ma //						

- 2. Elaborate TQM principles such as employee involvement and empowerment, quality circles, KAIZEN, etc.
- 3. Compare traditional and new management tools, concepts of Six Sigma and FMEA.
- 4. Explain the basic concepts and applications QFD and Six Sigma technique.
- 5. Identify the principles, requirements and implementation of ISO quality systems.
- 6. Analyze TQM implementation in manufacturing and service industry.

	Text Books								
1	Besterfield D.H., Total qualityManagement, 3rd ed., Pearson Education Asia, 2006.								
2	Evans J.R. and Lindsay W.M., The management and Control of Quality, 8th ed., first Indian								
	edition, Cengage Learning, 2012.								
3	Janakiraman B. and Gopal R.K., Total Quality Management, Prentice Hall India, 2006.								
	References								
1	Juran J.M. and Gryna F.M., Quality Planning and Analysis, McGraw-Hill Education								
2	Bedi Kanishka., Quality Management, Oxford University Press, 2006								
3	Suganthi L. and Samuel A., Total Quality Management, Prentice Hall India, 2006.								
	Useful Links								
1									
2									

	CO-PO Mapping														
		Programme Outcomes (PO) PSO													
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C01		2	1			2	3				2				
CO2	2	2				3		3				2			
CO3		3		1		2			3					2	
The strength of mapping is to be written as 1.2.3: Where, 1:Low, 2:Medium, 3:High															

	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	7	8	20	35						
4	Analyze	8	7	17	32						
5	Evaluate	5	5	23	33						
6	Create										
	Total 20 20 60 100										

		W	alchand Colleg	e of Engineerin	ng, Sangli				
			(Government M	V 2021-22	<i>inic)</i>				
				se Information					
Programme B.Tech. (Mechanical Engineering)									
Class.	Semes	ter	Final Year B. Tech	n. Sem VIII					
Cours	e Code								
Cours	e Nam	<u>,</u>	Automobile Engin	eering					
Desire	d Rea	isites:	8						
	<u>u 1104</u>								
Т	eaching	Scheme		Examination S	cheme (Marks)				
Lectu	re	3Hrs/week	T1	T2	ESE	Г	'otal		
Tutor	ial - 20 20 60								
Practi	cal	_		-					
Intera	ction	_		Cred	its: 3				
			Cou	rse Objectives					
	To un	derstand the co	onstruction and work	king principle of var	ious parts and system	ns of a	1		
1	auton	obile			1 5				
	To pe	rform basic ca	lculations required f	or vehicle performa	nce and for some of in	nporta	nt		
2	syster	ns such as Tra	nsmission (Gear Rat	ios), steering system	, and brake system.				
	To ma	ake student aw	are of latest trends in	n transportation tow	ards a safe, pollution f	free an	d fully		
3	auton	natic vehicle.		-	-		-		
	1								
		Cou	rse Outcomes (CO	) with Bloom's Tax	conomy Level				
At the	end of	the course, the	students will be abl	e to,					
CO1	Under	stand various	types of Engine & A	utomotive systems			Apply		
CO2	Analy	ze vehicle per	formance related to	engine, brake and st	eering systems.		Analyze		
CO3	Select	proper engine	e, gear ratios, and oth	her systems for give	n vehicle application v	with	Evaluate		
	refere	nce to safety a	nd pollution norms.						
	•						TT		
Modu				lule Contents			Hours		
	In	troduction, cl	assification and Au	of Engines Basic	ants components of Fn	gine			
	Pe	rformance of	Engine Automobi	les Major compor	ents and their funct	tions			
т.	Ty	pes of vehicl	e layouts, Types of	bodies. Requirem	ents of automotive p	ower	6		
1	pl	ants, Comparia	son and suitability	considerations. Elec	tric and Hybrid vehi	icles-	6		
	La	yout, advanta	ges and limitations.	New engine techno	ologies i.e turbo cha	rgers			
		VGT, VGT), (	engine emission Co	ontrol by 3-way ca	atalytic converter sys	stem,			
		hicle Perforn	(Luio & DS).						
	Re	esistance to ve	hicle motion, Air, H	Rolling and Gradien	t resistance, Accelera	ation,			
II	G	ade ability ar	nd draw bar pull, '	Traction and Tracti	ve effort, Distributio	on of	7		
	W	eight, Power r	equired for vehicle	propulsion, Selection	on of gear ratio, Rear	axle			
	ra	t10.							
		tomobile clut	<b>ystem</b> ch requirements T	vnes & functions	Single plate Multi r	alate			
	C	entrifugal and	Fluid clutches.	jpes & renetions,	Single plate, main p	jiute,			
III	Re	equirements of	gear box, Types of	gearboxes, construc	tion and Working		7		
	Pr	Principle of operation of automatic transmission, Torque converter, Epicyclic gear							
	tra	un, Constructi	on and working of	Propeller shaft, Ur	niversal joint, Final c	lrive,			
	Di C-	merential, Kea	r axles.	ing & Flootwigal	stome				
IV		ispension, ste	irements. Sprung :	and Un sprung m	uss. Types of autom	otive	7		
	su	spension syste	ems. Conventional	and Independent. S	Shock absorber, Type	es of	,		

