TY B.Tech Mechanical Engineering

Syllabus

AY 2025-26 onwards

SEM-V

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2025-26					
Course Information					
Programme	B. Tech. (Mechanical Engineering)				
Class, Semester	Third Year B. Tech., Sem. V				
Course Code	7ME301				
Course Name	Heat Transfer				
Desired Requisites:					
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	To introduce the various mechanisms of heat and mass transfer that characterizes a given physical system.
2	To make the students familiarize conservation equations along with models for heat transfer processes.
3	To prepare the students for analysis of one-dimensional steady and unsteady partial differential equations.
4	To train the students to develop representative models of real-life heat transfer processes and systems

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	Demonstrate the basic laws of heat and mass transfer and compute heat transfer rates.	III	Applying
CO2	Analyze problems involving steady and transient state heat transfer.	IV	Analysing

CO3	Assess the performance of thermal systems under different operating and geometrical conditions.	V	Evaluating
CO4	Design the two fluid Heat Exchangers for different applications	V	Evaluating

Module	Module Contents	Hours
I	**Introduction** Introduction to Heat transfer, difference between thermodynamics and heat transfer, modes of heat transfer. laws of heat transfer, thermal conductivity coefficient of heat transfer and Boiling & Condensation (Theory part)	4
II	**Conduction** Simple steady state problems in heat conduction, concept of thermal resistance and conductance. General equation of temperature field in three dimensional Cartesian coordinate systems. Application of above (one dimensional case) equation to the system of plane wall (including composite structure) as well as to the system with radial heat conduction i.e. cylinders and Sphere (including composite structures). Steady state conduction one dimensional) through extended surface (fins) of constant cross section. One dimensional steady state heat conduction with uniform heat generation, (plane wall and solid cylinder) critical radius of insulation. Concept of unsteady state heat conduction. Transient heat flow system with negligible internal resistance	9
III	**Radiation** Nature of thermal radiation, definitions of absorptivity, reflectivity, transmissivity, monochromatic emissive power, total emissive power and emissivity, concept of black body and gray body, Kirchhoff laws, Wien's law and Planck's law, deduction of Stefan Boltzmann equation. Lambert's cosine rule, intensity of radiation, energy change by radiation between two black surfaces with non-absorbing medium in between and in absence of reradiating surfaces, geometric shape factor, energy exchange by radiation between two gray surfaces without absorbing medium and absence of radiation and radiosity, radiation network method, network for two surfaces	9
IV	**Free Convection** Mass, momentum and energy conservation equations, non-dimensional numbers, hydrodynamic and thermal boundary layers, basics of heat transfer in external and internal laminar and turbulent flows, and use of co-relations. Free Convection and use of its co-relations	6
V	**Forced Convection** External flow: Thermal analysis of Flow over flat plate, cylinder, sphere and flow across tubes. Internal flow: Convection correlations, Hydrodynamic and thermal considerations, thermal analysis and convection correlations for circular and non-circular tubes.	6
VI	**Heat Exchangers** Exchangers, Tubular heat exchangers, Extended surface heat exchangers. Classification according to flow arrangement. Fouling factor, mean temperature difference, LMTD for parallel flow, counter flow, mean temperature for cross flow, correction factor, and special cases. The effectiveness by NTU method, effectiveness of parallel, counter flow and cross flow heat exchangers and design consideration. Heat pipe component and working principle.(Elementary treatment only) Types of Heat exchangers	5

Text Books

1	P. K. Nag, "Heat Transfer", Tata McGraw Hill Publishing, 3rd Edition, 2011
2	Yunus. A. Cengel, "Heat Transfer – A Practical Approach", Tata McGraw Hill,5th Edition, 2017
3	Incropera and Dewitt, "Fundamentals of Heat and Mass Transfer", Wiley publications, 7th Edition, 2013

References	
1	H. Schlichting , K. Gersten, " Boundary Layer Theory" Springer, 8th Edition, 2000
2	K Ramesh Shah, Dusan P. Sekulic, "Fundamentals of Heat Exchanger Design" Wiley, 5th Edition, 2012
3	J P Holman, Souvik Bhattacharyaa, " Heat Transfer" McGraw-Hill, 10th Edition, 2017
Useful Links	
1	https://nptel.ac.in/courses/112/101/112101097/
2	https://www.youtube.com/watch?v=IedD23t5jI4
3	https://web.iitd.ac.in/~pmvs/course_mel242.php

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1			3									1		
CO2	1	2		3									2	2
CO3			3								2		2	
CO4		3			2	3		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.
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)

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26

Course Information	
Programme	B. Tech. (Mechanical Engineering)
Class, Semester	Third Year B. Tech., Sem. V
Course Code	7ME302
Course Name	Applied Thermodynamics
Desired Requisites:	

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

Course Objectives	
1	To learn about gas and vapor cycles and their first-law and second-law efficiencies
2	To learn about gas dynamics of airflow
3	To learn about compressors with and without inter-cooling.
4	To analyze the performance of steam turbines.

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	Understand various practical power cycles.	II	Understanding
CO2	Recognize phenomena occurring in high-speed compressible flows.	III	Applying

CO3	Analyze energy conversion in various thermal devices such as steam turbines and compressors.	IV	Analyzing
CO4	Evaluate the performance characteristics of compressors and steam turbines using thermodynamic principles.	V	Evaluating

Module	Module Contents	Hours
I	**Combustion** Introduction to solid, liquid, and gaseous fuels – stoichiometry, exhaust gas analysis – the first law analysis of combustion reactions- heat calculations using enthalpy tables – adiabatic flame temperature.	4
II	**Vapor Power Cycles** Revision of basic Rankine Cycle. Rankine cycle with superheating, reheat, and regeneration. Numerical treatment.	8
III	**Gas Power Cycles** Air standard Otto, Diesel, and Dual cycles, Air standard Brayton cycle, the effect of reheat, regeneration and intercooling	8
IV	**Compressible Flow** Basics of compressible flow, stagnation properties, Isentropic flow of a perfect gas through a nozzle, choked flow, subsonic and supersonic flows- normal shocks- use of ideal gas tables for isentropic flow and normal shock flow	5
V	**Compressors** **Reciprocating compressors**: construction, work input, the necessity of cooling, isothermal efficiency, heat rejected, the effect of clearance volume, volumetric efficiency, the necessity of multistage, optimum intermediate pressure for minimum work required, after cooler, free air delivered, air flow measurement, capacity control. **Rotodynamic Air Compressors**: Centrifugal compressor, velocity diagram, theory of operation, losses, adiabatic efficiency, effect of compressibility, diffuser, pre-whirl, pressure coefficient, slip factor, performance.	7
VI	**Steam Turbines** Types of steam turbines, Analysis of steam turbines, velocity and pressure compounding of steam turbines. Numericals on steam turbines.	7

