# Final Year B.Tech Mechanical SEM-I & II Syllabus AY 2023-24

	Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)										
			A	Y 2023-24							
			Cour	se Information							
Progr	amme		B.Tech. (Mechani	cal Engineering)							
Class.	Semes	ter	Final Year B. Tecl	h., Sem VII							
Cours	se Code	9	5ME455	,							
Cours	e Nam	e	H-3 Project Manag	gement							
Desire	ed Req	uisites:									
Т	'eachin	g Scheme		Examination Scl	neme (Marks)						
Lectu	re	-	LA1	LA2	Lab ESE	Total					
Intera	iction	50									
		Credits: 1									
	Course Objectives										
1	10 prepare the students to manage projects by exploring both technical and managerial challenges and preparing the budget										
2	and preparing the budget. 2 To make aware the students about leadership and ethical qualities in dealing with real life project										
	2 To make aware the students about leadership and ethical qualities in dealing with real life project To induce qualities for working in interdisciplinary and cross functional teams with effective										
3	3 communication skills, economical and managerial challenges and commercial management.										
Course Outcomes (CO) with Bloom's Taxonomy Level											
At the	At the end of the course, the students will be able to,										
GO		0			Bloom's	Bloom's					
CO	Cou	rse Outcome St	tatement/s		I axonom	y Taxonomy Description					
	Grass	and perceive th	a project activities	with respect to resource		Understanding					
COL	requi	red and the cons	traint for feasibility	or completion within		Onderstanding					
	time	ted and the cons	diame for reasionity	or completion within	11						
	Estin	nate and prepare	budget for project c	completion, Understand	1	Analyzing					
CO2	comm	nercial managen	nent	1	IV						
CO3	Figur	e out and schedu	ule the project and a	ssess for controlling	V	Evaluating					
	critic	al path networks	8		• •						
				C							
	Contents										
Modu	ule	Module content				Hours					
1	]	ntroduction to P	Project Management			2					
2	]	Project Cost, Pla	nning, feasibility, ri	sk.		2					
3		Critical Path Net	works - Principles of	of Resource Schedulin	g.	2					
4	Executing and Controlling. 2										

5		Commercial Management and various regulations.	2					
6.		Study and use of software related to Project Management System.	3					
		Text Books						
1	Der	nnis Lock, Project Management - Gower Publishing Limited, 2013						
2	Samuel J. Mantel, Jr., Jack R. Meredith, Scott M. Shafer, Margaret M. Sutton, Project Management in Practice - JOHN WILEY & SONS, INC., 2011							
3	B.C. Punmia and Khandelwal, Project Planning and Control with PERT and CPM, Lakshmi Publications Pvt. Ltd., 2001							
4	HoraldKerzner, Project Management: A systems approach to planning, scheduling and controlling, John Wiley & Sons Inc., 2009							
5	The Ma	e factories act 1948 – Government of India 6. Meri Williams , The Principles of I nagement By – SitepointPvt Ltd., 2008	Project					
		References						
1	K. 1	Nagarajan, Project Management, New Age Int., 2nd ed. 2004.						
2	B.N	A.Naik, Project Management-Scheduling and Monitoring by PERT/CPM, 1984						
3	Wi	lliam R Duncan, A guide to the project management body of knowledge, PMI Pu	blications, 1996					
		Useful Links						
1	http	ps://www.apm.org.uk/resources/what-is-project-management/						
2	http	ps://www.projectmanager.com/project-management						

	CO-PO Mapping													
					Progra	mme (	Outcom	es (PO)	)				PS	0
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1								1					1	1
CO2									2					2
CO3							1						2	
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High														
Each CO of the course must map to at least one PO.														

#### Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

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

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)										
			AY 2023-24							
		Co	urse Information							
Progra	mme	B.Tech. (Mechar	nical Engineering)							
Class,	Semester	Final Year B. Te	ch., Sem VII							
Course	e Code	5ME403								
Course	e Name	H-4 Legal, IPR,	Safety							
Desire	d Requisites:									
Те	aching Scheme		Examinatio	n Scheme	(Marks)					
Lectur	e 1 Hrs/Week	MSE	ISE	ESF		Tota	ıl			
Tutori	al -	15 10 25 50								
			Credits: 1							
	Course Objectives									
1	To introduce the students about Legal, IPR, Safety laws.									
2	To disseminate know	wledge on patents.	patent regime in Ir	ndia and ab	oad and registr	ation a	spects.			
3 To be aware about current trends in IPR and Govt. steps in fostering IPR.										
5 TO be aware about current trends in IFK and Govt. steps in tostering IFK.										
	Cor	urse Outcomes (C	CO) with Bloom's '	Taxonomy	Level					
At the	end of the course, the	students will be ab	ole to,	<b>v</b>						
					Bloom's	B	loom's			
CO Course Outcome Statement/s Tourse Outcome Statement/s										
CO	<b>Course Outcome S</b>	Statement/s			Taxonomy	Tay	konomy			
CO	Course Outcome S	Statement/s			Taxonomy Level	Tax Des	konomy cription			
C0	Course Outcome S Understand about In	Statement/s	al, IPR, Safety laws	S	Taxonomy Level II	Tax Des Und	<b>cription</b> erstandin			
CO CO1	Course Outcome S Understand about In	Statement/s	al, IPR, Safety laws	S	Taxonomy Level II	Tax Des Und	<b>cription</b> erstandin g			
CO CO1 CO2	Course Outcome S Understand about In Interpret patent and	Statement/s Idian industry Lega copyright in innov	al, IPR, Safety laws	s k.	Taxonomy     Level     II     III	Tax Des Und	<b>cription</b> erstandin g pplying			
CO CO1 CO2	Course Outcome S Understand about In Interpret patent and Illustrate the import	Statement/s adian industry Lega copyright in innov ance of Indian indu	al, IPR, Safety laws vative research wor ustry Legal, IPR, S	s k. afety	TaxonomyLevelIIIIIIIIIV	Tax Des Und Ap	<b>xonomy</b> <b>cription</b> erstandin g oplying alyzing			
CO CO1 CO2 CO3	Course Outcome S Understand about In Interpret patent and Illustrate the importa laws.	Statement/s Idian industry Lega copyright in innov ance of Indian indu	al, IPR, Safety laws vative research wor ustry Legal, IPR, S	s k. afety	TaxonomyLevelIIIIIIV	Tay Des Und A <sub>I</sub> An	<b>xonomy</b> <b>cription</b> erstandin g pplying alyzing			
CO CO1 CO2 CO3	Course Outcome S Understand about In Interpret patent and Illustrate the importa laws.	Statement/s Idian industry Lega copyright in innov ance of Indian indu	al, IPR, Safety laws ative research wor ustry Legal, IPR, S	s k. afety	TaxonomyLevelIIIIIIV	Tax Des Und A <sub>I</sub>	xonomy cription erstandin g pplying alyzing			
CO CO1 CO2 CO3	Course Outcome S Understand about In Interpret patent and Illustrate the importa laws.	Statement/s Idian industry Lega copyright in innov ance of Indian indu	al, IPR, Safety laws vative research wor ustry Legal, IPR, S Contents	s k. afety	TaxonomyLevelIIIIIIV	Tay Des Und A <sub>I</sub>	xonomy cription erstandin g pplying alyzing			
CO CO1 CO2 CO3	Course Outcome S Understand about In Interpret patent and Illustrate the importa laws.	Statement/s Idian industry Lega copyright in innov ance of Indian indu	al, IPR, Safety laws vative research wor ustry Legal, IPR, S Contents	s k. afety	TaxonomyLevelIIIIIIV	Tay Des Und Aț	<b>xonomy</b> <b>cription</b> erstandin g oplying alyzing			
CO CO1 CO2 CO3	Course Outcome S Understand about In Interpret patent and Illustrate the importa laws.	Statement/s Idian industry Lega copyright in innov ance of Indian indu	al, IPR, Safety laws vative research work ustry Legal, IPR, S Contents	s k. afety	Taxonomy     Level     II     III     IV	Tax Des Und A <sub>I</sub> An	konomy cription erstandin g pplying halyzing			
CO CO1 CO2 CO3	Course Outcome S Understand about In Interpret patent and Illustrate the importa laws.	Statement/s Indian industry Lega copyright in innov ance of Indian indu	al, IPR, Safety laws vative research wor ustry Legal, IPR, S <b>Contents</b>	s k. afety	Taxonomy     Level     II     III     IV	Tax Des Und A <sub>I</sub> An	konomy cription erstandin g pplying alyzing Hours			
CO1 CO2 CO3	Course Outcome S Understand about In Interpret patent and Illustrate the importa laws.	Statement/s Idian industry Lega copyright in innov ance of Indian indu	al, IPR, Safety laws vative research wor ustry Legal, IPR, S <b>Contents</b> odule Contents	s k. afety	Taxonomy     Level     II     III     IV	Tax Des Und A <sub>I</sub> An	konomy cription erstandin g pplying alyzing Hours			
CO CO1 CO2 CO3	Course Outcome S Understand about In Interpret patent and Illustrate the importa laws.	Statement/s Idian industry Lega copyright in innov ance of Indian indu Mo Bureau of Indian St	al, IPR, Safety laws vative research work ustry Legal, IPR, S <b>Contents</b> odule Contents	s k. afety	Taxonomy     Level       II     III     IV	Tax Des Und Aț	konomy cription erstandin g oplying alyzing Hours			
CO1 CO2 CO3 Mod	Course Outcome S Understand about In Interpret patent and Illustrate the importa laws. lule Overview of E	Statement/s Indian industry Lega copyright in innov ance of Indian indu Mo Bureau of Indian St	al, IPR, Safety laws vative research work ustry Legal, IPR, S <b>Contents</b> odule Contents tandards Act of 198	s k. afety 36	Taxonomy     Level     II     III     IV	Tax Des Und A <sub>I</sub> An	konomy cription erstandin g pplying alyzing Hours 2			
CO1 CO2 CO3 Mod	Course Outcome S Understand about In Interpret patent and Illustrate the importa laws. Understand Overview of E	Statement/s Indian industry Lega copyright in innov ance of Indian indu Mo Bureau of Indian St	al, IPR, Safety laws vative research wor ustry Legal, IPR, S <b>Contents</b> odule Contents tandards Act of 198	s k. afety 36	Taxonomy     Level	Tax Des Und A <sub>I</sub> An	konomy cription erstandin g oplying alyzing Hours 2			
CO CO1 CO2 CO3 Mod	Course Outcome S Understand about In Interpret patent and Illustrate the importa laws. Understand about In Interpret patent and Illustrate the importa Illustrate the importation and Illustrate the impo	Statement/s Indian industry Lega copyright in innov ance of Indian indu Mo Bureau of Indian St nformation Act of	al, IPR, Safety laws vative research work ustry Legal, IPR, S <b>Contents</b> odule Contents tandards Act of 198 2005, In order to p	s k. afety 36 romote pub	Taxonomy         Level         II         III         IV	Tax Des Und Ap An	konomy cription erstandin g oplying alyzing Hours 2 2			
CO CO1 CO2 CO3 Mod	Course Outcome S         Understand about In         Interpret patent and         Illustrate the importation         laws.         Iule         Overview of E         The Right to In         public safety	Statement/s Idian industry Lega copyright in innov ance of Indian indu Mo Bureau of Indian St nformation Act of	al, IPR, Safety laws vative research wor ustry Legal, IPR, S <b>Contents</b> odule Contents tandards Act of 198 2005, In order to p	s k. afety 36 romote pub	Taxonomy         Level         II         III         IV	Tax Des Und Aı An	xonomy cription erstandin g oplying alyzing Hours 2 2			
CO CO1 CO2 CO3	Course Outcome S         Understand about In         Interpret patent and         Illustrate the importation         laws.         Iule         Overview of E         The Right to In         public safety	Statement/s Indian industry Lega Copyright in innov ance of Indian indu Mo Bureau of Indian St Information Act of	al, IPR, Safety laws vative research work ustry Legal, IPR, S <b>Contents</b> odule Contents tandards Act of 198 2005, In order to p	s k. afety 36 romote pub	Taxonomy         Level         II         III         IV	Tax Des Und A <sub>I</sub> An	konomy cription erstandin g pplying alyzing Hours 2 2			
CO1 CO2 CO3 Mod	Course Outcome S         Understand about In         Interpret patent and         Illustrate the importal         laws.         Iule         Overview of E         The Right to In         public safety         Intellectual Press	Statement/s Indian industry Lega Copyright in innov ance of Indian indu Mo Bureau of Indian St Information Act of Operty, Patents, Co	al, IPR, Safety laws vative research work ustry Legal, IPR, S Contents odule Contents tandards Act of 198 2005, In order to p opyrights, Tradema	s <u>k.</u> afety 36 romote pub rks,	Taxonomy         Level         II         III         IV	Tax Des Und Ap An	xonomy cription erstandin g pplying alyzing Hours 2 2 2			

_			-							
		Other forms of IP, Current Contour,								
	4		3							
		The Factories Act, 1948, The Mines Act, 1952,								
	5		2							
		The Dock Workers (Safety, Health & Welfare)								
	6	Act, 1986.	1							
		Text Books								
	1	Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management. India,								
	1	Cengage Learning India Private Limited.								
	2	D.S. S. Ganguly and C S Changeriya Labor & Industrial Acts & Laws (Safety Management								
		References								
	1	Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.								
		Useful Links								
	1	Cell for IPR Promotion and Management (http://cipam.gov.in/)								
	2	https://law.resource.org/pub/in/bis/manifest.med.html								
	3	World Intellectual Property Organization (https://www.wipo.int/about-ip/en/)								
	4	Office of the Controller General of Patents, Designs & Trade								
	4	(http://www.ipindia.nic.in/)								
	5	https://labour.gov.in/industrial-safety-health								

	CO-PO Mapping														
		Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1								1					1	1	
CO2									2					2	
CO3															
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High															
E 1 CO	C (1				4.1		DO								

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

#### Assessment (for Theory Course)

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

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

	Walchand College of Engineering, Sangli								
			(Government Al	V 2023-24					
			Cours	se Information					
Progr	amme		B. Tech. (Mechani	ical Engineering)					
Class.	Semes	ster	Final Year B. Tech	n., Sem. VII					
Cours	e Code	2	50E429	,					
Cours	e Nam	e	Industrial Automa	tion					
Desire	ed Rea	uisites:							
Т	eachin	g Scheme		Examination Scheme (N	(larks)				
Lectu	re	3Hrs/week	MSE	ISE E	SE	Total			
Tutor	ial	-	30	20 5	50	100			
	Credits: 3								
	Course Objectives								
1	To tra	ain the students	in the area of instru	mentation, automation and co	ontrol.				
2	2 To get the basic knowledge and practical experience in instrumentation, automation and control area and to work more effectively in manufacturing, process and automation industries								
	To g	et the knowled	dge of various eler	ments of industrial automat	tion – CAD/	CAM, sensors,			
3 pneumatics, hydraulics and CNC.									
		Cou	rse Outcomes (CO)	) with Bloom's Taxonomy I	Level				
At the	end of	the course, the	students will be able	e to,		1			
	C				Bloom's	Bloom's			
		se Outcome St	atement/s		Laxonomy   Lavel	<b>Taxonomy</b> Description			
C01	Ident	ify different ty	mes automation te	echnological and economic		Apply			
	issue	s involved in au	tomatic manufactur	ing of products		rippiy			
CO2	Interp appli	pret basic conce cations.	epts of sensors and	transducers into real world	V	Evaluate			
	Class	ify the major	components used	1 in automation such as	IV	Analyze			
	interfacing and protection circuits								
Modu	ıle		Modu	le Contents		Hours			
	I	ntroduction to	Automation						
	Ir	troduction: Rea	ason of automation,	Current trends, classification	and types of				
I	aı	utomation, App	plication of autom	ation, Goals of automation	n, Low cost	6			
	aເ	utomation, Curr	ent emphases in aut	tomation, Issues for automati	on in factory				
	0	peration, Ten st	rategies for automat	10n.					
		C and CNC	D ( 1 11)			6			
		igid automatic	on: Part handling,	Machine tools. Flexible	automation:				
	Computer control of Machine Tools and Machining Centres, NC and NC part								

	programming, CNC-Adaptive Control, Automated Material handling. Assembly, Flexible fixturing.									
III	Computer Aided design       Computer Aided Design: Fundamentals of CAD - Hardware in CAD-Computer Graphics Software and Data Base, Geometric modeling for downstream applications and analysis methods; Computer Aided Manufacturing: CNC technology, CNC Adaptive Control       7         Automation Floments       4									
IV	Automation ElementsLow cost automation: Mechanical & Electro mechanical Systems, Pneumaticsand Hydraulics, Illustrative Examples and case studies.	7								
V	Sensors and ProcessorsIntroduction, Sensor and transducers, Sensor technology, Selection of Transducers, Classification of sensors and transducers, History of Microprocessor, Programmable logic controller, Working of PLC.7									
VI	Modelling and SimulationIIntroduction to Modelling and Simulation: Product design, process routemodelling, Optimization techniques, Case studies & industrial applications									
	I ext Books Mikell P. Groover, "Automation Production systems and computer integrated m	anufacturing"								
1	Prentice Hall, 5 <sup>th</sup> edition, 2019.	anulactuling,								
2	Serope Kalpakjain and Steven R. Schmid, "Manufacturing Engineering and Te edition, Pearson, 2014.	chnology", 7 <sup>th</sup>								
3	Ibrahim Zeid, CAD/CAM : Theory & Practice, 6 <sup>th</sup> edition, 25 June 2009.									
	References									
1	Yoram Koren, "Computer control of manufacturing system", McGraw Hill, 1 <sup>st</sup> editi	ion, 2017								
2	webb and Keis, "Programmable Logic Controller – Principles and Applications", P India, 5 <sup>th</sup> Edition, 2002	rentice Hall of								
3	Kolk R.A. and Shetty Devdas, "Mechatronics System Design", Thomson Learn Edition	ing, 2007, 3 <sup>rd</sup>								
1	Useful Links									
	$\frac{\text{nttps://npte1.ac.in/courses/112/103/112103293/}{\text{nttps://npte1.ac.in/courses/112/103/112103293/}$									
2	https://onlinecourses.nptel.ac.in/noc20_me38/preview									
<u> </u>	https://npici.ac.in/courses/112/104/112104288/									
4	nups.//npter.ac.m/noc/courses/noc20/SEAVI2/noc20-me38/									

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

Civil

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

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

Computer	Science
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						CO-I	PO Ma	pping							
	Programme Outcomes (PO) PSO														
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C01	2	1			1	1									
CO2	2	1			2				2			1			
CO3	2	2	2		1							1			
The streng	gth of n	napping	g is to b	be writt	en as 1	,2,3; W	here, 1	:Low,	2:Med	ium, 3:	High				

