Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2022-23

Course Information

Programme	B.Tech. (Mechanical Engineering)
Class, Semester	Second Year B. Tech., Sem III
Course Code	6MA202
Course Name	Probability and Statistics
Desired Requisites:	Mathematics course at Higher Secondary Junior College

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

Course Objectives

1	Familiarize the students with techniques in probability and statistics.
2	Design a statistical hypothesis about the real world problem and conduct appropriate test for drawing valid inference about the population characteristics.

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** computational tools to solve Mathematical and Statistical problems	III	Apply
CO2	**Solve** problems in probability, statistics.	III	Apply

Module	**Module Contents**	**Hours**
I	**Random Variable** Discrete random variable, Continuous random variable, Probability mass function, Probability density function, Bivariate discrete random variable, Joint probability distribution, Joint distribution function of two dimensional discrete random variable, Examples	4
II	**Probability Distribution** Poisson Distribution, Gaussian Distribution, Exponential Distribution, Examples	4
III	**Sampling Distribution** Population, Sample, Random samples, large sample, small sample, Parameter, statistic, standard error of Statistic, sampling distribution of mean, sampling distribution of proportion, Examples	5
IV	**Testing of Hypothesis I** Hypothesis, null and alternative hypothesis, critical region, level of significance, Types of error, one tailed test, two tailed test, test of significance for large samples, Hypothesis testing for single population proportion, hypothesis testing for single population mean, Examples	5
V	**Testing of Hypothesis II** Test of significance for small samples, degrees of freedom, student t distribution: Definition and its properties, Test the significance of mean of random sample, Examples, Chi-square distribution: Definitions and its properties, chi square test, chi square test of goodness of fit, Examples,	5
VI	**Statistics:** Correlation, Linear regression, Curve fitting (a) straight line (b) logarithmic curve, Examples.	5

Text Books

1	Gupta and Kapoor, "Fundamental ofMathematical Statistics"

2	Vijay Rohatgi ,“An Introduction to probability and statistics”
References	
1	S.Ross, “Probability and Statistics for Engineers and Scientists”

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1												
CO2		1	2		1								1	
CO3	1			1	2	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 2022-23

Course Information

Programme	B.Tech. (Mechanical Engineering)
Class, Semester	Second Year B. Tech., Sem III
Course Code	6ME201
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 energy balance between system and its surroundings
2	To learn about application of I law to various energy conversion devices
3	To evaluate the changes in properties of substances in various processes
4	To understand the difference between high grade and low grade energies and II law limitations on energy conversion

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	Write energy balance to systems and control volumes, in situations involving heat and work interactions.	III	Apply
CO2	Evaluate changes in thermodynamic properties of substances.	IV	Analyze
CO3	Evaluate the performance of energy conversion devices and to differentiate between high grade and low grade energies.	V	Evaluate

Module	**Module Contents**	**Hours**
I	**Fundamentals and First law of Thermodynamics** Fundamentals - System & Control volume; Property, State & Process; Exact & Inexact differentials; Work - Thermodynamic definition of work; examples; Displacement work; Path dependence of displacement work and illustrations for simple processes; electrical, magnetic, gravitational, spring and shaft work. Temperature, Definition of thermal equilibrium and Zeroth law; Temperature scales; Various Thermometers- Definition of heat; examples of heat/work interaction in systems- First Law for Cyclic & Non-cyclic processes; Concept of total energy E, Various modes of energy, Internal energy and Enthalpy	8
II	**Properties of Pure substances** Definition of Pure substance, Ideal Gases and ideal gas mixtures, Real gases and real gas mixtures, Compressibility charts- Properties of two phase systems - Const. temperature and Const. pressure heating of water; Definitions of saturated states; P-v-T surface; Use of steam tables ; Saturation tables; Superheated tables; Identification of states & determination of properties, Mollier's chart.	6
III	**First law for flow steady and unsteady processes**	5

