Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2024-25

Course Information

Programme	B.Tech. (Mechanical Engineering)
Class, Semester	Second Year B. Tech., Sem III
Course Code	7ME201
Course Name	Thermodynamics
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 learn about work and heat interactions, and balance of energy between system and its surroundings
2	To learn about application of law to various energy conversion devices
3	To evaluate the changes in properties of substances in various processes

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	Recall knowledge of mathematics, science, and engineering for the needs in thermodynamics	II	Understanding
CO2	Write energy balance to systems and control volumes, in situations involving heat and work interactions	III	Applying
CO3	Evaluate changes in thermodynamic properties of substances	IV	Analyzing
CO4	Evaluate the performance of energy conversion devices and to differentiate between high grade and low grade energies.	V	Evaluating

Module	**Module Contents**	**Hours**
I	**INTRODUCTION AND BASIC CONCEPTS:** Thermodynamics and Energy, Systems and Control Volumes ,Properties of a System, State and Equilibrium, Processes and Cycles, Temperature and the Zeroth Law of Thermodynamics, Pressure Measurement **ENERGY, ENERGY TRANSFER, AND GENERAL ENERGY ANALYSIS**: Forms of Energy, Energy Transfer by Heat and Work, The First Law of Thermodynamics, Energy Conversion Efficiencies, Energy and Environment	7

II	**PROPERTIES OF PURE SUBSTANCES:** Pure Substance, Phases of a Pure Substance, Phase-Change Processes of Pure Substances, Property Diagrams for Phase-Change Processes, Property Tables, The Ideal-Gas Equation of State, Compressibility Factor—A Measure of Deviation from Ideal-Gas Behavior, Other Equations of State	6
III	**ENERGY ANALYSIS OF CLOSED SYSTEMS:** Moving Boundary Work, Energy Balance for Closed Systems, Specific Heats, Internal Energy, Enthalpy, and Specific Heats of Ideal Gases, solids and liquids. **MASS AND ENERGY ANALYSIS OF CONTROL VOLUMES:** Conservation of Mass, Flow Work and the Energy of a Flowing Fluid, Energy Analysis of Steady and Unsteady Flow Systems, Steady-Flow Engineering Devices.	7
IV	**THE SECOND LAW OF THERMODYNAMICS:** Introduction, Thermal Energy Reservoirs, Heat Engines, Refrigerators, Heat Pumps, Perpetual-Motion Machines, Reversible and Irreversible Processes, The Carnot Cycle, The Carnot Principles, Thermodynamic Temperature Scale, Carnot Heat Engine, Carnot Refrigerator and Heat Pump	7
V	**ENTROPY:** Entropy, Increase of Entropy Principle, Entropy Change of Pure Substances, Isentropic Processes, Property Diagrams Involving Entropy, The T ds Relations, Entropy Change of Liquids, Solids and Ideal Gases. **EXERGY** Exergy: Work Potential of Energy, Reversible Work and Irreversibility, Second-Law Efficiency, Exergy Change of a System, Exergy Transfer by Heat, Work, and Mass, The Decrease of Exergy Principle and Exergy Destruction, Exergy Balance: Closed Systems and Control Volumes.	7
VI	**GAS POWER CYCLES** Basic Considerations in the Analysis of Power Cycles, An Overview of Reciprocating Engines, Otto Cycle, Diesel Cycle, Stirling and Ericsson Cycles, Brayton Cycle **VAPOR AND COMBINED POWER CYCLES** The Carnot Vapor Cycle, Rankine Cycle: the Ideal Cycle for Vapor Power Cycles, Deviation of Actual Vapor Power Cycles From Idealized Ones. **REFRIGERATION CYCLES** Refrigerators and Heat Pumps, The Reversed Carnot Cycle, he Ideal Vapor-Compression Refrigeration Cycle, Actual Vapor-Compression Refrigeration Cycle	5

Text Books

1	P. K. Nag “Thermodynamics”, Tata McGraw Hill Publication, 20017, 6th Edition
2	Cengel and Boles, “Thermodynamics an engineering Approach”, Tata McGraw-Hill publication, Revised 9th Edition.

References

1	Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley and Sons.

2	Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India
3	Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons.
Useful Links	
1	https://archive.nptel.ac.in/courses/112/105/112105123/

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

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AY 2024-25

Course Information	
Programme	B. Tech. (Mechanical Engineering)
Class, Semester	Second Year B. Tech., Sem. III
Course Code	7ME202
Course Name	Material Science and Metallurgy
Desired Requisites:	

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

Course Objectives

1	To make the students familiarize with properties of different metals and their microstructural and crystallographic relevance.
2	To describe the solidification behavior of metals and its alloys and to predict their microstructure.
3	To explore different heat treatment processes, and NDT techniques.
4	To understand the application of Machine Learning in establishing correlations between microstructure and material properties in Materials Engineering.

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
CO 1	Identify different metals according to their physical, chemical and mechanical properties.	1	Remembering
CO 2	Describe solidification behavior of metals and its alloys and to predict their microstructure.	2	Understanding
CO 3	Measure performance of metals and its alloys based on its physical and mechanical properties.	5	Evaluating
CO 4	Design heat treatment cycle of ferrous and non-ferrous metals and alloys.	6	Creating
CO 5	Demonstrate processes of various NDT methods.	3	Applying
CO 6	Apply machine learning algorithms to effectively correlate microstructural features with material properties, enhancing their ability to predict material performance based on microstructural data.	4	Analyze

Module	Module Contents	Hours
I	Mechanical Behavior of Metals**,** Introduction to Science of metals, Properties of metals, Crystal defects, Deformation of metals, Role of dislocations in deformation, Strengthening Mechanisms, Theory behind creep	6

I I	Testing of Materials**,** Mechanical testing of materials (Destructive and Non - Destructive testing methods), Introduction to Fracture	7
I I I	Phase Diagram and Phase Transformations, Objectives and classification, System, phases and structural constituent of phase diagram, Iron –Carbon equilibrium diagram, Coring and dendritic segregation, Gibb's phase rule, Lever rule, Solid solutions, Eutectic, Peritectic and eutectoid system, Equilibrium diagrams for non -ferrous alloys, Experimental methods of determining phase diagrams. **Phase transformations: -** Concept of solidification of metals, Solidification of pure metals, Nucleation, Growth, Growth of the new phase, Solidification of alloys, Nucleation, growth and overall transformation rates, TTT and CCT diagrams	7
I V	Heat Treatment Processes, Definition, Purpose and classification of heat treatment processes for various types of steels, Bainite and Martensite formation, Concept of Hardenability, Introduction and applications of various case hardening and surface hardening treatments, Precipitation Hardening, Thermo mechanical treatments. Heat treatment defects	6
V	Application and properties of Stainless steel, Duplex stainless steels, Nickel alloys, HSLA, Maraging stainless steels, Precipitation hardenable stainless steels, Martensitic stainless steels, Carbon steels for General purpose, and pressure-containing parts	6
V I	Artificial Intelligence And Machine Learning In Materials Engineering, why AI/ML in Materials Engineering, Correlation between processing with materials structure, Machine Learning Approaches for Materials Design Statistical Tools, Machine Learning, Machine Learning Approaches for Materials Design: Microstructure property correlation, Materials Knowledge and Materials Data Science: AI/ML for materials characterization	7

References	
1	Sidney H. Avener, *Physical Metallurgy,* Tata McGraw Hill Education Private Limited, 2nd Edition, 1997
2	George E. Dieter, *Mechanical Metallurgy,* Tata Mc Graw Hill Publication, Si Metric Edition, 3 Revised edition, 1989.
3	Raymond Aurelius Higgins**,** *Engineering Metallurgy: Applied Physical Metallurgy,* Krieger publishing company, 5th Edition, 1983.

Useful Links	
1	https://nptel.ac.in/courses/113107078
2	

Textbooks	
1	V. Raghvan, *Materials Science and Engineering,* PHI Publication, 5th Edition, 2009.
2	V. Raghvan, *Physical Metallurgy,* PHI Publication, 2nd Edition, 2009.
3	William D. Callister, *Fundamentals of Materials Science and Engineering,* 5th Edition, Wiley India Pvt. Ltd, 2010

CO-PO Mapping

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

O2														
CO3			**2**											
CO4		**2**		**3**								**2**		
CO5						**3**		**2**	**1**			**2**		
CO6	**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.														