Text Books	
1	P. K. Nag "Engineering Thermodynamics", Tata McGraw Hill Publication, 6th Edition, 2017
2	R. Yadav, "Fundamentals of Thermodynamics", Central Publication house, Allahabad, Revised 7th Edition, 2011

References	
1	Cengel and Boles, "Thermodynamics an Engineering Approach", Tata McGraw-Hill publication, Revised 9th Edition, 2019
2	Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., "Fundamentals of Thermodynamics", John Wiley and Sons, 7th Edition, 2009
3	Moran, M. J. and Shapiro, H. N., "Fundamentals of Engineering Thermodynamics", John Wiley and Sons, 8th Edition, 1999

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
CO4	3	3	3	2									2	2

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

Assessment
The assessment is based on MSE, ISE, and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of a teacher's assessment. The mode of assessment can be field visits, 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)

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Course Information

Programme	B. Tech. (Mechanical Engineering)
Class, Semester	Third Year B. Tech., Sem. V
Course Code	7ME303
Course Name	Engineering Metrology
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2Hr/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	--	30	20	50	100
		Credits: 2			

Course Objectives

1	To elaborate basic concepts of standards and methods of dimensional measurement.
2	To train the students to apply principles of magnification, interferometry and instruments for screw threads and gears inspection.
3	To illustrate the knowledge to students on various concepts of metrology and advanced instruments.

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	Categorize the methods of measurement and errors in measurement.	II	Understand

CO2	Compare and utilize standards and measuring instruments for different dimensional parameters.	III	Apply
CO3	Estimate the limits of gauges and deviation in measurement parameters.	IV	Analyse
CO4	Illustrate the knowledge to students on various concepts of metrology and related advancements.	V	Evaluate

Module	Module Contents	Hours
I	**Linear and angular measurements** Metrology and measurement, Errors in measurement, Slip gauges and other devices of linear measurements; Bevel protractor, spirit level, clinometers, angle dekkor, sine bar, angle slip gauges	5
II	**Tolerances and gauging** Unilateral and bilateral tolerances, limit and fits, types of fits, plain gauges and gauge design, interchangeability and selective assembly	4
III	**Magnification and comparators** Mechanical, optical, electrical, pneumatic methods of magnification, types of comparators	4
IV	**Interferometry** Principles of interferometry and application in checking of flatness and height, types of interferometers	4
V	**Screw thread and Gear Inspection** Errors in screw threads, measurement of various elements of screw threads, floating carriage diameter measuring machine; Errors in gears, checking of individual elements and composite errors, gear tooth vernier caliper, Tool makers microscope, profile projector	5
VI	**Surface Finish Measurement** Types of textures obtained during m/c operation, direction of lay, texture symbols, instruments used in surface finish assessment; Coordinate measuring machine	4

Textbooks	
1	R.K. Jain, “Engineering Metrology”, Khanna Publisher, 2009
2	I.C. GUPTA, “Engineering Metrology”, Dhanpat Rai & Sons, 2018

References	
1	J.F.W. Gayler and C.R. Shotbolt, “Metrology for Engineers”, Cassell, 5th Edition, 2015
2	K.W.B. Sharp, “Practical Engineering Metrology”, Pitman London, 1st Edition 1973

Useful Links	
1	https://nptel.ac.in/courses/112/104/112104250/
2	https://nptel.ac.in/courses/112/106/112106179/
3	https://www.youtube.com/watch?v=7yzvno4AvKw

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2						2					1	2	
CO2	3	1												
CO3			3	2									2	
CO4			2	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
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)

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AY 2025-26

Course Information

Programme	B. Tech. (Mechanical Engineering)
Class, Semester	Third Year B. Tech., Sem. V
Course Code	7ME304
Course Name	Design of Machine Elements
Desired Requisites	Mechanics of Materials, Applied Mechanics

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

Course Objectives

1	To impart knowledge of the fundamental concepts of engineering design**,** including the general design process, various types of loads, factors of safety, and failure theories
2	To develop the ability to design machine components such as shafts, couplings, screws, joints, and springs under static and dynamic loading conditions.
3	To introduce advanced design concepts like fatigue failure, fluctuating loads, and ergonomic/aesthetic considerations for enhancing both safety and usability.

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 design procedures to mechanical components such as shafts,	III	Apply

	couplings, screws, and joints using suitable theories of failure and material properties.		
CO2	Analyze and design machine elements under static, fluctuating, and fatigue loading conditions, ensuring safety and performance.	IV	Analyze
CO3	Demonstrate an understanding of ergonomic and aesthetic considerations in the design of engineering components.	II	Understand
CO4	Select and design appropriate fastening methods such as welded, bolted, and riveted joints for various mechanical assemblies under different load conditions	V	Evaluate / Create

Module	Module Contents	Hours
I	**Basics of engineering design** General Design process and procedure, types of loads, factor of safety- its selection and significance, theories of failure and their applications, aesthetic and ergonomic considerations in design	5
II	**Design of shafts and accessories** Design of solid and hollow shafts based on elastic theories of failure, transmission and line shafts, splined shafts, types of couplings, design of muff, rigid flange and flexible bushed pin type flange couplings, design of keys and splines	6
III	**Design of screws** Forms of threads, design of power screws and nuts, types of induced stresses, efficiency of power screw, self-locking and overhauling properties, introduction to re -circulating ball screw.	7
IV	**Design of joints** Types of welded, bolted and riveted joints, design of welded, bolted and riveted joints subjected to transverse and eccentric loads	7
V	**Design against fluctuating load** Stress concentration - causes and remedies, fluctuating stresses, S-N. diagram under fatigue load, endurance limit, notch sensitivity, endurance strength- modifying factors, design for finite and infinite life under reversed stresses, cumulative damage in fatigue failure, Soderberg and Goodman diagrams, modified Goodman diagram, fatigue design for components under combined stresses such as shafts, and springs.	7
VI	**Design of Springs** Helical springs, design against static load, design against fluctuating load, optimum design of springs, types of springs and its design.	7

Text Books	
1	V. B. Bhandari, “Design of Machine Elements”, Tata McGraw Hill Publication, 3rd Edition, 2008
2	J.F. Shigley, “Mechanical Engineering Design”, McGraw Hill Publication, 8th Edition, 2008
3	R. L. Norton, “Design of Machinery”, McGraw Hill Publication, 3rd Edition, 2003

References	
1	Timothy Wentzell, “Machine Design”, Cengage Learning, 1st Edition, 2009
2	M. F. Spotts, T.E Shoup, Hornberger, Jayaram, Venkatesh, “Design of Machine Elements”, Pearson Education, 8th edition, 2011
3	PSG Design Data Book, Third Edition, 1978

Useful Links	
1	https://nptel.ac.in/courses/112/105/112105124/

CO-PO Mapping

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

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)

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Course Information	
Programme	B. Tech. (Mechanical Engineering)
Class, Semester	Third Year B. Tech., Sem. V
Course Code	7ME351
Course Name	Heat Transfer Lab
Desired Requisites:	

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

Course Objectives	
1	Introduce the various mechanisms of heat and mass transfer that characterizes a given physical system.
2	Formulate conservation equations along with models for heat transfer processes and use of analytical to solve one-dimensional steady and unsteady partial differential equations.
3	To develop representative models of real processes and systems and draw conclusions concerning process/system design or performance from attendant analysis.
4	To develop a professional approach to lifelong learning in design of some thermal systems to include the awareness of social and environment issues associated with engineering practices.