	First Law for Flow Processes - Derivation of general energy equation for a control volume; Steady state steady flow processes including throttling; Examples of steady flow devices; Unsteady processes; numericals on of steady and unsteady flow processes,	
IV	**Second Law of Thermodynamics** Second law - Definitions of direct and reverse heat engines; Definitions of thermal efficiency and COP; Kelvin-Planck and Clausius statements; Definition of reversible process; Internal and external irreversibility; Carnot cycle; Absolute temperature scale.	6
V	**Clausius inequality and Availability** Clausius inequality; Definition of entropy S ; entropy S is a property; Evaluation of S for solids, liquids, ideal gases and ideal gas mixtures undergoing various processes; Determination of entropy from steam tables- Principle of increase of entropy; Illustration of processes in T-s coordinates; Definition of Isentropic efficiency for compressors, turbines and nozzles- Irreversibility and Availability, Availability function for systems and Control volumes undergoing different processes, concept of Lost work.	7
VI	**Second law analysis for a control volume and Thermodynamic cycles** Second law analysis for a control volume. Exergy balance equation and Exergy analysis. Basic Rankine cycle; Basic Brayton cycle; Basic vapor compression cycle and comparison with Carnot cycle.	6

Text Books	
1	P. K. Nag "Thermodynamics", Tata McGraw Hill Publication, 3rd Edition, 2006
2	V. P. Vasandani and D. S. Kumar, "Heat Engineering", Metropolitan Book Company, 2nd Edition, 1975
3	R. Yadav, "Fundamentals of Thermodynamics", Central Publication house, Allahabad, Revised 7th Edition, 2011.

References	
1	Cengel and Boles, "Thermodynamics an Engineering Approach", Tata McGraw-Hill publication, Revised 7th Edition 2016
2	Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J. "Fundamentals of Thermodynamics", John Wiley and Sons, 6th Edition, 2003.
3	Jones, J. B. and Duggan, R. E. "Engineering Thermodynamics", Prentice-Hall of India , 2nd Edition, 1996
4	Moran, M. J. and Shapiro, H. N. "Fundamentals of Engineering Thermodynamics", John Wiley and Sons. 3rd Edition 2003.

Useful Links	
1	https://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	3	2											1	
CO2	3	2	1										1	
CO3	3	2	3		2	1							1	

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 2022-23

Course Information

Programme	B.Tech. (Mechanical Engineering)
Class, Semester	Second Year B. Tech., Sem III
Course Code	6ME202
Course Name	Materials Engineering
Desired Requisites:	

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

Course Objectives

1	To make the students familiarize with properties of different metals and their microstructural and crystallographic relevance.
2	To describe solidification behavior of metals and its alloys and to predict their microstructure.
3	To explore different heat treatment processes, and powder metallurgy.
4	To make students to investigate various NDT methods.

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	Relate influence of imperfections in plastic deformation process, strengthening mechanism and show its effect over mechanical properties by conducting destructive and non-destructive tests.	III	Apply
CO2	Explain various phase transformations and classify various heat treatment processes.	IV	Analyze
CO3	Apply knowledge of powder metallurgy process, special grade materials in engineering applications.	V	Evaluate

Module	**Module Contents**	**Hours**
I	Mechanical Behaviour 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
II	Testing of Materials, Mechanical testing of materials (Destructive and Non - Destructive testing methods), Introduction to Fracture, failure case studies	7
III	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
IV	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	Powder Metallurgy, Introduction, Manufacturing route for – Tool materials,	

	bearings and bushes, electrical contacts, brake pads etc. , failure of powder metallurgy components –case studies, Economic, Environmental and Social Issues in Materials Science and Engineering.	7
VI	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

Text Books	
1	V. Raghvan, "Solid State Phase Transformations", PHI Publication, 1st Edition, 1987, Reprinted 2004.
2	V. Raghvan, "Physical Metallurgy: Principles and Practice", PHI Publication, 3rd Edition, 2015.
3	William D. Callister, "Fundamentals of Materials Science and Engineering", Wiley India Pvt. Ltd, 9th Edition, 2014.
References	
1	Sidney H. Avener, "Physical Metallurgy", Tata McGraw Hill Education Private Limited, 2nd Edition, 2017
2	George E. Dieter, "Mechanical Metallurgy", Tata McGraw Hill Publication, Si Metric Edition, 3rd Revised edition, 2013.
3	Ashok Sharma, Rajan, "Heat Treatment: Principles & Techniques", PHI Learning Pvt. Ltd-New Delhi, 2nd edition, 2011.
Useful Links	
1	https://www.youtube.com/watch?v=KMcsjCXfLQw&list=PLyAZSyX8Qy5Am_2StOOQ5vCUE3VIcAenE
2	https://www.youtube.com/watch?v=5nBBUahtzc&list=PLyAZSyX8Qy5C8ciqBBlypbx91j4nowUbL
3	https://onlinecourses.nptel.ac.in/noc22_mm05/preview