A
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 2024-25

Course Information	
Programme	B. Tech. (Mechanical Engineering)
Class, Semester	Second Year B. Tech., Sem III
Course Code	7ME203
Course Name	Strength of Materials

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

Course Objectives	
1	Recall and define key concepts such as stress, strain, Hooke's law, and different types of stresses
2	Understand the relationships between stress, strain, and material properties
3	Apply the principles of mechanics of materials to calculate stresses, strains, and deflections in beams, shafts, and columns under various loading conditions

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 various mechanics of materials principles to analyze stress, strain, and deformation in structural elements	III	Applying
CO2	Analyze and design beams, shafts, and columns for various loading conditions	IV	Analyzing
CO3	Evaluate the behavior of materials under different stress states and select appropriate failure theories	V	Evaluating
CO4	Analyze and apply energy methods to solve problems in mechanics of materials	IV	Analyzing

Module	**Module Contents**	**Hours**
I	**Stresses and strain** Deformation in solids- Hooke's law, stress and strain- tension, compression and shear stresses- elastic constants and their relations- volumetric, linear and shear strains, thermal stresses. True stress and true strain	7
II	**Torsion and Bending of Beams** Torsion, stresses and deformation in circular and hollow shafts, stepped shafts, deflection of shafts fixed at both ends. Stress induced by pure bending of beam. Radius of curvature of beam in bending. Bending under moments about more than one axis	6
III	**Analysis of beam under bending:** Shear force and bending moment diagrams for beams under various loading and support conditions. Deflection of beam under different loading conditions (double integral method). Statically indeterminate beams.	8
IV	**Transformation of stress and strain** Normal and shear stress on oblique planes, principal stresses and planes. Mohr Circle. Combined effect of bending and shear in beams. Theories of failure. Plane stress and plane strain conditions.	6

V	**Buckling of Columns** Euler's formula for different end connections, concept of equivalent length, eccentric loading, Rankine formula	6
VI	**Energy Methods:** Strain energy, elastic strain energy in normal stress, bending, torsion and combined loading. Distortion strain energy principle	6

Text Books	
1	Beer and Johnson, Mechanics of Materials, McGraw Hill, 6th Edition , 2013
2	Hibbeler, R.C., Statics and Mechanics of Materials, Prentice-Hall, SI Edition , 2004
3	Ramamurthum, Strength of materials, DhanpatRai and Sons New Delhi, 3rd edition, 2009

References	
1	Den Hartog, Jacob P., Strength of Materials. Dover Publications Inc., 3rd Edidtion 1961
2	Timoshenko S., Strength of Materials. Krieger Publishing Company, 3rd edition, 1976
3	Mott, Robert L., Applied Strength of Materials, Prentice-Hall, 4th edition, 2002

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									1	
CO2		3	2	1									1	
CO3		3	2	1								1	1	
CO4		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

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 2024-25

Course Information

Programme	B. Tech. (Mechanical Engineering)
Class, Semester	Second Year B. Tech. SEM-I
Course Code	7ME204
Course Name	Manufacturing Processes - I
Desired Requisites:	NA

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

Course Objectives

1	To understand classification of manufacturing processes and develop an interest in primary shaping processes
2	To explain the basic fundamentals in metal forming processes such as forging, rolling, extrusion, wire drawing, sheet metal working etc.
3	To gain an understanding and interpret the breadth and depth of the field of manufacturing processes (primary shaping processes).
4	To learn and apply the basic terminology associated with primary shaping processes.
5	To evaluate the number of passes / stages and forces required in forming processes.
6	To study the recent developments in metal forming processes.

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	To summarize and classify different manufacturing processes	II	Understanding
CO2	To sketch and articulate different primary shaping processes	III	Applying
CO3	To illustrate and conclude the selection of proper primary shaping process for a particular components	IV	Analysing
CO4	To investigate the effect of parameters on manufacturing processes	V	Evaluating

Module	**Module Contents**	**Hours**
I	**Classification of Manufacturing Processes and Metal Casting** Classification of manufacturing processes, their advantages, applications, limitations etc. **Metal Casting – I:** Importance of casting, advantages, disadvantages and limitations of casting processes. Status of foundry industry at national and international level. Pattern materials, types of patterns, pattern allowances and colour codes used. Types of sand, their properties. Moulding and core making processes, Green sand Moulding, shell Moulding, CO2 Moulding. Components of gating system, functions and importance of runners and risers.	7
II	**Metal Casting – II:** Permanent mould casting processes such as Continuous casting, Gravity die casting, pressure die-casting, Centrifugal casting, Vacuum die casting, Squeeze casting. Lost foam casting investment casting. **Melting, pouring in Metal Casting:** Types of melting Furnaces-Cupola furnace, oil / gas fired furnaces, crucible furnaces, Electrical furnaces, Rotary furnaces. Furnace selection criteria, their applications. Cleaning-fettling of castings. Casting defects, their causes and remedies. Sustainable manufacturing approach.	6
III	**Metal Forming Processes:** Hot, cold and worm working. Recovery and Recrystallization. Formability	7

	and parameters affecting the yield strength of materials. Classification of various metal Forming processes, their special features with respect to other manufacturing processes. Friction and lubrication in Metal Forming processes. Stresses in Metal Forming process. **Forging:** Basic operations, types of forging, forging hammers/ presses, forging stages and force calculations, die design considerations, forging applications, Defects and remedies in forging process.	
IV	**Rolling** Classification of rolling processes, rolling mill types, condition for natural entry in rolling operation, number of passes in rolling, roll bite, elongation, reduction, rolling of sheets, plates, bars, sections and tubes, Ring Rolling and Thread Rolling operation,Case studies of products such as crank-shafts, different types of sections etc.Applications, defects and remedies in rolling process. **Extrusion:** Equipment and principles, types of extrusion, direct, indirect, impact, continuous, hydrostatic, tube extrusion, metal flow in extrusion, Die design considerations, factors affecting extrusion load, defects and remedies in extrusion.	7
V	**Drawing:** Types of Drawing, Rod/wire drawing, Die Design considerations, equipment and principles of process, Tube drawing, Seamless pipe manufacturing. defects and remedies in drawing. **Sheet Metal Forming Processes:** Introduction, press operations, types of dies, Nesting (strip layout) of sheet, Forces in blanking, Drawability of sheet metal, Deep drawing, Redrawing, Tractrix dies, Forming limit diagrams (FLD). Dieless forming of sheet metal.	6
VI	**Recent Developments in Foundry and Metal Forming:** Flaskless moulding in foundry, High energy rate forming processes such as Explosive forming, Electrohydraulic forming, Electromagnetic forming, Magnetic pulse forming. Metal forming in mashy state, forming by Laser beam / plasma arc etc. CAM and robot applications in foundries and forming industries.	6

Text Books	
1	P.N. Rao, “Manufacturing Technology- Foundry, Forming and Welding”, Vol. I Tata McGraw-Hill, 4th edition, 2013, ISBN: 9781259062575
2	P.C. Sharma, “A Textbook of Production Technology (Manufacturing Processes)”, S. Chand & Co., 8th Edition, 1999, ISBN: 978-8121901116
3	P. L. Jain, “Principles of Foundry Technology”, Tata McGraw-Hill, New Delhi, 5th Edition,2009, ISBN: 0070151296, 9780070151291
4	B. L. Juneja, “Fundamentals of Metal Forming Processes”, New Age International (P) Limited, 1st Edition, 2007
5	R. K. Rajput, “ A Textbook of Manufacturing Technology”, Laxmi Publications, 2016, ISBN:9788131802441

References	
1	E. Paul DeGarmo, J.T. Black, Ronald A. Kosher, “Materials and Processes in Manufacturing”, John Wiley and Sons Ltd, 9th revised edition, 2004.ISBN:,9780471656777
2	Schuler GmbH, “Metal Forming Handbook”, Springer, 5th Edition, 1998
3	Kalpakjian and Schmid, “Manufacturing processes for engineering materials”, Pearson India Limited, 7th Edition-2008,ISBN: 9780132272711
4	Heinz Tschaetsch, “Metal Forming Practise, Processes, Machines, Tools”, Springer, 7th Edition, 2005
5	V. N. Danchenko, “Metal Forming”, Ministry of Education and Science of Ukraine, National Metallurgy Academy of Ukraine, First Edition, 2007

Useful Links	
1	https://www.vlab.co.in/broad-area-mechanical-engineering

2	http://vlabs.iitb.ac.in/vlab/labsme.html
3	https://youtu.be/Tx1k2xYFWQU
4	https://youtu.be/Eceb02UhvyE
5	https://www.youtube.com/watch?v=zvc5OoYPL7M
6	https://youtu.be/2CIcvB72dmk
7	https://youtu.be/748_ME0p0Ag
8	https://www.youtube.com/watch?v=y6G2eiy6X04
9	https://onlinecourses.nptel.ac.in/noc21_me30/preview
10	https://youtu.be/o3kaIwbOq1E
11	https://www.youtube.com/watch?v=PB49vko0Il0
12	https://www.youtube.com/watch?v=yGKym19qxiM&t=16s
13	https://youtu.be/XNG3ewS39Lw
14	https://www.youtube.com/watch?v=Ic8Uc41IK1I

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			2						3				2		
CO3			2						1					2	
CO4		2		2	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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AY 2024-25

Course Information

Programme	B.Tech. (Mechanical Engineering)
Class, Semester	Second Year B. Tech., Sem III
Course Code	7ME251
Course Name	Thermodynamics 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 learn about work and heat interactions, and balance of energy between system and its surroundings
2	To learn about application of law to various energy conversion devices
3	To evaluate the changes in properties of substances in various processes

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	Describe the experimental procedure of experiments in thermodynamics lab	II	Understanding
CO2	Determine the properties of fluids used in various industrial systems such as Mechanical Power Production systems.	III	Applying
CO3	Calculate the calorific value of a given fuel by using Bomb calorimeter.	IV	Analyzing
CO4	Apply first law of thermodynamics to various cyclic systems.	V	Evaluating

List of Experiments / Lab Activities

List of Experiments:

Course Contents:

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

Fuel testing

1. Test on Grease dropping point apparatus.
2. Test on Redwood Viscometer.
3. Test on Aniline point apparatus.
4. Determination of flash and fire point of a lubricating oil.
5. A test on Bomb calorimeter.

