D. Y. Patil College of Engineering and Technology

Kasaba Bawada, Kolhapur

(An Autonomous Institute)

Accredited by NAAC with 'A' Grade

B. Tech Programme Structure

B. Tech.

(Mechanical Engineering)

(To be implemented from academic year **2023-24)**

D Y Patil College of Engineering and Technology, Kasaba Bawada, Kolhapur
Department of Mechanical Engineering

Department of Mechanical Engineering
Second Year B.Tech. In Mechanical Engineering
Semester-III

Sr. No	Course Code	Course Type	Name of the Course	Teaching Scheme PerWeek			Credits	Total Marks	Evaluation scheme			
				Lecture	Tutorial	Practical			Type	Max. Marks	Min. Marks for Passing	
1	201MEL201	BSC	Engineering Mathematics III	3	1	-	4	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
2	201MEL202	PCC	Fluid Mechanics	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
3	201MEL203	PCC	Kinematics Mechanism and Machines@	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
4	201MEL204	PCC	Manufacturing Processes	3			3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
5	201MEL205	PCC	Applied Thermodynamics	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
6	201MEP202	LC	Fluid Mechanics Lab	-	-	2	1	50	ISE	25	10	10
									ESE (POE)	25	10	10
7	201MEP203	LC	Kinematics Mechanism and Machines Lab	-	-	2	1	25	ISE	25	10	10
8	201MEP205	LC	Applied Thermodynamics Lab	-	-	2	1	50	ISE	25	10	10
									ESE (POE)	25	10	10
9	201MEP206	LC	Machine Drawing and Computer Aided Drafting Lab	-	1	2	1	50	ISE	25	10	10
									ESE (POE)	25	10	10
10	201MEP207	ESC	Python Programming Lab	-	1	2	1	25	ISE	25	10	10
11	201MEMC208	MC	Essentials of Electrical and Electronics Tech.	2	-	-	0	50	ESE	50	20	ESE
			Total	**17**	**3**	**10**	**23**	**750**	**Total Credits: 23**			
									Total Contact Hrs.: 30			

D Y Patil College of Engineering and Technology, Kasaba Bawada, Kolhapur
Department of Mechanical Engineering

Course Code	Definition
BSC	Basic Science Course
ESC	Engineering Science Course
HSMC	Humanity and Social Science including Management Course
PCC	Professional Core Course
PEC	Professional Elective Course
OEC	Open Elective Course
LC	Laboratory Course
MC	Mandatory Course

Abbreviations:

ISE: In Semester Evaluation,
MSE: Mid semester Examination,
ESE: End Semester Examination

Note:
1. @ indicates 2.5-hour duration ESE

D Y Patil College of Engineering and Technology, Kasaba Bawada, Kolhapur
Department of Mechanical Engineering

Department of Mechanical Engineering Second Year B.Tech. In Mechanical Engineering Semester-IV												
Sr. No	**Course Code**	**Course Type**	**Name of the Course**	**Teaching Scheme Per Week**			**Credits**	**Total Marks**	**Evaluation scheme**			
				Lecture	**Tutorial**	**Practical**			**Type**	**Max. Marks**	**Min. Marks for Passing**	
12	201MEL209	ESC	AIML for Mechanical Engineers	1	-	-	1	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
13	201MEL210	ESC	Strength of Materials	3	1	-	4	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
14	201MEL211	PCC	Fluid and Turbo Machinery	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
15	201MEL212	PCC	Machine Toolsand Processes	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
16	201MEL213	PCC	Theory of Machines	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
17	201MEP209	LC	AIML for Mechanical Engineers Lab	-	-	2	1	25	ISE	25	10	10
18	201MEP211	LC	Fluid and Turbo Machinery Lab	-	-	2	1	50	ISE	25	10	10
									ESE (POE)	25	10	10
19	201MEP213	LC	Theory of Machines	-	-	2	1	50	ISE	25	10	10
									ESE (POE)	25	10	10
20	201MEP214	ESC	Machining Technology Lab - I	-	-	2	1	75	ISE	25	10	10
									ESE (POE)	50	20	20
21	201MEP215	LC	3 D Modeling Lab	-	-	2	1	25	ISE	25	10	10
22	201MEMC216	MC	Environmental Studies	2			0					
			Total	**15**	**1**	**10**	**19**	**725**	**Total Credits: 19**			
									Total Contact Hrs.: 26			

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Course Code	Definition
BSC	Basic Science Course
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LC	Laboratory Course
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Abbreviations:
ISE: In Semester Evaluation,
MSE:-Mid semester Examination,
ESE: End Semester Examination

Note:

1. **@ indicates 2.5-hour duration ESE**
2. **Students have to undergo 4 to 6 weeks internship Semester after IV or VI during summervacation**

   (Guidelines for Internship is attached below)

Guidelines for Internship -

• The students are expected to undergo 4 to 6 weeks internship in Industry and work on relevant area as assigned by industry. The work done should be monitored and evaluated by the concerned Industrial expertbased on report prepared by the students. The department has to assign one faculty member who has to communicate with industry and monitor the internship related work periodically.