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
CO2			2						2			1		1
CO3			2									1	2	1

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

Assessment

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 2022-23

Course Information

Programme	B.Tech. (Mechanical Engineering)
Class, Semester	Second Year B.Tech., Sem III
Course Code	6ME203
Course Name	Strength of Materials
Desired Requisites:	Basic Engineering Mechanics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	1 Hrs/week	30	20	50	100
		Credits: 4			

Course Objectives

1	To make the students understand the nature of stresses developed in simple geometries such as bars, cantilevers, beams, shafts, cylinders and spheres for various types of simple loads.
2	To enable the students to calculate the elastic deformation occurring in various simple geometries for different types of loading.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Understand the nature of internal stresses that will develop within the components.	II	Understanding
CO2	Calculate the stresses in various simple components due to different loadings.	III	Applying
CO3	Evaluate the strains and deformation that will result due to the elastic stresses developed within the materials for simple types of loading.	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	6
II	**Torsion and Shear force and bending moment diagram** Torsion, stresses and deformation in circular and hollow shafts, stepped shafts, deflection of shafts fixed at both ends, stresses and deflection of helical springs.	7
III	**Stresses in beams** Beams and types transverse loading on beams- shear force and bend moment diagrams- Types of beam supports, simply supported and over-hanging beams, cantilevers. Theory of bending of beams, bending stress distribution and neutral axis, shear stress distribution, point and distributed loads, for various commonly used sections	7
IV	**Deflection of beams** Moment of inertia about an axis and polar moment of inertia, deflection of a beam using double integration method, computation of slopes and deflection in beams, Maxwell's reciprocal theorems	7
V	**Principal Stress** Normal and shear stress on oblique planes, principal stresses and planes. Mohr Circle. Combined effect of bending and shear in beams. Theories of failure	6
VI	**Buckling of Columns** Euler's formula for different end connections, concept of equivalent length,	6

	eccentric loading, Rankine formula	

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, Dhanpat Rai and Sons New Delhi, 3rd edition, 2009

References	
1	Den Hartog, Jacob P., Strength of Materials. Dover Publications Inc., 3rd Ediдtion 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	https://nptel.ac.in/courses/112/107/112107146/
2	https://nptel.ac.in/courses/112/107/112107147/
3	https://www.coursera.org/learn/mechanics-1
4	https://ocw.mit.edu/courses/materials-science-and-engineering/3-11-mechanics-of-materials-fall-1999/

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	

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

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B. Tech. (Mechanical Engineering)
Class, Semester	Second Year B. Tech., Sem. III
Course Code	6ME204
Course Name	Manufacturing Processes - I
Desired Requisites:	

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

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 casting, 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	Understand
CO2	To sketch and articulate different primary shaping processes.	III	Apply
CO3	To illustrate and conclude the selection of proper primary shaping process for a particular components.	IV	Analyse

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, CO_2 Moulding. Components of gating system, functions and importance of runners and risers.	9
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.	9
III	**Metal Forming Processes:** Hot, cold and worm working. Recovery and Recrystallization. Formability and	8

	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.	9
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.	10
VI	**Recent Developments in Foundry and Metal Forming**: Flaskless moulding in foundry, High energy rate forming processes such as Explosive forming, Electro-hydraulic forming, Electromagnetic forming, Magnetic pulse forming. Metal forming in mashy state, forming by Laser beam / plasma arc etc. Modernization, mechanization and use of computers in foundries and forming industries.	7

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	

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 2022-23

Course Information

Programme	B.Tech. (Mechanical Engineering)
Class, Semester	Second Year B.Tech., Sem III
Course Code	6ME251
Course Name	Thermodynamics Lab
Desired Requisites:	