	springs, Hotch- kiss and Torque tube drive, Reaction members-Radius rods,	
	Stabilizer bar, Air suspension system.	
	Function of steering, Steering system layout, Automotive steering mechanism,	
	Types of steering gear boxes, Condition for true rolling, Steering geometry-	
	Camber, Caster, King pin inclination, Toe-in and Toe-out, Wheel alignment, Slip	
	angle, Under steer & over steer conditions, Introduction of power steering,	
	Braking and Electrical System	
	Function of automotive brake system, Types of braking mechanism, internal	
	expanding & Disc brake, Mechanical, Hydraulic & Air brake system, Servo and	
	power brakes, Calculation of braking force required, stopping distance and dynamia weight transfer	
V	Automotive batteries Automotive lighting system Starting system Charging	7
	system Voltage and current regulator. Electric horn, Dash board gauges. Winer &	/
	side indicator circuit. Engine electronic control modules. Safety devices, braking	
	systems, antilock braking system (ABS), electronic brake force distribution (EBD)	
	and traction control.	
	Recent trends in Automotive Development	
	NVH and crashworthiness of vehicles, Emission norms and control, automotive	
	electronics, Automotive manufacturing and assembly, material and vendor	
УЛ	management, Testing and certification of vehicles Alternative energy sources,	
VI	natural gas, LPG, biodiesel, bio-ethanol, gasohol and hydrogen fuels in	6
	automobiles, modifications needed, performance, combustion & emission	
	characteristics of alternative fuels in SI and CI engines, Electric and Hybrid	
	vehicles, Application of Fuel Cells	
Modu	e wise Measurable Students Learning Outcomes :	
After t	ne completion of the course the student should be able to:	
1.	To select proper engine for given vehicular application	
2.	To analyze vehicle performance	
3.	To understand various types of transmission systems	
4.	To relate concepts of vehicle dynamics with daily experiences	
5.	To calculate braking performance of the vehicle in different conditions	
6.	To comprehend recent trends in automobile development	
	Text Books	
1	Kripal Singh, Automobile Engineering Vol II, Standard Publishers Distributors, Tenth 2007	e Edition,
2	P S Gill, Automobile Engineering II, S K Kataria and Sons, Second Edition, 2012	
3	R K Rajput, Automobile Engineering, Laxmi Publications, First Edition, 2007	
4	Jain K.K. and Asthana R.B., Automobile Engineering, Tata McGraw Hill, New Delhi, 2	002.
-	References	
1	P. w. Kett., Motor Venicle Science Part 2, Chapman and Hall, 1st Edition, 1982	h Edition
2	1989	in Edition,
3	Crouse and Anglin, Automotive Mechanics, McGrawhill Publication, Tenth Edition, 200	)7
1	Useful Links	
2		

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

	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										
3	Apply	7	8	20	35						
4	Analyze	8	7	17	32						
5	Evaluate	5	5	23	33						
6	Create										
	Total 20 20 60 100										

		W	alchand Colleg	ge of Engineerin ded Autonomous Instit	<b>g, Sangli</b>						
			A	Y 2021-22							
			Cour	se Information							
Programme B.Tech. (Mechanical Engineering)   Chara Sametar Final March D. Taala Sametar											
Class.	Semes	ter	Final Year B. Tecl	n Sem VIII							
Cours	e Code			.,							
Cours	e Nam	9	Mechanical Syster	n Design							
Desire	d Regi	isites:									
			1								
Te	Teaching SchemeExamination Scheme (Marks)										
Lectu	re	3Hrs/week	T1	T2	ESE	Т	Total				
Tutor	ial	-	20	20	60		100				
Practi	tical										
Intera	ction	-		Cred	its: 3						
		1	1								
			Cou	rse Objectives							
1	To pr	epare the stude	ents to succeed as de	signer in industry/te	chnical profession.						
2	To P	rovide students	s with a sound found	ation in mechanical	system design requi	ired to so	olve the				
2	proble	ems in industry	<i>.</i>								
3	To tra	in the students	for safe and efficient	nt design of structura	l parts of the mecha	anical sy	vstem				
A / 1	1 0		rse Outcomes (CO	) with Bloom's Tax	onomy Level						
At the	Expla	the course, the	f pressure vessels or	e to, d geor box design			Apply				
	Lino L	ahnson's math	ad of optimum desig	n to design machani	<u>cal components</u>		Apply				
$CO_2$	Estim	ate the toleran	ou of optimuli desig	mechanical compo	car components.		Fyaluate				
	Lotin			incenancai compo	inclus and systems.		Livaluate				
Modu			Mo	tule Contents			Hours				
Widdu	In	troduction to o	ntimum design for r	nechanical elements	adequate and optim	num	nours				
	de	sign. Johnson'	s method of optimu	m design- simple pro	blems in optimum of	design					
I	lik	e axially loade	ed members, shafts s	subjected to torsional	and bending mome	ents.	6				
	he	lical spring, le	vers. Optimum desig	gn with in Lagrange	multipliers.	,					
	(a	) Statistics in d	esign, probability, ra	andom variables- sar	nple and population	is,					
	No	ormal distribut	ion, Sampling distril	bution, Confidence in	itervals, population						
	co	mbinations (In	troductory treatmen	t, no questions to be	asked in examination	ons on					
II	5(	a))		_			7				
	(t	) Design for n	atural tolerances, Sta	atistical analysis of to	olerances. Introduct	ions					
	to	reliability and	its applications for	selections of factor o	f safety, study of pr	ocess					
		pability for des	sign. Everieble encod rend	a Craphical rapraga	ntation of speeds						
		ructure diagram	n Deviation diagram	ge, Orapilicai represe n Ray diagram Sele	ction of optimum r	av					
III	di	agram Differe	nce between number	r of teeth of successi	ve gears in a change	ay gear	7				
	hoy Analysis of twelve speed gear hoy. Compound ray diagram										
		in and thick cy	vlinders: failure crite	ria of vessels. Lame	's equation Clavari	ino's					
	an	d Birnie's equ	ation: Autofrettage a	and compound cylind	lers: Types of press	ure					
	ve	ssels-Horizont	al and vertical: Clas	sification of pressure	vessel as per IS282	25.					
IV	19	69. Introdduct	ion to design of pres	ssure vessels as per I	S Codes. Shell and a	end	7				
	clo	osures. Effect of	of opening & nozzle	s in shell & covers. T	Types of pressure ve	essel					
	su	pport									
	Sy	stem Approac	h to Design; Mathen	natical model; Lump	ed system; Dynamic	c					
V	re	sponse of lump	ed & distributed sys	stem; Modeling of m	asses, Elasticity, Ind	ertia,	6				
	Da	amping and frie	ction.	-	-		0				