The weightage of evaluation will be as under: -

a) Industry expert/Supervisor -70%

b) Department and faculty mentor includes preparation and submission of report to department at thebeginning of subsequent semester -30%

• Internship can be availed by the students during summer vacation after the completion of Semester IV orVI.

• The credits of internship will be considered in Semester VII

• The industry expert/Supervisor is expected to assign work worth of minimum of 100 to 120 hrs. for 4 to 6week duration and should monitor and evaluate periodically.

• At the completion of Internship work, the student is expected to prepare report on the work done and getcertified from the industry expert.

D Y Patil College of Engineering and Technology, Kasaba Bawada, Kolhapur
Department of Mechanical Engineering

Course Plan

Course Title : Engineering Mathematics - III	
Course Code : 201MEL201	**Semester : III**
Teaching Scheme : L-T-P : 3-1-0	**Credits : 4**
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks : 50**

Prerequisite: Quadratic Equations, Synthetic Division, Partial Fraction, Formulas of Derivatives& Integrations.

Course Objectives:

1. To develop mathematical skills and enhance thinking power of students.
2. To give the knowledge to the students of Applied Mathematics with an emphasis on the application of solving Mechanical Engineering problems.
3. To prepare students to formulate a mathematical model using engineering skills &interpret the solution in Mechanical Engineering and real world.

Course Outcomes (COs):

At the end of the course the student should be able to:

CO	Statement	BTL
C201.1	Make use of linear differential equation to solve the Mechanical engineering problems.	L3
C201.2	Describe the statistical data numerically by using lines of regression and curve fittings.	L3
C201.3	Apply knowledge of vector differentiation to find curl and divergence of vector fields.	L3
C201.4	Apply Laplace transforms to solve linear differential equations.	L3
C201.5	Use partial differential equation to solve the Mechanical engineering problems	L3
C201.6	Calculate Numerical Integration.	L3

Course Content

Content	Hours
Unit 1 : Linear Differential Equations and Its Applications Linear differential equations with constant coefficients. Rules to find complementary function. Methods to find particular integral (X = Sinax / Cosax, xV.) Application of linear differential equations – Whirling of Shaft and Oscillation of spring.	6

Unit 2:Regression & Curve Fitting Introduction. Lines of regression of bivariate data. Fitting of curves by method of least-squares. Fitting of straight lines. Fitting of second degree parabolic curves.	6
Unit 3:Vector Differential Calculus Differentiation of vectors. Gradient of scalar point function. Divergence of vector point function Curl of a vector point function. Irrotational, solenoidal and scalar potential function of a vector field.	6
Unit 4:Laplace Transformation Laplace transform of elementary functions Properties of Laplace transform Linearity property First shifting property Change of scale property Multiplication by and division by t Inverse Laplace transform Definition and important formulae Inverse Laplace transform by method of partial fraction Solution of linear differential equation with constant coefficients using Laplace transform	6
Unit 5: Partial Differential Equations and Applications Formation of partial differential equation Method of separation of variables. Wave equation and its solution One dimensional heat flow equation Solutions of Laplace equations by the Gauss – Seidel iterative method	6
Unit 6: Numerical Integration Trapezoidal Rule. Simpson's 1/3 rd Rule. Simpson's 3/8 th Rule Weddle's Rule.	6

Note – Minimum 10 Tutorials should be conducted covering all units and based on SAILAB / MATLAB

Sr. No.	Title of Tutorials	Contact Hr.
1	Linear Differential Equations	1
2	Applications Linear Differential Equations	1

3	Regression & Curve Fitting	1
4	Vector Differential Calculus	1
5	LaplaceTransformanditsApplications	1
6	Inverse Laplace Transform	1
7	Partial differential Equation.	1
8	Numerical Integration	1
9	Fitting of first and second degree curves using SCILAB / MATLAB	2
10	Trapezoidal and Simpson's Rule using SCILAB / MATLAB	2

Text Book:

1. Higher Engineering Mathematics, by B. S. Grewal (Khanna Publication, New Delhi, 40th Edition, 2007)
2. Higher Engineering Mathematics, by B.V. Ramana (Tata McGraw Hill Education Private Limited, Delhi, 1st Edition, 2007)

Reference Books:

1. Advance Engineering Mathematics by Erwin Kreyszig (Wiley India)
2. Numerical Methods in Engineering and Science, by Dr. B. S. Grewal (Khanna Publication, Delhi)
3. A text book of Applied Mathematics: Vol. I, II and III by J. N. Wartikar & P. N. Wartikar, Vidyarthi Griha Prakashan, Pune

D Y Patil College of Engineering and Technology, Kasaba Bawada, Kolhapur
Department of Mechanical Engineering

Course Plan

Course Title : Fluid Mechanics	
Course Code : 201MEL202	**Semester : III**
Teaching Scheme : L-T-P : 3-0-0	**Credits : 3**
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks : 50**

Prerequisite: Applied Physics, Applied Chemistry

Course Description:

This course will provide the students a basic knowledge of fluid properties, fluid statics, dynamics and fluid flow.

Course Objectives:

1. To introduce the students about various properties of fluid and pressure measuring devices.
2. To study basic concepts of fluid statics, buoyancy, floating and submerged bodies and its applications
3. To study physical significance of fluid kinematics, fluid dynamics and its applications. 4. To understand the different form of governing equation related to fluid flow.
5. To analyze and evaluate fluid mechanics systems by applying principles of Physics, mathematics, science and engineering.
6. To develop skills in the analysis of fluid systems for lifelong learning.

Course Outcomes (COs):

At the end of the course the student should be able to:

CO	Statement	BTL
C202.1	Explain fundamentals of fluid properties, pressure measurement and fluid statics	L2
C202.2	Identify the fluid flow problem and explain the theoretical concepts of fluid statics, fluid kinematics and fluid dynamics.	L2
C202.3	Apply governing equation of fluid mechanics i.e. Continuity equation, Bernoulli's Equation and momentum equation for different fluid flow applications.	L3
C202.4	Apply momentum equation and make basic analysis of laminar flow to calculate the energy losses.	L3
C202.5	Analyze the energy losses in fluid flow systems.	L4
C202.6	Apply theory of boundary layer, Drag and lift forces in proper cases and concept of compressible flow.	L3

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Course Content

Content	Hours
Unit 1: Properties of Fluids and Fluid Statics **I. Properties of Fluids:** Definition of fluid, Properties of fluid with applications - Mass Density, Weight Density, Specific Volume, Specific Gravity, Viscosity, Surface Tension, Capillarity, Compressibility, vapor pressure and Mach Number, Types of fluid with examples. **II. Fluid Statics:** Pascal's law and its applications, Hydrostatic law of pressure, Hydrostatic forces on the plane surfaces (Total Pressure), Centre of Pressure, Buoyancy, Stability of floating and submerged bodies, Metacenter, Metacentric Height and its application in shipping. (No Numerical Treatment on fluid Statics).	7
Unit 2: Fluid Kinematics Types of fluid flow, Continuity equation, Flow visualization, Streamline, Path line, streak line, Stream tube, Continuity equation in Cartesian coordinates in three dimensional forms. Velocity and Acceleration of fluid particles, Rotational and Irrotational flow, Stream function and velocity potential function. Eulerian and Langragian approach of fluid flow	6
Unit 3: Governing equations in Fluid Dynamics Equations of Motion ,Euler's Equation of motion, Integration of Euler's equation to obtain Bernoulli's equation, Bernoulli's Theorem, Applications of Bernoulli's theorem such as Venturimeter, orifice meter and Pitot tube, Kinetic Energy correction factor, Notch, Derivation of Flow over triangular and rectangular notches only, Orifice and its classification, Introduction of CFD & its applications.	7
Unit 4: Momentum Equation and Laminar flow **I. Momentum Equation**: Derivation of momentum equation, Applications of momentum equation, momentum correction factor, Analysis of fluid flow through pipe bends. **II. Laminar Flow:** Laminar flow through circular pipes, derivation of Hagen Poiseuille's equation and Laminar flow through parallel plates, Reynolds's Transport Theorem	7
Unit 5: Flow through Pipes Different energy losses in flow through pipe, Losses due to friction: Darcy's Welsbach equation and Chezy's equation, Minor Losses due to expansion, contraction, pipe fittings, at entrance, at exit, due to obstruction etc. Flow through Series pipe, Parallel pipe, Siphon pipes, Branching pipes and equivalent pipes, Power transmission, Hydraulic Gradient line (HGL) and Total Energy Line (TEL), Moody's Diagram.	7