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

Course Objectives

1	To impart the techniques to find physical properties of the oils, greases, and solid fuels used in steam generators.
2	To prepare the students for applying laws of thermodynamics to various thermodynamics devices.
3	To develop the skills of students for evaluating performance of thermodynamics systems.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Determine the properties of fluids used in various industrial systems such as Mechanical Power Production systems.	III	Apply
CO2	Calculate the calorific value of a given fuel by using Bomb calorimeter.	IV	Analyze
CO3	Apply first law of thermodynamics to various cyclic systems.	V	Evaluate

List of Experiments / Lab Activities

List of Experiments:

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, 3rd Edition., 2012,
2	V. P. Vasandani and D. S. Kumar, "Heat Engineering", Metropolitan Book Company, 2nd Edition. 1975,
3	R. Yadav, "Fundamentals of Thermodynamics", Central Publication house, Allahabad, Revised 7th Edition,2011.

References

1	Cengel and Boles, “Thermodynamics an engineering Approach”, Tata McGraw-Hill publication, Revised 7th Edition,2011,
2	R. Yadav, “Thermodynamics and heat engine”, Central Publication house Allahabad, Revised 7th Edition. 2016
3	R. Yadav, “Steam and Gas Turbine”, Central Publication house, Allahabad, Revised 7th edition,2010
Useful Links	
1	https://www.youtube.com/watch?v=g8LrAsL4oH0&list=PLRoYs08qHtE7HDTE3KerpAWPyqfQiEq8x
2	https://www.youtube.com/watch?v=h9LeZs0N8qQ
3	http://htv-au.vlabs.ac.in/

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

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO, 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	6ME252
Course Name	Materials Engineering Laboratory
Desired Requisites:	

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

Course Objectives

1	To demonstrate destructive and non-destructive test methods.
2	To describe solidification behaviour of metals and its alloys and to predict their microstructure, and phases
3	To demonstrate methodology for metallographic sample preparation

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	Examine various destructive and non destructive testing methods	III	Apply
CO2	Estimate effect of phases present in the microstructure over physical properties of materials.	IV	Analyze
CO3	Perform metallographic sample preparation process.	V	Evaluate

List of Experiments / Lab Activities

List of Experiments:

1. Tensile test as per ASTM/IS standards.
2. Hardness test
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.
6. Determination of grain size of metals and alloys.
7. Determination of intergranular attack in austenitic stainless steels.
8. Determination of hardenability of a given steel component.
9. Metallography/Microstructural examination test on ferrous and non ferrous metals and alloys as per
10. Heat treatment of steels.
11. Creep test
12. Thermal analysis

Text Books

1	V. Raghvan, "Solid State Phase Transformations", PHI Publication, 1st Edition, 1987, Reprinted 2004,
2	V. Raghvan, "Physical Metallurgy: Principles and Practice", PHI Publication, 3rd Edition, 2015.
3	William D. Callister, "Fundamentals of Materials Science and Engineering", Wiley India Pvt. Ltd, 9th Edition, 2014.

References

1	Sidney H. Avener, "Physical Metallurgy", Tata McGraw Hill Education Private Limited, 2nd

	Edition, 2017
2	George E. Dieter, “Mechanical Metallurgy”, Tata McGraw Hill Publication, Si Metric Edition, 3rd Revised edition, 2013.
3	Ashok Sharma, Rajan, “Heat Treatment: Principles & Techniques”, PHI Learning Pvt. Ltd-New Delhi, 2nd edition, 2011.
Useful Links	
1	https://sm-nitk.vlabs.ac.in/#
2	https://www.youtube.com/watch?v=D8U4G5kcpcM

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	3										2	1
CO2			2	1										1
CO3	2		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, 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	6ME254
Course Name	Manufacturing Process-I Lab
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2Hrs/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, die angle in wire drawing 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.	III	Apply
CO2	Compare different types of metal forming Process	IV	Analyze
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	V	Evaluate
CO4	Compose reports based on industrial visits.	VI	Create

List of Experiments / Lab Activities

List of Experiments:

A. Demonstration of types of patterns and hands on experience of Pattern making

[Location: Carpentry shop] **[4 Hrs] –** Brief report submission

B. Sand Testing (Any four) [Location: Foundry Shop] **[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) [8 Hrs]

1. Demonstration of open, closed and precision die forging using models charts.
2. Study of rolling process by using model or chart and evaluation of number of passes in rolling operation.
3. Study of metal extrusion process using model or chart.