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	Understand the basic laws and concepts of Conduction, Convection and Radiation, Boiling and Condensation heat transfer.	II	Understanding
CO2	Analyze problems of Radiation, Convection Heat Transfer and problems involving steady and transient state heat conduction in simple geometries.	IV	Analyzing
CO3	Evaluate the heat exchanger performance by using the method of log mean temperature difference and effectiveness methods.	V	Evaluating
CO4	Make a decision on effective heat transfer device /system	V	Evaluate

List of Experiments / Lab Activities

List of Experiments:
Following practicals should be considered for ISE and ESE evaluation.

Experiments

1. To find Thermal Conductivity of metal bar, insulating powder.
2. To find thermal conductivity of Composite wall and evaluate the performance of Pin fin.
3. To verify the Stefan –Boltzmann constant and find the emissivity of non-black surface.
4. To find the Heat Transfer coefficient in Natural Convection.
5. To find the Heat Transfer coefficient in Forced Convection.
6. Trial on Heat exchanger – parallel / counter flow.
7. To conduct the experiment on Pool Boiling, critical heat flux.
8. To find the Heat Transfer coefficient in Drop and film condensation.
9. Experiment on unsteady state heat transfer.
   Trial on compact heat exchanger and its performance

Demonstration / Study

1. Heat Pipe Demonstration.
2. Various applications of heat exchanger in process and food industries.
3. Visit to / Demonstration of Heat exchanger manufacturing plant/dairy plant

Text Books

1	P. K. Nag, "Heat Transfer", Tata McGraw Hill Publishing, 3rd Edition, 2011
2	Yunus. A. Cengel, "Heat Transfer – A Practical Approach", Tata McGraw Hill, 5th Edition, 2017
3	Incropera and Dewitt, "Fundamentals of Heat and Mass Transfer", Wiley publications, 7th Edition, 2013

References

1	H. Schlichting , K. Gersten, " Boundary Layer Theory" Springer, 8th Edition, 2000
2	K Ramesh Shah, Dusan P. Sekulic, "Fundamentals of Heat Exchanger Design" Wiley, 5th Edition,2012
3	J P Holman, Souvik Bhattacharyaa, " Heat Transfer" McGraw-Hill, 10th Edition, 2017

Useful Links

1	https://nptel.ac.in/courses/112/101/112101097/
2	https://www.youtube.com/watch?v=IedD23t5jI4
3	https://web.iitd.ac.in/~pmvs/course_mel242.php

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									2		2	
CO3	2	2	2		1						2		2	2
CO4				2		2								
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

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

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Course Information	
Programme	B. Tech. (Mechanical Engineering)
Class, Semester	Third Year B. Tech., Sem. V
Course Code	7ME352
Course Name	Applied Thermodynamics Lab
Desired Requisites:	

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

Course Objectives	
1	To learn about different power cycles
2	To develop the student's skills in applying the isentropic flow and normal shock to some flow systems.
3	To develop students' ability to investigate the engines and rotodynamic machines' performance.

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	Understand different power cycles	II	Understanding

CO2	Analyze the sonic, subsonic, and supersonic flow situations	IV	Analyzing
CO3	Investigate the performance of the engines and rotodynamic machines.	III	Applying

List of Experiments / Lab Activities

List of Experiments:

1. Study of factors affecting the performance of the Rankine cycle through numerical.
2. Study of reheat cycle with the help of numerical.
3. Study of the regenerative cycle with the help of numericals
4. Study of factors affecting the performance of Gas Power cycles through numericals.
5. Study of stagnation properties through numericals.
6. Study of centrifugal compressor and its performance through numericals.
7. Study of velocity and pressure compounding in steam turbines.

List of experiments (Trial/Demonstration type)

8. Trial on a gasoline engine to understand air standard Otto cycle.
9. Trial on diesel engine to understand air standard Diesel cycle.
10. Trial on the reciprocating compressor.
11. Trial on steam power plant and demonstration on Power Plant simulator.
12. Trial of Gas Power Plant on the simulator.

Text Books

1	P. K. Nag "Engineering Thermodynamics", Tata McGraw Hill Publication, 2017, 6th Edition
2	R. Yadav, "Fundamentals of Thermodynamics", Central Publication house, Allahabad, 2011, Revised 7th Edition

References

1	Cengel and Boles, "Thermodynamics an Engineering Approach", Tata McGraw-Hill publication, Revised 9th Edition, 2019
2	Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., "Fundamentals of Thermodynamics", John Wiley and Sons, 7th Edition, 2009
3	Moran, M. J. and Shapiro, H. N., "Fundamentals of Engineering Thermodynamics", John Wiley and Sons, 8th Edition, 1999

Useful Links

1	https://www.youtube.com/watch?v=v36FiXcxt0k&list=PLkUEX3IbW7leYWEB0baTgg6SbS2zVE-Au&index=3
2	https://www.youtube.com/channel/UC-znD1sQHOQIRqZBrs1UJbA/videos

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2											1	2
CO2	3	2	1		3			3	3		3		1	2
CO3	3	2	3		2	1			3				1	
CO4	2	2			2			2	2		3		1	2

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO, 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. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 5 Marks Submission at the end of Week 5	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 6 to Week 9 Marks Submission at the end of Week 9	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 10 to Week 12 Marks Submission at the end of Week 12	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

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AY 2025-26

Course Information	
Programme	B. Tech. (Mechanical Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	7ME353
Course Name	Engineering Metrology and Manufacturing Technology Lab
Desired Requisites:	

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

Course Objectives	
1	To elaborate various manufacturing processes and techniques for measuring the dimensions of manufactured parts.
2	To explore the importance of measurement of various parameters of linear and angular measurement and their characteristics.
3	To illustrate the knowledge to students on various concepts of manufacturing processes and metrology.