	Identification of needs of the developing society. Design and development process	
	of industrial products, various steps such as Ergonomics and aesthetic	
VI	requirements of product design, quality and maintainability consideration in	7
	product design, Use of modeling technique, prototype designs, conceptual	/
	design	
Modu	le wise Measurable Students Learning Outcomes :	
After t	he completion of the course the student should be able to:	
1.	Use Johnson's method of optimum design to design mechanical components.	
2.	Estmate the tolerances and reliability of mechanical components and systems.	
3.	Discuss the theory of gear box design.	
4.	Explain the theory of pressure vessels design.	
5.	Demonstrate the approach in system design	
6.	Design the products as per the needs of society considering aesthetics and ergonomics c	oncept
	Text Books	
1	V.B.Bhandari, "Design of Machine Element", Tata Mc- Graw Hill Publication, 4th Edi	ition, 2001
2	Shigley and C.R.Miscke, "Mechanical Engineering Design", Tata Mc- Graw Hill Publ	lication,
	2001	
3	M.F.Spotts, "Mechanical design analysis", Prentice Hall publication, 1964	
	References	
1	M.V.Joshi, "Process Equipment Design", Macmillal Publication, 1976	
2	Robert L.Norton, "Machine Design", Tata Mc- Graw Hill Publication, 2001	
3	Anurag Dixit, "Mechanical System Design", SCITECH publication, 2005	
4	Black P.H.and O.Eugene Adams, "Machine Design", Tata Mc- Graw Hill Publication,	3rd
4	Edition, 1993	
	Useful Links	
1		
2		

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

	Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course												
Bloom's Taxonomy Level T1 T2 ESE													
1	Remember												
2	Understand												
3	Apply	7	8	20	35								
4	Analyze	8	7	17	32								
5	Evaluate	5	5	23	33								
6	Create												