4. Study of wire drawing process and evaluate optimum die angle for wire drawing.
5. Study of various types of press tools and analysis of strip layout in sheet metal working.
6. Study of deep drawing process and evaluate number of draw and force required for deep drawing.

3. Report on industry visits related to Foundry and metal forming industries – [4 Hrs].

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 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, 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 IV
Course Code	6MA221
Course Name	Applied Mathematics for Mechanical Engineering.
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 develop 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 Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Understanding mathematical concepts in engineering field	III	Applying
CO2	Use mathematical and computational methods to solve the problems in science and engineering field	IV	Analysing

Module	**Module Contents**	**Hours**
I	**Fourier Series.** Periodic functions, Dirichlet's conditions, Definition, Determination of Fourier coefficients(Euler's formulae), expansion of functions, even and odd functions, change of interval and functions having arbitrary period, half range Fourier sine and cosine series	6
II	**Partial Differential Equations.** Four Standard forms of Partial differential equations and application to one dimensional Heat equation	5
III	**Matrices and its Application.** Transpose Adjoint, General properties, rank determinant, Jacobian ,Banded Matrix Transformation Matrices Rotation Translation, mirror scaling, concept of tensor.	7
IV	**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, Laplace transform of periodic functions.	8
V	**Vector Differential.** Concept of vector field, directional derivatives, gradient of vector field, tangent line to the curve. Velocity, acceleration, divergent and curl of vector field, conservative vector field.	6
VI	**Vector Integral.** Line integrals, Surface and volume integral, Greens theorem in plane, Gauss Divergence theorem, Stokes's Theorem.	7

Textbooks

1	"Advanced Engineering Mathematics", Erwin Kreyszig, Wiley Eastern Limited Publication, 1978, 1st Edition.

2	"A Text Book o[Applied Mathematics, Vol I and II", P. N. and J. N. Wartikar, Vidyarthi Griha Prakashan, Higher Engineering Maths", B.S. Grewal, Khanna Publication, 2005, 39th Edition Pune, 2006.
References	
1	Advanced Engineering Mathematics ", Wylie C.R., Tata McGraw Hill Publication, 1999, 8th Edition.
2	Advanced Engineering Mathematics ", H. K. Dass, S. Chand & Company Ltd., 1988, I " Edition
Useful Links	
1	https://www.youtube.com/watch?v=Na6N2DwdL_k&list=PLp6ek2hDcoNB3jiva0_CRJ-1wmTOo98E0
2	https://www.youtube.com/watch?v=W3HXK1Xe4nc

CO-PO Mapping

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

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	6ME222
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
4	To analyze the flow in water pumps and turbines.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain the basics of fluid properties, pressure measurement, fluid statics, kinematics, dynamics, and dimensional analysis.	III	Apply
CO2	Summaries the basic expressions and theory related to: fluid statics, kinematics, dynamics, dimensional analysis, boundary layer theory and its applications.	IV	Analyze
CO3	Analyze roto dynamic machines for their performance.	V	Evaluate

Module	**Module Contents**	**Hours**
I	**Properties of Fluids** Fluid Properties: viscosity, vapour pressure, compressibility, surface tension, Mach number. Pressure at a point, variation in pressure, Pascal law, and Pressure measurement by using different manometers.	4
II	**Fluid Kinematics** Different approaches to study fluid mechanics, Reynolds transport Theorem, Flow visualization, types of flow, strain rate, stream line, streak line, path lines, stream tubes, continuity equation in Cartesian coordinates in three dimensional forms, velocity and acceleration of fluid particles. Velocity potential function and stream function.	7
III	**Momentum equation and Viscous Flows** Momentum equation, Nervier Stoke equation, Development of Euler's equation, Integration of Euler's equation i.e. Bernoulli's equation, Application of Bernoulli's equation, Steady and unsteady flow through orifice. Orifice placed in pipe, Venturimeter, flow over triangular and rectangular notches, pitot tube. **Viscous/Laminar flow:** Plane poissullie flow and coutte flow, Laminar flow through circular pipes, Loss of head due to friction in viscous flow, Power absorbed in viscous flow. **b) Turbulent flow**: Reynolds experiment, frictional losses in pipe flow, shear stress in turbulent flow, major and minor losses (Darcy's and Chezy's equation), HGL, TEL, Flow through siphon pipes, Branching pipes and equivalent pipe.	7
IV	**Dimensional analysis and Boundary layers** **a) Dimensional analysis:** Dimensionally homogeneous equations,	7