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

#### Assessment

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				AY 2023-24									
<b>D</b>				urse Information	1								
Progr Closs	some	tor	B. I ech. (Mechani Final Vear B. Tec	the Sem VII									
Class,	semes		5ME451										
Cours	e Nam	e	Mechanical Vibr	ations Lab									
Desire	ed Rea	uisites:											
Te	aching	Scheme	Examination Scheme (Marks)										
Practi	ical	-	LA1	LA2	Lab ES	SE	Total						
Intera	nction	-	40		100								
	Credits: 1												
1	To be	aware about	t causes and effects	s of the vibration	on mechani	cal systems							
<ol> <li>I to be aware about causes and effects of the vibration on mechanical systems.</li> <li>2 To demonstrate mechanical vibration measuring instruments</li> </ol>													
<ul> <li>3 To analyze types of vibrations namely un-damped, damped, free and forced vibrations.</li> </ul>													
4 To determine the transmission of force and motion due to vibration.													
Course Outcomes (CO) with Pleam's Townson Level													
Course Outcomes (CO) with Bloom's Taxonomy Level													
				Bloom's	Bloom's								
CO	Cour	se Outcome	Statement/s			Taxonomy Level	Taxonomy Description						
C0 C01	Cour Demo	se Outcome	Statement/s	n, causes and basic	c elements	Taxonomy Level II	TaxonomyDescriptionUnderstanding						
CO CO1 CO2	Cour Demo and it Deter syster	se Outcome onstrate the c s measureme mine natural ns	Statement/s oncept of vibration ent frequency and cor	n, causes and basion responding mode	c elements shapes of	TaxonomyLevelIIIII	Taxonomy DescriptionUnderstandingApplying						
CO CO1 CO2 CO3	Cour Demo and it Deter system Meas	se Outcome onstrate the c s measureme mine natural ns ure force and	Statement/s oncept of vibration ent frequency and cor l motion transmiss	n, causes and basion responding mode ibility of given sy	c elements shapes of stem	Taxonomy LevelIIIIIIIIIV	Taxonomy DescriptionUnderstandingApplyingAnalyzing						
CO CO1 CO2 CO3	Cour Demo and it Deter syster Meas	se Outcome onstrate the c s measureme mine natural ns ure force and	Statement/s oncept of vibration ent frequency and cor l motion transmiss	n, causes and basic responding mode ibility of given sy	c elements shapes of stem	TaxonomyLevelIIIIIIV	Taxonomy         Description         Understanding         Applying         Analyzing						
CO CO1 CO2 CO3	Cour Demo and it Deter system Meas	se Outcome onstrate the c s measureme mine natural ns ure force and	Statement/s oncept of vibration ent frequency and cor l motion transmiss List of Exp	n, causes and basion responding mode ibility of given sy periments / Lab A	c elements shapes of stem Activities	Taxonomy     Level     II     III     IV	Taxonomy DescriptionUnderstandingApplyingAnalyzing						
CO1 CO2 CO3 List of Course Any te List of 1.	Cour Demo and it Deter systen Meas Experi e Conte en experi Study	se Outcome onstrate the c s measureme mine natural ns ure force and ments: nts: riments/lab se ments (study 7 of natural fr	Statement/s oncept of vibration ent frequency and cor d motion transmiss List of Exp essions from the list type) equency of two deg	n, causes and basic responding mode ibility of given sy <b>periments / Lab</b> A given below gree of freedom spr	c elements shapes of stem Activities	Taxonomy     Level     II     III     IV	Taxonomy DescriptionUnderstandingApplyingAnalyzing						
CO1 CO2 CO3 List of Course Any te List of 1. 2.	Cour Dema and it Deter systen Meas Experi Study Study	se Outcome onstrate the c s measureme mine natural ns ure force and ments: nts: timents/lab se ments (study of natural fr of natural fr	Statement/s oncept of vibration ent frequency and cor motion transmiss List of Exp essions from the list type) equency of two deg equency of double	n, causes and basic rresponding mode ibility of given sy <b>periments / Lab</b> A given below gree of freedom spr pendulum system.	c elements shapes of stem Activities	Taxonomy     Level     II     III     IV	Taxonomy         Description         Understanding         Applying         Analyzing						
CO CO1 CO2 CO3 List of Course Any te List of 1. 2. 3.	Cour Demo and it Deter syster Meas Experi e Conte en experi Study Study	se Outcome onstrate the c s measureme mine natural ns ure force and ments: nts: timents/lab se ments (study 7 of natural fr 7 of natural fr 7 of critical sp	Statement/s oncept of vibration ent frequency and cor motion transmiss List of Exp essions from the list type) equency of two deg equency of double p beed of shaft.	n, causes and basic rresponding mode ibility of given sy <b>periments / Lab</b> A given below gree of freedom spr pendulum system.	c elements shapes of stem Activities	Taxonomy     Level     II     III     IV	Taxonomy         Description         Understanding         Applying         Analyzing						
CO CO1 CO2 CO3 List of Course Any te List of 1. 2. 3. List of	Cour Dema and it Deter systen Meas Experi Study Study Study	se Outcome onstrate the c s measureme mine natural ns ure force and ments: nts: timents/lab se ments (study of natural fr of natural fr of critical sp ments (Trial /	Statement/s oncept of vibration ent frequency and cor mathematical motion transmiss List of Exp essions from the list type) equency of two deg equency of double p beed of shaft. The demonstration typ	n, causes and basic rresponding mode ibility of given sy <b>periments / Lab</b> A given below gree of freedom spr pendulum system. e)	c elements shapes of stem Activities	Taxonomy         Level         II         III         IV	Taxonomy         Description         Understanding         Applying         Analyzing						
CO CO1 CO2 CO3 List of Course Any te List of 1. 2. 3. List of 1.	Cour Dema and it Deter systen Meas Experi Study Study Study Study	se Outcome onstrate the c s measureme mine natural ns ure force and ments: nts: timents/lab se ments (study of natural fr of natural fr of critical sp ments (Trial /	Statement/s oncept of vibration ent frequency and cor mathematical motion transmiss List of Exp essions from the list type) equency of two deg equency of double p beed of shaft. The demonstration typ stiffness of spring from the statement of th	n, causes and basic rresponding mode ibility of given sy <b>periments / Lab</b> A given below gree of freedom spr pendulum system. e) rom static deflectio	c elements shapes of stem Activities ing mass sy	Taxonomy       Level       II       III       IV	Taxonomy         Description         Understanding         Applying         Analyzing						
CO CO1 CO2 CO3 List of Course Any te List of 1. 2. 3. List of 1. 2. 3.	Cour Demo and it Deter systen Meas Experi e Conte en experi Study Study Study Study Cexperin Deter Deter	se Outcome onstrate the c s measureme mine natural ns ure force and ments: nts: timents/lab se ments (study f of natural fr of natural fr of critical sp ments (Trial / trmination of r	Statement/s oncept of vibration frequency and cor mathematical motion transmiss List of Exp essions from the list type) equency of two deg equency of double p beed of shaft. Themonstration typ stiffness of spring finatural frequency of	n, causes and basic responding mode ibility of given sy <b>periments / Lab</b> A given below gree of freedom spr pendulum system. e) rom static deflection f single degree of f	c elements shapes of stem Activities ing mass syn n. reedom sprin	Taxonomy         Level         II         III         IV         stem.	Taxonomy         Description         Understanding         Applying         Analyzing						
CO CO1 CO2 CO3 List of Course Any te List of 1. 2. 3. List of 1. 2. 3. List of 3. 2. 3.	Cour Demo and it Deter syster Meas Experi Conte conte conte en experi Study Study Study Study Cexperin Deter Deter	se Outcome onstrate the c s measureme mine natural ns ure force and ments: nts: riments/lab se ments (study 7 of natural fr 7 of natural fr 7 of critical sp ments (Trial / rmination of r	Statement/s oncept of vibration frequency and cor mathematical motion transmiss List of Exp essions from the list type) equency of two deg equency of double beed of shaft. Demonstration typ stiffness of spring fr natural frequency of radius of gyration or	n, causes and basic responding mode ibility of given sy <b>periments / Lab</b> A given below gree of freedom spr pendulum system. (e) rom static deflection f single degree of f	c elements shapes of stem Activities ing mass sy- ing mass sy- reedom sprin lum	Taxonomy         Level         II         III         IV         stem.	Taxonomy         Description         Understanding         Applying         Analyzing						

- 5. Determination of torsional vibrations of single/two rotor system.
- 6. Demonstration of plot response curve of system under forced vibration.
- 7. Determination of damping effect on a system under forced vibration with viscous damping.
- 8. Determination of optimal frequency for dynamic vibration absorber.
- 9. Measurement of various parameters of vibrations.
- 10. Verification of Dunkerley's rule transverse vibrations.
- 11. Determination of mode shapes of beam with various boundary conditions.

	Text Books								
1	G. K. Grover, "Mechanical Vibration" Nemchand and Brothers, Roorkee, Third Edition, 2006								
2	Dr. V. P. Singh, "Mechanical Vibrations", S. Chand and Sons New Delhi, Second Edition,								
	2004								
2	J. S. Rao "Introductory Course On Theory And Practice Of Mechanical Vibrations", New Age								
3	International Publishers, Second Edition, 1999								
References									
1	Austin Church, "Mechanical Vibrations", Wiley Eastern. First Edition, 1963								
2	Cyril M. Harris, Charles E. Crede, "Shock and vibration handbook", McGraw-Hill, 1976								
3	S. S. Rao, "Mechanical Vibrations", Fourth Edition, 2006								
	Useful Links								
1	Virtual Labs (vlabs.ac.in)								
2	Hartnell Governor Practical Detailed - YouTube								

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

		Assess	ment	
There are thre IMP: Lab ESI	e components of lab E is a separate head o	assessment, LA1, L f passing (min 40 %	A2 and Lab ESE. 6), LA1+LA2 should be min 40%	
Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indica	ates starting week of	a semester. Lab acti	vities/Lab performance shall include perfor	ming

experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)								
AY 2023-24								
Course Information								
Programme	B.Tech. (Mechanical Engineering)							
Class, Semester	Final Year B. Tech., Sem VII							
Course Code	5ME441							
Course Name	Mini Project 5							
<b>Desired Requisites:</b>								

Teachir	ng Scheme	Examination Scheme (Marks)									
Practical	2 Hrs./Week	LA1	LA2	Lab ESE	Total						
Interaction	eraction -		30	100							
			Credits: 01								

	Course Objectives									
1	To acquaint with the process of identifying the needs and converting it into the problem.									
2	To familiarize the process of solving the problem in a group.									
2	To acquaint with the process of applying basic engineering fundamentals to attempt solutions to									
3	the problems.									
4	To inculcate the process of self-learning and research.									

#### Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Apply Knowledge and skill to solve academic / industrial / societal problems in a group.	III	Applying
CO2	Develop interpersonal skills to work as member of a group or leader.	III	Applying
CO3	Draw the proper inferences from available results through theoretical / experimental / simulation work.	V	Evaluating

#### **Course contents**

#### **Guidelines for Mini Project 5:**

- 1. Students are required to work in a group of maximum five students, and this group shall be the same as the project batch for the final year project.
- 2. Students should do survey and identify needs, which shall be converted into problem statement for mini project in consultation with faculty supervisor.
- 3. Students need to choose different topic for mini project than their final year B. Tech project.
- 4. Students shall submit implementation plan in the form of Gantt / PERT / CPM chart, which will cover weekly activity of mini project.
- 5. A log book is to be prepared by each group, wherein group can record weekly work progress,
- 6. Faculty advisor may give inputs to students during mini project activity; however, focus shall be on self-learning.
- 7. Students in a group shall understand problem effectively, propose multiple solution and select best possible solution in consultation with guide/ supervisor.

- 8. Students shall convert the best solution into working model using various components of their domain areas and demonstrate.
- 9. The solution to be validated with proper justification and report to be compiled in standard format as defined by the department.
- 10. The project work can be any of the form given below **but not limited to** :
  - a. Making physical working models, prototypes, and scaled models, of a concept machine.
  - b. Making virtual / CAD models of a sufficiently complex machines / concepts.
  - c. Making study, modeling, analysis, programming and simulation of a system / machine / operation / process.
  - d. Making study / teaching modules of a sufficiently complex topic for pedagogy purposes.
  - e. Any other project work in mechanical or multidisciplinary area in consultation with the faculty in charge.
- 11. Students can use workshop facility, different laboratory facilities, software, mathematical tools, simulation / animation tools etc. available or online freeware tools.
- 12. With the focus on the self-learning, innovation, addressing societal problems and entrepreneurship quality development within the students through the Mini Projects, it is preferable that the mini project of appropriate level and quality to be carried out.
- 13. Students need to ensure that mini project is not repeated from previous three years.
- 14. Students may complete mini project as an industry sponsored project, in consultation with the faculty advisor.
- 15. The students group can be allowed to work on the extension of the Mini Project 3 /4 with suitable improvements / modifications or a completely new project idea. This policy can be adopted on case by case basis.

#### Guidelines for Assessment of Mini Project Practical / Oral Examination:

- Report should be prepared as per the guidelines issued by the department.
- Mini Project shall be assessed through a presentation and demonstration of working model by the student project group to faculty advisor.
- Students shall be motivated to publish a paper based on the work in student competitions / Conferences / journals.

Mini Project shall be assessed based on following points;

- 1. Quality of problem and Clarity
- 2. Innovativeness in solutions
- 3. Cost effectiveness and Societal impact
- 4. Full functioning of working model as per stated requirements
- 5. Effective use of skill sets
- 6. Effective use of standard engineering norms
- 7. Contribution of an individual's as member or leader
- 8. Fluency in written and oral communication
- 9. Quality of project report

#### **Text Books**

- 1 Suitable books and e books on design engineering, manufacturing processes, thermal engineering, design of experiments, optimization techniques suitable for selected project domain.
- References

   1
   Suitable user manuals of software tools and research papers from reputed national and international journals and conferences.

#### **Useful Links**

1 Any online resources suitable for project domain.

	CO-PO Mapping													
		Programme Outcomes (PO)												
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3								3			3	2	
CO2	2	3	3						3			2	2	1
CO3				3		2		3	2	2	3	3		1
The stren	The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High													
Each CO	of the	course	e must	map to	o at lea	st one	PO, ar	nd pref	erably	to only	y one l	PO.		

Assessment											
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%											
Assessment	Assessment Based on Conducted Typical Schedule (for 26-week Sem)										
		by									
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30							
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30							
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40							
Week 1 indica	ates starting week of a	a semester. Lab a	activities/Lab performance shall include per	forming							

week I indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)												
	AY 2023-24											
	Course Information											
Progr	Programme B.Tech. (Mechanical Engineering)											
Class,	Class, Semester Final Year B. Tech., Sem VII											
Cours	Course Code 5ME454											
Cours	Course Name Project I											
Desired Requisites:         Basic and advanced concepts and principles in mechanical												
engineering, graduate level courses. Latest developments in												
	mechanical engineering field.											
T	eachin	g Scheme		Exam	ination Scheme (	Marks)						
Practi	ical	6 Hrs/Week	LA1	LA2	ESE		Total					
Intera	action	-	30	30	40		100					
					Credits: 03							
				C OI:	··•							
	D	• 1.	····	Course Objec	tives		t					
	Prov	ide an oppor	tunity to stu lected by then	and encourage	work independent e them to think in	ntiy on a dependently	topic/ problem					
1	bring	g out the conclu	ision under th	e given circum	stances and limitat	ions.	y on their own to					
	Encou	urage creative t	hinking proce	ss to help them	to get confidence	by planning	g and carrying					
2	out th	e work plan of	the project an	d to successful	ly complete the same	me, through	1 observations,					
	discus	ssions and deci	sion making p	process.	1 00 1							
3	To en	able students to	o for technical	report writing	and effective pres	entations.						
		Соци	sa Autoomas	(CO) with Rl	om's Taxanamy	Loval						
At the	end of	the course, the	students will	be able to.								
						Bloom's	Bloom's					
CO	Cour	se Outcome St	tatement/s			Taxonom Level	y Taxonomy Description					
	Will I	be able to unde	erstand the im	portance of tea	m work and will	III	Apply					
CO1	be ab	le to work in	a team for a	chieving group	p goals / will be							
	prepa	red to assume a	a leadership ro	ole in any team.								
	Will	have ability to	explain vari	ous concepts a	ind tools used in	IV	Analyze					
CO2	Will 1	project.	vze and give	solutions for a	specific problem							
	staten	nent related to	their project.	solutions for a	specific problem							
602	Willt	be able to prepa	are and presen	t a detailed rep	ort based on	V	Evaluate					
003	projec	et work spread	over two sem	esters.								
				Course conte	ents							
Proje	ct Defi	nition:-										
	Creat	tion of product	, apparatus, sn	nall equipment,	test setup, experir	nental set u	p, prototype					
_	based	l on new idea.	•									
	Innov	vation of existin	ng product.		, . ,		<i>,</i>					
	Energ	gy audit/ conse	rvation-studie	s of departmen	t/ section / plant /o	rganization	/ machine etc.					

- Making of machine and renovation of machine.
- Experimental set up to verify and confirm scientific concepts.
- Experimental verification of principles of mechanical engineering, analysis or simulation of a process.
- Multidisciplinary projects.
- Projects using modern electronic / computer based tools, software etc. in consultation with faculty in-charge.

#### Industry sponsored projects:

Students may carry out sponsored project fulfilling the requirements mentioned above.

The project contents should be such that it is to be carried out over entire academic year by the group.

#### Synopsis:-

Synopsis should contain:-

- a. Need of project- How you are inspired of particular project.
- b. Aim and objective of project topic.
- c. Idea/ideas used in the project work.
- d. How will you 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.
- 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.

#### 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.

## Students are encouraged to publish a technical paper in conference / reputed peer reviewed journals based on their project work.

#### Project shall be assessed based on following points;

- 1. Quality of problem and Clarity
- 2. Innovativeness in solutions
- 3. Cost effectiveness and Societal impact
- 4. Full functioning of working model as per stated requirements
- 5. Effective use of skill sets
- 6. Effective use of standard engineering norms
- 7. Contribution of an individual's as member or leader
- 8. Fluency in written and oral communication
- 9. Quality of project report

#### **Text Books**

 Image: Image:

#### Useful Links

1 As per the need of the project.

CO-PO Mapping														
		Programme Outcomes (PO)										PS	0	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3								3			3	3	
CO2		3	3	3	3		2		3		3		2	1
CO3		3						3		3	3			1
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High														
Each CO	of the c	ourse 1	nust m	ap to a	t least o	one PO	, and p	referab	ly to oi	nly one	PO.			

Assessment										
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%										
Assessment	Assessment Based on Conducted Typical Schedule (for 26-week Sem)									
		by								
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30						
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30						
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40						
Week 1 indica	ates starting week of a	a semester. Lab a	activities/Lab performance shall include per	forming						
experiments,	mini-project, presenta	tions, drawings,	programming, and other suitable activities,	as per						
the nature and	l requirement of the la	ab course. The ex	xperimental lab shall have typically 8-10	T						
experiments a	nd related activities i	f any.								