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	Use manufacturing processes and measuring instruments.	III	Applying
CO2	Calibrate and analyse metrological instruments used for dimensional and related measurements.	IV	Analysing
CO3	Illustrate the knowledge to students on various concepts of manufacturing processes and metrology.	V	Evaluating
CO4	Develop simple component by machining operations.	VI	Create

List of Experiments / Lab Activities/Topics

List of Lab Experiments/ Activities:

Part A: Manufacturing Processes

1. Simple job having Lathe, Milling machine operation [4 Hrs].
2. Demonstration on CNC / VMC machine [2Hrs].
3. Study and demonstration of 3-D Printing [2Hrs].
4. Study and demonstration of Non-Conventional Machining Processes: EDM, WEDM [2 Hrs].
5. Study and demonstration on Micromachining centre setup [2 Hrs].
6. Study and demonstration of Laser machining [2Hrs].

Part B: Metrology

1. Calibration of metrological instruments.
2. Angular measurements.
3. Study and use of principles of comparator and interferometry.
4. Screw thread measurement.
5. Gear inspection.
6. Study and use coordinate measuring machine.

Textbooks

1	R.K. Jain, "Engineering Metrology", Khanna Publisher, 21st Edition
2	I.C. GUPTA, "Engineering Metrology", Dhanpat Rai & Sons, 2nd Edition, 1988
3	P.N. Rao, "Manufacturing Technology- Metal cutting and Machine tools", Vol. 2 Tata McGraw-Hill, 4th edition, 2018
4	P.C. Sharma, "A Textbook of Production engineering", S. Chand & co, 2006. ISBN: 9788121901116

References

1	J.F.W. Gayler and C.R. Shotbolt, "Metrology for Engineers", Cassell, 1990
2	K.W.B. Sharp, "Practical Engineering Metrology", Pitman London, 1st Edition 1973
3	Serope Kalpakjian, Steven R. Schmid, "Manufacturing Engineering and Technology", Pearson (Prentice Hall), Fifth Edition, 2005
4	HMT, "Production Technology", Tata McGraw-Hill Publications. Ltd., 2017 ISBN: 978-0070964433 ,New Delhi

Useful Links

1	https://www.youtube.com/watch?v=FqSJhY_lctc&list=PLkUEX3IbW7le4Okwm_qe4a1h6634USZTi
2	https://www.youtube.com/watch?v=5--saq-oYBE&list=PLrcSDk_gQ7jiQCfWEzw93ZMaxHkg2v-CC
3	https://www.youtube.com/watch?v=7yzvno4AvKw
4	http://msvs-dei.vlabs.ac.in/msvs-dei/ [http://vlabs.iitb.ac.in/vlab/labsme.html]
5	https://www.vlab.co.in/broad-area-mechanical-engineering
6	https://www.youtube.com/watch?v=on_juMwWrc4
7	https://www.youtube.com/watch?v=68LWCNGDvls
8	https://www.youtube.com/watch?v=tJ7bhA4EgO4

9	https://www.youtube.com/watch?v=kyeDtbmCSgw

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1			3			2							2	
CO2			3			2							2	
CO3				3								2	2	
CO4			1								1		2	
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

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

SEM - VI

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2025-26					
Course Information					
Programme	B. Tech. (Mechanical Engineering)				
Class, Semester	Third Year B. Tech., Sem. VI				
Course Code	7ME321				
Course Name	Machine Design				
Desired Requisites:	Mechanics of solids, Design of Machine Elements, Metallurgy				
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	--	30	20	50	100
		Credits: 4			
Course Objectives					
1	To design and analyze mechanical components such as gears, bearings, clutches, brakes, and belt drives.				
2	To select appropriate machine elements using design standards and manufacturer catalogues.				
3	To evaluate component performance based on strength, efficiency, and safety criteria.				
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	Classify and describe various mechanical components like gears, bearings, and belt drives based on their applications.	III	Understanding
CO2	Analyze forces, stresses, and material behavior to design machine elements under different loading conditions.	IV	Analysing
CO3	Evaluate the performance and safety of components using design theories and validate with catalog data.	V	Evaluate
CO4	Design and recommend appropriate machine components for given applications using design standards and tools.	VI	Creating

Module	Module Contents	Hours
I	**Design of Gears** Classification and selection of spur and helical gears, terminology, force analysis, beam strength and wear strength based gear design, design for maximum power transmission capacity	8
II	**Design of rolling contact bearing** Design and analysis of rolling contact bearings, selection of bearings from manufacturer's catalogue	6
III	**Design of Belt drives** Types of belts, maximum power transmission, selection from manufacturer's catalogue	5
IV	**Design of sliding contact bearing** Design and analysis of sliding contact bearings, hydrodynamic and hydrostatic bearings, Reynold's equation and numerical solutions using dimensionless parameter	7
V	**Design of clutches and brakes** Uniform pressure and wear theory, types of clutches and brakes (band and internal expanding) and their design	7
VI	**Cylinders and pressure vessels** Thin and thick cylinders, Lame's equation, Clavarino's and Birnie's equation, Autofrettage	6
ISE – 50% weightage of ISE is assigned for designing a Mechanical system. The design can include theoretical designing of components, solid modelling, report preparation.		

Textbooks	
1	V. B. Bhandari, "Design of Machine Elements", Tata McGraw Hill Publication, 3rd Edition, 2008
2	J.F. Shigley, "Mechanical Engineering Design", McGraw Hill Publication, 8th Edition, 2008
3	R. L. Norton, "Design of Machinery", McGraw Hill Publication, 3rd Edition, 2003

References	
1	Timothy Wentzell, "Machine Design", Cengage Learning, 1st Edition, 2009
2	M. F. Spotts, T.E Shoup, Hornberger, Jayaram, Venkatesh, "Design of Machine Elements", Pearson Education, 8th edition, 2011
3	PSG Design Data Book, Third Edition, 1978

Useful Links	
1	https://nptel.ac.in/courses/112/105/112105124/

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	
CO1	1		1									1	2	
CO2	1	1	2	2									1	
CO3	1	2	3	3								1	2	
CO4	2	2	3						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. 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)

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26

Course Information

Programme	B. Tech. (Mechanical Engineering)
Class, Semester	Third Year B. Tech., Sem. VI
Course Code	7ME322
Course Name	Mechatronics and Automation
Desired Requisites:	

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

Course Objectives

1	Understand the mechatronic system, usage and advantages of mechatronics.
2	To understand the importance of automation in the of field machine tool based manufacturing.
3	To get the knowledge of various elements of manufacturing automation-CAD/CAM, sensors, pneumatics, hydraulics and CNC.