	Buckingham's π Theorem, calculation of dimensionless parameters. Similitude complete similarity, model scales **b) Introduction to boundary layer theory and analysis.**	
V	**Rotodynamic machines** 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	**Classification and Performance of hydro turbines.** 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.	7

Text Books	
1	S K Som, Gautam Biswas, SumanChakraborty, "Introduction to Fluid Mechanics and Fluid Machines" Tata McGraw – Hill Publication. 3rd Edition 2012.
2	M. Potter, D.Wiggert "Fluid Mechanics" Schaum's Outline Series Mcgraw-Hill New York Second edition 2008.
3	R.K.Bansal, "A Text book of Fluid Mechanics and Hydraulic Machines", Laxmi Publications Pvt. Ltd. New Delhi 9th edition, 2005.

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	CengelYunus A. And Cimbala John M. "Fluid Mechanics and Fundamental and applications", Tata Mcgraw-Hill New Delhi. 1st Edition 2006.

Useful Links	
1	https://www.youtube.com/results?search_query=fluid+mechanics+nptel
2	https://www.youtube.com/watch?v=HGbbdXNcIQA&list=PLbMVogVj5nJQEgL1sHuY24d6omOqXInnt
3	https://nptel.ac.in/courses/112/103/112103290/

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

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

Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

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

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

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B. Tech. (Mechanical Engineering)
Class, Semester	Second Year B. Tech., Sem IV
Course Code	6ME223
Course Name	Manufacturing Processes - II
Desired Requisites:	

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

Course Objectives

1	To familiarize students in various metal cutting, joining and finishing processes.
2	To introduce students with various plastic processing, additive manufacturing and various non-conventional 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	Understand
CO2	To illustrate/practice various cutting, joining, finishing, plastic processing and additive manufacturing, non-conventional machining processes.	III	Apply
CO3	Differentiate and investigate various cutting, joining, finishing, plastic working and additive manufacturing, non-conventional machining processes.	IV	Analyze

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, Surface finish and integrity. machining. Major operations performed on Lathe, Milling, shaping machines.	8
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, resistance welding such as spot, seam and projection welding.	6
III	**Plastic Processing and Additive Manufacturing Processes:** Thermosetting and thermoplastic materials, comparison with other materials, their properties and applications. blow moulding, compression moulding, injection moulding, thermoforming, rotational moulding and calendaring	7

	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, and other super finishing processes.	6
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	7
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	3
CO1	3					1									
CO2	2				1									1	
CO3		1											2		

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

Assessment (for Theory Course)
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. 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	6ME224
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**
CO1	Identify mechanism that should be used according to application and find degrees of freedom of different mechanisms.	II	Understand
CO2	Analyse various linkage mechanisms for optimal functioning	IV	Analyze
CO3	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 and regular gear train kinematics	6

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		3		1									1	
CO2		3		1									1	
CO3			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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Course Information

Programme	B. Tech. (Mechanical Engineering)
Class, Semester	Second Year B. Tech., Sem. IV
Course Code	6ME225
Course Name	Design of Machine Elements
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 take overview of codes, standards and design guidelines for different machine elements.
2	To explain the effect of combined loading on machine elements and safety critical design.
3	To appraise the relationships between component level design and overall machine system design and performance.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	apply theories of failure in design of various machine elements.	III	Apply
CO2	estimate design parameters of machine elements.	IV	Analyze
CO3	evaluate the performance of machine elements subjected to different loading conditions.	V	Evaluate