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)							
AY 2023-24							
Course Information							
Programme	B.Tech. (Mechanical Engineering)						
Class, Semester	Final Year B. Tech., Sem VII						
Course Code	5ME452						
Course Name	Refrigeration & Air Conditioning Lab						
Desired Requisites:							

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

	Course Objectives								
1	To enable the students to analyze and solve refrigeration related problems by applying principles of mathematics, science and engineering.								
2	To prepare students to use modern tools & techniques.								
3	To train students with effective communication skill to demonstrate refrigeration/air conditioning theories.								
4	To develop skills to fulfill industrial needs.								
5	To develop a professional approach to lifelong learning in the refrigeration/ air conditioning /cryogenics.								

Course Outcomes	(CO) with Bloom's Taxonomy Le	evel

At the end of the course, the students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Performance the experiments in refrigeration and air- conditioning as per given objectives.	III	Applying
CO2	Analyze different refrigeration, air conditioning and cryogenic systems with their applications.	IV	Analyzing
CO3	Measure the performance of different systems under different condition	V	Evaluating

#### List of Experiments / Lab Activities

#### List of Experiments:

#### Course Contents:

Following practical's should be considered for ISE and ESE evaluation

#### Experiments

1 Trial on vapour compression refrigeration system.

- 2 Trial on Heat Pump.
- 3 Trial on ice plant.
- 4 Trial on Cascade system.
- 5 Trial on air conditioning system.

#### **Demonstration / Study**

1. Study and demonstration of refrigeration system for house hold refrigerator, water cooler, ice plant and cold storage.(Industrial Visit is desirable)

- 2. Study and demonstration of controls in refrigeration
- 3. Study and demonstration on window, split & central air conditioner.
- 4. Study of dehydration, charging leak testing and testing of refrigeration system.
- 5. Study and demonstration of absorption system.
- 6. Study of method for star rating and EER for domestic appliances like house hold refrigerator.
- 7. Study of heat pump. / Vortex tube /pulse tube refrigeration.
- 8. Study/ Trial on multi stage compression refrigeration system.
- 9. Study/ trial on air washer.
- 10. Study/ trial on multi evaporator refrigeration system.

In case of mini-projects, drawing, presentations etc., write the relevant details of the same.

	Text Books										
1	Dossat "Refrigeration", Pearson, fourth edition, 2007.										
n	C. P. Arora, "Refrigeration and Air conditioning", Tata McGraw Hill Education Private										
2	Limited, third edition,2008										
	References										
1	Stocker. ,"Refrigeration and Air Conditioning", McGraw-Hill Publishing , 2nd										
1	Edition,2008										
2	W. P. Jones, "Air Conditioning Engineering", Rutledge, 5th Revised Edition, 2001.										
3	Willis H. Carrier, "Carrier Hand Book "Jonathan Castro, 2013										
	Useful Links										
1	https://www.youtube.com/watch?v=4HmA3sT0C1Y&t=11s										
2	https://www.youtube.com/watch?v=5dgRgBuWDZw&t=2s										
3	https://www.youtube.com/watch?v=MjZahESS-48										
4	https://www.youtube.com/watch?v=14-kyt-a1DU										

CO-PO Mapping														
		Programme Outcomes (PO)										PS	0	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2							2		1				
CO2	2	2			1									
CO3	2									1	1			
The stren	The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High													
Each CO	of the	course	must r	nap to	at leas	t one F	O, and	l prefei	ably to	o only o	one PC	).		

Assessment												
There are three components of lab assessment, LA1, LA2 and Lab ESE.												
IMP: Lab ES	IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%											
Assessment Based on Conducted Typical Schedule (for 26-week Sem)												
		by										
	Lab activities,	Lab Course	During Week 1 to Week 8									
LA1	attendance,	Eab Course	Marks Submission at the end of Week	30								
	journal	Paculty	8									
	Lab activities,	Lab Course	During Week 9 to Week 16									
LA2	attendance,	Eao Course	Marks Submission at the end of Week	30								
	journal	Faculty	16									
Lab ESE	Lab activities,	Lab Course	During Week 18 to Week 19	40								
	journal/	Marks Submission at the end of Week										
	performance	External										

		Examiner as applicable	19			
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include						
performing experiments, mini-project, presentations, drawings, programming, and other suitable						
activities, as per the nature and requirement of the lab course. The experimental lab shall have						
typically 8-10 experiments and related activities if any.						

### Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

			1		,		
				AY 2023-24			
			Со	urse Information			
Progr	amme		B.Tech. (Mecha	nical Engineering)			
Class, Semester Final Year B. Tech., Sem VII							
Cours	e Code		5ME453				
Cours	se Nam	2	Techno Socio A	ctivity			
Desire	ed Requ	isites:					
Т	eachin	g Scheme		Examination S	cheme (Marks)		
Pract	ical	-	LA1	LA2	Lab ESE	Total	
Intera	iction	1 Hrs./Week	15	15	20	50	
				Cred	its: 1		
			C	ourse Objectives			
1	In this will be	course the stud considered.	ent performance	in co-curricular and ext	ra-curricular activ	vities over four year	'S
<ul> <li>The institute, state, national and international level activities are like technical events, Sports, Cultural, Social, and Students Club etc. These activities help the students to develop leadership skills, team integrity, coordination skills, 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>							
Course Outcomes (CO) with Bloom's Taxonomy Level							
At the end of the course, the students will be able to,							
CO Course Outcome Statement/s				Bloom's	s Bloom's	; ;	
	Cour				Level	Descriptio	)n
CO1	CO1 Notice an improvement in his/her understanding and presentation skills.				ion III	Applying	ş

CO2	Understand and value the importance of working in a diversified team/areas.	IV	Analyzing				
CO3	Demonstrate the soft skills like presentation skills, technical report writing etc.	V	Evaluating				
	List of Experiments / Lab Activities						
The pr submi The fa Rubric	The proctor faculty will be mentoring a given student batch for the duration of four years. The students shall submit proof of their achievements in various extra and co-curricular activities from First year to Final year. The faculty will evaluate the students' performance at the end of 8th semester, based on the Rubrics provided by the department from time to time.						
	Text Books						
1	Not applicable.						
	References						
1	Not applicable.						
	Useful Links						
1	Not applicable.						

CO-PO Mapping														
		Programme Outcomes (PO)								PS	0			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1								1					1	1
CO2									2					2
CO3							1						2	
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High														
Each CO	Each CO of the course must map to at least one PO, and preferably to only one PO.													

Assessment						
There are three components of lab assessment, LA1, LA2 and Lab ESE.						
IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%						
Assessment	Based on	Conducted	Typical Schedule (for 26-week Sem)	Marks		

		by				
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30		
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30		
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40		
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.						

Walchand College of Engineering, Sangli					
	(Government Aided Autonomous Institute)				
AY 2023-24					
Course Information					
Programme	B.Tech. (Mechanical Engineering)				
Class, Semester	Final Year B. Tech., Sem VII				
Course Code	5ME401				
Course Name	Mechanical Vibrations				
<b>Desired Prerequisites:</b>	Engineering Mathematics, Engineering Mechanics				

Teaching Scheme			Examinatio	on Scheme (Marl	ks)	
Lecture	3Hrs/week	MSE	ISE	ESE	Total	
Tutorial	-	30	20	50	100	
		Credits: 3				

Course Objectives				
1	To make students aware about causes and effects of the vibration on mechanical systems.			
2	To discuss types of vibrations namely un-damped, damped, free and forced.			
3	To elaborate the process of transmission of force and motion due to vibration.			
4	To demonstrate mechanical vibration measuring instruments			

# Course Outcomes (CO) with Bloom's Taxonomy Level At the end of the course, the students will be able to,

СО	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Explain the basics of vibration, causes and basic elements and its measurement	II	Understanding
CO2	Apply numerical methods in finding natural frequency and corresponding mode shapes of systems	III	Applying
CO3	Analyze linear and torsional systems with single and two degree of freedom under free and forced vibrations, for their natural frequency and response to excitations	IV	Analyzing

Module	Module Contents	Hours
Ι	<b>Introduction</b> Importance and scope, Concepts and terms used, SHM, vector method of representing harmonic motions, Complex method of representing vibration, Fourier series and harmonic analysis, stiffness of springs in combinations.	7
II	<ul> <li>Single degree free and forced vibration: Damped and undamped</li> <li>(a) Undamped free vibrations, derivation of differential equation with solution, energy method, types of damping, free vibrations with viscous damping, logarithmic decrement, coulomb damping, and damping materials.</li> <li>(b) Forced Vibrations: Types of excitation, forced excitation, forced vibrations with constant harmonic excitation, steady state vibration, excitation due to unbalance in machines, support excitation, response due to above types of excitations, transmissibility, force transmissibility and</li> </ul>	8

	motion transmissibility, vibration isolators, commercial isolation materials and shock mounts					
III	Two degree free and forced vibration(a) Free un-damped vibrations – Principal modes and natural frequencies,co-ordinate coupling and principal co-ordinates. (b) Forced vibrations (Undamped) – Harmonic excitation, vibration, dampers and absorbers,dynamic vibration absorber – tuned and Un tuned type	7				
IV	<b>Torsional Vibration</b> Natural frequency of free torsional vibrations, effect of inertia of the constraint on torsional vibrations, free torsional vibrations of a single rotor system, two rotor system and three rotor system. Torsionally equivalent shaft, free torsional vibrations of a geared system.	6				
V	<ul> <li>Vibration Measuring Instruments         Instruments for measurement of displacement, velocity, acceleration and frequency of vibration, introduction of X – Y plotter, spectral analyzers, FFT analyzer.     </li> <li>Introduction to Numerical Methods in Vibration         Holzer method, Releigh's method, matrix iteration method, introduction to F. E. M., Analysis techniques used in vibration (Eigen value analysis)     </li> </ul>	6				
VI	Critical Speed of Shaft Critical speed of a light shaft having a single disc with and without damping, Critical speeds of a shaft having multiple discs, secondary critical speeds	6				
	Text Books					
1	G. K. Grover, "Mechanical Vibration" Nemchand and Brothers, Roorkee, Third	Edition, 2006				
2	Dr. V. P. Singh, "Mechanical Vibrations", S. Chand and Sons New Delhi, S 2004	Second Edition,				
3	J. S. Rao "Introductory Course On Theory And Practice Of Mechanical Vibrat International Publishers, Second Edition, 1999	ions", New Age				
	References					
	Austin Church, "Mechanical Vibrations", Wiley Eastern. First Edition, 1963	r:11 1076				
$\frac{2}{2}$	2 Cyril M. Harris, Charles E. Crede, "Shock and vibration handbook", McGraw-Hill, 1976					
3 S. S. Rao, "Mechanical Vibrations", Fourth Edition, 2006						
	Useful Links					
1	Module 1 - Lecture 1 - Rigid Body Motion - YouTube					
2	2 Introduction old - YouTube					
$\frac{2}{3}$	Mod-1 Lec-1 Overview of the Course, Practical and Research Trends - YouTub	e				
	,					

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

#### Assessment (for Theory Course)

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

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

		W	alchand Col	lege of Engine	ering, Sa	ngli					
			Governmen	$\frac{1}{4} \frac{1}{4} \frac{1}$	Institute)						
			C	AT 2023-24							
Programme B.Tech (Mechanical Engineering)											
Class	. Sem	ester	Final Year B.	Fech., Sem VII	<i>,</i> /						
Cours	se Co	de	5ME402								
Cours	se Na	me	Refrigeration a	Refrigeration and Air Conditioning							
Desir	ed Re	equisites:	8								
Te	achin	g Scheme	MCD	Examination	n Scheme (I	Marks)					
Lectu	re	2Hrs/week	MSE	ISE	ESE		Total				
Tutor	rial	-	30	20	50		100				
				C	realts: 2						
				aurea Obiastivas							
	То	anable the st	idents to analys	ourse Objectives	paration ral	atad problems	hy applying				
1	prin	ciples of math	ematics science	and engineering		ated problems	by apprying				
2	To	prepare studen	ts to use modern	tools, techniques.							
2	То	practice effec	tive communication	ation skill to dem	onstrate re	frigeration/air	conditioning				
3	theo	ories.				_					
4 To develop skills in the analysis of refrigeration/air conditioning/cryogenics system research or design & industrial needs.							es systems in				
<b>5</b> To develop a professional approach to lifelong learning in the							frigeration/air				
	con	ditioning/cryo	genics to include	nics to include the awareness of social and environment issues.							
		Con	neo Autoomos (	CO) with Plaam's	Taxonomi	Loval					
At the	e end	of the course of	the students will	be able to							
		or the course,		<i>be uble to</i> ,		Bloom's	Bloom's				
CO	Cou	irse Outcome	Statement/s			Taxonomy	Taxonomy				
					Level	Description					
CO1	App	oly knowledge	of mathematics.	science, and engin	neering for	III	Applying				
	the	needs in refrig	eration, air cond	itioning and cryog	enic .	117	A 1 ·				
CO2	Ana	lyze different	refrigeration, ai	r conditioning and	cryogenic	IV	Analyzing				
	Eva Eva	luate refriger	applications.	onditioning syste	ms under	V	Fyaluating				
CO3	diff	erent condition	nation & an e	onantioning system	•	Lvalaating					
Module Module Contents							Hours				
	]	Review of The	ermodynamics:								
Laws, Generation			l equations, Pr	ocesses, Equation	s applied t	o processes.					
		Applications o	f refrigeration.								
т		Basic Refriger	ration Cycles:	4 arra1a - C'arra1a - 37			F				
		Larnot cycle,	Reversed Carno	i cycle, Simple Va	apor compre	ession cycle,	5				
		heat exchange	r. Calculations	and performance	of above cy	veles. Actual					
	,	vapor compres	ssion cycle. Bel	l Coleman - Rev	ersed Brvto	n cycle. Air					
		cycles for airci	rafts (Descriptiv	e Treatment).	1,00	,, <b></b>					
II		Multi pressur	e System and H	Refrigerants:			4				

	Multi pressure System Removal of flash gas Flash inter-cooling Water-cooling Multistage	
	Multi-evaporator and Cascade System.	
	<b>Refrigerants:</b> Classification Desirable Properties like Thermodynamic physical &	
	chemical. Comparison among commonly used refrigerants, Selection of	
	Refrigerants,	
	Effect on Ozone depletion and global warming, Alternative Refrigerants.	
	Cryogenics and Vapor Absorption System:	
	Cryogenics: Introduction to cryogenic engineering and application liquefier and	
	cryocoolers.	
ш	Vapor Absorption System:	5
	Aqua Ammonia system, Enthalpy-Concentration chart. analysis of	5
	system Lithium Bromide -water vapor absorption system Coefficient of	
	Performance, Comparison with Vapor Compression cycle. (Descriptive	
	treatment only).	
	Refrigeration Equipments	2
IV	Types of Compressor, Condenser, Evaporator, Expansion devices, & selection use of insulation its types & applications	3
	Psychrometry	
	Moist air as a working substance, Psychrometric properties of air, Use of	
	Psychrometric tables and charts, Processes, Combinations and Colculations ADP, Coil Condition line Sensible heat factor, Pyrass	
v	factor. Air washer and it's applications.	-
	Comfort:	5
	Thermal exchange between human body and environment, factors	
	affecting comfort, effective temperature comfort chart, ventilation	
	Heating and Cooling Load Calculation:	
	Representation of actual air conditioning process by layouts and on	
VI	Psychrometric charts, load analysis, RSHF, GSHF, ESHF, Enumeration	4
	and brief explanation of the factors forming the load on refrigeration and air conditioning systems. Energy requirements of different types of air	4
	conditioning systems, Energy conservation in air conditioning.	
	Text Books	notion Driver
1	Limited third edition 2008	cation Private
2	Roy J. Dossat "Principle of Refrigeration", Pearson, fourth edition, 2007.	
	<b>References</b>	M.C. 11'1'
1	wildert F. Stoecker, industrial refrigeration handbook, 1 <sup>st</sup> edition, Professional Publishing, 1998	McGraw-Hill
2	Wilbert F. Stoecker, Jerold W Jones ,"Refrigeration and Air Conditioning",	McGraw-Hill
	Publishing , 2nd edition ,2008	MO
3	Shan K. Wang, "Handbook of air conditioning and refrigeration" international second edition.	McGraw-Hill
	Useful Links	
1	https://nptel.ac.in/courses/112/107/112107208/	
Z	nups://npte1.ac.m/courses/112/105/112105128/	

	CO-PO Mapping													
	Programme Outcomes (PO)												PS	50
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2												3	
CO2	2	2										1	2	2
CO3	2			2								1		2
T1	41 f	•	1	• • • •	1	т	2. 14.	1. /	, TT. 1			1		

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

#### Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)							
AV 2023-24							
A1 2023-24							
	Course Information						
Programme	B.Tech. (Mechanical Engineering)						
Class, Semester	Final Year B. Tech., Sem VII						
Course Code	5ME411						
Course Name	Finite Element Method						
Desired Requisites:							

Teaching	g Scheme		Examination Scheme (Marks)								
Lecture	3Hrs/week	MSE	MSE ISE ESE Total								
Tutorial	-	30	30 20 50 100								
			Credits: 3								

	Course Objectives
1	To explain the general steps in finite element method.
2	To solve various field problems using finite element method.
3	To apply variational formulation method to solve mechanical engineering problems.
4	To use modern software to simulate structural, thermal and fluid problems.