Total	20	20	60	100

A Y 2021-22     Course Information     Programme   B. Tech. (Mechanical Engineering)     Class, Semester   Final Year B. Tech., Sem VIII     Course Code     Course Code     Course Code     Course Name   Design of Transmission Systems     Desired Requisites:     Teaching Scheme   Examination Scheme (Marks)     Lecture   3Hrs/week   T1   T2   ESE     Total   -     Course Objectives     Totain students in the standard procedure available for design of Mechanical power transmission components.     Totain students with knowledge of gear design.     Course Outcomes (CO) with Bloom's Taxonomy Level     At the end of the course, the students will be able to,     Course Outcomes (CO) with Bloom's Taxonomy Level     At the end of the course, the students will be able to,     Course Outcomes (CO) with Bloom's Taxonomy Level     At the end of the course, the students will be able to,     Course			W	alchand Colleg	e of Engineerin	<b>g, Sangli</b>								
Course Information       Programme     B.Tech. (Mcchanical Engineering)       Class, Semester     Final Year B. Tech., Sem VIII       Course Code     End Year B. Tech., Sem VIII       Course Name     Design of Transmission Systems       Desired Requisites:     Examination Scheme (Marks)       Lecture     3Hrs/weck     T1     T2     ESE     Total       Tutorial     -     0     60     100     Practical     -       Interaction     -     Credits: 3     -     -     -       Transmission components.     To train students in the standard procedure for the design of Mechanical power transmission ongonents.     -     -       3     To provide the students with knowledge of gear design.     -     -       C01     Explain the theory of power transmission and gear box design.     Apply     -       C02     Explain the theory of power transmission and gear box design.     Apply     -       C03     Design the gear box as per the need of functioning of machine.     Evaluate     -       Module     Module Contents     Hours     -     -       I <th></th> <th></th> <th></th> <th>A</th> <th>Y 2021-22</th> <th>uic)</th> <th></th> <th></th>				A	Y 2021-22	uic)								
Programme     B. Tech. (Mechanical Engineering)       Class, Semester     Final Year B. Tech., Sem VIII       Course Code     Course Name     Design of Transmission Systems       Desired Requisites:     Design of Transmission Systems     Desired Requisites:       Teaching Scheme     Examination Scheme (Marks)       Lecture     3His/week     T1     T2     ESE     Total       Tutorial     -     20     20     60     100       Practical     -     Credits: 3       To gain knowledge on the principles and procedure for the design of Mechanical power transmission components.     To train students in the standard procedure available for design of transmission systems of machines.       3     To provide the students with knowledge of gear design.     Apply       Ket he end of the course, the students will be able to,     Apply       CO1     Explain the theory of power transmission and gear box design.     Apply       Course Outcomes (CO) with Bloom's Taxonomy Level     Analyze       At the end of the course, the students will be able to,     Course outcomes (Co) with Bloom's Taxonomy Level       At the end of the course, the students will be able to,     Course outcomes (Co) with Bloom's Taxonomy Level     Analyze <th></th> <th></th> <th></th> <th>Cour</th> <th>se Information</th> <th></th> <th></th> <th></th>				Cour	se Information									
Class, Semester   Final Year B. Tech., Sem VIII     Course Code     Course Name   Design of Transmission Systems     Design of Transmission Systems     Design of Transmission Systems     Teaching Scheme   Examination Scheme (Marks)     Lecture:   3Hrs/week   TI   T2   ESE   Total     Transmission Systems     Course Objectives     Course Objectives     Transmission components.     To train students in the standard procedure available for design of transmission systems of machines.     Course Outcomes (CO) with Bloom's Taxonomy Level     At the end of the course, the students will be able to,     Course Outcomes (CO) with Bloom's Taxonomy Level     At the end of the course, the students will be able to,     Course Outcomes (CO) with Bloom's Taxonomy Level     At the end of the course, the students will be able to,     Course Outcomes (CO) with Bloom's Taxonomy Level     At the end of the course, the students will be able to, <th and="" colspanting="" gear<="" of="" power="" th="" the="" theory="" transmission=""><th>Progr</th><th>amme</th><th></th><th>B.Tech. (Mechani</th><th>cal Engineering)</th><th></th><th></th><th></th></th>	<th>Progr</th> <th>amme</th> <th></th> <th>B.Tech. (Mechani</th> <th>cal Engineering)</th> <th></th> <th></th> <th></th>	Progr	amme		B.Tech. (Mechani	cal Engineering)								
Course Code       Course Name     Design of Transmission Systems       Desired Requisites:       Teaching Scheme     Examination Scheme (Marks)       Lecture     3Hrs/week     T1     T2     ESE     Total       Tutorial     -       Interaction     -     Course Objectives       To gain knowledge on the principles and procedure for the design of Mechanical power transmission components.       To rain students in the standard procedure available for design of transmission systems of machines.       Course Outcomes (CO) with Bloom's Taxonomy Level       At the end of the course, the students will be able to.       Course Outcomes (CO) with Bloom's Taxonomy Level       At the end of the course, the students will be able to.       Course Outcomes (CO) with Bloom's Taxonomy Level       At the end of the course, the students will be able to.       Course Outcomes (CO) with Bloom's Taxonomy Level       At the end of the course, the students will be able to.       Course Outcomes (CO) with Bloom's Taxonomy Level	Class,	Semes	ter	Final Year B. Tech	n., Sem VIII									
Course Name     Design of Transmission Systems       Desired Requisites:     Design of Transmission Systems       Teaching Scheme     Examination Scheme (Marks)       Lecture     3Hrs/weck     T1     T2     FSE     Total       Tutorial     -     20     20     60     100       Practical     -     Credits: 3     Total       Interaction     -     Course Objectives     Course objectives       To gain knowledge on the principles and procedure for the design of Mechanical power transmission components.     To train students in the standard procedure available for design of transmission systems of machines.     To provide the students with knowledge of gear design.       3     To provide the students will be able to.     Apply     Valuet       Ket the end of the course, the students will be able to.     Apply     Valuet     Valuet       Module     Module Contents     Hours     Hours       I     Straight the transmission element.     Evaluate     6       Obsign the gear box as per the need of functioning of machine.     Evaluate     6       GO3     Design the transmission clements- design of flat belts & pulleys, selection of V-belts and pulleys, selectio	Cours	e Code												
Desired Requisites:       Teaching Scheme     Examination Scheme (Marks)       Lecture     3Hrs/week     T1     T2     ESE     Total       Tutorial     -     20     20     60     100       Practical     -     -     -     -     -       Interaction     -     Credits: 3     -     -     -       Interaction     -     Course Objectives     -     -     -       To gain knowledge on the principles and procedure for the design of Mechanical power transmission components.     To train students in the standard procedure available for design of transmission systems of machines.     -     -       3     To provide the students with knowledge of gear design.     Apply       Course Outcomes (CO) with Bloom's Taxonomy Level     Atthe end of the course, the students will be able to,     Apply       CO1     Explain the theory of power transmission and gear box design.     Apply       C03     Design the gear box as per the need of functioning of machine.     Evaluate       Module     Module Contents     Hours       I     Gear transmission elements- design of flat belts & pulleys, s	Cours	e Name	9	Design of Transm	ission Systems									
Teaching Scheme     Examination Scheme (Marks)       Lecture     3Hrs/week     T1     T2     ESE     Total       Tutorial     -     20     20     60     100       Practical     -     -     -     -     -       Interaction     -     Course Objectives     -     -     -       To gain knowledge on the principles and procedure for the design of Mechanical power transmission components.     To rain students in the standard procedure available for design of transmission systems of machines.     -       3     To provide the students with knowledge of gear design.     -     -     -       CO1     Explain the theory of power transmission and gear box design.     Apply     -     Analyze       CO2     Explain the theory of power transmission and gear box design.     Apply     -     -       CO3     Design the gear box as per the need of functioning of machine.     Evaluate     -     -       Module     Module Contents     Hours     -     -     -     -       1     and pulleys, selection of boisting wire ropes and pulleys, design of chains and sprockets     -<	Desire	ed Requ	isites:											
Teaching SchemeExamination Scheme (Marks)Lecture318/weekT1TotalTutorial-Cola202060Interaction-ColaTo practical-Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2"Colspan="2"Colspan="2"Colspan="2"Colspan="2"Colspan="2"Colspan="2"Colspan="2"Colspan="2"Colspan="2"Colspan="2"Colspan="2"Colspan="2"Colspan="2" <th< th=""><th></th><th></th><th></th><th>1</th><th></th><th></th><th></th><th></th></th<>				1										
Lecture3Hrs/weekT1T2ESETotalTutorial-202060100PracticalInteractionCredits: 3Course ObjectivesTo gain knowledge on the principles and procedure for the design of Mechanical power transmission components.1To train students in the standard procedure available for design of transmission systems of machines3To provide the students with knowledge of gear designCourse Outcomes (CO) with Bloon's Taxonomy LevelAt the end of the course, the students will be able to.CO1Explain the theory of power transmission and gear box design.ApplyCO2Use the given data tables to arrive at proper specifications of flexible power transmission element.AnalyzeModule ContentsHoursModule ContentsHoursGear transmission elements- design of flat belts & pulleys, selection of V-belts and pulleys, selection of hoisting wire ropes and pulley, design of chains and sprockets1Gear transmission- speed ratios and number of teeth, force analysis, tooth stresses, dynamic effects, faigue strength, gear materials, Design of straight tooth spure gear and parallel axis helical gears.81Gear box- geometric progression, standard step ratio; Ray diagram, kinematics layout; Design of shaing the dimensions of a pair of straight bevel gears; Worm gear, merits & demerits, terminology, thermal capacity, m	Т	eaching	s Scheme		Examination Sc	heme (Marks)								
Tutorial     -     20     20     60     100       Practical     -	Lectu	re	3Hrs/week	T1	T2	ESE	Т	otal						