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	Identify basic elements of mechanical, electrical, and control systems for automation and analyze them.	III	Applying

CO2	Employ use of mechatronic system, software's, controllers and optimization techniques for automation systems.	IV	Analysing
CO3	Verify automation systems knowledge into various modern applications.	V	Evaluate
CO4	Create a compact, dedicated PLC solution for targeted industrial automation.	VI	Create

Module	Module Contents	Hours
I	**Introduction to Mechatronics** Origin, Scope, History, Evolution. Definition, Application of Mechatronics- Design and modelling, software integration, motion control, Vibration and noise control, microsystems, optics	6
II	**Sensors and Transducers** Role of measurement systems, Sensors in mechatronic systems, classification of sensors, Performance Terminology, Selection of sensors, Types of transducers, Displacement and position measurement, Inductive transducers, Capacitive transducers, piezoelectric transducers, Sensors for robotic systems, Photoelectric transducers, Flow sensors, Thermal transducers, SONAR, Other transducers	7
III	**Signal Conditioning and Controls** Signal generation, Transformers, Semiconductors, Signal manipulation and conversion, ADC and DAC. Relay and contactors. Microprocessor, Microcontroller, PLC, Arduino and Raspberry Pi controllers	7
IV	**Introduction to Automation** Why automation, current trends, Rigid automation Introduction, Mechanisation vs automation, Applications, Goals, Social issues, Low cost automation, Types, Reasons for automation, Issues, Ten strategies.	5
V	**NC and CNC** NC and NC part programming, CNC- adaptive control, automated material handling, assembly, flexible fixtures. **Computer Aided design** Fundamentals of CAD- Hardware in CAD- Computer graphics software and data base, Geometric modeling for downstream applications and analysis methods **Modeling and Simulation** Product design, process route modeling, optimization techniques, case studies and industrial applications	7
VI	**Robotics and automation** Introduction to robotics, mechanical and electro mechanical systems, pneumatics and hydraulics, Illustrative examples and case studies	7

Textbooks	
1	Mikell P. Groover, "Automation, Production systems and computer integrated manufacturing", Prentice Hall, 2007
2	Serope Kalpakjain and Steven R. Schmid, "Manufacturing Engineering and Technology", 7th edition, Pearson, 2013
3	Ibrahim Zeid, CAD/CAM : Theory & Practice, 2nd edition, 2006
4	R.K.Rajput - A textbook of mechatronics, - Education asia.

References

1	YoramKoren, “Computer control of manufacturing system”, McGraw Hill, 1st edition, 2017
2	Webb and Reis, “Programmable Logic Controller – Principles and Applications”, Prentice Hall of India, 5th Edition, 2002
3	Kolk R.A. and Shetty Devdas, “Mechatronics System Design”, Thomson Learning, 2007, 3rd Edition
4	Bolton - Mechatronics - Pearson Third edition
Useful Links	
1	https://nptel.ac.in/courses/112/103/112103293/
2	https://onlinecourses.nptel.ac.in/noc20_me58/preview
3	https://nptel.ac.in/courses/112/104/112104288/
4	https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-me58/

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1												
CO2		1	2		1								2	
CO3	1			1	2	1							2	
CO4				1		2							2	

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

Assessment

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

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26

Course Information	
Programme	B.Tech. (Mechanical Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	7ME323
Course Name	Computational Methods for Structures and Fluids
Desired Requisites:	

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

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	Explain the use of mathematical modeling and FEM.	II	Understanding

CO2	Use modern tools, software, and equipment's to analyze and solve the problems and interpret the data	III	Applying
CO3	Analyze mechanical components, systems and projects required for industry by using CFD	IV	Analyzing
CO4	Analyze mechanical components, systems and projects required for industry by using FEM.	IV	Analyzing

Module	Module Contents	Hours
I	**Introduction to FEM** 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
I V	Introduction to CFD Philosophy of CFD, Governing equations of Fluid Dynamics, Presentations of Forms particularly suited for CFD, Mathematical behavior of PDEs	7
V	Basic Aspects of Discretization Finite Difference Method, Explicit Implicit approach, Errors and Stability analysis: A broader perspective, properties of discretization schemes, Solution techniques using FDM	6
VI	Finite Volume Method Introduction, FVM for one dimensional diffusion problem, steady state one dimensional convection diffusion problems, different schemes, assessment of different schemes.	7

Text Books	
1	S. S. Rao, “Finite Element Method in Engineering”, Elsevier Publication, 4th Edition, 2004
2	P. Seshu, “Textbook of Finite Element Analysis”,1st Edition. 2008.
	M. J Fagan, “Finite Element Analysis- Theory and Practice”; Longman Scientific & Technical, 1st Edition, 1992
References	
1	J. N. Reddy, “An Introduction to Finite Element Method”, Tata McGraw Hill publication co. 2nd Edition, 1993
2	Logan D. L. “A first course in Finite Element Method”, Cengage learning, 4th Edition, 2008.
3	O. C, Zienkiewicz “The Finite Element Method – Basic Concepts and Linear Applications”, Tata McGraw Hill publication co., 5th Edition, 2000
4	Anderson, J.D., “*Computational Fluid Mechanics The Basics with applications”, McGraw-Hill Publication 2013*
5	H.K.Versteeg and W Malalasekera, “Introduction to Computational Fluid Dynamics” 1995
6	Muralidhar K. and Sundararajan T., "*Computational Fluid Flow and Heat Transfer"*, Narosa Publishing House, 2nd edition, New Delhi 2011.
7	Subas V. Patankar*"Numerical heat transfer fluid flow",* Hemisphere Publishing Corporation, 1980.
Useful Links	
1	https://nptel.ac.in/courses/112/106/112106135/
2	https://nptel.ac.in/courses/112/104/112104115/

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	2	2	2	2									2		
CO2	2	2	2	2	2								2	2	
CO3	2	2	2	2	2									1	
CO4	2	2	2	2	2								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.
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)

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26

Course Information	
Programme	B. Tech. (Mechanical Engineering)
Class, Semester	Third Year B. Tech., Sem. VI
Course Code	7ME371
Course Name	Mechatronics and Automation Lab
Desired Requisites:	

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

Course Objectives	
1	To revise basic electronic/electrical concepts and understand use of basic electronics components like diodes, transistors etc. and their use in amplification and switching.
2	To Demonstrate use of sensors and their integration with microcontroller and PLC and use of microcontroller for doing various tasks.
3	To make students familiar with various modern and advanced control tools.