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At the end of the course, the students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Explain the use of mathematical modeling and FEM.	III	Applying
$CO^{2}$	Use modern tools, software, and equipments to analyze and	IV	Analyzing
002	solve the problems and interpret the data		
$CO^{2}$	Analyze mechanical components, systems and projects	V	Evaluating
CO3	required for industry by using FEM.		_

Module	Module Contents	Hours
Ι	<b>Introduction to FEM</b> Basic concepts of FEM – Historical background, relevance and scope for FEM – need for approximation, applications of FEM in various fields, advantages and limitations of FEM.	6
II	Introduction Discretization, interpolation, shape function, formulation of element characteristics matrices, assembly and solution.	7
III	Introduction, Geometrical approximations, Simplification through symmetry, Basic element shapes and behaviour, Choice of element type, Size and number of elements, Element shape and distortion, Location of nodes, Node and element numbering.	7
IV	Types of elements, order of element. Formulation of element characteristic matrices and vectors for elasticity problems: One dimensional elasticity – two dimensional elasticity, axi-symmetric elasticity. Formulation procedures, the variational formulation, the	7

weighted residual method. Thermal problems, one dimensional heat								
problems.								
Introduction, co- ordinate transformations, assembly of element								
equations, incorporation of the boundary conditions, solution of the	6							
equations, matrix operations, elimination method, penalty method								
Model validity and accuracy, mesh design and refinement, element	_							
distortions, result processing, model checking.	7							
Text Books								
S. S. Rao, "Finite Element Method in Engineering", Elsevier Publication, 4th H	Edition, 2004							
P. Seshu, "Textbook of Finite Element Analysis",1st Edition. 2008.								
M. J Fagan, "Finite Element Analysis- Theory and Practice"; Longman Scient	tific & Technical,							
1st Edition, 1992	,							
· · · · · · · · · · · · · · · · · · ·								
References								
J. N. Reddy, "An Introduction to Finite Element Method", Tata McGraw Hi	ll publication co.							
2nd Edition, 1993	-							
Logan D. L. "A first course in Finite Element Method", Cengage learning, 4th	Edition, 2008.							
O. C, Zienkiewicz "The Finite Element Method – Basic Concepts and Linear Applications",								
<sup>3</sup> Tata McGraw Hill publication co., 5th Edition, 2000								
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Useful Links								
https://nptel.ac.in/courses/112/106/112106135/								
https://nptel.ac.in/courses/112/104/112104115/								
	<ul> <li>weighted residual method. Thermal problems, one dimensional heat transfer, two dimensional heat transfer, Torsional problems, Fluid flow problems.</li> <li>Introduction, co- ordinate transformations, assembly of element equations, incorporation of the boundary conditions, solution of the equations, matrix operations, elimination method, penalty method</li> <li>Model validity and accuracy, mesh design and refinement, element distortions, result processing, model checking.</li> <li><b>Text Books</b></li> <li>S. S. Rao, "Finite Element Method in Engineering", Elsevier Publication, 4th F P. Seshu, "Textbook of Finite Element Analysis", 1st Edition. 2008.</li> <li>M. J Fagan, "Finite Element Analysis- Theory and Practice"; Longman Scient 1st Edition, 1992</li> <li><b>References</b></li> <li>J. N. Reddy, "An Introduction to Finite Element Method", Tata McGraw Hi 2nd Edition, 1993</li> <li>Logan D. L. "A first course in Finite Element Method – Basic Concepts and Line Tata McGraw Hill publication co., 5th Edition, 2000</li> <li><b>Useful Links</b></li> <li>https://nptel.ac.in/courses/112/106/112106135/</li> <li>https://nptel.ac.in/courses/112/104/112104115/</li> </ul>							

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

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

#### Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

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

Walchand College of Engineering, Sangli								
		AY	2023-24	uic)				
		Course	Information					
Program	mme	B.Tech. (Mechan	ical Engineering)					
Class, S	Semester	Final Year B. Te	ch., Sem VII					
Course	Code	5ME412						
Course	Name	Industrial Engine	ering					
Desired Requisites:								
Teaching Scheme (Marks)								
Lecture	Hrs/week	MSE	ISE	ES	SE	Total		
Tutoria		30	20	5	0	100		
	-		Crea	lits: 03	•	100		
		Course	e Objectives					
1	To make the students implementing projects.	to aware about pro	cesses, methods fo	or effectiv	ve plannin	g, controlling,	and	
2	To utilize the tools and	l techniques for solv	ving industrial engi	neering p	roblems.			
3	To apply project mana	gement related tool	s in the industry.					
			·(1 D1 1 D		•			
At the e	Course and of the course, the stur	e Outcomes (CO) v donta will be able to	with Bloom's Taxo	onomy Lo	evel			
At the end of the course, the students will be able to, Bloom's Bloom's								
		Course Outcome Statement/s Taxonomy						
CO	Cou	rse Outcome Stat	ement/s		Taxono Level	my Taxono Descript	omy tion	
<b>CO</b> CO1	Cou Explain methods, proc engineering.	rse Outcome Stat	ement/s es in industrial		Taxono Level III	my Taxono Descript Applyin	omy tion	
CO CO1 CO2	Cou Explain methods, proc engineering. Illustrate the basic con manufacturing and serv	rse Outcome Stat esses, and their type cepts of industrial e vice sector.	ement/s es in industrial ngineering in the		Taxono Level III IV	my Taxono Descript Applyin Analyzi	omy tion ing ing	
CO1 CO2 CO3	Cou Explain methods, proc engineering. Illustrate the basic con manufacturing and ser Examine various tools engineering problems.	rse Outcome Stat esses, and their type cepts of industrial e vice sector. and techniques for	ement/s es in industrial ngineering in the solving the industri	ial	Taxono Level III IV V	my Taxono Descript Applyin Analyzi Evaluat	my tion ing ing ting	
CO CO1 CO2 CO3	Cou Explain methods, proc engineering. Illustrate the basic con manufacturing and ser Examine various tools engineering problems.	rse Outcome Stat esses, and their type cepts of industrial e vice sector. and techniques for	ement/s es in industrial ngineering in the solving the industri	ial	Taxono Level III IV V	my Taxono Descript Applyin Analyzi Evaluat	omy tion ing ing ting	
CO CO1 CO2 CO3 Modu	Cou Explain methods, proceeding engineering. Illustrate the basic con manufacturing and serv Examine various tools engineering problems.	rse Outcome Stat esses, and their type cepts of industrial e vice sector. and techniques for Module	ement/s es in industrial ngineering in the solving the industri e Contents	ial	Taxono Level III IV V	my Taxono Descript Applyin Analyzi Evaluat Hour	omy tion ing ing ting s	
CO CO1 CO2 CO3 Modu	Cou Explain methods, proceeding engineering. Illustrate the basic commanufacturing and serr Examine various tools engineering problems.	rse Outcome Stat esses, and their type cepts of industrial e vice sector. and techniques for <u>Module</u> E., Productivity a	ement/s es in industrial ngineering in the solving the industri e Contents nd PPC	al	Taxono Level III IV V	my Taxono Descript Applyin Analyzi Evaluat	ing ing ing is	
CO1 CO2 CO3 Modu	Cou         Explain methods, proceengineering.         Illustrate the basic commanufacturing and serre         Examine various tools engineering problems.         le         Introduction of I.         Definitions, function of Server and Ser	rse Outcome Stat esses, and their type cepts of industrial e vice sector. and techniques for Module E., Productivity a cions and status ervice sector, Prod	ement/s es in industrial ingineering in the solving the industri e Contents nd PPC of I.E. departme uctivity – concept a	ial nt in Mand objec	Taxono Level III IV V	my Taxono Descript Applyin Analyzi Evaluat Hour ing ors	ing ing ing is	
CO CO1 CO2 CO3 Modu	Cou         Explain methods, proceengineering.         Illustrate the basic commanufacturing and serre         Examine various tools engineering problems.         le         Introduction of I.         Definitions, function of ganization and Saffecting, tools and Saffecting	rse Outcome Stat esses, and their type cepts of industrial e vice sector. and techniques for Module E., Productivity a cions and status ervice sector, Prod nd techniques, Va	ement/s es in industrial ingineering in the solving the industri e Contents nd PPC of I.E. departme uctivity – concept solution lue analysis. Proof PPC Sales foreces	ial nt in M and objec fuction I	Taxono Level III IV V Ianufactur ctives, fact Planning a t methods	my Taxono Descript Applyin Analyzi Evaluat Hour ing ors and of	ing ing ing is	
CO CO1 CO2 CO3 Modu	Cou Explain methods, proc engineering. Illustrate the basic con manufacturing and ser Examine various tools engineering problems. Ie Introduction of I. Definitions, funct organization and S affecting, tools a Control – Element Capacity requirem	rse Outcome Stat esses, and their type cepts of industrial e vice sector. and techniques for Module E., Productivity a cions and status ervice sector, Prod nd techniques, Va ts and functions of ent planning.	ement/s es in industrial ingineering in the solving the industri e Contents nd PPC of I.E. departme uctivity – concept solution lue analysis. Proc 'PPC, Sales foreca	ial nt in N and objec luction I isting and	Taxono Level III IV V Ianufactur ctives, fact Planning a d methods	my Taxono Descript Applyin Analyzi Evaluat Hour ing ors and of	omy tion ing ing ting	
CO CO1 CO2 CO3 Modu	Cou         Explain methods, proceengineering.         Illustrate the basic con manufacturing and ser         Examine various tools engineering problems.         le         Introduction of I.         Definitions, funct organization and Saffecting, tools and Control – Element Capacity requirem         Plant Layout and	rse Outcome Stat esses, and their type cepts of industrial e vice sector. and techniques for Module E., Productivity a tions and status ervice sector, Prod nd techniques, Va ts and functions of ent planning. material handling	ement/s es in industrial ingineering in the solving the industri e Contents nd PPC of I.E. departme uctivity – concept solute lue analysis. Proc PPC, Sales foreca	ial nt in M and object duction I asting and	Taxono Level III IV V Ianufactur tives, fact Planning a d methods	my Taxono Descript Applyin Analyzi Evaluat Hour ing ors and of	ing ing ing rs	
CO CO1 CO2 CO3 Modu	Cou Explain methods, proc engineering. Illustrate the basic con manufacturing and ser Examine various tools engineering problems. Ie Introduction of I. Definitions, funct organization and S affecting, tools a Control – Element Capacity requirem Plant Layout and Plant layout:-Site and tabhigues us	rse Outcome Stat esses, and their type cepts of industrial e vice sector. and techniques for Module E., Productivity a cions and status ervice sector, Prod nd techniques, Va ts and functions of ent planning. material handling selection, principle	ement/s es in industrial ingineering in the solving the industri e Contents nd PPC of I.E. departme uctivity – concept s lue analysis. Proc PPC, Sales foreca	ial nt in M and objec luction I usting and roduction	Taxono         Level         III         IV         V         Ianufactur         etives, fact         Planning at         1 methods         n types, to         ing Meta	my Taxono Descript Applyin Analyzi Evaluat Hour ing ors and of 6	omy tion ing ing ting	
CO CO1 CO2 CO3 Modu I II	Cou         Explain methods, proceengineering.         Illustrate the basic commanufacturing and serres         Examine various tools engineering problems.         le         Introduction of I.         Definitions, function of ganization and Saffecting, tools and Control – Elementic Capacity requirem         Plant Layout and Plant layout:-Site and techniques us handling: - Objection	rse Outcome Stat esses, and their type cepts of industrial e vice sector. and techniques for Module E., Productivity a tions and status ervice sector, Prod nd techniques, Va ts and functions of ent planning. material handling selection, principle ed, maintenance, lin ctive, elements fit	ement/s es in industrial ingineering in the solving the industri e Contents nd PPC of I.E. departme uctivity – concept a lue analysis. Proc PPC, Sales foreca s and objectives, p ine balancing, layou unctions, principle	ial nt in M and objec duction I isting and roduction put plann es. types	Taxono Level III IV V V Ianufactur tives, fact Planning a d methods n types, to ing. Mate of mate	my Taxono Descript Applyin Analyzi Evaluat Hour ing ors and of ols rial 7	ing ing ing is	
CO CO1 CO2 CO3 Modu I II	Cou         Explain methods, proceengineering.         Illustrate the basic consistence on manufacturing and serre         Examine various tools engineering problems.         le         Introduction of I.         Definitions, function         organization and S         affecting, tools at         Control – Elementic         Capacity requirem         Plant Layout and         Plant layout:-Site         and techniques us         handling: - Object	rse Outcome Stat esses, and their type cepts of industrial e vice sector. and techniques for Module E., Productivity a ions and status ervice sector, Prod nd techniques, Va ts and functions of ent planning. material handling selection, principle ed, maintenance, li ctive, elements, fin ts, unit load concep	ement/s es in industrial ngineering in the solving the industrian e Contents nd PPC of I.E. departme uctivity – concept solution lue analysis. Proc PPC, Sales foreca s and objectives, p ine balancing, layou unctions, principle ot, Economics of m	ial nt in M and objec luction I sting and roduction put plann s, types aterial ha	Taxono Level III IV V V Ianufactur ctives, fact Planning a d methods n types, to ing. Mate of mate ndling.	my Taxono Descript Applyin Analyzi Evaluat Evaluat Hour ing ors and of 6	ing ing ing is	
CO CO1 CO2 CO3 Modu I II	Cou         Explain methods, proceengineering.         Illustrate the basic commanufacturing and serres         Examine various tools engineering problems.         le         Introduction of I.         Definitions, function of ganization and Saffecting, tools are         Control – Elementic         Capacity requirem         Plant Layout and         Plant layout:-Site         and techniques us         handling: - Object         Method study	rse Outcome Stat esses, and their type cepts of industrial e vice sector. and techniques for Module E., Productivity a cions and status ervice sector, Prod nd techniques, Va ts and functions of ent planning. material handling selection, principle ed, maintenance, fin ctive, elements, fin ts, unit load concep	ement/s es in industrial ingineering in the solving the industrian e Contents nd PPC of I.E. departme uctivity – concept solution analysis. Proceed PPC, Sales foreca solution analysis, proceed proceed analysis and objectives, principle of the balancing, layor unctions, principle of the conomics of m	ial nt in M and objec duction I usting and roduction out plann ss, types aterial ha	Taxono Level III IV V V Ianufactur tives, fact Planning a d methods n types, to ing. Mate of mate ndling.	my Taxono Descript Applyin Analyzi Evaluat Hour ing ors and of ols rial 7	ing ing ing s	
CO CO1 CO2 CO3 Modu I I II	Cou         Explain methods, proceengineering.         Illustrate the basic con manufacturing and serre         Examine various tools engineering problems.         le         Introduction of I.         Definitions, function organization and Saffecting, tools at Control – Elementic Capacity requirem         Plant Layout and Plant layout:-Site and techniques us handling: - Object handling equipmer         Method study         Definitions, object	rse Outcome Stat esses, and their type cepts of industrial e vice sector. and techniques for Module E., Productivity a tions and status ervice sector, Prod nd techniques, Va ts and functions of ent planning. material handling selection, principle ed, maintenance, li ctive, elements, fu ts, unit load conceptives, various recom	ement/s es in industrial ingineering in the solving the industrial e Contents nd PPC of I.E. departme uctivity – concept s lue analysis. Prod PPC, Sales foreca s and objectives, p ine balancing, layou unctions, principle ot, Economics of m	ial nt in M and object luction H asting and roduction put plann es, types aterial ha methods	Taxono Level III IV V V Ianufactur trives, fact Planning a 1 methods n types, to ing. Mate of mate ndling.	myTaxonoDescriptionApplyinAnalyzinEvaluationEvaluationIng ors and ofIng ools rial rial7ent t6	omy tion ing ing ting s	

	Work measurement						
IV	Definitions, objectives, activity and elements, performance rating, rating						
	methods, allowances, group timing techniques, work sampling, PMTS.						
v	Inventory Control	7					
v	Different Models of Inventory Systems, MRP, Make or Buy decision.	/					
3.71	Network Techniques	(					
VI	CPM and PERT, Construction, Time cost trade off.	0					
	Text Books						
Khanna O.P., "Industrial Engineering and Management", Dhanpat Rai Publications (P) Ltd							
<sup>1</sup> Delhi. Year 2003							
Martand Telsang "Industrial Engineering and Production Management" S. Chand &							
<sup>2</sup> Ltd., New Delhi Year 2003							
	References						
1	Gavrial Salvendy" Handbook of Industrial engineering" John Wiley and sons, New	York, 2007					
2	M. I. Khan "Industrial Engineering" New age international(P) Ltd, New Delhi, 2004						
2	International labour office, "Introduction to work study" Publisher International Lab	our					
3	office, 1969, 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												PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1					2				3				3	
CO2				3	1	2							2	2
CO3					2		2	3						3
The strength of ma	apping	g is to	be wr	itten a	s 1: L	ow, 2	: Med	ium, 3	B: Hig	h				

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

#### Assessment (for Theory Course)

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

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

	Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)										
				AY 2023-24							
			Cou	rse Information	l						
Progr	amm	2	B.Tech. (	Mechanical Engi	ineering)						
Class											
Cours											
Cours	se Nar	ne	Solid Me	chanics							
Desir	ed Pre	reanisites:	Advanced Strength of Materials								
Desir											
Те	eachin	g Scheme		Examinatio	n Scheme	(Marl	(5)				
Lectu	re	3 Hrs/week	MSE	ISE	ESE	(1,1411	Total				
Tutor	rial 🗌	-	30	20	50		100				
Tutor	141			<u> </u>	redits: 3		100				
				C	i cuits. o						
			Co	urse Objectives							
1	To p	rovide students lems in industr	s a sound k	mowledge in stre	ess analys	is requi	ired to solve the				
2	To to	each the mathe	ematical an	d physical princ	iples in u	ndersta	nding the linear				
	conti		1 01 3011 <b>u</b> 3.								
		Course Out	tcomes (CC	)) with Bloom's	Taxonon	ıv Lev	ല				
At the	e end c	of the course th	ne students	will be able to							
		1 110 00 1150, 11		will be usie to,	Bloo	m's	Bloom's				
CO	Сош	rse Outcome S	Statement/s	\$	Taxo	nomv	Taxonomy				
				-	Leve		Description				
CO1	Disc	uss the differer	t concepts	in stress analysis	s. II		Understanding				
coa	Appl	y basic relatio	ns between	n stress and strai	ins III		Applying				
CO2	to so	lve complex pr	oblems in	stress analysis.			11 5 8				
	Anal	yse the deform	ation behav	vior of solids und	der IV		Analyzing				
CO3	diffe	rent types	of load	ing and obta	ain						
	math	ematical soluti	ons for sin	ple geometries.							
Modu	ıle		Modu	le Contents			Hours				
	A	nalysis of Stre	ess and Str	ain							
т	Ir	troduction, C	concepts in	n Stress and S	Strain an	alysis,	7				
1	P	rincipal stresse	es, Govern	ing equations in	cartensic	n and	/				
	p	olar coordinate	es, General	ized Hooke's law	V						
	T	wo Dimension	al Probler	ns in Elasticity							
	P	lane stress an	d plane st	rain problems.	Stress fur	nction,					
II	st	ress function	for plane	stress and plan	ne strain	cases.	6				
	S	olution of tv	vo-dimensi	onal problems	with di	ferent					
	10	ading conditio	ns by the u	se of polynomial	ls.						
III	III Axisymmetric Loaded Members										

	Governing equations, stress in thick walled cylinder under internal and external pressure, stresses in rotating flat solid disk, flat disk with central hole	
	Torsion	
IV	Torsion of prismatic bars of solid section, Membrane analogy, Torsion of thin walled of open cross section and multiple cell closed sections.	7
	Thermal Stresses	
V	Thermoelastic stress-strain relations, Equations of equilibrium, Strain-displacement relations, Thin Circular disk: Temperature symmetric about centre, Long Circular cylinder	7
	Plasticity	
VI	Theoretical concepts of plasticity, The flow curve, True stress and True strain, Yield criteria, Plastic stress strain relationship, Elastic plastic problems in bending. Some engineering applications of elasticity and plasticity	6
	Text Books	
1	S.P. Timoshenko and J.N. Goodier, <i>"Theory of Elasticity"</i> Publishing Co. Ltd., 3 <sup>rd</sup> Edition, 1970.	', McGraw-Hill
2	Beer and Johnston, "Mechanics of Materials", McGraw Hill, 6th	Edition, 2012
3	L.S. Srinath, " <i>Advanced Mechanics of Solids</i> ", Tata McGraw-Co. Ltd, 3 <sup>rd</sup> Edition 2009.	Hill Publishing
	References	
1	Shames, I.H. and Pitarresi, J.M, "Introduction to solid Mechanic learning Pvt. Ltd, 3 <sup>rd</sup> Edition, 2009	cs", PHI
2	Hulse, R and Cain J, "Solid Mechanics", Palgrave publisher, 2nd	Edition, 2004.
3	F.B Seely and Smith, "Advanced Mechanics of Materials", Sons, 2 <sup>nd</sup> Edition, 1978.	John Wiley &
	Useful Links	
1	https://nptel.ac.in/courses/112/101/112101095/	
2	https://nptel.ac.in/courses/105/105/105105177/	
3	https://nptel.ac.in/courses/112/107/112107146/	