Thermodynamics Laws application

1. Vapor compression tutor.
2. Air conditioning Tutor.
3. Mini steam power plant.

4. Cooling Tower.
5. Measurement of thermal conductivity of metal rod under steady state conditions.
6. Reciprocating compressor unit.
7. Internal combustion engine setup.

Text Books	
1	P. K. Nag "Thermodynamics", Tata McGraw Hill Publication, 20017, 6th Edition
2	Cengel and Boles, "Thermodynamics an engineering Approach", Tata McGraw-Hill publication, Revised 9th Edition.

References	
1	Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley and Sons.
2	Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India
3	Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons.

Useful Links	
1	https://archive.nptel.ac.in/courses/112/105/112105123/

CO-PO Mapping

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

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 (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 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.

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Course Information	
Programme	B. Tech. (Mechanical Engineering)
Class, Semester	Second Year B. Tech., Sem. III
Course Code	7ME252
Course Name	Material Science and Metallurgy Laboratory
Desired Requisites:	

Teaching Scheme		Examination Scheme (Marks)			
Lab	2 Hr/week	**LA 1**	**L A2**	**Lab ESE**	**Total**
Tutorial	--	30	30	40	100
		Credits: 1			

Course Objectives	
1	Understand Fundamental Principles and Procedures of Material Testing
2	Develop Proficiency in Experimental Techniques and Instrumentation
3	Interpret Test Results and Analyze Material Properties
4	Apply Knowledge to Solve Materials Engineering 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
CO 1	To demonstrate proficiency in material testing techniques	3	Apply
CO 2	To analyze and interpret data from material tests	4	Analyze
CO 3	To apply experimental knowledge in solving materials engineering problems	3	Apply
CO 4	To develop critical thinking skills in evaluating material testing processes	5	Evaluate
CO 5	To communicate effectively about experimental procedures and findings	4	Communicate
CO 6	To understand and apply ASTM and other standards in material testing	2	Understand

	List of Experiments	

1. Tensile test of Steel,and non ferrous metals and alloys
2. Hardness test: Rockwell and Brinell
3. Charpy Impact test
4. Demonstration tests- Ultrasonic testing, Magnetic particle test, Dye penetrant test, Spark Test, Spectro chemical analysis, Thickness measurement test, Electrical conductivity measurement test.
5. Determination of volume fraction of phases as per ASTM E 562.
6. Determination of grain size of metals and alloys as per ASTM E112 and IS 4748.
7. Determination of hardenability of a given steel component.
8. Metallography test on ferrous and nonferrous metals and alloys as per ASTM E407/ASM Handbook Vol.9.
9. Heat treatment of steels.
10. Correlation Analysis Between Processing Parameters and Materials Structure.
11. Machine Learning for Materials Characterization.

References	
1	Sidney H. Avener, *Physical Metallurgy,* Tata McGraw Hill Education Private Limited, 2nd Edition, 1997
2	George E. Dieter, *Mechanical Metallurgy,* Tata Mc Graw Hill Publication, Si Metric Edition, 3 Revised edition, 1989.
3	Raymond Aurelius Higgins**,** *Engineering Metallurgy: Applied Physical Metallurgy,* Krieger publishing company, 5th Edition, 1983.

Useful Links	
1	https://nptel.ac.in/courses/113107078
2	

Textbooks	
1	V. Raghvan, *Materials Science and Engineering,* PHI Publication, 5th Edition, 2009.
2	V. Raghvan, *Physical Metallurgy,* PHI Publication, 2nd Edition, 2009.
3	William D. Callister, *Fundamentals of Materials Science and Engineering,* 5th Edition, Wiley India Pvt. Ltd, 2010

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	**2**					**3**							1	2
CO3			**2**											
CO4		**2**		**3**								**2**	1	2
CO5						**3**		**2**	**1**			**2**	1	2
CO6	**2**	**3**	**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.

A ssessment

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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Course Information

Programme	B. Tech. (Mechanical Engineering)
Class, Semester	Second Year B. Tech. SEM-I
Course Code	7VSME251
Course Name	Workshop Practice
Desired Requisites:	Manufacturing Processes-I

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

Course Objectives

1	To demonstrate different wood working processes, types of pattern, demonstration and hands on experience of pattern making
2	To explain various types and properties of molding sand
3	To classify and study different metal forming processes and process parameters
4	To acquire knowledge of number of passes and stages required in metal forming operations
5	To acquire the knowledge of press tools, strip layout, deep drawing and number of draws required.

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	Show the types of patterns, demonstrate and hands on experience of pattern making	II	Applying
CO2	Compare different types of metal forming Process	III	Analysing
CO3	Recommend the properties of sand, number of passes in rolling, die angle in wire drawing, number of draws and strip layout in sheet metal working	IV	Evaluating
CO4	Compose reports based on industrial visits	V	Creating

List of Experiments / Lab Activities/Topics

List of Experiments:

A. Demonstration of types of patterns and hands on experience of Pattern making [4 Hrs]

B. Sand Testing [8 Hrs]

1. Preparation of sand for mould and core making with demonstration of small components
2. Tensile, Compressive and shear strength of molding sand
3. Permeability test for molding sand
4. Moisture content test for molding sand
5. Hardness test (mould /core) [Green and Dry]
6. Sand grain Size analysis (Grain Fineness No. on Sieve Shake apparatus)

C. Metal forming (Any four) [10 Hrs]

1. Simulation of open, closed and precision die forging using forming simulation software.
2. Simulation of rolling process by using forming simulation software and evaluation of number of passes in rolling operation.
3. Simulation of metal extrusion process using forming simulation software.
4. Simulation of wire drawing process and evaluate optimum die angle for wire drawing using forming simulation software.
5. Simulation of various types of press tools and analysis of strip layout in sheet metal working using forming simulation software.
6. Simulation of deep drawing process and evaluate number of draw and force required for deep drawing using forming simulation software.
7. Casting Simulation for simulating end-to-end casting process, filling, solidification, heat stress and heat treatment simulation

D. Report on industry visits related to Foundry and metal forming industries.

Textbooks	
1	P. N. Rao, "Manufacturing Technology- Foundry, Forming and welding", Vol. I Tata McGraw-Hill, 4th edition, 2013, ISBN: 9781259062575
2	P.C.Sharma,“A Textbook of Production Technology(Manufacturing processes)”,S. Chand & co.,8th revised edition 2014. ISBN:8 I -219- 1 114-1
3	R. K. Rajput, “ A Textbook of Manufacturing Technology”, Laxmi Publications, 2016, ISBN:9788131802441
4	B.L.Juneja,“ Fundamentals of Metal forming processes”, New Age International (P) Ltd., Publishers, 2018, 978-8122430899
5	R. K. Jain ,“Production technology”, Khanna Publishers, Delhi, 17th Edition,2001, ISBN: 9788174090997

References	
1	George E. Dieter, "Mechanical Metallurgy", McGraw Hill Book Company, Revised 3rd Indian edition, ISBN : 9780070168930, 2013
2	W.A.J. Chapman, "Workshop Technology", CBS Publishing & Distributors, New Delhi, Vol. I [ISBN13:9788123904016]2001, Vol. II [ISBN:9788123904115] 2007 and Vol. III [ISBN:9788123904122] 1995
3	P. H. Joshi,“Press Tools-Design and Construction”, S. Chand & Company Ltd.,2010, ISBN:81-219-2938-5

Useful Links	
1	https://www.vlab.co.in/ba-nptel-labs-mechanical-engineering
2	https://www.vlab.co.in/broad-area-mechanical-engineering
3	https://www.youtube.com/watch?v=gOms0cwsK3Y
4	https://www.youtube.com/channel/UC7MhW1yD_wun48LBtBojtzw
5	https://www.youtube.com/watch?v=yGKym19qxiM
6	https://www.youtube.com/watch?v=AiBnWJD0HIc
7	https://www.youtube.com/watch?v=wtj_GhWb_jQ
8	https://youtu.be/HSn3G3r69QE

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	
CO2	2												2	
CO3	2			2										2
CO4			2			2							1	
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.														