Module	**Module Contents**	**Hours**
I	**Basics of engineering design** General Design process and procedure, types of loads, factor of safety- its selection and significance, theories of failure and their applications, aesthetic and ergonomic considerations in design	5
II	**Design of shafts and accessories** Design of solid and hollow shafts based on elastic theories of failure, transmission and line shafts, splined shafts, types of couplings, design of muff, rigid flange and flexible bushed pin type flange couplings, design of keys and splines	6
III	**Design of screws** Forms of threads, design of power screws and nuts, types of induced stresses, efficiency of power screw, self-locking and overhauling properties, introduction to re -circulating ball screw.	7
IV	**Design of joints** Types of welded, bolted and riveted joints, design of welded, bolted and riveted joints subjected to transverse and eccentric loads	7
V	**Design against fluctuating load**	7

	Stress concentration - causes and remedies, fluctuating stresses, S-N. diagram under fatigue load, endurance limit, notch sensitivity, endurance strength- modifying factors, design for finite and infinite life under reversed stresses, cumulative damage in fatigue failure, Soderberg and Goodman diagrams, modified Goodman diagram, fatigue design for components under combined stresses such as shafts, and springs.	
VI	**Design of Springs** Helical springs, design against static load, design against fluctuating load, optimum design of springs, types of springs and its design.	7

Text Books	
1	V. B. Bhandari, "Design of Machine Elements", Tata McGraw Hill Publication, 3rd Edition, 2008
2	J.F. Shigley, "Mechanical Engineering Design", McGraw Hill Publication, 8th Edition, 2008
3	R. L. Norton, "Design of Machinery", McGraw Hill Publication, 3rd Edition, 2003
References	
1	Timothy Wentzell, "Machine Design", Cengage Learning, 1st Edition, 2009
2	M. F. Spotts, T.E Shoup, Hornberger, Jayaram, Venkatesh, "Design of Machine Elements", Pearson Education, 8th edition, 2011
3	PSG Design Data Book, Third Edition, 1978
Useful Links	
1	https://nptel.ac.in/courses/112/105/112105124/

CO-PO Mapping

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

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Course Information

Programme	B.Tech. (Mechanical Engineering)
Class, Semester	Second Year B. Tech., Sem IV
Course Code	6ME272
Course Name	Fluid Mechanics and Fluid 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 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.	III	Apply
CO2	Investigate the performance parameters of fluid turbo machines.	IV	Analyze
CO3	Interpret the performance of fluid turbo machines.	V	Evaluate

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.

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

Text Books

1	Modi and Seth," Fluid mechanics and hydraulic machines", Standard book house, third edition 2012
2	N.S. Govindrao, "Fluid flow machines", Tata Mc Hill, Second edition 1983.
3	Jagdish Lal, "Fluid and Turbo machines", New Age publisher, Second edition 1982.

4	S K Som, Gautam Biswas, Suman Chakraborty, "Introduction to Fluid Mechanics and Fluid Machines" Tata McGraw – Hill Publication. 3rd Edition, 2012.
References	
1	P.L. Balleny, "Thermal Engg.", Khanna pub. New delhi, third edition, 2002.
2	Cohen and Rogers, "Gas turbines and Compressor", Pearson Ed, second edition, 1996.
3	3. R. Yadav, "Thermodynamics and Heat Engines – Vol-II",CPH Allahabad , third edition 1999.
Useful Links	
1	https://www.youtube.com/watch?v=HGQM913rI10&list=PLkUEX3IbW7lclZ9jK-thjumHM2-meHGjF
2	https://nptel.ac.in/courses/112/103/112103290/

CO-PO Mapping

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

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO, 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. IV
Course Code	6ME273
Course Name	Manufacturing Processes Lab – II Lab
Desired Requisites:	

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

Course Objectives

1	To perform simple job having turning and milling operations.
2	To understand and demonstrate CNC, VMC machines.
3	To demonstrate and familiarize with different types of grinding machines and operations.
4	To summarize and demonstrate different types of non-conventional machining processes.
5	To make aware of Micromachining 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	Illustrate the knowledge of the metal cutting, Joining, finishing, advanced and non- conventional machining processes.	III	Apply
CO2	Differentiate between conventional, non-conventional manufacturing processes.	IV	Analyze
CO3	Compare the performance of various manufacturing processes.	V	Evaluate
CO4	Produce simple component by machining operations.	VI	Create