Practical   -     Interaction   -     Interaction   -     Course Objectives     1   To gain knowledge on the principles and procedure for the design of Mechanical power transmission components.     2   To train students in the standard procedure available for design of transmission systems of machines.     3   To provide the students with knowledge of gear design.     Course Outcomes (CO) with Bloom's Taxonomy Level     At the end of the course, the students will be able to,   Apply     C01   Explain the theory of power transmission and gear box design.   Apply     C02   transmission element.   Evaluate     C03   Design the gear box as per the need of functioning of machine.   Evaluate     Module Module Contents   Hours     At pulleys, selection of hoisting wire ropes and pulleys, design of chains and sprockets   6     Gear transmission-speed ratios and number of teeth, force analysis, tooth stresses, dynamic effects, fatigue strength, gear materials; Design of straight tooth spur gear and parallel axis helical gears based on strength and wear considerations, pressure angle in the normal and transverse plane; equivalent number of teeth and forces for helical gears.   7     III   Estimating the dimensions of a pair of straight bevel gears; Worm gear, merits & demerits, terminology, thormal capacity,	Tutor	ial	-	20	20	60		100						
Interaction     -     Credits: 3       Course Objectives       1     To gain knowledge on the principles and procedure for the design of Mechanical power transmission components.       2     To train students in the standard procedure available for design of transmission systems of machines.       3     To provide the students with knowledge of gear design.       Course Outcomes (CO) with Bloom's Taxonomy Level       At the end of the course, the students will be able to,       CO1     Explain the theory of power transmission and gear box design.       C02     Use the given data tables to arrive at proper specifications of flexible power transmission element.       C03     Design the gear box as per the need of functioning of machine.     Evaluate       Module       Module Contents     Hours       Flexible transmission elements- design of flat belts & pulleys, selection of V-belts and pulleys, selection of hoisting wire ropes and pulleys, design of chains and sprockets     6       Gear transmission- speed ratios and number of teeth, force analysis, tooth stresses, dynamic effects, fatigue strength, gear materials; Design of straight tooth spur gear and parallel axis helical gears based on strength and wear considerations, pressure angle in the normal and transverse plane; equivalent number of teeth and forces for helical gears.     7       III	Practi	cal	-		-									
Course Objectives       1     To gain knowledge on the principles and procedure for the design of Mechanical power transmission components.       2     To train students in the standard procedure available for design of transmission systems of machines.       3     To provide the students with knowledge of gear design.       Course Outcomes (CO) with Bloom's Taxonomy Level       At the end of the course, the students will be able to,     Apply       CO1     Explain the theory of power transmission and gear box design.     Apply       CO2     transmission element.     Analyze       CO3     Design the gear box as per the need of functioning of machine.     Evaluate       Module Module Contents     Hours       I     and pulleys, selection of hoisting wire ropes and pulleys, selection of V-belts and pulleys, selection of hoisting wire ropes and pulleys, design of chains and sprockets     6       II     and parallel axis helical gears based on strength and wear considerations, pressure angle in the normal and transverse plane; equivalent number of teeth and forces for helical gears.     8       III     Straight bevel gear- tooth terminology, tooth forces and stresses, efficiency, estimating the dimensions of a pair of straight bevel gears; Worm gear, merits & demerits, terminology, thermal capacity, materials, forces & stresses, efficiency, estimating the dimensions of a pair of straight bevel gears;	Intera	ction	-		Credi	its: 3								
Course Objectives       1     To gain knowledge on the principles and procedure for the design of Mechanical power transmission components.       2     To train students in the standard procedure available for design of transmission systems of machines.       3     To provide the students with knowledge of gear design.       6     To provide the students with knowledge of gear design.       7     Course Outcomes (CO) with Bloom's Taxonomy Level       At the end of the course, the students will be able to,     Apply       CO1     Explain the theory of power transmission and gear box design.     Apply       CO2     Transmission element.     Analyze transmission element.       CO3     Design the gear box as per the need of functioning of machine.     Evaluate       Module     Module Contents     Hours       I     and pulleys, selection of hoisting wire ropes and pulleys, design of chains and esprockets     6       I     and pulleys, selection of straight gear materials; Design of straight tooth spur gear and parallel axis helical gears based on strength and wear considerations, pressure angle in the normal and transverse plane; equivalent number of teeth and forces for helical gears.     7       III     Straight bevel gear- tooth terminology, tooth forces and stresses, efficiency, estimating the dimensions of a pair of straight bevel gears; terminology, h														
1   To gam knowledge on the principles and procedure for the design of Mechanical power transmission components.     2   To train students in the standard procedure available for design of transmission systems of machines.     3   To provide the students with knowledge of gear design.     Course Outcomes (CO) with Bloom's Taxonomy Level     At the end of the course, the students will be able to,   Apply     CO1   Explain the theory of power transmission and gear box design.   Apply     CO2   Use the given data tables to arrive at proper specifications of flexible power transmission element.   Evaluate     CO3   Design the gear box as per the need of functioning of machine.   Evaluate     Module   Module Contents   Hours     I   and pulleys, selection of hoisting wire ropes and pulleys, selection of V-belts and pulleys, selection of hoisting wire ropes and pulleys, design of straight tooth spur gear and parallel axis helical gears based on strength and wear considerations, pressure angle in the normal and transverse plane; equivalent number of teeth and forces for helical gears.   8     III   Straight bevel gear- tooth terminology, tooth forces and stresses, equivalent number of teeth.   7     Estimating the dimensions of a pair of straight bevel gears; terminology, helix angles, sizing of a pair of helical gears.   7     V   Gear tooth spur gear pair. Cross helical gears, terminology, h		-		Cou	rse Objectives									
Image: transmission components.     2   To train students in the standard procedure available for design of transmission systems of machines.     3   To provide the students with knowledge of gear design.     Course Outcomes (CO) with Bloom's Taxonomy Level     At the end of the course, the students will be able to,   COI     CO1   Explain the theory of power transmission and gear box design.   Apply     CO2   Use the given data tables to arrive at proper specifications of flexible power transmission element.   Analyze     CO3   Design the gear box as per the need of functioning of machine.   Evaluate     Module   Module Contents   Hours     Flexible transmission elements- design of flat belts & pulleys, selection of V-belts and pulleys, selection of hoisting wire ropes and pulleys, design of chains and sprockets   6     II   and pulleys, selection of hoisting wire ropes and pulleys, design of straight tooth spurg gear and parallel axis helical gears based on strength and wear considerations, pressure angle in the normal and transverse plane; equivalent number of teeth and forces for helical gears.   8     III   Straight bevel gear- tooth terminology, tooth forces and stresses, equivalent number of teeth.   7     Estimating the dimensions of a pair of straight bevel gears; Worm gear, merits & demerits, terminology, thermal capacity, materials, forces & stresses, efficiency, estimating the size of worm gear pair.	1	To ga	in knowledge	on the principles and	I procedure for the de	esign of Mechanical	power							
2   To trans students in the standard procedure available for design of transmission systems of machines.     3   To provide the students with knowledge of gear design.     Course Outcomes (CO) with Bloom's Taxonomy Level     At the end of the course, the students will be able to,   Apply     CO1   Explain the theory of power transmission and gear box design.   Apply     CO2   Use the given data tables to arrive at proper specifications of flexible power transmission element.   Analyze     CO3   Design the gear box as per the need of functioning of machine.   Evaluate     Module   Module Contents   Hours     I   Flexible transmission elements- design of flat belts & pulleys, selection of V-belts and pulleys, selection of hoisting wire ropes and pulleys, design of chains and sprockets   6     Gear transmission- speed ratios and number of teeth, force analysis, tooth stresses, dynamic effects, fatigue strength, gear materials; Design of straight tooth spur gear and parallel axis helical gears based on strength and wear considerations, pressure angle in the normal and transverse plane; equivalent number of teeth and forces for helical gears.   7     III   Straight bevel gear- tooth terminology, tooth forces and stresses, efficiency, estimating the dimensions of a pair of straight bevel gears; Worm gear, merits & demerits, terminology, thermal capacity, materials, forces & stresses, efficiency, estimating the size of worm gear pair. Cross helical gears, erminology, helix angles, sizing o		transr	transmission components. To train students in the standard procedure available for design of transmission systems of											
Machines.     To provide the students with knowledge of gear design.     Course Outcomes (CO) with Bloom's Taxonomy Level     At the end of the course, the students will be able to,   Apply     CO1   Explain the theory of power transmission and gear box design.   Apply     CO2   Use the given data tables to arrive at proper specifications of flexible power   Analyze     CO3   Design the gear box as per the need of functioning of machine.   Evaluate     Module   Module Contents   Hours     I   Flexible transmission elements- design of flat belts & pulleys, selection of V-belts and pulleys, selection of hoisting wire ropes and pulleys, design of chains and sprockets   Gear transmission- speed ratios and number of teeth, force analysis, tooth stresses, dynamic effects, fatigue strength, gear materials; Design of straight tooth spur gear and parallel axis helical gears based on strength and wear considerations, pressure angle in the normal and transverse plane; equivalent number of teeth and forces for helical gears.   Straight bevel gear- tooth terminology, tooth forces and stresses, equivalent number of teeth.   7     IIII   Straight bey eigen of a pair of straight bevel gears; Worm gear, merits & demerits, terminology, thermal capacity, materials, forces & stresses, efficiency, estimating the size of worm gear pair. Cross helical gears, iszing of a pair of helical gears.   7     IV   layout; Design of sliding mesh gear box, Design of multi-seed gear box for ma	2	10 tra	To train students in the standard procedure available for design of transmission systems of											