Assessment				
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	All WCE Programme
Class, Semester	SY BTech 1st & 2nd Sem
Course Code	7VE201
Course Name	Value Education
Desired Requisites:	Open mind and a willingness to learn

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	01Hrs/week	LA1	LA2	ESE	Total
Tutorial	01 Hrs/week	30	30	40	100
		Credits: -			

Course Objectives

1	Develop holistic personal and professional skills by enhancing communication, emotional intelligence, and resilience to foster positive relationships and sustainable living practices.
2	Promote ethical and sustainable leadership through the application of integrity, teamwork, and a growth mindset to navigate success and failure while mastering effective presentation and communication skills.
3	Empower lifelong learning and contribution by reflecting on personal values, engaging in critical thinking, and committing to continuous self-assessment and professional development for addressing global challenges.

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 Descriptor**
CO1	Learn effective communication, empathy, and relationship- building skills to foster positive interactions in personal and professional settings.	I	Remembering
CO2	Incorporate sustainable habits into daily life and build resilience through mindfulness and stress management to handle challenges and support environmental stewardship.	II	Understanding
CO3	Develop goal-setting and achievement strategies, manage success and failure, and deliver impactful presentations for overall personal and professional development.	III	Applying
CO4	Strengthen analytical skills and creative problem-solving techniques to make informed decisions and tackle complex issues in various contexts.	IV	Analyzing

Module	**Module Contents**	**Hours**
I	**Interpersonal skills** Introduction to Relationships, Communication Skills, Emotional Intelligence, Conflict Resolution, Maintaining Healthy Relationships	5
II	**Sustainable Living** Introduction to Sustainability, Environmental Impact, Sustainable Practices, Community Involvement, Personal Action Plan	5
III	**Inner Peace and Resilience** Understanding Inner Peace, Mindfulness and Meditation, Stress Management, Building Resilience, Positive Mindset	5

IV	**The Art of Winning** Winning Mindset, Goal Setting, Perseverance and Adaptability, Teamwork and Leadership, Case Studies and Real-life Examples	5
V	**Success and Failure Management** Understanding Success and Failure, Learning from Failure, Growth Mindset, Balancing Success and Failure, Personal Development Plan	5
VI	**The Art of Presentation** Introduction to Presentations, Content Organization, Verbal and Non-Verbal Communication, Practice and Delivery, Feedback and Improvement	5

Textbooks	
1	Stephen R. Covey, *The 7 Habits of Highly Effective People*, Free Press, 25th Anniversary Edition, 2013.
2	Daniel Goleman, *Emotional Intelligence: Why It Can Matter More Than IQ*, Bantam Books, 10th Anniversary Edition, 2005.
3	Carol S. Dweck, *Mindset: The New Psychology of Success*, Ballantine Books, Updated Edition, 2016.
4	William McDonough and Michael Braungart, *Cradle to Cradle: Remaking the Way We Make Things*, North Point Press, 1st Edition, 2002.
5	Garr Reynolds, *Presentation Zen: Simple Ideas on Presentation Design and Delivery*, New Riders, 2nd Edition, 2011.

References	
1	Covey, S. R. (1989). *The 7 Habits of Highly Effective People*. Simon & Schuster.
2	Rosenberg, M. B. (2015). *Nonviolent Communication: A Language of Life*. PuddleDancer Press.
3	Carnegie, D. (1998). *How to Win Friends and Influence People*. Simon & Schuster.
4	Covey, S. R. (1989). *The 7 Habits of Highly Effective People*. Simon & Schuster.
5	Rosenberg, M. B. (2015). *Nonviolent Communication: A Language of Life*. PuddleDancer Press.

Useful Links	
1	https://ideas.ted.com/how-to-build-closer-relationships/
2	https://www.nationalgeographic.com/environment/article/sustainable-living
3	https://www.lexisnexis.in/blogs/family-law-in-india/
4	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8937019/
5	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8710473/

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	-	2		
CO2	-	-	-	-	-	2	3	2	2	-	-	2		
CO3	-	-	-	1	-	1	-	2	3	2	2	2		
CO4	-	-	-	3	2	2	2	2	2	2	3	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 LA1, LA2 and ESE.
LA1 shall be typically on modules 1 to 3.
LA2 shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be Tests, assignments, oral, seminar etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 30 - 40% weightage on modules 1 to 3 and 60 - 70% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (LA1+LA2+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. (Civil /Mech)
Class, Semester	S.Y.B.Tech Mechanical, SEM-I
Course Code	7EM201
Course Name	Understanding Incubation and Entrepreneurship
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	03Hrs/week	LA1	LA2	ESE	Total
Tutorial	-	30	30	40	100

Credits: 3 (Select any one evaluation pattern)

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	3 Hrs/week				

Course Objectives

1	To familiarize the entrepreneurial framework and the start-up projects which help students to navigate through their own entrepreneurial journey.
2	To develop an entrepreneurial mind-set thereby encouraging the journey of transformation to convert an idea or a solution into a business
3	

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 Descriptor**
CO1	Translate creative ideas into a sustainable business opportunity	II	Understand
CO2	Apply principles and practice of new entrepreneurial venture planning to assess a business idea	III	Apply
CO3	Differentiate among types of Business Models	IV	Analyze
CO4	Evaluate decision making towards establishing enterprises in real life situations	V	Evaluate

Module	**Module Contents**	**Hours**
I	**Introduction to Entrepreneurship** Hand holding for Entrepreneurship GDC start-up stories, The Entrepreneurial Mind-Set , Corporate Entrepreneurship , Generating and Exploiting New Entries	7
II	**Innovation and Entrepreneurship Types** Methodology for Innovation, Team Building, Problem Statement Presentation	6

III	**The Innovation Process** Innovation and Entrepreneurship, Solar Oven case-study Paradigm shift from Design to Entrepreneurship, Bio- Med Innovation and Entrepreneurship, Healthcare and Innovation, Human Centered Innovation, Success Stories	7
IV	**Introduction to Incubators** Business Model Canvas, Technology led Entrepreneurship, Introduction to SINE Incubator, Lean Model Canvas SINE, Start-up Stories:	7
V	**From Corporate to Entrepreneurship** Creativity and Generating Product Ideas, From Idea to Proof of Concept, Network Entrepreneurship	7
VI	**Case Study** Learning from examples Start-up PITCHES - Using Lean Canvas Model	6

Textbooks	
1	Disciplined Entrepreneurship: 24 Steps to a Successful Startup by Bill Aulet
2	The Essence of Medical Device Innovation by B Ravi
3	THE FORTUNE AT BOTTOM OF PYRAMID: Eradicating Poverty Through Profits by C.K.Prahalad Stay Hungry

References	
1	Stay Foolish by Rashmi Bansal
2	The Entrepreneurial Connection: East Meets West in the Silicon Valley by Gurmeet Naroola
3	Innovation By Design: Lessons from Post Box Design & Development by B. K. Chakravarthy , Janaki Krishnamoorthi
4	
5	

Useful Links	
1	

CO-PO Mapping

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

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.				

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Course Information	
Programme	B.Tech.
Class, Semester	Second Year (Civil Engineering and Mechanical Engineering), Sem III
Course Code	7MA202
Course Name	Applied Mathematics for Civil Engineering and Mechanical Engineering
Desired Requisites:	Engineering Mathematics I&II

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 03			

Course Objectives

1	To impart mathematical skills and enhance thinking power of students.
2	To introduce fundamental concepts of mathematics and their applications in engineering fields.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statements**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Descriptor**
CO1	**Use** Laplace Transform and Inverse Laplace Transform to solve linear differential equation.	II	Understanding
CO2	**Understand** Fourier series of periodic functions.	II	Understanding
CO3	**Apply** PDEs for solving Engineering problems.	III	Applying
CO4	**Apply** various discrete & continuous distributions to solve real life problems.	III	Applying
CO5	**Apply** basic concepts of Vector calculus to solve problems with conditions arising in engineering field.	III	Applying

Module	**Module Contents**	**Hours**
I	**Laplace Transform and Its Applications:** Definition, Transform of Standard functions, Properties, Transform of derivative and Integral, Inverse Laplace Transform, Convolution Theorem, Applications to solve linear differential equations.	**8**
II	**Fourier Series:** Periodic functions, Dirichlet's conditions, Definition, determination of Fourier coefficients (Euler Formulae), Expansion of functions, Even and odd functions, change of interval and functions having arbitrary period, Half range Fourier sine and cosine series.	**7**