List of Experiments / Lab Activities

List of Experiments:

1. Simple job having Lathe, Milling machine operation [6 Hrs].
2. Demonstration on CNC / VMC machine [2Hrs].
3. Demonstration on grinding processes such as cylindrical, surface, centreless grinding machines [2 Hrs].
4. Study and demonstration of 3-D Printing [2Hrs].
5. Study and demonstration of Non-Conventional Machining Processes: EDM, WEDM, Laser machining [6 Hrs].
6. Study and demonstration on Micromachining centre setup [4 Hrs].
7. Report on industry visits related to Manufacturing Processes –II curriculum – [2 Hrs].

Text Books

1	P. N. Rao, "Manufacturing Technology- Foundry, Forming and Welding", Vol. 1 Tata McGraw-Hill, 5th edition, 2018
2	P.N. Rao, "Manufacturing Technology- Metal cutting and Machine tools", Vol. 2 Tata McGraw-Hill, 4th edition, 2018
3	P.C. Sharma, "A Textbook of Production engineering", S. Chand & co, 2006. ISBN: 9788121901116

4	P.H. Joshi, “Press Tools-Design and Construction”, S. Chand & Company Ltd.,2010, ISBN:81-219-2938-5
5	R. K. Rajput, “ A Textbook of Manufacturing Technology”, Laxmi Publications, 2016, ISBN:9788131802441
References	
1	W.A.J. Chapman, "Workshop Technology", CBS Publishing & Distributors, New Delhi,Vol.I [ISBN13:9788123904016]2001, Vol.II [ISBN:9788123904115] 2007 andVol.III [ISBN:9788123904122] 1995
2	HMT, “Production Technology”, Tata McGraw-Hill Publications. Ltd., 2017 ISBN: 978-0070964433 ,New Delhi
3	Serope Kalpakjian, Steven R. Schmid, “Manufacturing Engineering and Technology”, Pearson (Prentice Hall), Fifth Edition, 2005
Useful Links	
1	http://msvs-dei.vlabs.ac.in/msvs-dei/ [http://vlabs.iitb.ac.in/vlab/labsme.html]
2	https://www.vlab.co.in/broad-area-mechanical-engineering
3	https://www.youtube.com/watch?v=gOms0cwsK3Y
4	https://www.youtube.com/watch?v=on_juMwWrc4
5	https://www.youtube.com/watch?v=dwftwb-J1E4
6	https://www.youtube.com/watch?v=68LWCNGDvls
7	https://www.youtube.com/watch?v=EALXTht-stg
8	https://www.youtube.com/watch?v=tJ7bhA4EgO4
9	https://www.youtube.com/watch?v=kyeDtbmCSgw

CO-PO Mapping

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

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

Assessment

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

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40

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

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Course Information

Programme	B.Tech. (Mechanical Engineering)
Class, Semester	Second Year B. Tech., Sem IV
Course Code	6ME274
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

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	

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 IV
Course Code	6ME275
Course Name	Machine Drawing and CAD 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

List of Experiments / Lab Activities/Topics

List of Lab Activities:

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

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											
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 IV
Course Code	6ME276
Course Name	Presentation and Report Writing
Desired Requisites:	

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

Course Objectives

1	To review and increase student's understanding of the specific topics.
2	To read, summarise and review research articles and gain an understanding of a new field, in the absence of text book
3	To judge the value of different contributions and identify promising new directions.

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	Review and increase their understanding of the specific topics	III	Apply
CO2	Read research papers critically and efficiently	IV	Analyze
CO3	Summarize and review the topics in absence of textbooks.	V	Evaluate

List of Experiments / Lab Activities

List of Experiments:

Based on any recent subject student should choose the topic for report writing and presentation. (Subcomponents: Introduction, Literature review, modeling (if any), case study, applications, advantages, disadvantages, future scope and conclusions etc.)

Text Books

1	As per topic chosen by student.

References

1	As per topic chosen by student.

Useful Links

1	As per the topic chosen by the student.

CO-PO Mapping

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

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

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