S   To provide the students with knowledge of gear design.     Course Outcomes (CO) with Bloom's Taxonomy Level     At the end of the course, the students will be able to,   Apply     CO1   Explain the theory of power transmission and gear box design.   Apply     Use the given data tables to arrive at proper specifications of flexible power transmission element.   Analyze     CO2   Use the given data tables to arrive at proper specifications of flexible power transmission element.   Evaluate     Module   Module Contents   Hours     Flexible transmission elements- design of flat belts & pulleys, selection of V-belts and pulleys, selection of hoisting wire ropes and pulleys, design of chains and sprockets   6     II   Gear transmission-speed ratios and number of teeth, force analysis, tooth stresses, dynamic effects, fatigue strength, gear materials; Design of straight tooth spur gear and parallel axis helical gears based on strength and wear considerations, pressure angle in the normal and transverse plane; equivalent number of teeth and forces for helical gears.   7     III   Straight bevel gear- tooth terminology, tooth forces and stresses, efficiency, estimating the dimensions of a pair of straight bevel gears; Worm gear, merits & demerits, terminology, thermal capacity, materials, forces & stresses, efficiency, estimating the size of worm gear pair. Cross helical gears, terminology, helix angles, sizing of a pair of helical gears.   7     IV   Gear box- geometric progression, standard step ra		machines.												
Course Outcomes (CO) with Bloom's Taxonomy Level     At the end of the course, the students will be able to,   Apply     CO1   Explain the theory of power transmission and gear box design.   Apply     CO2   Use the given data tables to arrive at proper specifications of flexible power transmission element.   Analyze     CO3   Design the gear box as per the need of functioning of machine.   Evaluate     Wodule   Module Contents   Hours     Flexible transmission elements- design of flat belts & pulleys, selection of V-belts and pulleys, selection of hoisting wire ropes and pulleys, design of chains and sprockets   6     Gear transmission- speed ratios and number of teeth, force analysis, tooth stresses, dynamic effects, fatigue strength, gear materials; Design of straight tooth spur gear and parallel axis helical gears based on strength and wear considerations, pressure angle in the normal and transverse plane; equivalent number of teeth and forces for helical gears.   8     III   Straight bevel gear- tooth terminology, tooth forces and stresses, equivalent number of teeth.   7     Estimating the dimensions of a pair of straight bevel gears; Worm gear, merits & demerits, terminology, thermal capacity, materials, forces & stresses, efficiency, estimating the size of worm gear pair. Cross helical gears, terminology, helix angles, sizing of a pair of helical gears.   7     IIII   Gear box- geometric progression, standard step ratio; Ray diagram, kinemat		10 pr		this with knowledge	of gear design.									
At the end of the course, the students will be able to,At the end of the course, the students will be able to,CO1Explain the theory of power transmission and gear box design.ApplyCO2Use the given data tables to arrive at proper specifications of flexible power transmission element.AnalyzeCO3Design the gear box as per the need of functioning of machine.EvaluateWodule Module ContentsHoursHoursFlexible transmission elements- design of flat belts & pulleys, selection of V-belts and pulleys, selection of hoisting wire ropes and pulleys, design of chains and sprocketsIISteat transmission- speed ratios and number of teeth, force analysis, tooth stresses, 			Сон	urse Outcomes (CO	) with Bloom's Tax	onomy Level								
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CO2transmission element.CO3Design the gear box as per the need of functioning of machine.EvaluateModuleModule ContentsHoursModuleModule ContentsHoursIFlexible transmission elements- design of flat belts & pulleys, selection of V-belts and pulleys, selection of hoisting wire ropes and pulleys, design of chains and sprockets6IGear transmission- speed ratios and number of teeth, force analysis, tooth stresses, dynamic effects, fatigue strength, gear materials; Design of straight tooth spur gear and parallel axis helical gears based on strength and wear considerations, pressure angle in the normal and transverse plane; equivalent number of teeth and forces for helical gears.8IIIStraight bevel gear- tooth terminology, tooth forces and stresses, equivalent number of teeth.7IIIIEstimating the dimensions of a pair of straight bevel gears; Worm gear, merits & demerits, terminology, thermal capacity, materials, forces & stresses, efficiency, estimating the size of worm gear pair. Cross helical gears, terminology, helix angles, sizing of a pair of helical gears.8IVGear box- geometric progression, standard step ratio; Ray diagram, kinematics layout; Design of sliding mesh gear box, Design of multi-seed gear box for machine tool applications; constant mesh gear box8	CO2	Use th	ne given data ta	ables to arrive at pro	per specifications of	flexible power		Analyze						
CO3Design the gear box as per the need of functioning of machine.EvaluateModuleModule ContentsHoursIFlexible transmission elements- design of flat belts & pulleys, selection of V-belts and pulleys, selection of hoisting wire ropes and pulleys, design of chains and sprockets6IGear transmission- speed ratios and number of teeth, force analysis, tooth stresses, dynamic effects, fatigue strength, gear materials; Design of straight tooth spur gear and parallel axis helical gears based on strength and wear considerations, pressure angle in the normal and transverse plane; equivalent number of teeth and forces for helical gears.8IIIStraight bevel gear- tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of a pair of straight bevel gears; Worm gear, merits & demerits, terminology, thermal capacity, materials, forces & stresses, efficiency, estimating the size of worm gear pair. Cross helical gears, terminology, helix angles, sizing of a pair of helical gears.7IVGear box- geometric progression, standard step ratio; Ray diagram, kinematics layout; Design of sliding mesh gear box, Design of multi-seed gear box for machine tool applications; constant mesh gear box8		transr	nission elemen	it.										
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II   and parallel axis helical gears based on strength and wear considerations, pressure   8     III   and parallel axis helical gears based on strength and wear considerations, pressure   8     angle in the normal and transverse plane; equivalent number of teeth and forces for helical gears.   8     III   Straight bevel gear- tooth terminology, tooth forces and stresses, equivalent number of teeth.   7     III   Estimating the dimensions of a pair of straight bevel gears; Worm gear, merits & demerits, terminology, thermal capacity, materials, forces & stresses, efficiency, estimating the size of worm gear pair. Cross helical gears, terminology, helix angles, sizing of a pair of helical gears.   7     IV   Gear box- geometric progression, standard step ratio; Ray diagram, kinematics layout; Design of sliding mesh gear box, Design of multi-seed gear box for machine tool applications; constant mesh gear box   8		du	namic effects	fatigue strength ge	r materials: Design	of straight tooth spu	esses,							
III   and parametrication bench gears based on strength and wear considerations, pressure   6     angle in the normal and transverse plane; equivalent number of teeth and forces for helical gears.   5     III   Straight bevel gear- tooth terminology, tooth forces and stresses, equivalent number of teeth.   7     III   Estimating the dimensions of a pair of straight bevel gears; Worm gear, merits & demerits, terminology, thermal capacity, materials, forces & stresses, efficiency, estimating the size of worm gear pair. Cross helical gears, terminology, helix angles, sizing of a pair of helical gears.   7     IV   Gear box- geometric progression, standard step ratio; Ray diagram, kinematics layout; Design of sliding mesh gear box, Design of multi-seed gear box for machine tool applications; constant mesh gear box   8	п	an	d parallel axis	helical gears based	on strength and wear	considerations pre	ssure	8						
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angles, sizing of a pair of helical gears.     Gear box- geometric progression, standard step ratio; Ray diagram, kinematics     IV   layout; Design of sliding mesh gear box, Design of multi-seed gear box for   8     machine tool applications; constant mesh gear box   8     V   Cam design, types: pressure angle and undercutting base circle determination,		es	timating the siz	ze of worm gear pair	Cross helical gears	, terminology, helix								
IV   Gear box- geometric progression, standard step ratio; Ray diagram, kinematics     IV   layout; Design of sliding mesh gear box, Design of multi-seed gear box for     machine tool applications; constant mesh gear box   8     V   Cam design, types: pressure angle and undercutting base circle determination,		an	gles, sizing of	a pair of helical gear	rs.									
IV   Iayout; Design of sliding mesh gear box, Design of multi-seed gear box for   8     machine tool applications; constant mesh gear box   8     V   Cam design, types: pressure angle and undercutting base circle determination,		Ge	ear box- geome	etric progression, sta	indard step ratio; Ray	diagram, kinemati	cs							
machine tool applications; constant mesh gear box     Cam design, types: pressure angle and undercutting base circle determination,	IV	lay	yout; Design of	t sliding mesh gear b	box, Design of multi-	-seed gear box for		8						
Cam design, types: pressure angle and undercutting base circle determination,		ma	achine tool app	olications; constant n	nesh gear box	• • • •								
V foreas and surface strasses	v		um design, type	es: pressure angle an	a undercutting base	circle determination	ı,	5						
Iorces and surface stresses Design of plots obtables, one obtables, interval stress line size			rees and surfac	te stresses	an anna shut-l '			3						
VI United States and and Block brakes external shoe brakes	VI		tches: Flectro	magnetic clutches.	es, cone cluicnes, m Rand and Block brak	es external shoe br	u akes	6						