III	**Partial Differential Equations and its application:** Standard forms of partial differential equations i) $f(p,q)=0$ ii) $f(p,q,z)=0$ iii) $f_1(x,p)=f_2(y,q)$ iv) Lagrange's Form application to one dimensional heat equation.	**6**
IV	**Probability Distribution:** Random Variable, Discrete random variable, Continuous random variable, Probability mass function, Probability density function, Poisson distribution, Normal distribution, Examples.	**5**
V	**Vector Differentiation:** Concept of vector field, directional derivatives, gradient of vector field, tangent line to the curve, velocity, acceleration, divergent and curl of vector field.	**6**
VI	**Vector Integral:** Line integrals, surface integral, Green's theorem in plane, Stoke's Theorem.	**7**

	Textbooks
1	*"A Text Book of Applied Mathematics",* P. N. and J. N. Wartikar, Vol I and II", Vidyarthi Griha Prakashan, Pune, 2006.
2	*"Higher Engineering Mathematics"*, B .S. Grewal, Khanna Publication, 44th Edition , 2017.
	References
1	*"An Introduction to probability and Statistics"*, V.K. Rohatgi , Wiley Publication, 2nd Edition, 2008.
2	"*Advanced Engineering Mathematics",* Wylie C.R, Tata McGraw Hill Publication, 8th Edition, 1999.
3	*"Higher Engineering Mathematics",* H. K. Dass , S. Chand & Company Ltd., 1st Edition 2014.
4	*"Higher Engineering Mathematics",* B. V. Ramana, McGraw Hill Publication, 2018.
5	*"Advanced Engineering Mathematics"*, Erwin Kreyszig, Wiley Eastern Limited Publication, 10th Edition, 2015.
	Useful Links
1	https://www.youtube.com/watch?v=Na6N2DwdL_k&list=PLp6ek2hDcoNB3jiva0_CRJ1wmTOo98E0
2	https://www.youtube.com/watch?v=W3HXK1Xe4nc
3	

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1													
CO2	2	1												
CO3	2	1												
CO4	1	1												
CO5	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

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AY 2024-25

Course Information

Programme	B.Tech. (Mechanical Engineering)
Class, Semester	Second Year B. Tech., Sem IV
Course Code	7ME221
Course Name	Fluid Mechanics and Fluid Machines
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 learn about the application of mass and momentum conservation laws for fluid flows
2	To understand the importance of dimensional analysis
3	To obtain the velocity and pressure variations in various types of simple flows

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	Recall knowledge of mathematics, science, and engineering for the needs in fluid mechanics.	I	Remembering
CO2	Explain the basics of fluid properties, pressure measurement, fluid statics, kinematics, dynamics, and dimensional analysis.	II	Understanding
CO3	Summaries the basic expressions and theory related to: fluid statics, kinematics, dynamics, dimensional analysis, boundary layer theory and its applications.	III	Applying
CO4	Explain analyze rotodynamic machines for their performance	IV	Analyzing

Module	**Module Contents**	**Hours**
I	**INTRODUCTION AND BASIC CONCEPTS:** Introduction, No-Slip Condition, Classification of Fluid Flows, **PROPERTIES OF FLUIDS:** Density and Specific Gravity, Vapor Pressure and Cavitation, Coefficient of Compressibility, Viscosity, Surface Tension and Capillary Effect **PRESSURE AND FLUID STATICS:** Hydrostatic Forces on Submerged Plane Surfaces, Hydrostatic Forces on Submerged Curved Surfaces, Buoyancy and Stability, Fluids in Rigid-Body Motion	7

	FLUID KINEMATICS: Lagrangian and Eulerian Descriptions, Flow Visualization, Plots of Fluid Flow Data, Reynolds Transport Theorem	
II	**MASS, BERNOULLI, AND ENERGY EQUATIONS:** Introduction, Conservation of Mass, Mechanical Energy and Efficiency, The Bernoulli Equation and its applications, General Energy Equation, Energy Analysis of Steady Flows	6
III	**MOMENTUM ANALYSIS OF FLOW SYSTEMS:** Newton's Laws and Conservation of Momentum, Choosing a Control Volume, Forces Acting on a Control Volume, The Linear Momentum Equation, Rotational Motion and Angular Momentum, Angular Momentum Equation	7
IV	**DIMENSIONAL ANALYSIS AND MODELING:** Dimensional Homogeneity, Dimensional Analysis and Similarity, The Method of Repeating Variables and the Buckingham Pi Theorem, **FLOW IN PIPES:** Laminar and Turbulent Flows, The Entrance Region, Laminar and Turbulent Flows in pipes, Minor Losses, Flow Rate and Velocity Measurement **DIFFERENTIAL ANALYSIS OF FLUID FLOW:** The Stream Function, Cauchy's Equation, The Navier–Stokes Equation **FLOW OVER BODIES: DRAG AND LIFT:** Boundary Layer Approximation, Drag and Lift, Friction and Pressure Drag	7
V	**FUNDAMENTALS OF TURBOMACHINERY :** Euler's equation – theory of Rotodynamic machines – various efficiencies – velocity components at entry and exit of the rotor, velocity triangles – Centrifugal pumps, working principle, work done by the impeller, performance curves – Cavitation in pumps Reciprocating pump – working principle	7
VI	**TYPES OF TURBOMACHINERY:** Classification of water turbines, heads and efficiencies, velocity triangles- Axial, radial and mixed flow turbines- Pelton wheel, Francis turbine and Kaplan turbines, working principles – draft tube- Specific speed, unit quantities, performance curves for turbines – governing of turbines	5

Text Books	
1	S K Som, Gautam Biswas, Suman Chakraborty, "*Introduction to Fluid Mechanics and Fluid Machines*" Tata McGraw – Hill Publication. 3rd Edition 2012.
2	Cengel Yunus A. And Cimbala John M. "*Fluid Mechanics and Fundamental and applications*", Tata Mcgraw-Hill New Delhi. 4th Edition 2017
3	Dr. R. K . Bansal, " Fluid mechanics and Hydraulic machines" Laxmi Publication, 9th Edition 2010

References	
1	Streeter, Wylie and Bedford, "*Fluid Mechanics*", Tata McGraw – Hill Publication. 9th Edition 2000.
2	Franke and White, "*Fluid Mechanics*", Tata Mcgraw-Hill New Delhi. 5th Edition 2003

3	M. Potter, D.Wiggert *"Fluid Mechanics"* Schaum's Outline Series Mcgraw-Hill New York 2008..

Useful Links	
1	https://archive.nptel.ac.in/courses/112/105/112105269/

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

Programme	B.Tech. (Mechanical Engineering)
Class, Semester	Second Year B. Tech., Sem IV
Course Code	7ME222
Course Name	Kinematics and Theory of Machines
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 make the students understand the kinematics and rigid- body dynamics of kinematically driven machine components
2	To make the students understand the motion of linked mechanisms in terms of the displacement, velocity and acceleration at any point in a rigid link
3	To enable the students to design linkage mechanisms and cam systems to generate specified output motion
4	To make the students understand the kinematics of gear trains

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**
CO 1	Remember facts, terms, basic concepts, and methods related to theories of machines.	I	Remember
CO 2	Identify mechanism that should be used according to application and find degrees of freedom of different mechanisms.	II	Understand
CO 3	Analyse various linkage mechanisms for optimal functioning	IV	Analyze
CO 4	Develop various linkage mechanism for different applications	V	Evaluate

Module	**Module Contents**	**Hours**
I	Classification of mechanisms- Basic kinematic concepts and definitions- Degree of freedom, mobility- Grashof's law, Kinematic inversions of four bar chain and slider crank chains- Limit positions- Mechanical advantage- Transmission angle- Description of some common mechanisms- Quick return mechanism, straight line generators- Universal Joint- Rocker mechanisms	7
II	Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity acceleration analysis, instantaneous centers, velocity and acceleration analysis using loop closure equations, Coincident points- Coriolis component of acceleration	8
III	Introduction to linkage synthesis three position graphical synthesis for motion and path generation kinematic analysis of simple mechanisms slider crank mechanism dynamics	7

IV	Classification of cams and followers- Terminology and definitions- Displacement diagrams- Uniform velocity, parabolic, simple harmonic and cycloidal motions- derivatives of follower motions- specified contour cams- circular and tangent cams- pressure angle and undercutting, sizing of cams, graphical and analytical disc cam profile synthesis for roller and flat face followers	7
V	Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/undercutting- helical, bevel, worm, rack & pinion gears, epicyclic	6
	and regular gear train kinematics	
VI	Surface contacts- sliding and rolling friction- friction drives, belt and rope drives bearings and lubrication, friction clutches and brakes	5

Text Books	
1	Ratan S.S, "Theory of Machines", Tata McGraw Hill, New Delhi, 3rd Edition, 2011.
2	Sadhu Singh,"Theory of Machines", Pearson Education, 2nd Edition, 2009
3	H. G. Phakatkar,"Theory of Machines I", Nirali Publication, 5th Edition 2009.