CO-PO Mapping														
	Programme Outcomes (PO) PSO													
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2												2	
CO2			2								3	3	2	
CO3	2		2									3	2	
The stree	noth o	fman	ning i	s to he	- writt	en as	$1 \cdot I \circ$	w 2.1	Medin	m 3.	High			

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

#### Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

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

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)									
			AY	2023-24					
			Course	Information					
Progr	amme		B. Tech. (Mechanic	al Engineering)					
Class,	Seme	ster	Final Year B. Tech.	, Sem VIII					
Cours	se Cod	e	5ME491						
Cours	se Nam	e	Project 2						
Desire	ed Req	uisites:	Basic and advanced	concepts and principles in	mechanical en	gineering,			
			graduate level cours	ses. Latest developments in	manufacturing	g technology.			
Т	'eachin	g Scheme		Examination Scheme (I	Marks)				
Practi	ical	12 Hrs./Week	LA1	LA2 La	ab ESE	Total			
Intera	ction	-	30	30	40	100			
				Credits: 6					
			Cours	e Objectives					
1	To he	elp students to id	lentify real life needs	and discuss project require	ments.				
2	To gi	ve technical sol	utions through the lat	est design & development t	ools.				
3	To di	rect students to	compare and analyze	the IT platforms for efficie	ent solutions.				
		~			_				
A 4 41	1 (		rse Outcomes (CO)	with Bloom's Taxonomy I	Level				
At the	end of	the course, the	students will be able	to,	Dia ana ?a				
	Bloom's Bloom's								
CO	Course Outcome Statement/s Taxonomy Taxonom								
CO		Co	ourse Outcome State	ement/s	Taxonomy Level	Taxonomy Description			
СО	Integ	rate project at each area of the contract of	ourse Outcome State	ement/s	Taxonomy Level	Taxonomy Description			
C0 C01	Integ	rate project at ea	ourse Outcome State	ement/s rare development life	Taxonomy Level III	TaxonomyDescriptionApplying			
C0 C01	Integ cycle Reco	rate project at ea	ach stage of the softw	ement/s vare development life s real-world challenges.	Taxonomy Level III IV	Taxonomy       Description       Applying			
CO CO1	Integ cycle Reco Deve	rate project at ea mmend project	ach stage of the softw t plans that addres software projects	ement/s are development life s real-world challenges. that support program's	Taxonomy     Level     III     IV	Taxonomy DescriptionApplyingAnalyzing			
CO CO1 CO2	Integ cycle Reco Deve strate	rate project at ea mmend project lop successful gic goals and sa	ach stage of the softw t plans that addres software projects tisfies the customer r	ement/s rare development life s real-world challenges. that support program's needs.	Taxonomy       Level       III       IV	Taxonomy DescriptionApplyingAnalyzing			
CO CO1 CO2	Integ cycle Reco Deve strate	rate project at ea mmend project lop successful gic goals and sa rate project at ea	ach stage of the softw t plans that addres software projects itisfies the customer r ach stage of the softw	ement/s are development life s real-world challenges. that support program's needs. are development life	Taxonomy       Level       III       IV       V	Taxonomy         Description         Applying         Analyzing         Evaluating			
CO CO1 CO2 CO3	Integ cycle Reco Deve strate Integ cycle	rate project at ea mmend project lop successful gic goals and sa rate project at ea	ach stage of the softw t plans that addres software projects ttisfies the customer r ach stage of the softw	ement/s rare development life s real-world challenges. that support program's needs. rare development life	Taxonomy       Level       III       IV       V	Taxonomy         Description         Applying         Analyzing         Evaluating			
CO CO1 CO2 CO3	Integ cycle Reco Deve strate Integ cycle	rate project at ea mmend project lop successful gic goals and sa rate project at ea	ach stage of the softw t plans that addres software projects tisfies the customer n ach stage of the softw	ement/s rare development life s real-world challenges. that support program's needs. are development life	Taxonomy       Level       III       IV       V	Taxonomy         Description         Applying         Analyzing         Evaluating			
CO CO1 CO2 CO3	Integ cycle Reco Deve strate Integ cycle	rate project at ea mmend project lop successful egic goals and sa rate project at ea	ach stage of the softw t plans that addres software projects ttisfies the customer r ach stage of the softw List of Experiment	ement/s rare development life s real-world challenges. that support program's needs. rare development life ts / Lab Activities/Topics	Taxonomy         Level         III         IV         V	Taxonomy         Description         Applying         Analyzing         Evaluating			
CO CO1 CO2 CO3	Integ cycle Reco Deve strate Integ cycle	rate project at ea mmend project lop successful gic goals and sa rate project at ea pletion of manu	ach stage of the software projects software projects ttisfies the customer n ach stage of the software List of Experiment facturing / processing	ement/s rare development life s real-world challenges. that support program's needs. rare development life ts / Lab Activities/Topics g-assembly / testing / analys	Taxonomy         Level         III         IV         V         sis / simulation	Taxonomy         Description         Applying         Analyzing         Evaluating         work of the			
CO CO1 CO2 CO3	Integ cycle Reco Deve strate Integ cycle	rate project at ea mmend project lop successful egic goals and sa rate project at ea pletion of manu	ach stage of the software projects software projects stisfies the customer mach stage of the software List of Experiment facturing / processing	ement/s rare development life s real-world challenges. that support program's needs. rare development life ts / Lab Activities/Topics g-assembly / testing / analys	Taxonomy         Level         III         IV         V         sis / simulation	Taxonomy         Description         Applying         Analyzing         Evaluating         work of the			
CO CO1 CO2 CO3	Integ cycle Reco Deve strate Integ cycle	rate project at ea mmend project lop successful egic goals and sa rate project at ea pletion of manu ect. ng, result analys	ach stage of the softw t plans that addres software projects ttisfies the customer r ach stage of the softw List of Experiment facturing / processing sis etc.	ement/s rare development life s real-world challenges. that support program's needs. rare development life ts / Lab Activities/Topics g-assembly / testing / analys	Taxonomy         Level         III         IV         V         sis / simulation	Taxonomy         Description         Applying         Analyzing         Evaluating         work of the			
CO CO1 CO2 CO3	Integ cycle Reco Deve strate Integ cycle Com proje	rate project at ea mmend project lop successful gic goals and sa rate project at ea  pletion of manu cct. ng, result analys onstration of the	ach stage of the software projects software projects tisfies the customer r ach stage of the software <b>List of Experiment</b> facturing / processing sis etc.	ement/s rare development life s real-world challenges. that support program's needs. rare development life ts / Lab Activities/Topics g-assembly / testing / analys	Taxonomy         Level         III         IV         V         sis / simulation	Taxonomy         Description         Applying         Analyzing         Evaluating         work of the			
CO CO1 CO2 CO3	Integ cycle Reco Deve strate Integ cycle Com proje Testi Dem Rect	rate project at ea mmend project lop successful egic goals and sa rate project at ea pletion of manu ect. ng, result analysi onstration of the ifications/ correct	ach stage of the softwach stage of the softwach stage of the softwach and the software projects statisfies the customer mach stage of the softwach stage s	ement/s rare development life s real-world challenges. that support program's needs. rare development life ts / Lab Activities/Topics r-assembly / testing / analys ext completed.	Taxonomy         Level         III         IV         V         sis / simulation	Taxonomy         Description         Applying         Analyzing         Evaluating         work of the			
CO CO1 CO2 CO3	Integ cycle Reco Deve strate Integ cycle Com proje Testi Dem Rect nts ar	rate project at ea mmend project lop successful gic goals and sa rate project at ea pletion of manu ect. ng, result analysionstration of the ifications/ correct e encouraged	ach stage of the software projects software projects tisfies the customer rach stage of the software tach stage of the software facturing / processing sis etc. working of the projection if required to be to publish a techn	ement/s rare development life s real-world challenges. that support program's needs. rare development life ts / Lab Activities/Topics g-assembly / testing / analys ect completed. ical paper in conference	Taxonomy         Level         III         IV         V         sis / simulation         e / reputed p	Taxonomy         Description         Applying         Analyzing         Evaluating         work of the			
CO CO1 CO2 CO3	Integ cycle Reco Deve strate Integ cycle Com proje Testi Dem Rect nts ar als bas	rate project at ea mmend project lop successful gic goals and sa rate project at ea pletion of manu ect. ng, result analys onstration of the ifications/ correct e encouraged ed on their min	ach stage of the softwate ach stage of the softwate software projects stisfies the customer mach stage of the software facturing / processing sis etc. working of the projection if required to be to publish a techn in project work.	ement/s rare development life s real-world challenges. that support program's needs. rare development life ts / Lab Activities/Topics r-assembly / testing / analys rect completed. ical paper in conference	Taxonomy         Level         III         IV         V         sis / simulation         e / reputed p	Taxonomy         Description         Applying         Analyzing         Evaluating         work of the			
CO CO1 CO2 CO3 O Stude journa Projec	Integ cycle Reco Deve strate Integ cycle Com proje Testi Dem Rect nts ar als bas ct shall	rate project at ea mmend project lop successful egic goals and sa rate project at ea pletion of manu- ect. ng, result analysionstration of the ifications/ correct e encouraged ed on their min-	ach stage of the software projects software projects tisfies the customer mach stage of the software tach stage of the software tisfies the customer mach stage of the software tisfies the customer mach stage of the software tisfies the customer mach stage of the softwar	ement/s rare development life s real-world challenges. that support program's needs. rare development life ts / Lab Activities/Topics g-assembly / testing / analys ect completed. ical paper in conference ints;	Taxonomy         Level         III         IV         V         vis / simulation         e / reputed p	Taxonomy         Description         Applying         Analyzing         Evaluating         work of the         eeer reviewed			
CO1 CO2 CO3 CO3 Stude journa Project 1. Qua	Integ cycle Reco Deve strate Integ cycle Com proje Testi Dem Recti <b>nts ar</b> <b>als bas</b>	rate project at ea mmend project lop successful gic goals and sa rate project at ea pletion of manu ect. ng, result analys onstration of the fications/ correct e encouraged ed on their min be assessed ba problem and Cl	ach stage of the softwate ach stage of the softwate software projects stisfies the customer r ach stage of the softwate facturing / processing sis etc. working of the projection if required to be to publish a techn ii project work. sed on following poi arity	ement/s rare development life s real-world challenges. that support program's needs. rare development life ts / Lab Activities/Topics g-assembly / testing / analys ect completed. ical paper in conference ints;	Taxonomy         Level         III         IV         V         sis / simulation         e       / reputed p	Taxonomy         Description         Applying         Analyzing         Evaluating         work of the         eeer reviewed			
CO1 CO2 CO3 CO3 Stude journa Project 1. Qua 2. Inno	Integ cycle Reco Deve strate Integ cycle Com proje Testi Dem Rect nts ar als bas ct shall ality of ovative	rate project at ea mmend project lop successful gic goals and sa rate project at ea pletion of manu ect. ng, result analys onstration of the ifications/ correct e encouraged ed on their min be assessed ba problem and Cl ness in solution	ach stage of the softwate plans that address software projects stisfies the customer mach stage of the softwate stage of the project state state stage of the project state sta	ement/s rare development life s real-world challenges. that support program's needs. rare development life ts / Lab Activities/Topics r-assembly / testing / analys r-assembly / testing / analys ext completed. ical paper in conference ints;	Taxonomy         Level         III         IV         V         is / simulation         e / reputed p	Taxonomy         Description         Applying         Analyzing         Evaluating         work of the         eeer reviewed			
CO1 CO2 CO3 CO3 Stude journa Projec 1. Qua 2. Inno 3. Cos	Integ cycle Reco Deve strate Integ cycle Com proje Testi Dem Rect nts ar als bas ct shall ality of	rate project at ea immend project ilop successful egic goals and sa rate project at ea interproject at ea in	ach stage of the software projects software projects stisfies the customer rach stage of the software fach stage of the software facturing / processing sis etc. working of the project ction if required to be to publish a techn in project work. sed on following poin arity stietal impact	ement/s rare development life s real-world challenges. that support program's needs. rare development life ts / Lab Activities/Topics g-assembly / testing / analys ect completed. ical paper in conference ints;	Taxonomy         Level         III         IV         V         sis / simulation         e / reputed p	Taxonomy         Description         Applying         Analyzing         Evaluating         work of the         eeer reviewed			

- 5. Effective use of skill sets
- 6. Effective use of standard engineering norms
- 7. Contribution of an individual's as member or leader
- 8. Fluency in written and oral communication
- 9. Quality of project report

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

CO-PO Mapping														
	Programme Outcomes (PO)											PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3								3			3	3	
CO2	3 3 3 3 2 3 2 1													
CO3		3						3		3	3			1
The stren	The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High													
Each CO	of the	course	must r	nap to	at leas	t one P	O, and	l prefer	ably to	o only	one PC	).		

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

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.

(Government Aided Autonomous Institute)						
AY 2023-24						
Course Information						
Programme	B. Tech. (Mechanical Engineering)					
Class, Semester Final Year B. Tech., Sem VIII						
Course Code	5ME421					
Course Name	Automobile Engineering					
<b>Desired Requisites:</b>	Desired Requisites:					

Teaching	g Scheme	Examination Scheme (Marks)							
Lecture	3 Hrs./week	MSE	ISE	ESE	Total				
Tutorial	-	30	20	50	100				
		Credits: 3							

	Course Objectives
1	To make students familiar with various basic systems of a modern automobile.
2	To introduce the mathematical treatments required for vehicle performance and for some of important systems such as steering system and brake system.
3	To make students aware about latest trends in transportation towards a safe, pollution free and fully automatic vehicle.
4	To survey output doubte to from the most life output of the survey of with survey of a filleness

4	To empower students t	o face the real	life automotive	usage with great	ter confidence.
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Course Outcomes (	(CO) with	Bloom's Taxonomy Level
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At the end of the course, the students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Descriptio n
601	Comprehend about various automotive systems and recent trends	II	Understand
COI	in automobile design, development, manufacturing and assembly.		ing
CO2	Relate concepts of vehicle dynamics with daily experiences.	III	Applying
CO3	Analyze acceleration, barking and steering performance of a	IV	Analyzing
	vehicle in different driving conditions.		

Module	Module Contents	Hours
I	<b>Introduction, classification and Automotive power plants</b> Introduction, Broad classification of Automobiles. Major components and their functions. Types of vehicle layouts, Types of bodies. Requirements of automotive power plants. Comparison and suitability considerations.	4
	Electric and Hybrid vehicles- Layout, advantages and limitations.	
II	Vehicle Performance Resistance to vehicle motion, Air, Rolling and Gradient resistance, Acceleration, Gradeability and draw bar pull, Traction and Tractive effort, Distribution of weight, Power required for vehicle propulsion, Selection of gear ratio, Rear axle ratio.	7
III	Automobile Systems Transmission System : Function, requirement and types of following parts: Automobile clutch Gearbox Differential final drive rear axle propeller shaft	9

	Suspension, Steering Braking and Electrical System:						
	Function, types, requirements of the above mentioned systems. Key concepts of						
	each of the mentioned systems. (Numericals from suspension, steering and						
	braking systems only. Theory part of electrical system)						
	Introduction to Hybrid and Electric Vehicles						
	Electric Vehicles: Architecture of an electric vehicle, essentials and performance						
	of electric vehicles Traction motor characteristics, tractive effort, transmission						
IV	requirements, vehicle performance, energy consumption, advantage and	6					
	limitations.						
	Hybrid Vehicles: Hybrid electric drivetrains concepts, architecture, design,						
	control strategies, merits and demerits.						
	Electric Propulsion Systems & Energy storage devices						
	Electric propulsion systems: DC motor drives, induction motor drives,						
T.	permanent magnet motor drives and switched reluctance motor drives.	-					
V	Energy Storage Devices: Electrochemical batteries, thermodynamic voltage,	/					
	lead-acid batteries, nickel based batteries, lithium based batteries, flywheel and						
	ultra-capacitors, Battery management systems, range calculation.						
	Vehicle Testing and Recent trends in Automotive Development						
	Road Test, free acceleration test, down test, passer by noise test, road load data						
	acquisition for vehicle.						
VI	Test tracks: Proving ground testing, high speed track, pavement track,						
	corrugated track, mud track, steering pad, gradient and other related tests. NVH						
	and crashworthiness of vehicles, Emission norms and control. Recent advances						
	in automobiles.						
	Text Books						
1	Kripal Singh, "Automobile Engineering Vol. II", Standard Publishers Distributors, Tenth 2007	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	Iqbal Husain, "Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2011						
5	Mehrdad Ehsani, YiminGao, Sebastien E. Gay and Ali Emadi, "Modern Electric, Hybrid	Electric and					
5	Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2009.						
	References	4 1 1 1 2					
1	Newton, Steeds and Garrett, "The Motor Vehicle", Butterworths International Edition, 11	th Edition,					
2	1989 Crouse and Anglin "Automotive Mechanics" McGrawhill Publication Tenth Edition 20	)07					
$\left  \begin{array}{c} 2 \\ 3 \end{array} \right $	P W Kett. "Motor Vehicle Science Part - 2." Chanman & Hall" 2nd Edition 1982						
4	James Larminie, "Electric Vehicle Technology Explained". John Wiley & Sons. 2003.						
5	Sandeep Dhameja, "Electric Vehicle Battery Systems", Newnes, 2000						
	Useful Links						
1	https://nptel.ac.in/courses/107/106/107106088/						
2	https://nptel.ac.in/courses/107/106/107106080/						
3	https://ed.iitm.ac.in/~shankarram/Course_Files/ED5160/ED5160_Journal_Complete_Not	es.pdf					
4	http://nptel.ac.in/courses/108103009/						