internal expanding shoe brake.

# Module wise Measurable Students Learning Outcomes :

After the completion of the course the student should be able to:

- 1. Select the proper belt for the given application.
- 2. To design spur and helical gears to suit the system requirement.
- 3. To design worm and bevel gears as per system requirement.
- 4. Discuss the theory of gear box design.
- 5. Estimate the profile of cam based on the requirement.
- 6. Design the products as per the needs of society considering aesthetics and ergonomics concept.

	Text Books
1	Bhandari V, Design of Machine Elements, 3rd Edition, Tata McGraw-Hill Book Co, 2010.
2	Shigley J., Mischke C., Budynas R. and Nisbett K., Mechanical Engineering Design, 8th ed., Tata
2	McGraw Hill, 2010.
3	N. K. Mehta, Machine Tool Design and Numerical Control, 3rd ed., Tata McGraw Hill, 2012.
	References
1	R. L. Norton, Design of Machinery, McGraw Hill Publication, 3rd Edition, 2003
2	Jindal U.C., Machine Design: Design of Transmission System, Dorling Kindersley, 2010.
3	Maitra G. and Prasad L., Handbook of Mechanical Design, 2nd ed., Tata McGraw Hill, 2001.
4	PSG Design Data Book
	Useful Links
1	
2	

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

## **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	7	8	20	35								
4	Analyze	8	7	17	32								
5	Evaluate	5	5	23	33								
6	6 Create												
Total     20     20     60													