References	
1	Thomas Bevan, "Theory of Machines", CBS Publishers, New Delhi, 1st Edition, 2010.
2	J. E. Shigley,"Theory of Machines and Mechanism", , McGraw Hill, New York. 4th Edition, 2011
3	G.S. Rao and R.V. Dukipatti, "Theory of Machines and Mechanism", New Age International Publications Ltd. New Delhi. 2011

Useful Links	
1	Kinematics of Mechanisms and Machines - YouTube
2	Module 1 Lecture 1 Kinematics Of Machines - YouTube
3	Lecture 01 | Introduction to Kinematics of Machines | KOM - YouTube
4	https://onlinecourses.nptel.ac.in/noc22_me25/preview

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
CO2		3		1									1	
CO3		3		1									1	
CO4			3			1							1	

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

Assessment

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
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AY 2024-25

Course Information

Programme	B. Tech. (Mechanical Engineering)
Class, Semester	Second Year B. Tech. SEM-II
Course Code	7ME223
Course Name	Manufacturing Processes - II
Desired Requisites:	NA

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

Course Objectives

1	To familiarize students in various metal cutting, joining and finishing processes
2	To introduce students with various plastic processing, additive manufacturing and various nonconventional machining processes
3	To train the students to identify various process and response variables in cutting, joining and finishing processes.
4	To familiarize students about CNC, VMC and various micromachining processes.
5	To make aware of various non-conventional machining processes.

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	To summarize and compare various cutting, joining, finishing, plastic working and additive manufacturing, non-conventional machining processes.	II	Understanding
CO2	To illustrate/practice various cutting, joining, finishing, plastic processing and additive manufacturing, non-conventional machining processes	III	Applying
CO3	Differentiate and investigate various cutting, joining, finishing, plastic working and additive manufacturing, non-conventional machining processes	IV	Analysing
CO4	To estimate the effect of various process parameters in cutting, joining, finishing, plastic working and additive manufacturing, non-conventional machining processes	V	Evaluating

Module	**Module Contents**	**Hours**
I	**Metal Cutting:** Single and multi-point cutting, Machinability, cutting tool materials, cutting fluids,Tool geometry, Orthogonal / oblique cutting, various force components, tool wear and tool life and its economics, Surface finish and integrity machining. Major operations performed on Lathe, Milling, shaping machines.	7
II	**Joining Processes:** Overview and classification of joining processes: Soldering, brazing, oxifuel gas welding such as oxyacetylene and pressure gas welding, arc welding such as shielded metal arc welding, gas metal arc welding, submerged arc welding, plasma arc welding, Electrodes and Electrode Coatings, resistance welding such as spot, seam and projection welding, Solid-State Welding, Friction Stir Welding, HAZ.	6
III	**Plastic Processing and Additive Manufacturing Processes:** Classification of Plastics and its properties,Thermosetting and thermoplastic materials, comparison with other materials, their properties and	7

	applications. blow moulding, compression moulding, injection moulding, thermoforming, rotational moulding and calendaring Introduction to Additive manufacturing: Rapid prototyping(3D Printing) Types of 3D printing, advantages, applications.	
IV	**Finishing Processes:** Overview and classification of finishing processes, Grinding process-abrasive materials, grinding wheel specification and types, grinding machine classification and grinding operations. Lapping, Honing, Buffing, Barrel Tumbling, Burnishing.	7
V	**Non-conventional Machining Processes – I:** Importance and scope of various non-conventional machining processes like Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining,Ultrasonic Machining, micro machining, their working Principle, Process Parameters, comparison and application of these processes	6
VI	**Non-conventional Machining Processes – II:** Electrical Discharge Machining, wire EDM, Electro-chemical machining (ECM),Laser Beam Machining (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining (EBM), their working Principles, Process Parameters, comparison and application of these processes	6

Text Books	
1	P.C. Sharma, "A Textbook of Production Technology (Manufacturing processes)", S. Chand & co.,8th revised edition 2014. ISBN:8121911141.
2	P.N. Rao, "Manufacturing Technology- Foundry, Forming and Welding", Vol. I Tata McGraw-Hill, 4th edition, 2013, ISBN: 9781259062575.
3	George E. Dieter, "Mechanical Metallurgy", Tata McGraw Hill Publication, Si Metric Edition, 3rd Revised edition, 2013, ISBN : 9780070168930.
4	Jagadeesha T, "Unconventional Machining Processes", Dreamtech Press, Edition 2020, ISBN No:978-93-89976-05-2

References	
1	E. Paul DeGarmo, J.T. Black, Ronald A. Kosher, "Materials and Processes in Manufacturing", John Wiley and Sons Ltd, 9th revised edition, 2004.ISBN:,9780471656777
2	Jagadeesha T, "Non-traditional Machining Processes", Dreamtech Press, Edition 2020, ISBN No:978-93-85920-72-9
3	Serope Kalpakjian, Steven R. Schmid, Manufacturing Engineering and Technology', Pearson (Prentice Hall), Fifth Edition, 2005
4	V. K. Jain, Introduction to Micromachining, Alpha Science, 2010, ISBN 1842654853, 9781842654859

Useful Links	
1	https://youtu.be/Qx-Kx4GapgI
2	https://youtu.be/ljveGnQw2G0?list=PLSGws_74K018JY-1RyIj0cm4yppa1h54r
3	https://youtu.be/ZLlwfXSXEVc?list=PLSGws_74K01_zyzpQkNtm-6ickGhCwi-4
4	https://youtu.be/TlhGTSDfQxc
5	https://youtu.be/Vy4nlWoPPmo
6	https://youtu.be/mmKy5PbndQI?list=PLyqSpQzTE6M-KwjFQByBvRx464XpCgOEC
7	https://www.youtube.com/watch?v=sPhTjrvpGyE&t=1838s
8	https://www.youtube.com/watch?v=WJtF1wEOeAw
9	https://www.youtube.com/watch?v=ICjQ0UzE2Ao
10	https://www.youtube.com/playlist?list=PLzCSUZGIUJkaSyCzPiQMWynGyxmC8hrpl
11	https://www.youtube.com/watch?v=Hc6mfNWT8oQ&t=7s
12	https://www.youtube.com/watch?v=cxU1zUOpGLk&t=3016s
13	https://youtu.be/xf6TbK68hHY
14	https://www.youtube.com/watch?v=06QxjEAMrKc&list=PLwFw6Nkm8oWqFJUxiUuu5c0uHK076lz2K

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

Walchand College of Engineering, Sangli

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AY 2024-25

Course Information

Programme	B.Tech. (Mechanical Engineering)
Class, Semester	Second Year B. Tech., Sem IV
Course Code	7ME271
Course Name	Fluid Mechanics and Fluid Machines 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 introduce the students about basic principles and laws through conducting experiments in laboratory
2	To enable the students to analyze the fluid turbo machines
3	To develop skills in the evaluation of fluid turbo machines.

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 basic principles and laws and conduct the experiments for validation	II	Understanding
CO2	Investigate the performance parameters of fluid turbo machines	III	Applying
CO3	Interpret the performance of fluid turbo machines.	IV	Analyzing
CO4	Evaluate the performance of fluid turbo machines.	V	Evaluating

List of Experiments / Lab Activities

List of Experiments:

a) Study and demonstration.

1. Study of similarity principles.

b) Experiments and Trials (Any twelve)

1. Experiment on Impact of Jet.
2. Experiment on Prandtl type pitot type apparatus.
3. Verification of Bernoulli's Equation.
4. Calibration of Venturi meter and Orifice meter.
5. Calibration of V-Notch
6. Calibration of Orifice and Mouthpiece apparatus.
7. Experiment on Reynolds apparatus.
8. Determination of Minor losses in pipe fittings.
9. Determination of loss in pipes (series/parallel/different material)
10. Trial on Pelton Turbine.
11. Trial on Kaplan Turbine.
12. Trial on Francis Turbine.

13. Trial on Centrifugal Pump.
14. Trial on Gear Pump.
15. Trail on Cavitation apparatus

Text Books	
1	S K Som, Gautam Biswas, Suman Chakraborty, "*Introduction to Fluid Mechanics and Fluid Machines*" Tata McGraw – Hill Publication. 3rd Edition 2012.
2	Cengel Yunus A. And Cimbala John M. "*Fluid Mechanics and Fundamental and applications*", Tata Mcgraw-Hill New Delhi. 4th Edition 2017

References	
1	Streeter, Wylie and Bedford, "*Fluid Mechanics*", Tata McGraw – Hill Publication. 9th Edition 2000.
2	Franke and White, "*Fluid Mechanics*", Tata Mcgraw-Hill New Delhi. 5th Edition 2003
3	M. Potter, D.Wiggert *"Fluid Mechanics"* Schaum's Outline Series Mcgraw-Hill New York 2008..

Useful Links	
1	https://archive.nptel.ac.in/courses/112/105/112105269/

CO-PO Mapping

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

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 (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 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.

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Course Information

Programme	B.Tech. (Mechanical Engineering)
Class, Semester	Second Year B. Tech., Sem IV
Course Code	7ME272
Course Name	Kinematics and Theory of Machines Lab
Desired Requisites:	

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

Course Objectives

1	To develop skills of generation of gear tooth and cam profiles.
2	To prepare the students to perform the analysis of gear drives and mechanisms.