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

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

#### Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

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

	Walchand College of Engineering, Sangli							
	AV 2023-24							
			Cour	se Information				
Progra	mme		B Tech (Mechanic	cal Engineering)				
Close	Somost	or	Einal Vear B. Tech	Som VIII				
Class,	Semest		5ME421					
Course	Nomo		SIVIE451	d Dynamiaa				
Desine	d Dogu		Computational Flui	la Dynamics				
Desire	a kequ	isites:						
Т	eaching	Scheme		Examination Scheme	(Marks)			
Lectur	'e	3 Hrs/week	MSE	ISE	ESE	Total		
Tutori	al	_	30	20	50	100		
				Credits: 3		100		
			Cou	rse Objectives				
1	To far	niliarize the stu	dents about different	prediction methods and the	role of CFD.			
2	To pr	epare the stude	ents to derive differ	ent forms of governing equ	uations used	in CFD and their		
Z	signifi	cance.						
3	To and	alyze N-S equat	tions and the differen	t numerical techniques used	in CFD.			
4	To tra	in the students t	to select the appropri-	ate conditions to solve the pr	oblem with Cl	FD.		
1	1 0	Co	urse Outcomes (CO	) with Bloom's Taxonomy	Level			
At the	end of t	he course, the s	tudents will be able t	0,				
CO		C		harman 4/a	Bloom's	Bloom's		
CO		Co	ourse Outcome Stat	tement/s	I axonomy	I axonomy Description		
CO1	Summ	arize the predic	tion methods and ba	sic methodology of CFD	II	Understanding		
CO2	Derive	e various govern	ning equations in diff	Ferent forms		Applying		
	Analy	ze the differen	t numerical techniq	ues for solving fluid flow	IV	Analyzing		
CO3	proble	ems.	1			5		
	•					1		
Modu	le		Modul	e Contents		Hours		
	In	troduction						
I	Pr	ediction meth	od, experimental	techniques, analytical me	ethods, CFD	7		
	ap	plication, typica	al problems/ Problem	Solving with CFD – Metho	dology.			
	Co	onservation lav	vs and the model eq	uations	6 1			
п	GO	overning equation	ons of fluid flow a	ind heat transfer, Equations	of the state,	(		
II Navier-Stokes eq			uations for a New	0				
	go	neport equation	ons of fluid flow, Diffuse of n	hysical behavior	of the general			
	E S	act solution of	the Navier-Stokes (	equations and boundary co	nditions			
	In	roduction. Tra	nsformation of the	Governing Partial Different	ial Equations			
III	G	id Generation 7	Techniques.		ar Equations,	7		
	Bo	oundary condition	ions: introduction,	types of boundary condition	ons, Potential			
	pit	falls and final r	emarks.		-			
IV	Ba	sic computatio	nal techniques:			6		
	Finite Difference Formulations: Introductory remarks, Taylor Series Expansions,							

	Finite difference by Polynomials, Finite difference equations, Applications. Finite Volume Method: Introduction, Steady one-dimensional problem, the central discretization schemes, Properties of discretization schemes, Assessment of the central differencing scheme for convection-diffusion problems, 1-D examples, 2-D examples.	
V	<b>Solution methods</b> This chapter deals with basic numerical discretization approaches discussed in earlier chapter and mold them into various techniques that will allow the numerical solution of flow problems. Lax- Wendroff Technique McCormack's Technique, Crank-Nicolson Technique ,Relaxation Technique, ADI Technique, Pressure correction Technique.	7
VI	<b>Post processing</b> Results are usually reviewed in one of two ways. Graphically and Alpha numerically. Graphically: Vector plots, Contours, Iso-surfaces, Flow lines, Animation. Alpha numerical techniques.	6
1	Iext Books Anderson ID "Introduction to Computational fluid Dynamics" McGrayy Hill Dublic	ation 2008
1	Muralidhar K and Sundararaian T "Computational Fluid Flow and Heat T	anon 2008
2	Publishing House 2 <sup>nd</sup> edition New Delhi 2011	
3	Hoffmann K, A "Computational Fluid Dynamics" Publication of engineering education	n system, 2000.
	References	
1	Suhas V. Patankar, "Numerical heat transfer fluid flow", Hemisphere Publishing Corpo	oration, 1980.
2	H. K. Versteeg and W Malalasekera, "Introduction to Computational Fluid Dyna group, 1998.	mics" Longman
3	Fletcher C.A.J., "Computational Techniques for Fluid Dynamics I," Fundament Techniques, Springer-Verlag, 1987	tal and General
	Useful Links	
1	https://nptel.ac.in/courses/112/107/112107208/	
2	https://nptel.ac.in/courses/103/106/103106073/	

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

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

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

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

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

Walchand College of Engineering, Sangli							
(Overnment Autonomous Institute)							
			Course I	nformation			
Progr	amme		B Tech (Mecha	nical Engineering)			
Class	Semester	•	Final Year B Te	ch Sem VIII			
Cours	e Code		5ME433				
Cours	e Name		Condition Monitor	oring of Machines and Sig	mal Processing		
Desire	d Reauis	ites:		string of theorem of and one	,		
	<u>u riequis</u>						
	Teaching	Scheme		Examination Scheme	(Marks)		
Lectur	re	3 Hrs/week	MSE	ISE	ESE	Total	
Tutori	ial	-	30	20	50	100	
				Credits: 3			
			Course	Objectives			
	To mak	e students awar	e of some metho	ods and procedures apr	olied for gene	ral Condition	
1	Monitor	ing.		1 11	8		
2	To make monitor	e students appreciating and vibration-l	te and understand based condition mo	the basic idea behind vibr onitoring, know the genera	ation-based stru Il stages of CM	ctural health	
3	To prep signals	are students capal	ole to apply some	basic techniques for anal	ysis of random	and periodic	
4	To prep	are students awa	re of some basic	instrumentation used for	or machinery	and structural	
	violatio	Course (	5 Dutcomes (CO) wi	ith Bloom's Taxonomy I	evel		
At the	end of the	e course, students	will be able to,				
			· · · · · · · · · · · · · · · · · · ·		Bloom's	Bloom's	
CO		Course	e Outcome Staten	Taxonomy	Taxonomy		
<u> </u>	Calavlat	a tha abarratariati	o of much lower molot	Description			
C01	Annly k	nowledge for prev	entive maintenance			Applying	
	Investig	ate the data for the	troubleshooting vi	Analysing			
CO3	mechani	cal machines		1		, ,	
Modu	le		Module (	Contents		Hours	
_	Тур	es of Maintenanc	e			_	
I	Type	es of maintenance.	, basic idea of heal	th monitoring and conditi	on monitoring	7	
	OI St	ructures and mach	ines. Critical speed	1 of shafts, Some basic lec	nniques.		
II	Stud prop	y of periodic a erties, power sp tral analysis	nd random signa ectral density fur	ls, probability distributinctions of commonly for	on, statistical ound systems,	6	
	Fou	rier Transform					
III	Four appl	ier transform: the transform of the transform to real sign	e basic idea of als, resonant frequ	Fourier transform, inter encies, modes of vibration	pretation and	6	
	Vibi	ration Based Faul	lt Diagnosis				
IV Introduction to vibration			on-based monitori	ng, Machinery condition	monitoring by	6	
1,	vibra	ation analysis: Us	e and selection of	0			
	instr	uments lightights of Cond	ition Monitoring				
v	Typi macl	cal applications of cond hines, unbalance, 1	f condition monito nisalignment, fault	oring using vibration analy ty gears and bearings, vib	vsis to rotating ration problem	7	
		ed to the foundation	on. I ransmissions	of vibration and its isolation	on		
VI	Othe Othe temp	er health monito perature analysis, A	bring techniques, Applications	acoustic emission, oi	l debris and	6	

	Text Books
1	Adams M. L., Rotating Machinery Analysis - from Analysis to Troubleshooting, CRC Press, 2nd edition, 2009
2	Cornelius S., Paresh G., Practical Machinery Vibration Analysis and Predictive Maintenance, Newnes, 1st edition, 2004
3	Mohanty A. R., Machinery Condition Monitoring-Principles and Practices, CRC Press, 1st edition, 2015
	References
1	William J. H., Davis N., Drake P. R., Condition Based Maintenance and Machine Diagnostics, Springer Netherlands , 2nd edition, 1994
2	L.L. Faulkner, Handbook of Industrial Noise Control, Industrial press, 1st edition 1976
3	Rao S. S., Mechanical Vibrations, Pearson education, 5th edition, 2010
	Useful Links
1	https://www.youtube.com/watch?v=aKcDBg8c4hk
2	https://www.youtube.com/watch?v=6dFnpz_AEyA
3	https://nptel.ac.in/courses/112/105/112105232/
4	https://nptel.ac.in/courses/112/105/112105048/

CO-PO Mapping														
				Р	rograi	nme C	Outcon	nes (PC	))				PS	5 <b>0</b>
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1				2					1				1	
CO2							2				2			3
CO3	2		3									2		3
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High														

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

#### Assessment

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MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

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

		W	alchand Colleg	ge of Engineering, S	angli				
			(Government A	ided Autonomous Institute)					
			A	Y 2023-24					
Drogr	ommo		R Tech (Mechani	se information					
Close	Somo	stor	Einel Veer P. Teel	Som VIII					
Class,	Semes		5ME422						
Cours	o Nom		JML432	acomont					
Docino	d Dog	uisitos.	Total Quality Mail	agement					
Desire	eu keq	uisites:							
T	achin	a Sahama		Examination Sahama	(Marks)				
Lootu	ro	2 Hrs/week	MSF		ESE	Total			
Tutor	iel	J IIIS/ WEEK	20	20	50 ESE	100			
Tutor	121	-	50	20 Crodits: 3	50	100			
				Creans, 5					
			Cou	rsa Objectives					
1	Tom	ake the student	Cou	lamental principles of total	auglity mana	aement			
1	Ton	rovide the student	ents the knowledge	of new concents like cus	tomer focus	gemen.			
2	and a	ssociated costs		of new concepts like cus	ionner rocus, c	lustomer retention			
3	To pi	repare the stude	ents for the analysis	and use of various TQM to	ools.				
		Cou	irse Outcomes (CO	) with Bloom's Taxonom	y Level				
At the	end of	the course, the	students will be abl	e to,					
со		Co	urse Outcome Stat	ement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description			
	Unde	rstand on quali	ty management phil	osophies and		Understanding			
CO1	frame	eworks.	ty management phil	osophies and	11	Onderstanding			
CO2	Deve	frameworks.							
	2 Develop in-depth knowledge on various tools and techniques of an Appryng quality management and their application								
	quali Leari	ty management	and their applications of quality tools and	n. n. nd techniques in both	IV	Analysing			
CO3	quali Learn manu	ty management the application the the application	and their applications of quality tools and service industry.	n. nd techniques in both	IV	Analysing			
CO3	quali Learn manu	ty management the application of the application of acturing and s	and their applications of quality tools and their spectrum of a service industry.	n. nd techniques in both	IV	Analysing			
CO3 Modu	quali Leari manu	ty management the application of the application of acturing and s	and their applications of quality tools and service industry.	n. nd techniques in both e Contents	IV	Applying Analysing Hours			
CO3 Modu I	quali Learn manu Ile In D so fr fo	ntroduction ntroduction pervice quality, ramework, qua pocus, customer	and their applications of quality tools and service industry. Module uality, need and ev costs and value of a lity gurus and cont satisfaction, custom	e <b>Contents</b> olution of quality, produc quality, basic concepts of rributions, barriers to TQ er complaints and custome	IV IV t quality and TQM, TQM M, customer r retention	Applying Analysing Hours 7			
CO3 Modu I	quali Learn manu ile In D so fr fc T L en p p	ntroduction ntroduction offinitions of q ervice quality, ramework, qua ocus, customer <b>QM Principle</b> eadership, stra mpowerment, erformance a artnership, su	and their application and their application sof quality tools and service industry. Module uality, need and ev costs and value of of lity gurus and cont satisfaction, custom s ategic quality pla teamwork, quality ppraisal, continuc oplier rating and se	e Contents olution of quality, produc quality, basic concepts of tributions, barriers to TQ er complaints and custome nning, employee involve y circles, recognition a pous process improveme election	IV IV t quality and TQM, TQM M, customer r retention vement and and reward, nt, supplier	Applying Analysing Hours 7 6			

IV	<b>TQM Techniques</b> Just in time (JIT), Quality Function Deployment (QFD), Taguchi quality loss function, TPM- concepts, improvement needs, performance measures	7
V	Quality systems Need for ISO 9000, ISO 9001-9008; Quality system- elements, documentation,; Quality auditing, QS 9000, ISO 14000- concepts, requirements and benefits	6
VI	<b>TQM Implementation</b> TQM implementation in manufacturing and service sectors, casestudies of TQM implementation	6
	Text Books	
1	Besterfield D.H. et al., Total quality Management, 3rd ed., Pearson Educat	tion Asia, 2006
2	Evans J.R. and Lindsay W.M., The management and Control of Qua Cengage Learning, 2012	lity, 8 <sup>th</sup> edition,
3	Janakiraman B. and Gopal R.K., Total Quality Management, Prentice Hall	India, 2006
	References	
1	Juran J.M. & Gryna , Quality Planning and Analysis	
2	Feigenban, Total Quality Control, McGraw Hill Book Company	
3	Suganthi L. and Samuel A., Total Quality Management, Prentice Hall Indi	a, 2006
	Useful Links	
1	https://nptel.ac.in/courses/110/104/110104080/	
2	https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-me26/	

	CO-PO Mapping													
				Р	rograi	nme C	Outcon	nes (PO	<b>D</b> )				PS	<b>50</b>
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1												2	
CO2	2		2					2			1			
CO3	1	3						1						

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

#### Assessment

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		W	alchand Colleg (Government Ai	ge of Engineering, Sa	ngli						
			Α	Y 2023-24							
			Cours	se Information							
Progra	amme		B. Tech. (Mechani	ical Engineering)							
Class,	Semes	ter	Final Year B. Tech	n., Sem VIII							
Cours	e Code		5ME435	,							
Cours	e Namo	2	Computer Integrat	ed Manufacturing							
Desired Requisites:											
Teaching Scheme     Examination Scheme (Marks)											
Lectur	re	3 Hrs/week	MSE	ISE	ESE	Total					
Tutori	ial	-	30	20	50	100					
				Credits: 3							
			Cour	rse Objectives							
1	To ex	pose the studer	nt to the various fund	damentals of computer assis	sted manufact	uring systems.					
2	To ma CAD/	ake the student CAM database	s familiar with criter e for design and man	ria for implementing system nufacturing.	s associated v	with software and					
3	To ex	plain students	about Robotics and	l its allied interdisciplinary	approach, co	omponent design,					
5	sensor	r technology, c	omputer science and	l artificial intelligence.							
		Carr		)	T						
At the	end of	the course the	students will be able	) with Bloom's Taxonomy	Level						
At the		the course, the	students will be ably	c 10,	Bloom's	Bloom's					
СО		С	ourse Outcome Sta	tement/s	Taxonom	y Taxonomy					
					Level	Description					
CO1	Choos way.	se sensors, actu	ators and motion co	onversion devices in logica		Applying					
CO2	Defen	d the workir	ng of Robot sof	tware/ hardware in CIN	[ V	Evaluating					
	Desig	n of the mo	dern information r	processing system through		Creating					
CO3	comp	uters.									
Modu	lle	· •	Modu	le Contents		Hours					
		mputer Integ	rated Manufacturi	ng e components sutomation	and evolution	m					
	of	CIM. Advanta	ges limitations sco	ne and globalization view.		11					
T	- F	Product Develo	pment through CIM								
	In	troduction, pro	duct development	cycle, sequential engineeri	ng, concurre	nt 6					
	en	gineering, con	parison between SH	E and CE, implementation	of CE, CE an	d					
	IT	, soft and h	ard prototyping, c	characteristics of CE, su	ccess of Cl	Ξ,					
тт	ap	plications of C	E.	IM Incolored 41							
		n process and	nost process metho	INI Implementation	NC machina	s   /					
	- 1	n-process and	post process metho	nuologies, integrations of C	inc machine	s,					

	robot in CIM environment. - Communication, software/ Hardware:	
	Availability of software, network topologies for LAN, network interface card and protocols, Network operating systems.	
	- CIM models: Introduction, ESPRIT- CIM OSA model, the NIST- AMRF hierarchical model, the Siemens model, digital equipment corporation model, IBM concept of CIM	
	Computer Aided Process Planning	
III	Structure, information requirements, CAD based process planning, Group Technology, Coding structure, MICLASS system, Variant and generative process planning, Implementation considerations	6
IV	<b>Robotics in CIM</b> Historical development, various terminologies, classification, degrees of freedom and degrees of motion, manipulation of robot components, joints and symbols, work volume, work envelope, accuracy and repeatability, configuration, Numerical examples.	7
V	<ul> <li>Robot Programming and Modular Components</li> <li>Methods, languages, advantages and limitations of robot, requirements for robot in an Industries, specifications of robot, operational capabilities level of robot, modular robot components, wrist mechanism, Numerical examples.</li> <li>Robot Sensors, Actuators and Motion Conversion:</li> <li>Internal and external sensors, force sensors, thermocouples, performance characteristics, standard test signals, controllers, PLC and robotics.</li> <li>Robot actuators, micro grippers, motion conversion systems, harmonic drives, robot safety.</li> </ul>	8
VI	Advanced SystemsHeuristics decision for robot, Fuzzy logic for robot control, Artificial NeuralNetwork for robotics, Biped Robot, Biomimetic robotics, calibration.Shop floor data collection, Automatic data collection, Data acquisition system	5
	Text Books	f= -4
1	Prentice Hall International publication 2004	anulacturing,
2	AppuKuttan K.K, "Robotics", I. K. International publication, 2007.	
3	Groover M.P., Nagel R.N., Ordey N.G. "Industrial Robotics- Technology, Prog Applications," McGraw Hill International, 2012.	gramming and
1	<b>Keterences</b> Pichard M. Murrai, Zaviang Li, S. Shankar Sastry, "Debatic Manipulation," CBC De	2001
2	S.R. Deb. "Robotics Technology and Flexible Automation" Tata McGraw Hill 200	0
3	Urich Rembold, "Computer Integrated Manufacturing Technology and System," 19	95
	Useful Links	
1	https://nptel.ac.in/content/storage2/112/105/112105249/MP4/mod01lec01.mp4	
2	NPTEL Link: https://youtu.be/a6_fgnuuYfE	
3	NPTEL Link: https://youtu.be/49RET0N-ITY	
4	NPTEL Link: https://youtu.be/9fqygvj-O2s	