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	Select appropriate electrical/ electronic components like diodes, transistors etc. to form meaningful circuits.	III	Applying
CO2	Analyze logic for operating a particular system by using a PLC or a microcontroller	IV	Analysing
CO3	Summarize the requirements of process elements and equipment's available in modern era	V	Evaluating
CO4	Create independent small application oriented PLC based design	VI	Create

List of Experiments / Lab Activities

Term work shall contain experiments from following list:

1. Demonstration and development based on Relay logic control
2. PLC based Ladder logic programming
3. Traffic control system for three/ four/ six road crossing.
4. Programming and controlling for lift/ elevator system.
5. Programming and controlling for coin counter systems.
6. Demonstration and use of star delta starter.
7. Programming and controlling for HMI.
8. Programming and controlling for Vending machine operation.
9. Automated bottle filling plant
10. Automatic object detection and identification

Text Books	
1	Gaonkar, “Introduction of 8085”, Penram International Publishing (I) Pvt. Ltd, 2002.
2	Hackworth J.and Hackworth D. It, “Programmable Logic Controller — Programming Methods and Applications”, Pearson Education, 2006.
References	
1	“Manufacturer’s Manuals for different PLC Systems”.
2	Gary Dumming, “Introduction to PLC”, Delmar Publication
Useful Links	
1	https://www.youtube.com/watch?v=J89K1x7b6Ec&list=PLg0bf3Cfp1mwNBrZ-oERNOAVU_iMpaclW

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1												
CO2		1	2										2	
CO3			2											
CO4			2										2	
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
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 2025-26

Course Information

Programme	B. Tech. (Mechanical Engineering)
Class, Semester	Third Year B. Tech., Sem. VI
Course Code	7ME372
Course Name	Computational Methods for Structures and Fluids Lab
Desired Requisites:	

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

Course Objectives

1	To explain the finite element method, its fundamentals and general steps.
2	To describe the underlying theory, assumptions and modeling issues in FEM
3	To provide hands on experience using finite element software to model, analyze and design systems of mechanical engineering.
4	To provide hands on experience using finite element software to simulate structural, fluid and thermal problems.

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	Categorize the mathematical methods and finite element procedures for engineering applications.	II	Understanding
CO2	Select the procedures for structural, thermal and fluid analysis of 1D, 2D and 3D problems.	III	Applying
CO3	Execute the structural, fluid, thermal and dynamic analysis using FEM software.	IV	Analyzing
CO4	Execute fluid, thermal and dynamic analysis using CFD software.	IV	Analyzing

List of Experiments / Lab Activities

List of Experiments:
Following practical's should be considered for ISE and ESE evaluation.
The students are expected to solve the problems by using any FEM software.

1. Analysis of stepped bar
2. Thermal and fluid analysis of composite wall
3. Torsional analysis of shaft
4. Analysis of truss
5. Problems on shape functions
6. Structural and fluid 2D analysis
7. Structural and fluid 3D analysis
8. Modal Analysis
9. Thermal and fluid 2D analysis
10. Thermal and fluid 3D analysis
11. Geometrical nonlinear analysis
12. Contact nonlinear analysis
13. Material nonlinear analysis
14. Industrial Visit to software company.

Text Books	
1	S. S. Rao, "*Finite Element Method in Engineering*", Elsevier Publication, 4th Edition, 2004
2	P. Seshu, "*Textbook of Finite Element Analysis",* 1st Edition, PHI publication, 2008.
3	M. J Fagan, "*Finite Element Analysis- Theory and Practice";* Longman Scientific & Technical, 1st Edition, 1992

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

Useful Links	
1	https://www.udemy.com/course/ansys-mechanical-apdl-for-finite-element-simulation
2	https://www.youtube.com/watch?v=qx69C-UyxsE&list=PLtt6-ZgUFmMKFfbOBhmCwG30KIVyvhDop

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2		3				3					1	1
CO2	2	2		2				2					1	1
CO3	3	3	2	3	3			3			2		3	3
CO4	3	3		3	3			3			2		2	2

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

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks

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

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AY 2025-26

Course Information

Programme	B.Tech. (Mechanical Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	7VSME371
Course Name	Mini Project
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs./Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 01			

Course Objectives

1	To familiarize students with the concept of project based learning.
2	To give hands-on experience to students on developing problem statement and methodology to attempt solving such problems.
3	To learn the technical report writing skills.
4	To ensure seamless working in team.

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	Conceive a problem statement either from rigorous literature survey or from the requirements raised from need analysis.	II	Understanding

CO2	Cultivate teamwork and collaboration skills by requiring students to work effectively in teams, manage project tasks, and communicate ideas clearly.	III	Applying
CO3	Write comprehensive report on mini project work.	IV	Analysing
CO4	Design, and develop the model / prototype / algorithm in order to solve the conceived problem.	VI	Creating

Course contents

Guidelines:

1. The mini-project is a team activity having 3-5 students in a team.
2. Mini project should include mainly Mechanical Engineering contents but can be multi-disciplinary as well.
2. The mini project may be a complete hardware or a combination of hardware and software.
3. Mini Project should cater to a small system required in laboratory, repair, maintenance or upgradation of existing laboratory equipment or solution for a real life problem/case study.
4. After interactions with batch teacher and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of mini-project.
5. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.
6. The student is expected to exert on design, development and testing of the proposed work as per the schedule.
7. Completed mini project and documentation in the form of mini project report is to be submitted at the end of semester.

Guidelines for Assessment of Mini Project Examination:

Each batch should prepare a detailed technical report as per the guidelines issued by the department / guide.

Mini Project shall be assessed through a presentation and demonstration by the student project group to faculty advisor / a panel of examiners.

Students shall be motivated to publish a paper based on the work in students competitions / Conferences / journals.

Mini Project shall be assessed based on following points;

1. Quality of problem and clarity.
2. Proper use of knowledge and practices of mechanical and or other engineering disciplines.
3. Effective use of tools and skill sets.
4. Contribution of an individual's as a team member.
5. Clarity in written and oral communication and preparation and presentation of final technical report.

Text Books

1	Various national, international and industry standards applicable to project area.
2	Handbooks and user manuals for software's, equipment and products.

References

1	Meredith, Jack R., and Samuel J. Mantel Jr. Project management: a managerial approach. John Wiley & Sons, 2011.
2	K. T. Ulrich, S. D. Eppinger, and M. C. Yang , Product Design & Development, , 7th Edition, McGraw Hill, 2019.
3	M. Mahajan, Industrial Engineering and Production Management, 1st Edition, DhanpatRai & Co. (P) Limited, 2015.
4	V. Balachandran and Chandrasekaran, Corporate Governance, Ethics and Social Responsibility, PHI, 2nd Edition, 2011

Useful Links

1	
2	

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3		1		2	2	1		3			3	2	
CO2	2	2	3		2	1	2	1	3		3		2	1
CO3		3						3		3				1
CO4										3	2			1
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Idea and synopsis presentation, aim and objectives	Project guide Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Actual progress report	Lab Course Faculty	During Week 7 to Week 12Marks Submission at the end of Week 12	30
Lab ESE	Analysis of the model or project, technical report and final presentation	Lab Course Faculty and External Examiner as applicable	During Week 13 to Week 16 Marks Submission at the end of Week 16	40
Week 1 indicates starting week of a semester. Performance shall include idea finalization, synopsis presentation, continuous evaluation and final presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the mini project.				