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 principles of kinematics to plot velocity and acceleration diagrams of mechanisms.	III	Apply
CO2	Investigate gear trains for various power transmission systems.	IV	Analyze
CO3	Evaluate various types of gears and belt drives.	V	Evaluate
CO4	Use knowledge of theories of machines to invent new mechanisms or improve existing ones, integrating different components to achieve desired functionalities.	VI	Create

List of Experiments / Lab Activities

List of Experiments:

Term Work contains following:-

1. To plot displacement, velocity and acceleration curves for two types of cam follower systems.
2. To verify angular displacement ratio of shafts connected by Hooke's joint
3. To find out Coriolis component of acceleration.
4. To develop computer program for velocity and acceleration analysis of four bar chain and single slider crank mechanism.
5. To generate involute gear tooth profile.
6. To solve problems on epicyclic gear train by tabular method.
7. To determine moment of inertia by Bi-filler suspension, Tri-filler suspension or compound pendulum method.
8. To study different mechanisms and analyse them with respect to links, joints, Degrees of freedoms.
9. To analyse gear trains in lathe, drilling, milling machine etc
10. To study any one automobile gearbox.

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

Text Books

1	Ratan S.S, "Theory of Machines", Tata McGraw Hill, New Delhi, 3rd Edition, 2011.
2	V. B. Bhandari, "Design of Machine Elements", Tata McGraw Hill, 3rd Edition, 2011
3	Sadhu Singh,"Theory of Machines", Pearson Education, 2nd Edition, 2009

References

1	Thomas Bevan, “Theory of Machines”, CBS Publishers, New Delhi, 1st Edition, 2010.
2	J. F. Shigley,“Mechanical Engineering Design”, , McGraw Hill, New York. 4th Edition, 2011

Useful Links	
1	Virtual Labs (vlabs.ac.in)
2	Kinematics and Dynamics of Mechanisms (iitkgp.ac.in)

CO-PO Mapping

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

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AY 2024-25

Course Information

Programme	B. Tech. (Multi-Disciplinary Minor)
Class, Semester	Second Year B. Tech. SEM-II
Course Code	7MDME201
Course Name	Elements of Mechanical Engineering
Desired Requisites:	NA

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

Course Objectives

1	To engage students in analysing mechanisms used in Mechanical Engineering
2	To prepare the students for applying concepts of motion transmission using mechanisms and gears

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 operation of various power plants, first and second laws of thermodynamics	II	Understanding
CO2	Calculate degrees of freedom and understand the concept of inversion in mechanisms.	III	Applying
CO3	Classify gears based on type and terminology.	IV	Analysing
CO4	Select belts, chains, shafts, keys, couplings, and bearings for various power transmission applications.	V	Evaluating

Module	**Module Contents**	**Hours**
I	**Conventional and nonconventional power plants** Steam power plants, hydropower plant, four stroke and two stroke petrol and diesel engines Diesel power plant, wind power plants	7
II	**Study of mechanical systems** Pumps, compressors, refrigeration, and air conditioning system, hydraulic and pneumatic systems.	6
III	**Basic thermodynamics** First and second law of thermodynamics. Gas processes, Cannot cycle, Otto cycle, Joule cycle, Air standard efficiency, numerical on above	7
IV	**Basics of Machines and Mechanisms** Objective of kinematic analysis of mechanism, classification of links, pairs, Basic terminology and kinematic symbols, kinematic chains, plane motion; constraints and degrees of freedom, mechanism and machines, inversion of mechanisms along with their practical applications.	7
V	**Elements of Power Transmission - I** Gears: Classification and Basic terminology, Fundamental law of gearing, the cycloidal and involute profile, standards in tooth forms, spur gears and other types of gears	6
VI	**Elements of Power Transmission – II** Introduction to belt and chain drives, types of belt drives, shafts, keys, couplings, sliding and rolling contact bearings	6

Text Books

1	Beer and Johnson, Mechanics of Materials, McGraw Hill, 6th Edition , 2013
2	S S Rattan, Theory of Machines, McGraw Hill, 3rd edition, 2016
3	R. Yadav, Applied Thermodynamics, Central Publishing House, 3rd Edition, 2011
References	
1	Den Hartog, Jacob P., Strength of Materials. Dover Publications Inc., 3rd Edition 1961
2	Yunus A Cengel and Michael Boles, Thermodynamics: An engineering approach, McGraw Hill, 9th Edition, 2015
Useful Links	
1	https://archive.nptel.ac.in/courses/112/104/112104188/
2	https://www.youtube.com/watch?v=kC2SEiGaqoA
3	https://nptel.ac.in/courses/112104304

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			1				
CO2	1	3	2				2								
CO3	2			1		1									
CO4	1				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)

Walchand College of Engineering, Sangli

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Course Information	
Programme	B. Tech. (Mechanical Engineering)
Class, Semester	Second Year B. Tech., Sem IV
Course Code	7ESME201
Course Name	Numerical Methods

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	1 Hrs/week	30	20	50	100
		Credits: 3			

Course Objectives

1	Recall and define the basic concepts of numerical errors, stability, and convergence in numerical methods
2	Understand the theoretical foundations of various numerical methods, including their strengths and weaknesses
3	Apply numerical methods in computer programs to solve problems in engineering and science, interpreting the results critically

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	Analyze and solve various types of algebraic and transcendental equations using appropriate numerical methods	IV	Analyzing
CO2	Evaluate the accuracy, convergence, and limitations of different numerical methods for solving problems in engineering and science	V	Evaluating
CO3	Apply numerical methods to curve fitting, interpolation, differentiation, and integration of real-world data	III	Applying
CO4	Analyze and solve ordinary and partial differential equations using numerical techniques appropriate for specific applications	IV	Analyzing

Module	**Module Contents**	**Hours**
I	**Roots of Algebraic Equations** Bracketing methods- Bisection method, false position method, Open methods- Newton Rapson, Multiple roots, System of non-linear equations. Roots of polynomials	5
II	**Linear Algebraic Equation** Gauss elimination method-Naïve Gauss elimination, Pitfalls of elimination methods, nonlinear system of equations. Cramer's rule, Matrix inversion- LU decomposition, Gauss Seidel method.	5
III	**Curve Fitting** Least square regression- Linear regression, Polynomial regression. Interpolation-Newton's divided difference, Interpolating Polynomials	4
IV	**Numerical Differentiation and Integration** Newton cote's integration formulae – Trapezoidal rule, Simpson's rule, Integration of unequal segments. Romberg's integration and Gauss quadrature. Numerical Differentiation- Differentiation Formulae, Richardson Extrapolation, Derivation of unequally spaced data	5

V	**Ordinary Differential Equation** Euler method, improved Euler's method, Runge-Kutta methods, System of equations. Boundary value and Eigen value problem: shooting method, Finite difference method, Eigen value problem, power method	5
VI	**Partial Differential Equation** Finite Difference – Elliptic Equatiosn – Laplace equation, Liebmen method, Boundary conditions. Parabolic equations, explicit method, implicit method, Crank Nicolson method	4

Text Books	
1	Chapra, Steven C., and Raymond A. Canale. Numerical Methods with Applications: An Introduction. McGraw-Hill Education, 5th edition, 2018.
2	Burden, Richard L., J. Douglas Faires, and Anil M. Kainen. Numerical Analysis. Brooks/Cole Cengage Learning, 3rd Edition, 2016.
3	Atkinson, Kendall A. An Introduction to Numerical Analysis. John Wiley & Sons, 2008.

References	
1	Press, William H., Brian P. Flannery, Saul A. Teukolsky, and William T. Vetterling. Numerical Recipes 3.0: The Art of Scientific Computing. Cambridge University Press, 3rd edition, 2007.
2	Dahlquist, Germund, and Åke Björck. Numerical Methods. Dover Publications, 1st edition, 2008.
3	Kantorovich, L. V. Lectures on Numerical Methods. Dover Publications, 1964.