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

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

#### Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

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

Interview numeric numeri numeric numeric numeric numeric numeric numeric nu			Wal	chand College of	of Engineering, Sa	ngli						
Course Information           Programme         B. Tech. (Mechanical Engineering)           Class, Semester         Final Year B. Tech., Sem VIII           Course Code         SME436           Course Code         SME436           Course Name         Design of Transmission System           Teaching Scheme         Examination Scheme (Marks)           Lecture         3 Hrs/week         MSE         ISE         Total           Totain students in the standard procedure available for design of transmission systems of machines.           2         To provide the students with a nound foundation in the use standard data and catalogues           Course Outcome (CO) with Bloom's Taxonomy Level           At the end of the course, the students will be able to.           Course Outcome Statement/s         Bloom's Taxonomy Level           At the end of the course, the students will be able to.           Course Outcome Statement/s         Bloom's Taxonomy Level           At the end of the course, the students will be able to.         Bloom's Taxonomy Description           CO         Cours				(Oovernment Atdea AV 2	2023-24							
Programme       B. Tech. (Mechanical Engineering.)         Cluss, Semester       Final Year B. Tech., Sem VIII         Course Ode       5ME436         Course Name       Design of Transmission System         Desired Requisites:       Teaching Scheme         Teaching Scheme       Examination Scheme (Marks)         Lecture       3 Hrs/week       MSE       ISE       ESE         Tutorial       -       30       20       50       100         Credits: 3       Credits: 3       -       30       20       50       100         Image: To train students in the standard procedure available for design of transmission systems of machines.       2       To provide the students with knowledge of gear design.       -       -       -       -         3       To provide students with a sound foundation in the use standard data and catalogues       -				Course I	nformation							
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II       Spire Gears       Sear 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       Bevel and Worm Gears       8         III       Bevel and Worm Gears       7         III       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.       7		sn	iu pulleys, selectio	n of noisting wire	ropes and pulleys, des	ign of chains and						
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II       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       Bevel and Worm Gears       8         III       Straight 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.       7         IV       Design of Coar Pay       9		G	ear transmission- sp	beed ratios and num	ber of teeth, force analy	sis, tooth stresses						
Image: International 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.       Image: Imag	П	dy	namic effects, fatig	ue strength, gear ma	aterials; Design of straig	t tooth spur gear	. 8					
Image: In the normal and transverse plane; equivalent number of teeth and forces for helical gears.       Bevel and Worm Gears         Image: Straight 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.       7		an	d parallel axis heli	cal gears based on s	trength and wear consid	lerations, pressure						
Interfact geals.         Bevel and Worm Gears         Straight 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.		an	angle in the normal and transverse plane; equivalent number of teeth and forces for									
III       Straight 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.       7		B	evel and Worm Ge	ars								
III       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.       7         IV       Design of Coar Pay       9		St	raight bevel gear- to	both terminology, to	oth forces and stresses,	equivalent number						
Image: 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.       ////////////////////////////////////	ш	of	teeth. Estimating	the dimensions of a	pair of straight bevel g	gears; Worm gear,	7					
efficiency, estimating the size of worm gear pair. Cross helical gears, terminology, helix angles, sizing of a pair of helical gears.		m	erits & demerits,	terminology, therma	al capacity, materials,	forces & stresses						
nelix angles, sizing of a pair of nelical gears.		ef	ficiency, estimating	the size of worm g	ear pair. Cross helical g	ears, terminology						
	IV	he n	enix angles, sizing of	a pair of helical gea	ГS		<u> </u>					
Gear box- geometric progression, standard step ratio: Ray diagram, kinematics	1 V	G	ear box- geometric	progression stand	ard step ratio: Rav dia	agram, kinematics	O					

	layout; Design of sliding mesh gear box, Design of multi-seed gear box for machine tool applications: constant mesh gear box	
V	Cam Design           Cam design, types: pressure angle and undercutting base circle determination, forces and surface stresses	5
VI	Clutch and Brake Design Design of plate clutches, axial clutches, cone clutches, internal expanding rim clutches; Electromagnetic clutches; Band and Block brakes, external shoe brakes, internal expanding shoe brake.	6
-	Text Books	-
1	Bhandari V.B., Design of Machine Elements, 3rd edition, Tata McGraw-Hill Book Co, 201	.8
2	Shigley J., Mischke C., Budynas R. and Nisbett K., Mechanical Engineering Design, 8t McGraw Hill, 20104.	h edition, Tata
3	Mehta N.K., Machine Tool Design and Numerical Control, 3rd edition, Tata McGraw Hill,	2012
	D. 4	
-	Reterences	
1	Norton R.L., Design of Machinery, McGraw Hill Publication, 3rd edition, 2013	
2	Jindal U.C., Machine Design: Design of Transmission System, Dorling Kindersley, 2010.	
3	Maitra G. and Prasad L., Handbook of Mechanical Design, 2nd edition, Tata McGraw Hill,	2001
4	PSG Design Data Book	
	Useful Links	
1	https://nptel.ac.in/courses/112/106/112106137/	
2	https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-me16/	
3	https://www.digimat.in/nptel/courses/video/112105234/L35.html	

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

#### Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

		W	alchand Colleg (Government Al	ge of Engineerin	<b>g, Sa</b> <sup>(te)</sup>	ngli	
			Α	Y 2023-24			
			Cour	se Information			
Progra	amme		B. Tech. (Mechanic	cal Engineering)			
Class,	Semest	ter	Final Year B. Tecl	n., SEM-VIII			
Cours	e Code		5ME434				
Cours	e Name	2	Gas Dynamics and	Jet Propulsion			
Desire	d Requ	isites:		<b>1</b>			
			I				
Т	eaching	g Scheme		Examination Sc	heme (	Marks)	
Lectur	re	3 Hrs./week	MSE	ISE		ESE	Total
Tutori	ial	-	30	20		50	100
				Credit	:s: 3		
			Cou	rse Objectives			
1	To in	troduce students	about the basic diffe	erence between incomp	oressibl	le and compre	essible flow
2	To pr	ovide knowledg	e related to phenome	non of shock waves ar	nd its e	ffect on flow.	
3	To pr	epare the studen	ts To gain some basi	c knowledge about jet	propul	sion and Roc	ket Propulsion.
A ( 1	1.0		urse Outcomes (CO	) with Bloom's Taxo	nomy l	Level	
At the	end of	the course, the s	tudents will be able t	0,		DI	Dl
CO		C	una Onteema Stat	tom on the		Bloom's	Bloom's
		Cu	ourse Outcome Stat	lement/s		I axonomy	Description
	-			ann in an manaihla	and	П	
CO1	Interr	oret the basic	e difference betw	een incompressible			Understanding
001	Interp comp	oret the basic ressible flow.	e difference betw	een incompressible	unu	11	Understanding
CO2	Interp comp Recog	oret the basic ressible flow. gnize phenomen	c difference betw	nd its effect on flow.		III	Applying
CO2 CO3	Interp comp Recog analy	oret the basic ressible flow. gnize phenomen ze gas dynamics	c difference betw on of shock waves an principles in the Jet	nd its effect on flow. and Space Propulsion		III IV	Applying Analyzing
CO2 CO3	Interp comp Recog analy	bret the basic ressible flow. gnize phenomen ze gas dynamics	e difference betw on of shock waves an principles in the Jet	nd its effect on flow. and Space Propulsion		III III IV	Applying Analyzing
CO2 CO3 Modu	Interp comp Recog analy:	oret the basic ressible flow. gnize phenomen ze gas dynamics	e difference betw on of shock waves an principles in the Jet <b>Modul</b>	and Space Propulsion e Contents		III III IV	Applying Analyzing Hours
CO2 CO3 Modu	Interp comp Recog analy Ile B	oret the basic ressible flow. gnize phenomen ze gas dynamics asic Concepts A	c difference betw on of shock waves an principles in the Jet Modul And Isentropic Flow	een incompressible nd its effect on flow. and Space Propulsion e Contents s		III IV	Applying Analyzing Hours
CO2 CO3 Modu	Interp comp Recog analy Ile Bi En	asic Concepts A	c difference betw on of shock waves an principles in the Jet <b>Modul</b> And Isentropic Flow mentum equations o	een incompressible nd its effect on flow. and Space Propulsion e Contents s f compressible fluid	flows	III IV - Stagnation	Applying Analyzing Hours 7
CO2 CO3 Modu	Interp comp Recog analy Ile Ba En sta	asic Concepts A nergy and mon ates, Mach wave	c difference betw on of shock waves an principles in the Jet <b>Modul</b> And Isentropic Flow nentum equations of es and Mach cone – ]	and Space Propulsion e Contents f compressible fluid Effect of Mach number b Norable and Diffusion	flows r on co	III IV – Stagnatior ompressibility	Applying Analyzing Hours 7
CO2 CO3 Modu	Interp comp Recog analy Ile Bi En st st	asic Concepts A nergy and mon ates, Mach wave Isentropic flow	c difference betw on of shock waves an principles in the Jet <b>Modul</b> And Isentropic Flow nentum equations of es and Mach cone – 1 through variable duct	een incompressible nd its effect on flow. and Space Propulsion e Contents s f compressible fluid Effect of Mach numbe ts – Nozzle and Diffus	flows r on co ers.	III IV – Stagnatior ompressibility	Applying Analyzing Hours 7
CO2 CO3 Modu I	Interp comp Recog analy Ile Ba En str - - Fl	asic Concepts A nergy and mon ates, Mach wave low Through D ows through c	c difference betw on of shock waves an principles in the Jet <b>Modul</b> And Isentropic Flow hentum equations of es and Mach cone – 1 through variable duct ucts onstant area ducts	een incompressible nd its effect on flow. and Space Propulsion e Contents s f compressible fluid Effect of Mach numbe ts – Nozzle and Diffus with heat transfer (1)	flows r on cc ers.	III IV – Stagnatior ompressibility	Applying Analyzing Hours 7
CO2 CO3 Modu I	Interp comp Recog analy Ile Ba En sta - FI FI	asic Concepts A nergy and mon ates, Mach wave lsentropic flow ows through c riction (Fanno fl	c difference betw on of shock waves an principles in the Jet <b>Modul</b> And Isentropic Flow nentum equations of es and Mach cone – I through variable duct ucts onstant area ducts ow) – variation of flo	and Space Propulsion <b>e Contents</b> <b>f</b> compressible fluid Effect of Mach number ts – Nozzle and Diffus with heat transfer (I pow properties.	flows r on co ers. Rayleig	III IV - Stagnatior pmpressibility gh flow) and	Applying Analyzing Hours A A A A A A A A A A A A A A A A A A A
CO2 CO3 Modu I II	Interp comp Recos analy Ile B En str - Fl Fl Fl Fl N	asic Concepts A nergy and mon ates, Mach wave low Through D ows through c riction (Fanno fl ormal And Obl	c difference betw on of shock waves an principles in the Jet <b>Modul</b> And Isentropic Flow hentum equations of es and Mach cone – I through variable duct ucts onstant area ducts ow) – variation of flo lique Shocks	een incompressible nd its effect on flow. and Space Propulsion e Contents s f compressible fluid Effect of Mach numbe ts – Nozzle and Diffus with heat transfer (1 ow properties.	flows r on cc ers. Rayleig	III IV – Stagnatior ompressibility gh flow) and	Applying Analyzing Hours 7 7 1 7
CO2 CO3 Modu I II III	Interp comp Recog analy Ile B En str - Fl Fl Fl Fl Fl Fl Fl Fl G	asic Concepts A nergy and mon ates, Mach wave Isentropic flow low Through D ows through c riction (Fanno fl ormal And Obl overning equation	c difference betw on of shock waves an principles in the Jet <b>Modul</b> And Isentropic Flow hentum equations of es and Mach cone – 1 through variable duct ucts onstant area ducts ow) – variation of flo lique Shocks ions – Variation of	een incompressible nd its effect on flow. and Space Propulsion e Contents s f compressible fluid Effect of Mach numbe ts – Nozzle and Diffus with heat transfer (1 ow properties.	flows r on co ers. Rayleig	III IV - Stagnation ompressibility gh flow) and e normal and	Applying Analyzing Hours Hours A 7 A 7 A 7
CO2 CO3 Modu I II III	Interp comp Recog analy B E S S C F F F F F F F F F S C S C S C S C	asic Concepts A nergy and mon ates, Mach wave lisentropic flow ows through c ciction (Fanno fl ormal And Obl overning equation	c difference betw on of shock waves an principles in the Jet <b>Modul</b> And Isentropic Flow mentum equations of es and Mach cone – 1 through variable duct ucts onstant area ducts ow) – variation of flo lique Shocks ions – Variation of Prandtl – Meyer relat	een incompressible nd its effect on flow. and Space Propulsion e Contents s f compressible fluid Effect of Mach number ts – Nozzle and Diffus with heat transfer (1) ow properties. flow parameters acru- ions – Applications	flows r on co ers. Rayleig	III IV - Stagnatior ompressibility gh flow) and e normal and	Applying Analyzing Hours A 7 A 7 A 7 A 6
CO2 CO3 Modu I II III	Interp comp Recog analy Ile Bi En sta - Fi Fi Fi Fi Fi G ob	asic Concepts A nergy and mon ates, Mach wave low Through D ows through C iction (Fanno fl ormal And Obl overning equation blique shocks – 1 et Propulsion	c difference betw on of shock waves an principles in the Jet <b>Modul</b> And Isentropic Flow hentum equations of es and Mach cone – I through variable duct ucts onstant area ducts ow) – variation of flo lique Shocks tons – Variation of Prandtl – Meyer relat	een incompressible nd its effect on flow. and Space Propulsion e Contents s f compressible fluid Effect of Mach numbe ts – Nozzle and Diffus with heat transfer (I ow properties. flow parameters acre ions – Applications	flows r on cc ers. Rayleig	III IV - Stagnatior ompressibility gh flow) and e normal and	Applying Analyzing Hours A 7 A 7 A 7 A 6
CO2 CO3 Modu I II III	Interp comp Recog analy Ile B En str - Fl Fl Fl Fl Fl Fl Fl Fl	asic Concepts A nergy and mon ates, Mach wave low Through D ows through c riction (Fanno fl ormal And Obl overning equation of Propulsion heory of jet pr	c difference betw on of shock waves an principles in the Jet <b>Modul</b> And Isentropic Flow hentum equations of es and Mach cone – 1 through variable duct ucts onstant area ducts ow) – variation of flo lique Shocks ions – Variation of Prandtl – Meyer relat	een incompressible nd its effect on flow. and Space Propulsion e Contents s f compressible fluid Effect of Mach number ts – Nozzle and Diffus with heat transfer (In we properties. flow parameters acreations flow parameters acreations equation – Thrust po	flows r on co ers. Rayleig	III IIV - Stagnatior ompressibility gh flow) and e normal and	Applying Analyzing Hours Hours A 7 A 7 A 7 A 6 A 7
CO2 CO3 Modu I II III	Interp comp Recog analy: Ile B: En str En str Fi Fi Fi Fi Fi Fi G ob	asic Concepts A asic Concepts A nergy and mon ates, Mach wave low Through D ows through c riction (Fanno fl ormal And Obl overning equation blique shocks – 1 et Propulsion heory of jet pr ficiency – Ope	c difference betw on of shock waves an principles in the Jet <b>Modul</b> And Isentropic Flow mentum equations of es and Mach cone – 1 through variable duct ucts onstant area ducts ow) – variation of flo lique Shocks tons – Variation of Prandtl – Meyer relat opulsion – Thrust of erating principle, cy-	een incompressible nd its effect on flow. and Space Propulsion e Contents s f compressible fluid Effect of Mach number ts – Nozzle and Diffus with heat transfer (1) wy properties. flow parameters acro ions – Applications equation – Thrust po cle analysis and use fan and turbo properties acro	flows r on co ers. Rayleig	III IV - Stagnatior ompressibility gh flow) and e normal and nd propulsive gnation state	Applying Analyzing Hours A 7 A 7 A 7 A 6 A 6 C 7
CO2 CO3 Modu I II III	Interp comp Recog analy Ile Bi En sta - Fi Fi Fi Fi Fi G ob C Ti ef	asic Concepts A nergy and mon ates, Mach wave low Through D ows through C ows through C iction (Fanno fl ormal And Obl overning equation blique shocks – 1 et Propulsion heory of jet pr ficiency – Ope	c difference betw on of shock waves an principles in the Jet <b>Modul</b> And Isentropic Flow hentum equations of es and Mach cone – I through variable duct ucts onstant area ducts ow) – variation of flo lique Shocks tons – Variation of Prandtl – Meyer relat opulsion – Thrust e trating principle, cy- m jet, turbojet, turbo	een incompressible and its effect on flow. and Space Propulsion e Contents s f compressible fluid Effect of Mach number ts – Nozzle and Diffus with heat transfer (1) wy properties. flow parameters acreations ions – Applications equation – Thrust po cle analysis and use fan and turbo prop eng	flows r on cc ers. Rayleig oss the wer ar of sta jines.	III IV - Stagnatior ompressibility gh flow) and e normal and ad propulsive	Applying Analyzing Hours A A A A A A A A A A A A A A A A A A A
CO2 CO3 Modu I II III IV	Interp comp Recog analy Ile Ba En str - FI F1 F1 F1 F1 F1 F1 F1 F1 F1 F1 F1 F1 F1	asic Concepts A nergy and mon ates, Mach wave lisentropic flow low Through D ows through c ciction (Fanno fl ormal And Obl overning equation beory of jet pr ficiency – Ope erformance of ra pace Propulsion ypes of rocke	c difference betw on of shock waves an principles in the Jet Modul And Isentropic Flow hentum equations of es and Mach cone – 1 through variable duct ucts onstant area ducts ow) – variation of flo lique Shocks ions – Variation of Prandtl – Meyer relat opulsion – Thrust of rating principle, cyon m jet, turbojet, turbo of Gas Dynamics Anot t engines – Proper	een incompressible nd its effect on flow. and Space Propulsion e Contents s f compressible fluid Effect of Mach number ts – Nozzle and Diffus with heat transfer (In we properties. flow parameters acreations flow parameters acreations equation – Thrust por cle analysis and use fan and turbo prop eng d Jet Propulsion ellants-feeding system	flows r on co ers. Rayleig oss the wer at of sta jines.	III IV - Stagnation ompressibility gh flow) and e normal and ad propulsive gnation state	Applying Analyzing Hours Hours A 7 A 7 A 7 A 7 A 7 A 7 A 7 A 7 A 7 A 7

VI	Performance Study Performance study – Staging – Terminal and characteristic velocity – Applications – space flights.	6
	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, Ne 1996.	ew Delhi,
	References	
1	Cohen. H., G.E.C. Rogers and Saravanamutto, "Gas Turbine Theory", Longman Group Ltd., 19	980
2	Ganesan. V., "Gas Turbines", Tata McGraw Hill Publishing Co., New Delhi, 2010.	
3	Shapiro. A.H.," Dynamics and Thermodynamics of Compressible fluid Flow", John wiley, No 1953.	ew York,
	Useful Links	
1	https://nptel.ac.in/courses/112/106/112106166/	
2	https://web.iitd.ac.in/~pmvs/course_mcl341.php	
3	https://arc.aiaa.org/loi/jjp	

CO-PO Mapping														
	Programme Outcomes (PO) P										PS	5 <b>0</b>		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2												3	
CO2			2									3	2	2
CO3		2												1
The stren	oth of 1	mannir	no is to	he wr	itten as	$1 \cdot L_{0}$	$w 2 \cdot N$	Iedium	3. H	ioh				

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

#### Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

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

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)							
AY 2023-24							
	Course Information						
Programme	B. Tech. (Mechanical Engineering)						
Class, Semester	Final Year B. Tech., SEM-VIII						
Course Code	5ME437						
Course Name	Combustion						
Desired Requisites:	Desired Requisites:						

Teachin	g Scheme	Examination Scheme (Marks)						
Lecture	3 Hrs./week	MSE	ISE	ESE	Total			
Tutorial	-	30	20	50	100			
			Cred	its: 3				

	Course Objectives							
1	To learn about applications and scope of combustion.							
2	To understand thermodynamics, chemistry and physics of combustion							
3	To learn laminar premixed flame and flame stabilizations.							
4	To learn about the compressors with and without intercooling.							
5	To learn the spray and solid fuel combustion.							