Professional Elective Course Syllabus

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2025-26					
Course Information					
Programme	B.Tech. (Mechanical Engineering)				
Class, Semester	Third Year B. Tech., Sem VI				
Course Code	7ME331				
Course Name	PE-1 CAD/CAM				
Desired Requisites: AutoCAD, basic drafting techniques etc.					
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			
Course Objectives					
1	To impart the knowledge on basic fundamentals, principles and working of various NC, CNC machines and CMM.				

2	To explain the students about recent developments in CNC machines and part programming methods for CNC turning and milling operations.
3	To make students aware of different types of cutting tools for machining operations.
4	To develop the students for mathematical representation of geometries and different tolerance techniques.
5	To make students aware of computer use for data exchange formats and tools.

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	Explain appropriate operation and CNC machines for machining.	II	Understanding
CO2	Develop part programs for CNC machining.	III	Applying
CO3	Examine mathematical model to transform the geometries.	IV	Analyze
CO4	Discuss applications of different database management principles in CAD/CAM.	V	Evaluate

Module	Module Contents	Hours
I	**Introduction to CAD/CAM and CNC Tools** Automation in manufacturing, product cycle with and without CAD/CAM, Types of productions, Numerical control definition and history. Main components of NC system, NC Procedure, NC motion control system, Advantages and disadvantages of NC, CNC, DNC, etc. CNC machine tools, principle of operation of CNC, construction features including structure, drive system, tool-work movement actuation system, feedback system, machine control system.	4
II	**Different components of CNC tools** CNC Tooling- Different types of tools and tool holders used on CNC machines, parameters for selection of configuration of cutting tools, Modular tools and fixtures, use of pallets for work holding, palletizing of fixtures.	4
III	**CNC Programming** CNC Programming - Detailed manual part programming on Lathe and machining centres using G and M codes, APT programming-Punched tape in NC, tape coding and formats, APT language, Circular and linear interpolation, CNC programming - Tool length compensation, cutter radius compensation, sub routine, DO loop, Canned Cycle, etc. Optimization of tool path (to reduce machining time).	5
IV	**Geometric Modeling and Analysis** Types of mathematical representation of curves, surfaces, Solid Representation - Boundary Representation (B-rep), Constructive Solid Geometry (CSG) and other methods, Feature Based Modeling, Assembly Modeling, Behavioral Modeling, Conceptual Design & Top-down Design, Modeling of product in CAE softare and analysis techniques using approximation and matrix method. Data exchange formats like IGES, STEP etc.	4
V	**Geometry Transformation** Introduction and need of transformation, Mathematical models of Translation, scaling, reflection, rotation, homogeneous representation, concatenated transformation. Mapping of geometric model, visual realism, projections of geometric model.	5
VI	**Computer Aplication in Design, Manufacturing and Analysis**	

	Collaborative Design, Principles, Approaches, Tools, Design Systems. Product Data Management (PDM), concurrent engineering, PLM concept.	4

Text Books	
1	Geoffrey Boothroyd and Winston A. Knight, "*Fundamentals of machining and machine tools*", Third Edition, CRC Mechanical Engineering.2000
2	Jon Stenerson and Kelly Curran "*Computer Numerical Control: Operations and Programming",* Prentice-Hall of India Pvt. Ltd. New Delhi, 2007.
3	B.S. Pabla, M.Adithan, " *CNC Machines*", New Age International (P) Publishers, First Edition 1994, Reprint 2005.

References	
1	Mikell P. Groover, Emory W. Zimmers, "*CAD/CAM: Computer-Aided Design and Manufacturing*", Prentice-Hall, 1984.
2	Ibrahim Zeid, *" Mastering CAD/CAM"*, Tata McGraw Hill Education Pvt Ltd., New Delhi, Special Indian Edition, 2007, Ninth Reprint 2010.
3	Ibrahim Zeid, R. Sivasubramanian, "*CAD/CAM: Theory and Practice*", Tata McGraw Hill Companies, Special Indian Edition, 2009.

Useful Links	
1	https://archive.nptel.ac.in/courses/112/102/112102101/
2	https://nptel.ac.in/courses/112104031
3	https://archive.nptel.ac.in/courses/112/102/112102103/

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3		2										2	1
CO2					2									1
CO3						2							2	1
CO4					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

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)

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*	
AY 2025-26	
Course Information	
Programme	B. Tech. (Mechanical Engineering)
Class, Semester	Third Year B. Tech., SEM-VI
Course Code	7ME332
Course Name	PE-1 Product Lifecycle Management
Desired Requisites:	

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

Course Objectives	
1	To provide the knowledge of different information systems used in an engineering enterprises
2	To impart the recent knowledge in the broader field of product development and various lifecycle aspects involved
3	To provide exposure to application of software tools for addressing problems in product design and development

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	Summarize various phases in product life cycle and its considerations in product development	II	Understanding
CO2	Relate PLM backend technologies and its implementation.	III	Apply
CO3	Connect database management systems used in PLM applications.	IV	Analyzing
CO4	Explain DFX principles for product development.	V	Evaluating

Module	Module Contents	Hours
I	**Introduction** 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	**PLM evolution** 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** Computer aided design (CAD), Product data management (PDM), Enterprise resource planning (ERP), Supply chain management (SCM), Customer relationship management (CRM), Knowledge management (KM)	7
V	**PLM and Database Management System** Database modeling (relational, object-oriented models, web models), Database systems (i.e., databases and rule management), Data warehousing, Databases and WWW, XML databases, Information retrieval, Distributed databases, Heterogeneous databases and data integration	6
VI	**PLM implementation** PLM implementation, Challenges, Data Interpretability, Business Process Reengineering, PLM implementation case studies.	7

Text Books

1	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	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/106/106/106106220/
2	https://www.youtube.com/watch?v=LW8TMDwhc7w&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	1
CO4					2								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.
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)

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26

Course Information	
Programme	B. Tech. (Mechanical Engineering)
Class, Semester	Third Year B. Tech., Sem. VI
Course Code	7ME333
Course Name	Computer Integrated Manufacturing
Desired Requisites:	

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

Course Objectives	
1	To expose the student to the various fundamentals of computer assisted manufacturing systems.
2	To make the students familiar with criteria for implementing systems associated with software and CAD/CAM database for design and manufacturing.
3	To explain students about Robotics and its allied interdisciplinary approach, component design, sensor technology, computer science and artificial intelligence.