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													3
CO2			3								2		3	
CO3		3		3							1		3	2
CO4	2	3		3					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

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 2024-25

Course Information	
Programme	B.Tech. (All branches)
Class, Semester	Second Year B.Tech., Sem - II
Course Code	
Course Name	Employability Skills Development (ESD)
Desired Requisites:	--

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	4Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives	
1	To improve the problem-solving skills of students
2	To understand the approach towards problem solving
3	Understanding the sectional cut-offs for different companies

Course Outcomes		
CO1	Ability to improve the accuracy percentage	
CO2	Understand the current changing recruitment trends	
CO3	Understanding the differential marking scheme in papers	
CO4	Performance improvement in competitive exams like CAT, GATE	

Module	**Module Contents**	**Hours**
I	**Arithmetic I** Ratio, Proportion, Mark Up & Discount, Averages, Mixtures & Alligations, Simple & Compound Interest	6

II	**Arithmetic II** Percentages, Profit & Loss, Time & Work, Time, Speed & Distance, Boat & Streams, Linear Races s	8
II	**Numbers** Cyclicity, Remainders, Cyclicity of Remainders, Indices, Factors, LCM, HCF	4
III	**Permutation, Combination, Probability** Fundamental principal of counting, Arrangements, Selection, Grouping, Distribution, Independent Events, Conditional Probability, Binomial Distribution	6
IV	**Logical Reasoning** Clocks, Calendars, Games & Tournaments, Analytical Puzzles, Binary Logic, Blood relations, Directions, Coding, Decoding, Seating Arrangement (Linear, Circular & Rectangular)	6
V	**Verbal Ability I** Vocabulary - Synonyms, Antonyms, Analogies Reading Comprehension, Para Jumbles	6
VI	**Verbal Ability II** Parts of Speech, Tenses, Subject Verb Agreement	4
Text Books		
1	Quantitative Aptitude - Abhijit Guha	
2	Quantitative Aptitude - Sarvesh Agarwal	
References		
1	Quicker Maths - M. Tyra	
2	Quantitative Aptitude - Chandresh Agarwal	
3	Puzzles to puzzle you - Shakuntala Devi	
Useful Links		
1	www.campusgate.co.in	
2	www. Lofoya.com	
3	www.brainbashers.com	

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

Assessment
The assessment is based on the MCQ test which will be conducted online through the platform and it will be a proctored test. No negative marking will be there in the test. Test will be of 60 minutes with 20 questions each on Quantitative Aptitude, Logical Reasoning & Verbal Ability

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2024-25

Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Second Year B. Tech., Sem III & IV
Course Code	7IK201
Course Name	Introduction to Ancient Indian Technology
Desired Requisites:	General curiosity, maturity expected from adult student.

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	02 Hrs/week	MSE	ISE	ESE	Total
Tutorial	0 Hrs/week	30	20	50	100
		Credits: 2			

Course Objectives

1	The course is designed for undergraduate students, interested in learning about the ancient Indian technology which is the hallmark of glorious Indian civilization.
2	The objective is to emphasize on nature centric aspects of ancient Indian technologies that can be adopted in modern time.
3	The course is to expose the students to ancient science and technologies which can be adopted for modern technological 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 Descriptor
CO1	Name the ancient Indian technological achivments	1	Remenbering
CO2	Comprehend the concept of Indian traditional knowledge and its relevance	2	Understanding
CO3	Explain the Indian contribution to the world at large	2	Understanding
CO4	Judge the ancient Indian technology.	5	Evaluating

Module	Module Contents	Hours
I	Introduction: Why are ancient Indian science and technology relevant today? What is science? How is it different from technology? .	4
II	Philosophy of ancient Indian technology, how is different from modern technology? Ancient Indian Scientific methods. Glimpses of ancient Indian science and technology?.	4
III	Material technology in ancient India : Mining, Metals and Metallurgy, Iron Making and craftsmanship, Wootz Steel Technology	5
IV	Extraction of Zinc in ancient India, Glass making, Bead making Techniques, Ceramic Technology.	4
V	Water Harvesting Technology, Irrigation Systems. Town planning, Building construction, Sanitation from ancient India period.	5
VI	Agriculture and Textile Technology in context of ancient India i.e Bharat.	4

	Textbooks	
	1	Transcript of the NPTEL course available at https://archive.nptel.ac.in/courses/101/104/101104065/. Title of the course "Introduction To Ancient Indian Technology" by Prof. D.P. Mishra Department of Aerospace Engineering, IIT Kanpur
	References	
	1	The NPTEL course available at https://archive.nptel.ac.in/courses/101/104/101104065/. Title of the course "Introduction To Ancient Indian Technology" by Prof. D.P. Mishra Department of Aerospace Engineering, IIT Kanpur
	Useful Links	
	1	https://archive.nptel.ac.in/courses/101/104/101104065/

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		
CO3	1					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 Tests, assignments, oral, seminar etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 30 - 40% weightage on modules 1 to 3 and 60 - 70% 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	Second Year B. Tech., Sem IV
Course Code	7VSME271
Course Name	Computer Aided Design and Drafting Lab
Desired Requisites:	Basics of Engineering Drawing

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

Course Objectives

1	To make the student familiar with Indian Standards for drawing.
2	To make the student acquainted with standard machine parts and sub-assemblies readily available in market.
3	To develop students to apply knowledge of different limits, fits, and tolerances on assembly drawings.
4	To provide sound knowledge of detail and assembly procedure.
5	To highlight the importance of auxiliary views and interpenetration.
6	To learn to use suitable drafting software.

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 Bureau of Indian Standards drawing conventions in drawings and drafting software to draw assembly and detail drawings.	II	Understanding
CO2	Produce proportionate sketches of standard machine components with use limits, fits and tolerances on assembly drawings.	III	Applying
CO3	Produce detail drawings from given assembly drawings and vice-versa.	III	Applying
CO4	Create the solid models and assemblies using the 3D modelling softwares.	V	Evaluating

List of Experiments / Lab Activities/Topics

List of Lab Activities:

PART A. Following sheets are to be completed on A2 size drawing sheet.

Sheet No 1. Based on BIS conventions

Sheet No 2. Based on free hand sketching

Sheet No 3. Drawing details and assembly containing maximum twelve parts by taking actual measurement on parts.

Sheet No 4. Drawing details and assembly from given drawing of details and entering limits fits and tolerances, surface finish symbols, geometrical tolerances etc.

PART B. Following drawings to be completed using suitable drafting software on A4 size papers

Sheet No.5 Simple 2D figures

Sheet No.6 One detail and assembly drawing containing not more than ten parts

Sheet No.7 One 3D object.

Textbooks

1	P.S.Gill, "*Machine Drawing*", S.K. Kataria and Sons,2002.

2	N.D.Bhatt, "*Machine Drawing",* Charotor Publication House ,2001.
3	N.Sidheshwar, P.Kannaiah and V.V.S.Sastry, "*Machine Drawing*"McGraw Hill,2001.
References	
1	I.S.:SP46 *Engineering drawing practice for schools and colleges* BIS Publication.
2	I.S.:696 *Code of practice for general engineering drawings*. BIS Publication.
3	I.S.:2709 *Guide for selection of fits*. BIS Publication.
Useful Links	
1	https://nptel.ac.in/courses/112102101
2	https://www.youtube.com/watch?v=5xQdrWly1ls&list=PLbkIghvjQ7P8qhyX-L2HYBbDzzF4ntW7w
3	https://www.youtube.com/watch?v=ptJfomL1I7o&list=PLLvBXFAV-DeIsmVkmcNv2RzwCuT1XvhTV

CO-PO Mapping

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

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

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Course Information

Programme	B.Tech. (Mechanical Engineering)
Class, Semester	Second Year B. Tech., Sem III
Course Code	7CE271
Course Name	Field Study
Desired Requisites:	Basics of Mechanical Engineering

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

Course Objectives

1	Gain practical insights into industry operations through visits and interactions.
2	Promote an interdisciplinary approach to problem-solving, integrating technological, business, and societal perspectives.
3	Instill a sense of ethical responsibility and social impact in the development and implementation of solutions.
4	Strengthen written and oral communication skills for presenting and defending case studies.
5	Promote an interdisciplinary approach to problem-solving, integrating technological, business, and societal perspectives.

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 ability to critically observe and understand the operations of various industries, and effectively identify key challenges and inefficiencies within these settings.	II	Understanding
CO2	Exhibit strong analytical skills, capable of conducting thorough research and systematic documentation.	III	Applying
CO3	Showcase the ability to approach problem-solving from an interdisciplinary perspective, integrating technological, business, and societal considerations.	III	Applying
CO4	Possess enhanced written and oral communication skills, enabling them to effectively present and defend their case studies.	V	Evaluating

List of Experiments / Lab Activities/Topics

1. **Introduction and Fundamentals:**
   - Overview of techno-societal case studies: definition, importance, and objectives.
   - Understanding industry operations, processes, and key performance indicators.
2. **Problem Identification and Research:**
   - Techniques for identifying operational challenges and inefficiencies.
   - Methods for collecting and documenting data during industry visits, including ethical considerations.
3. **Data Analysis and Solution Development:**
   - Analytical methods and tools for interpreting collected data.
   - Developing innovative and feasible technological solutions.
   - Evaluating solutions based on feasibility, cost-effectiveness, and social impact.
4. **Case Study Development and Presentation:**
   - Structuring and writing comprehensive case studies.
   - Enhancing communication skills for effective presentation and defense of case studies.
   - Practical industry exposure through visits and interaction with industry professionals, culminating in a capstone project that integrates all course elements.

Textbooks	
	NA

References	
	NA

Useful Links	
	NA

CO-PO Mapping

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

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High
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IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

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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.