## Course Outcomes (CO) with Bloom's Taxonomy Level At the end of the course, the students will be able to,

CO	<b>Course Outcome Statement/s</b>	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Understand applications and scope of combustion.	II	Understanding
CO2	Understand chemistry and physics of combustion.	II	Understanding
CO3	Analyze premixed flame and diffusion characteristics.	III	Analyzing

Module	Module Contents	Hours
Ι	<b>Introduction:</b> Introduction to combustion, Applications of combustion, Types of fuel and oxidizers, Characterization of fuel, Various combustion mode, Scope of combustion.	6
II	<b>Thermodynamics of Combustion:</b> Thermodynamics properties, Laws of thermodynamics, Stoichiometry, Thermochemistry, adiabatic temperature, chemical equilibrium.	7
III	<b>Chemistry of Combustion:</b> Basic Reaction Kinetics, Elementary reactions, Chain reactions, Multistep reactions, simplification of reaction mechanism, Global kinetics.	6
IV	<b>Physics of Combustion:</b> Fundamental laws of transport phenomena, Conservations Equations, Transport in Turbulent Flow.	7
V	<b>Premixed Flame:</b> One dimensional combustion wave, Laminar premixed flame, Burning velocity measurement methods, Effects of chemical and physical variables on Burning velocity, Flame extinction, Ignition, Flame stabilizations, Turbulent Premixed flame.	6
VI	<b>Diffusion Flame:</b> Gaseous Jet diffusion flame, Liquid fuel combustion, Atomization, Spray	7

Combustion, Solid fuel combustion.

	Text Books								
1	D.P. Mishra, Fundamentals of Combustion, Prentice Hall of India, New Delhi, 2008.								
References									
1	Kuo K.K. "Principles of Combustion" John Wiley and Sons, 2005.								
2	Strehlow R A., "Fundamentals of combustion" McGraw Hill Book Company, 1984.								
	Useful Links								
1	https://nptel.ac.in/courses/112/105/112105123/								
2	https://nptel.ac.in/content/storage2/courses/112104117/ui/Course home-lec6.htm								

CO-PO Mapping														
	Programme Outcomes (PO)										PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3										1	2	2
CO2	3	2	1	2	3			3	3	1	3		2	2
CO3	3	2	1		2	1	1		3					1
The stron	ath of	monnie	a is to	haw	itton of	1.10		Andium	2·U	iah				

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

#### Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

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

Walchand College of Engineering, Sangli (Government Aided Autonomous Institute)										
			A	Y 2023-24						
	Course Information									
Progra	amme		B. Tech. (Mechani	ical Engineering)						
Class,	Semest	ter	Final Year B. Tech	n., Sem VIII						
Course Code 5ME439										
Course Name Mechanical System Design										
Desire	d Requ	isites:	J	6						
Te	eaching	Scheme		Examination Scheme	(Marks)					
Lectur	re	3Hrs/week	MSE	ISE	ESE	Total				
Tutor	ial	-	30	20	50	100				
				Credits: 3						
	T	.1 . 1	Cour	rse Objectives	<u> </u>					
1	To pre	epare the stude	nts to succeed as des	signer in industry/technical	profession.	1, 1, 1				
2	ro Pr proble	ovide students	with a sound found.	dation in mechanical system	n design require	ed to solve the				
3	To tra	in the students	for safe and efficier	nt design of structural parts	of the mechanic	al system.				
	Course Outcomes (CO) with Bloom's Taxonomy Level									
At the	At the end of the course, the students will be able to,									
	Bloom's									
CO		C	aurea Autaama Sta	tomontla	Taxanamy	Taxanamy				
CO		С	ourse Outcome Sta	tement/s	Taxonomy Level	Taxonomy Description				
CO CO1	Expla	C	ourse Outcome Sta	tement/s	Taxonomy Level	TaxonomyDescriptionApplying				
CO CO1	Expla Use J	C in the theory o ohnson's meth	ourse Outcome Sta f pressure vessels an nod of optimum de	tement/s Id gearbox design. esign to design mechanica	TaxonomyLevelIIIIV	TaxonomyDescriptionApplyingAnalyzing				
CO CO1 CO2	Expla Use J compo	in the theory o ohnson's methonents.	ourse Outcome Sta f pressure vessels an nod of optimum de	tement/s ad gearbox design. esign to design mechanica	TaxonomyLevelIIIIV	TaxonomyDescriptionApplyingAnalyzing				
CO CO1 CO2	Expla Use J compo Estim	in the theory of ohnson's methonents. ate the toleran	ourse Outcome Sta f pressure vessels an nod of optimum de aces and reliability	tement/s d gearbox design. esign to design mechanica of mechanical component	Taxonomy       Level       III       IV       V	Taxonomy DescriptionApplyingAnalyzingEvaluating				
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CO CO1 CO2 CO3 Modu	Expla Use J compo Estima and sy le Int op	C in the theory o ohnson's methonents. ate the toleran ystems. croduction to op timum design, timum design	f pressure vessels an nod of optimum de nees and reliability <b>Modu</b> ptimum design for n Johnson's method of like axially loaded n	tement/s ad gearbox design. esign to design mechanicat of mechanical component le Contents nechanical elements, adeque of optimum design- simple nembers, shafts subjected to	Taxonomy       Level       III       IV       V	Taxonomy         Description         Applying         Analyzing         Evaluating         Hours         6				
CO CO1 CO2 CO3 Modu	Expla Use J compo Estimand sy le Int op op bea	C in the theory of ohnson's methonents. ate the toleran ystems. croduction to op timum design, timum design in nding momenta	f pressure vessels an nod of optimum de aces and reliability <b>Modu</b> ptimum design for n Johnson's method c like axially loaded n s, helical spring, leve	tement/s ad gearbox design. ssign to design mechanical of mechanical component le Contents nechanical elements, adeque of optimum design- simple nembers, shafts subjected to ers. Optimum design with i	Taxonomy Level       III       IV       V	Taxonomy         Description         Applying         Analyzing         Evaluating         Hours         6				
CO CO1 CO2 CO3 Modu	Expla Use J compo Estima and sy le Int op op be: mu	C in the theory o ohnson's methonents. ate the toleran ystems. croduction to op timum design, timum design in nding momenta altipliers	f pressure vessels an nod of optimum de nees and reliability <b>Modu</b> ptimum design for n Johnson's method c like axially loaded n s, helical spring, leve	tement/s ad gearbox design. esign to design mechanical of mechanical component le Contents mechanical elements, adeque of optimum design- simple members, shafts subjected to ers. Optimum design with in pandom variables, sample or	Taxonomy Level       III       IV       V	Taxonomy         Description         Applying         Analyzing         Evaluating         Hours         6				
CO CO1 CO2 CO3 Modu	Expla Use J compo Estima and sy le Int op op be: mu (a)	C in the theory of ohnson's methonents. ate the toleran ystems. croduction to op timum design, timum design, timum design adding momenta altipliers Statistics in do production to op	f pressure vessels and nod of optimum de nees and reliability Modul ptimum design for n Johnson's method of like axially loaded n s, helical spring, leve esign, probability, ra	tement/s d gearbox design. esign to design mechanica of mechanical component le Contents nechanical elements, adequ of optimum design- simple nembers, shafts subjected to ers. Optimum design with i andom variables- sample ar pution. Confidence interval	Taxonomy Level       III       IV       V	Taxonomy         Description         Applying         Analyzing         Evaluating         Hours         6				
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CO CO1 CO2 CO3 Modu	Expla Use J compo Estima and sy le Int op op be mu (a) No con	C in the theory o ohnson's methonents. ate the toleran ystems. croduction to op timum design, timum design, timum design, timum design adding moment altipliers Statistics in de ormal distribution mbinations on	f pressure vessels an nod of optimum de nees and reliability <b>Modu</b> ptimum design for n Johnson's method of like axially loaded n s, helical spring, leve esign, probability, ra on, Sampling distribution troductory treatment 5(a)	tement/s ad gearbox design. esign to design mechanical of mechanical component le Contents mechanical elements, adeque of optimum design- simple members, shafts subjected to ers. Optimum design with it andom variables- sample ar pution, Confidence interval t, no questions to be asked	Taxonomy         Level         III         IV         V         V         te and         oroblems in         torsional and         n Lagrange         d populations,         population         n	Taxonomy         Description         Applying         Analyzing         Evaluating         Hours         6         7				
CO CO1 CO2 CO3 Modu I	Expla Use J compo Estima and sy le Int op op be: mu (a) No con exa	C in the theory of ohnson's methonents. ate the toleran ystems. croduction to op timum design, timum design, timum design, timum design adding momenta altipliers Statistics in do ormal distribution mbinations (In aminations on a) Design for points	f pressure vessels and nod of optimum de ices and reliability Modul ptimum design for n Johnson's method of like axially loaded n s, helical spring, leve esign, probability, ra on, Sampling distrib troductory treatment 5(a)	tement/s d gearbox design. esign to design mechanica of mechanical component le Contents nechanical elements, adequ of optimum design- simple nembers, shafts subjected to ers. Optimum design with i andom variables- sample ar bution, Confidence interval t, no questions to be asked atistical analysis of tolerare	Taxonomy Level       III       IV       V	Taxonomy         Description         Applying         Analyzing         Evaluating         Hours         6         7				
CO CO1 CO2 CO3 Modu I	Expla Use J compo Estima and sy le Int op op be: mu (a) No com exa (b)	C in the theory of ohnson's methonents. ate the toleran ystems. croduction to op timum design, timum design, timum design i nding momenta altipliers Statistics in de ormal distributi mbinations (In aminations on ) Design for na roductions to t	f pressure vessels and nod of optimum de aces and reliability Modu ptimum design for n Johnson's method of like axially loaded n s, helical spring, leve esign, probability, ra on, Sampling distrib troductory treatment 5(a) atural tolerances, Sta	tement/s ad gearbox design. esign to design mechanical of mechanical component le Contents mechanical elements, adeque of optimum design- simple members, shafts subjected to ers. Optimum design with it andom variables- sample ar pution, Confidence interval t, no questions to be asked attistical analysis of tolerance blications for selections of the	Taxonomy         Level         III         IV         V         te and         problems in         torsional and         torsional and         n Lagrange         d populations,         population         n         es.         actor of safety	Taxonomy         Description         Applying         Analyzing         Evaluating         Hours         6         7				
CO CO1 CO2 CO3 Modu I	Expla Use J compo Estima and sy le Int op op be mu (a) No con exa (b) Int	C in the theory of ohnson's methonents. ate the toleran ystems. croduction to op timum design, timum design, timum design, timum design of the toleran timum design, timum design of the toleran timum design of toleran timum design of toleran timum design	f pressure vessels and nod of optimum de nees and reliability Modul ptimum design for n Johnson's method of like axially loaded n s, helical spring, leve esign, probability, ra ion, Sampling distribut troductory treatment 5(a) atural tolerances, Star centability and its app canability for design	tement/s ad gearbox design. esign to design mechanical of mechanical component le Contents mechanical elements, adeque of optimum design- simple members, shafts subjected to ers. Optimum design with it andom variables- sample ar pution, Confidence interval t, no questions to be asked attistical analysis of tolerance plications for selections of tolerance	Taxonomy         Level         III         IV         V         V         Ite and problems in torsional and n Lagrange         d populations, population n         ess.         actor of safety,	Taxonomy         Description         Applying         Analyzing         Evaluating         Hours         6         7				
CO CO1 CO2 CO3 Modu I II	Expla Use J compo Estima and sy le Int op op be: mu (a) No co: exa (b) Int stu	C in the theory of ohnson's methonents. ate the toleran ystems. roduction to op timum design, timum design, timum design, timum design, timum design, timum design, timum design of the toleran timum design, timum	f pressure vessels and nod of optimum de ices and reliability Modul ptimum design for n Johnson's method of like axially loaded n s, helical spring, leve esign, probability, ra on, Sampling distribut troductory treatment 5(a) atural tolerances, Stare eliability and its app capability for design h to Design: Mathem	tement/s  d gearbox design.  sign to design mechanica of mechanical component  le Contents nechanical elements, adequ of optimum design- simple nembers, shafts subjected to ers. Optimum design with i andom variables- sample ar bution, Confidence interval t, no questions to be asked atistical analysis of tolerance blications for selections f	Taxonomy         Level         III         IV         V         te and         oroblems in         torsional and         torsional and         n Lagrange         d populations,         a, population         n         es.         actor of safety,	Taxonomy         Description         Applying         Analyzing         Evaluating         Hours         6         7         7				

	Inertia, Damping and friction.				
IV	<ul> <li>Thin and thick cylinders; failure criteria of vessels; Lame's equation;</li> <li>Clavarino's and Birnie's equation; Autofrettage and compound cylinders;</li> <li>Types of pressure vessels-Horizontal and vertical; Classification of pressure</li> <li>vessel as per IS2825, 1969.Introdduction to design of pressure vessels as per</li> <li>IS Codes. Shell and end closures. Effect of opening &amp; nozzles in shell &amp;</li> <li>covers. Types of pressure vessel support</li> </ul>				
V	Determination of variable speed range- Graphical representation of speeds- Structure diagram- Deviation diagram- Ray diagram- Selection of optimum ray diagram- Difference between number of teeth of successive gears in a change gear box- Analysis of twelve speed gear box- Compound ray diagram	6			
VI	Approach to industrial product based on idea generation and innovations to meet the creative process involved in idea marketing, designers, mind-criticism, design process, creation needs of the developing society. Design and development process of industrial products, various steps such as Ergonomics and aesthetic requirements of product design, quality and maintainability consideration in product design, Use of modeling technique, prototype designs, conceptual design	7			
1	V. B. Bhandari , "Design of Machine Element", Tata Mc- Graw Hill Publication 2001	, 4th Edition,			
2	Shigley and C. R. Miscke, "Mechanical Engineering Design", Tata Mc- Graw Hi 2001	ll Publication,			
3	M. F. Spotts, "Mechanical design analysis", Prentice Hall publication, 1964				
4	Black P. H. and O. Eugene Adams, "Machine Design", Tata Mc- Graw Hill Pt Edition, 1993	ublication, 3rd			
5	W. H. Mayall ,"Industrial Design for Engineers", Illife, 1967				
1	Keterences M. V. Joshi, "Drocoss Equinment Design", Macmillen Dublication, 1076				
2	Robert I. Norton "Machine Design" Tata Mc- Graw Hill Publication 2001				
3	Anurag Dixit, "Mechanical System Design", SCITECH publication, 2005				
4	Percy H. Hill "The Science of Engineering Design", Holt McDougal, 1970.				
	Useful Links				
1	https://nptel.ac.in/courses/112/105/112105124/				
2	https://onlinecourses.nptel.ac.in/noc20_ch17/preview				

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	1 2 3 4 5 6 7 8 9 10 11 12								12	1	2		
CO1	3		2									3	3	
CO2			2					2				2	2	2
CO3		2	1	1										1
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High														
Each CO	of the	course	must r	nap to	at leas	t one P	Ю.							

Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

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

Walchand College of Engineering, Sangli										
	(Government Alaea Autonomous Institute) AV 2023-24									
	Course Information									
Progra	Programme B. Tech. (Mechanical Engineering)									
Class,	Class, Semester Final Year B. Tech., SEM-VIII									
Cours	Course Code 5ME438									
Cours	e Nam	e	Product Lifecycle	Management						
Desire	ed Req	uisites:								
T	<b>. : .</b> .	a Cahama		Examination Scheme (	Manley)					
Lootu		2 Urg/wool	MSE	Examination Scheme (	viarks)	Total				
Tutor	re ial	SHIS/Week			50	100				
Tutor		-		Crediter 3	30	100				
	Credits: 3									
			Com	rsa Ahiactivas						
1	Top	ovide the know	ledge of different in	formation systems used in a	n engineering (	enternrises				
1	To jr	npart the recent	t knowledge in the h	proader field of product deve	lopment and v	arious lifecycle				
2	aspec	ts involved	i lillo viteage in the c	founder mond of product dove						
2	Тор	rovide exposure	e to application of s	software tools for addressing	g problems in	product design				
3	and c	levelopment								
		Cou	rse Outcomes (CO	) with Bloom's Taxonomy	Level					
At the	end of	the course, the	students will be abl	e to,						
CO		C			Bloom's	Bloom's				
CO		C	ourse Outcome Sta	itement/s	I axonomy	Description				
	Expl	ain various pha	ses in product life of	cycle and its considerations		Annlying				
CO1	in pr	oduct developm	ent	cycle and his considerations		rippijing				
CO2	Disci	uss PLM backer	nd technologies and	its implementation	IV	Analyzing				
CO3	Appl	y DFX principle	es for product devel	opment	V	Evaluating				
		· • •	•	_						
Modu	le		Modu	le Contents		Hours				
	lr	troduction								
_	Globalization and international business, Global competitiveness and									

Ι	Globalization and international business, Global competitiveness and manufacturing excellence, Operating environment, Business challenges, Emergence of information Age, Data and information management, Role of information systems.	6
II	<b>PLM evolution</b> Pre-PLM era, Sequential engineering, Concurrent engineering, Integrated product process development (IPPD),DFX, Design for manufacturability, Design for assembly, Design for disassembly, Design for environment	7
III	Product Lifecycle Management PLM Need, PLM overview, PLM system architecture, PLM functionalities, PLM systems and its benchmarking	6
IV	Pillars of PLM systems	7

	Computer aided design (CAD), Product data management (PDM), Enterprise								
	relationship management (CRM), Knowledge management (KM)								
	PLM and Database Management System								
V	Database modeling (relational, object-oriented models, web models), Database								
	systems (i.e., databases and rule management), Data warehousing, Databases	6							
	and WWW, XML databases, Information retrieval, Distributed databases,	0							
	Heterogeneous databases and data integration								
	PLM implementation								
VI	PLM implementation, Challenges, Data Interpretability, Business Process	7							
	Reengineering, PLM implementation case studies.								
Text Books									
Stark John, Product Lifecycle Management - 21st Century Paradigm for Product Realization,									
Springer, 2005.									
2 Hoffer J, Prescott M, McFadden F, Modern Database Management, Prentice Hall, 2007.									
References									
1	Ramakrishnan R and Gehrke J, "Database Management Systems", McGraw-Hill Publisher, 2002.								
2	2 Kusiak A, "Concurrent Engineering: Automation, Tools, and Techniques", John Wiley & Sons								
	1993.								
3	Magrab E, Gupta S, McClusky P, Sandborn P, "Integrated Product and Process Design and								
_	Development: The Product Realization Process", CRC Press, 2010.								
Useful Links									
1	https://nptel.ac.in/courses/106/106106220/								
2	https://www.youtube.com/watch?								
	v=LW&TMDwhc/w&list=PLeL2LKQLdbQvCnxVaL8WENwBPtQqTUTm4								
3	www.odoo.com/cloud/plm-software								

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

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