Unit 6: Boundary Layer Theory and Forces on Immersed Bodies **I. Boundary Layer Theory:** Boundary layer thickness, its characteristics, laminar and turbulent boundary layers, Displacement thickness, Momentum thickness, Energy thickness, separation, boundary layer control, Introduction to Compressible flow. **II. Forces on Immersed Bodies:** Lift and Drag, Drag on a flat plate and on aerofoil, Types of drags, Development of lift (Magnus effect)	6

Text Book:

1. "Fluid Mechanics", R. K. Bansal, Laxmi publications. New Delhi, 2018.
2. "Fluid mechanics and Hydraulic Machines", Modi and Seth, 22nd Edition 2018.

Reference Books:

1. "Fluid Mechanics", V.L. Streeter and E.B. Wylie, Tata McGraw Hill Pvt. Ltd., New Delhi, 2017.
2. "Mechanics of Fluid", Merle C. Potter, Prentis Hallof India, New Delhi, 2nd Edition.
3. "Fluid Mechanics", Fox and McDonald, John Wiley and Sons, New York, 8th Edition.
4. "Fundamentals of Fluid Mechanics", B.R. Munson, D.F. Young, T. H. Okiishi Wiley India Pvt. Ltd.
5. "Fluid Mechanics and Machinery", C.S. Ojha, , Oxford University Press.

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Course Plan

Course Title : Kinematics Mechanism and Machines @	
Course Code : 201MEL203	**Semester : III**
Teaching Scheme : L-T-P : 3-0-0	**Credits : 3**
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks : 50**

@ Theory paper of 02.30 hours duration

Prerequisite: Engineering Physics, Engineering mathematics, Fundamentals of Civil Engineering (Engineering Mechanics)

Course Description:

Kinematics and theory of Machines may be defined as that branch of Engineering-science, which deals with concepts of mechanisms, the study of relative motion between the various parts of a machine, and forces acting on them. The knowledge of this subject is very essential for an engineer in designing the various parts of a machine.

Course Objectives:

1. To describe various terminology related to kinematics of mechanism
2. To develop competency in drawing velocity and acceleration diagram for mechanisms.
3. To discuss the effect of friction bearings, screw.
4. To study the different types of cam and follower motion and its selection for engineering application.
5. To study basics of power transmission devices
6. To study the different types of governors and its characteristics and turning diagram of flywheel

Course Outcomes (COs):

At the end of the course the student should be able to:

CO	Statement	BTL
C203.1	Understand fundamental & various terminology associated with kinematics of mechanism and machine.	L2
C203.2	Prepare velocity and acceleration diagram for a given mechanism with graphical method.	L3
C203.3	Understand laws of friction and Power loss due to friction in bearings, screw	L2
C203.4	Prepare cam profile with respect follower motion for different application	L3
C203.5	Explain need and modes of power transmission and their engineering application.	L2
C203.6	Explain the different types of governors and turning moment diagram of flywheel.	L2

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Course Content

Content	Hours
Unit 1: Fundamentals of Mechanisms Link, Kinematic pair, Kinematic chain, Mechanism, Inversions, Types of constrained motions, Grubber's criterion, Grashof"s criterion for mobility, Kutzbach criterion, Four barchain and its inversions, Slider crank chain and its inversions, Double slider crank chain and its inversions, Hooke's joint(only theoretical treatment).	5
Unit 2: Velocity and Acceleration Analysis in Mechanism Graphical analysis of velocity and acceleration for different mechanisms using relative velocity and acceleration method, (Simple Problems), Klein's construction for slider crank mechanism, Instantaneous centre method (Up to 6 IC)	10
Unit 3: Friction Introduction of friction, Friction in pivot bearings, Friction circle, friction in screw.	5
Unit 4: Cams and Followers Types of cams and followers, Terminologies used ,profiles of cam for specified motion of the follower ,spring load on the follower , Jumping of follower	8
Unit 5: Belts and Dynamometers Introduction, Type of belts, Slip and creep of belt, Tension ratio in belts, Initial tension, Open & cross belt drive, Length of belt, Power transmitted by belt, Introduction and types of dynamometer	6
Unit 6: Governors and Flywheel Types of governors, Porter and Hartnell governor, Controlling force and stability of governor, Hunting, Sensitivity, Isochronism, Governor effort and power, Insensitiveness of governors. **Flywheel:** Turning moment diagrams, Fluctuation of energy, Coefficient of fluctuation, of speed, Rimmed flywheel.	6

Text Book:

1. "Theory of Machines", Rattan S.S, Tata McGraw Hill New Delhi, 5thKindle Edition.2019
2. "Theory of Machines", V.P. Singh, Dhanpat Rai and Sons. 6th Edition

Reference Books:

1. "Theory of Machines and Mechanism", Shigley, McGraw Hill, New York, 4 th Edition,2014
2. "Theory of Machines", Dr. R.K. Bansal, Laxmi Publication.
3. "Theory of Machines and Mechanism", G.S. Rao and R.V. Dukipatti, New Age, Delhi.
4. "Theory of Machines", P.L.Ballany, Khanna Publication, New Delhi, 3rd Edition.