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	Choose sensors, actuators and motion conversion devices in logical way.	III	Apply
CO2	Analyze how emerging technologies like IoT, AI and machine learning influence advanced manufacturing systems.	IV	Analyse
CO3	Defend the working of Robot software/ hardware in CIM environment.	V	Evaluate
CO4	Design of the modern information processing system through computers.	VI	Create

Module	**Module Contents**	**Hours**
I	Computer Integrated Manufacturing - Introduction, definition, importance, components, automation and evolution of CIM. Advantages, limitations, scope and globalization view. - Product Development through CIM: Introduction, product development cycle, sequential engineering, concurrent engineering, comparison between SE and CE, implementation of CE, CE and IT, soft and hard prototyping, characteristics of CE, success of CE, applications of CE.	6
II	Automated Quality Control and CIM Implementation - In-process and post process methodologies, integrations of CNC machines, 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	7
III	Computer Aided Process Planning Structure, information requirements, CAD based process planning, Group Technology, Coding structure, MICLASS system, Variant and generative process planning, Implementation considerations	6

IV	Robotics in CIM 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	Robot Programming and Modular Components 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. Robot Sensors, Actuators and Motion Conversion: -Internal and external sensors, force sensors, thermocouples, performance characteristics, standard test signals, controllers, PLC and robotics. -Robot actuators, micro grippers, motion conversion systems, harmonic drives, robot safety.	8
VI	Advanced Systems Heuristics decision for robot, Fuzzy logic for robot control, Artificial Neural Network for robotics, Biped Robot, Biomimetic robotics, calibration. Shop floor data collection, Automatic data collection, Data acquisition system.	5

Textbooks	
1	Mikell P. Groover, "Automation, Production systems and computer integrated manufacturing", Prentice Hall, 2007
2	AppuKuttan K.K, "Robotics", I. K. International publication, 2007.
3	Groover M.P., Nagel R.N., Ordey N.G. "Industrial Robotics- Technology, Programming and Applications," McGraw Hill International, 2012.

References	
1	Richard M. Murrai, Zexiang Li, S Shankar Sastry, "Robotic Manipulation," CRC Press, 2001
2	S.R. Deb, "Robotics Technology and Flexible Automation," Tata McGraw Hill, 2000
3	Urich Rembold, "Computer Integrated Manufacturing Technology and System," 1995

Useful Links	
1	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	2
CO2						1								3
CO3											2			
CO4						1					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.
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)

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26

Course Information

Programme	B. Tech. (Mechanical Engineering)
Class, Semester	Third Year B. Tech., Sem. VI
Course Code	7ME334
Course Name	Additive Manufacturing
Desired Requisites:	

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

Course Objectives

1	To provide comprehensive knowledge of the wide range of additive manufacturing processes, capabilities and materials.
2	To understand the software tools and techniques used for additive manufacturing.
3	To create physical objects that facilitates product development/prototyping requirements.

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	Elaborate the fundamental concepts of Additive Manufacturing/3D Printing.	II	Understand
CO2	Describe the process of 3D modelling for additive manufacturing, including the use of CAD software.	III	Applying
CO3	Identify specific parts used in different applications that can be produced using additive manufacturing.	IV	Analysing
CO4	Evaluate the suitability of AM processes for specific industrial applications in terms of cost, time, and quality	V	Evaluate

Module	**Module Contents**	**Hours**

I	**Introduction to Additive Manufacturing** Definition of Additive Manufacturing (3D Printing), Additive vs Subtractive Manufacturing, Rapid prototyping (RP), Historical development of Rapid Prototyping, Areas of Application (Basic Introduction) Advantages and Limitations of Additive Manufacturing, commonly used Terms, Classification of Additive Manufacturing Processes, Process overviews, Steps Involved.	6
II	**Additive Manufacturing Processes I: Fused Deposition Modelling and Stereo lithography** Fused Deposition Modelling (FDM): FDM Technology, Various FDM Printers and Specifications, Process Parameters of Models and specifications, Process, Materials for FDM, Their Application areas and Comparison, Applications, Advantages and Disadvantages. Stereo lithography (SLA): Specifications of SLA Printers, Process, working principle, photopolymers, photo polymerization, layering technology, laser and laser scanning, Applications, Advantages and Disadvantages.	7
III	**Additive Manufacturing Processes II:** Directed Energy Deposition, Material Jetting, Binder Jetting, Powder Bed Fusion, Sheet Lamination etc.: Specifications, Process Parameters of Models and specifications, Process, Materials, Application areas and Comparison, Applications, Advantages and Disadvantages.	6
IV	**Design Potential of Rapid Prototyping:** Aspects of CAD for Additive Manufacturing (3D Modelling, Slicing, STL file Generation etc.) Conventional design for manufacturing and assembly (DFM, DFMA), Geometrical freedom, design complexity/ optimization, parts consolidation, body fitting customization and multiple assemblies manufactured as one, Customer input and customization. 3D Scanning and digitization, AM Software: data formats and standardization, Slicing algorithms , Advanced Slicing	7
V	**Post Processing of AM Parts:** Support Material Removal, Surface Texture Improvement, Accuracy Improvement, Aesthetic Improvement, and Preparation for use as a Pattern, Property Enhancements using Non-thermal and Thermal Techniques. Details of Sanding, Vapor Smoothing, Priming & Painting, Polishing, Coating, Electroplating, Welding etc.	6
VI	**Applications of Additive Manufacturing** Form and fit checking, Ergonomic Studies, Functional testing, Automotive applications- Parts of racing cars, Applications in Aerospace industry, Construction industry, Applications in Medical field , Rapid Tooling: Mold making, Rapid tooling for die, permanent mold casting, Rapid manufacturing of sheet metal forming tools, casting pattern plates by rapid tooling, RP for series production investment casting, Advances in Additive Manufacturing	7
Textbooks		
1	Gibson, I., Rosen, D.W. and Stucker, B., “Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing”, Springer, 2015.	
2	Chua, C.K., Leong K.F. and Lim C.S., “Rapid prototyping: Principles and applications”, Third edition, World Scientific Publishers, 2010.	
3	Patri K. Venuvinod and Weiyin Ma, Rapid Prototyping: Laser-based and Other Technologies, Springer, 2004.	
References		
1	Liou, L.W. and Liou, F.W., “Rapid Prototyping and Engineering applications: A tool box for prototype development”, CRC Press, 2011.	
2	Kamrani, A.K. and Nasr, E.A., “Rapid Prototyping: Theory and practice”, Springer, 2006.	
3	Hilton, P.D. and Jacobs, P.F., Rapid Tooling: Technologies and Industrial Applications, CRC Press, 2000	

Useful Links	
1	https://archive.nptel.ac.in/courses/112/103/112103306/
2	https://onlinecourses.nptel.ac.in/noc25_mm02/preview
3	https://markforged.com/resources/blog/design-for-additive-manufacturing-dfam
4	https://www.hubs.com/knowledge-base/how-design-parts-metal-3d-printing/
5	https://www.rapidmade.com/design-for-additive-manufacturing
6	https://all3dp.com/1/design-for-additive-manufacturing-dfam-simply-explained/#where-to-learn-dfam

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		1	2	2	1								1	
CO3		2	1	3		1						1		2
CO4		2		2							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. 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)