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)												
			A	V 2021-22								
			Cour	se Information								
Progr	amme		B.Tech. (Mechani	cal Engineering)								
Class.	Semes	ter	Final Year B. Tecl	n. Sem VIII								
Cours	e Code			,								
Cours	e Nam	e	Experimental Stre	ss Analysis								
Desire	d Rea	isites:	I I I I I I I I I I I I I I I I I I I	j								
Т	eaching	Scheme		Examination Sc	heme (Marks)							
Lectu	re	3Hrs/week	T1	T2	ESE	Г	Total					
Tutor	ial	-	20	20	60		100					
Practi	cal	-		-		<u> </u>						
Intera	ction	-		Credi	its: 3							
			Cou	rse Objectives								
1	To provide a basic knowledge of techniques in experimental stress analysis.											
2	To sh	ow strain gaug	e bridge configuration	ons and related instru	imentation to take i	readings						
2	To tea	ach different p	olariscope arrangem	ents along with auxil	iary equipment req	uired for	r					
3	photo	hotoelasicity										
A / /1	1 6	Cou	irse Outcomes (CO	) with Bloom's Tax	onomy Level							
At the	Expla	the course, the	students will be abl	e to,	fmaasuramant		Apply					
CO1 Explain the basics of stress, strain and the various methods of measurement.												
C02	Identi	fy various met	bods and instrument	tation for strain mass	urement		Fyaluate					
0.05	Identi	ity various met					Lvaluate					
Modu	la		Mod	Jule Contents			Hours					
Wibuu	In	troduction to F	SA Advantages of	FSA techniques Neo	ressity of various F	SA	110015					
	m	ethods, method	lology of problem so	olving by ESA. Intro	duction of few cond	cents						
I	of	Mechanics of	materials and prefer	ably some understan	ding of the theory of	of	6					
	ela	asticity.		<b>,</b>	<u> </u>							
	Tł	neory of Photo	Elasticity: Introduct	ion, Optics related to	photo elasticity-							
	O	rdinary light, N	Ionochromatic light	, polarized light, natu	ral and artificial							
	bi	refringence, S	tress optic law in tw	o dimensions at norm	nal incidence, mate	rial						
	fri	nge value in te	erms of stress function	on, Polariscope – Pla	ane polariscope, Cir	cular						
	pc	lariscope, Diff	Ferent Arrangements	, Effect of stressed m	odel in plane polar	iscope						
		Isoclinics, Isoc	hromatics, Effect of	stressed model in ci	rcular polariscope-							
II	Ise	ochromatics, U	lse of white light and	d determination of or	ders of isochromati	C	8					
	fri	nges seen in th	e circular polarisco	pe, Fractional fringe	measurement: (i) T	ardy's						
	M	ethod (with de	rivation) (ii) Babine	t Soleil Method.								
	Ph	otoelastic Mat	erials		1 1	1						
	Ci	iterion for sele	terials. Casting tech	erials, Properties of c	ommonly employed	1 ions						
	pi pi	rtaining to mai	terial selection. Calil	bration methods -circ	cular disc. tensile	.0115						
	sp	ecimen, beam	model, Significance	of material fringe va	alue.							
	De	etermination of	f direction of Princip	oal stresses at given p	oint, Determination	n of						
	ex	act fringe orde	er N and the principa	l stress difference (σ	1- $\sigma$ 2) at the given	point,						
III	Se	paration methor	ods i) Method based	on Hook's Law ii) E	Electrical analogy m	lethod	6					
	iii	) Oblique incid	lence method iv) Sh	ear difference metho	d, Scaling model re	sults						
	to	prototype										
IV	In	troduction, typ	es, construction and	material, Gauge fact	or, cross or transve	rse	7					

	sensitivity, correction for transverse strain effect, semiconductor strain gauge.	
	Selection and Mountings of Strain Gauges: Grid, backing, adhesive, mounting	
	methods, checking gauge installation, Moisture proofing. Strain Gauge\ Circuitry:	
	Measurement of force or load, Measurement of torque, Strain measurement of	
	rotating shaft, Measurement of pressure or vacuum.	
	Introduction – Analysis of strain gauge data by analytical and graphical methods,	
	Analysis when principal stress directions are known, Analysis when principal	
	stress directions are unknown, i) Delta rosette ii) Tee-rosette iii) Four element	7
	rectangular rosette iv) Rectangular rosette – Two and three element.	
	Brittle coating method - merits, demerits, applications, Moiré fringe method -	
VI	merits, demerits, applications, Birefringent coating-principle and working of	r.
	reflection polariscope	6
Modu	e wise Measurable Students Learning Outcomes :	
After t	ne completion of the course the student should be able to:	
1.	Explain the basics of stress, strain and the various methods of measurement.	
2.	Apply the knowledge of photoelasicity to find out isoclinic and isochromatic pattern.	
3.	Interpret the various methods of fractional fringe measurement.	
4.	Use various methods and instrumentation for electrical resistance strain gauge.	
5.	Estimate the strain by various strain arrangements i.e. Delta, Tee and rectangular.	
6.	Demonstrate the brittle coating technique.	
	Text Books	
1	. James W. Dally, William Franklin Riley, "Experimental Stress Analysis", McGraw Hil	1, 3rd
1	Edition, 1991	
	Srinath, L. S., Raghava, M.R., Lingaiah K., Gargesha G., Pant B. and Ramachandra, K.,	
2	"Experimental Stress Analysis", Tata McGraw Hill, New Delhi, 1984	
	References	
1	Dr. Sadhu Singh, "Experimental Stress Analysis", Khanna Publications, 6th Edition, 200	)9
2	Richard C. Dove, Paul H. Adams , "Experimental Stress Analysis and Motion Measurer	ment",
2	Merrill Books Publisher; 1st Edition, 1964	
	Useful Links	
1		
2		

	CO-PO Mapping														
	Programme Outcomes (PO) PSO														
	<u>1 2 3 4 5 6 7 8 9 10 11 12 1 2 3</u>														
C01	2		2										2		
CO2	CO2     1     2     2     2														
CO3	2			2								2	3		
The stron	ath of	monnir	a is to	haur	itton of	1 2 2.	Whore	1.Lo		ladium	2.11	-h			

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

### 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	7	8	20	35
4	Analyze	8	7	17	32
5	Evaluate	5	5	23	33
6	Create				
Total		20	20	60	100