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Course Plan

Course Title : Manufacturing Processes	
Course Code : 201MEL204	**Semester : III**
Teaching Scheme : L-T-P : 3-0-0	**Credits : 3**
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks : 50**

Prerequisite: Workshop Practice –I, Engineering Chemistry.

Course Description:

The course is meant as an introduction towards primary manufacturing processes such as casting, forming and welding. Further apply this knowledge to select appropriate method for manufacturing specific job.

Course Objectives:

To

1. Understand basic principal of metal casting, its types and moulding techniques.
2. Study various metal joining processes and classify them according to application
3. Study various metal forming processes and their applications
4. Introduction to powder metallurgy and polymer processing

Course Outcomes (COs):

At the end of the course the student should be able to:

CO	Statement	BTL
C204.1	Interpret basic concepts of metal casting processes and solve numerical on gating system	L3
C204.2	Describe the fundamentals of metal joining processes & classify them	L2
C204.3	Demonstrate their understanding of metal forming processes	L2
C204.4	Explain powder metallurgy and various polymer processing techniques	L2

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Course Content

Content	Hours
Unit 1:Metal Casting Introduction to Manufacturing Processes, Classification of Manufacturing Processes, Importance of casting as manufacturing Process, advantages and disadvantages of Casting processes, Pattern, Types of patterns and cores and core boxes, materials used and selection criteria for pattern making, pattern allowances. Components of gating system, functions and importance of runners and risers, solidification control devices: chills, ceramics bricks, directional solidification. **Numerical on casting gating system**. Types of Moulding and core making sands and their properties, Green sand, shell sand CO2 sand, oil sand, Cold box process. Moulding machines and core making machines.	9
Unit 2:Melting Practice and Special Casting Processes Types of melting furnaces-Cupola furnace, oil/gas fired furnaces, crucible furnaces, Electrical furnaces, Rotary furnaces, etc. Furnace selection criteria their applications and melting practice on different furnaces. Metal pouring equipment's, Cleaning-fettling of castings. Casting defects, their causes and remedies. Inspection of casting. Investment casting, Continuous casting, Gravity die casting, pressure die-casting, Centrifugal casting, Vacuum die casting, Squeeze casting.	8
Unit 3:Polymer Processing Thermosetting and thermoplastic materials, their properties and applications, Introduction to blow moulding, injection moulding, extrusion, calendaring and thermo forming.	4
Unit 4:Metal Joining Processes Welding processes:- Overview and classification of welding processes Fusion welding Oxy fuel gas welding Arc welding- Theory, TIG, MIG, SMAW& SAW. Electric slag welding, Thermit welding, Pressure welding Resistance welding: Spot & Seam welding, Friction welding, Ultrasonic Welding, Brazing, Soldering &Polymer joining processes	7

Unit 5: Metal Forming Processes Rolling: Introduction, Hot and cold rolling, Rolling Mill Classification, Defects in rolling. Forging: Introduction, Forging Machines (board Hammer, Air and Steam, Hydraulic Hammer), Open and Closed die Forging, Defects in forging. Extrusion: Introduction, Direct, Indirect, Tube, Impact and Hydraulic Extrusion, Defects in extrusion. Drawing: Introduction and Types of Wire, rod and pipe drawing, defects in drawing.	10
Unit 6: Powder Processing a) Advantages, Limitations and Applications of Powder Metallurgy b) Powder manufacturing types- Mechanical, Physical, Chemical and Electro-Chemical c) Mixing/ Blending. d) Compaction- types- Conventional, Isostatic, HERF, Powder rolling and extrusion e) Sintering- Types liquid stage and solid stage sintering f) Finishing operations: Sizing, Machining, Infiltration and Impregnation g) Flowcharts for – Self-lubricating bearings.	4

Text Book:

1. P. N. Rao, “Manufacturing Technology- Foundry, Forming and Welding”, Vol. I, Tata McGraw-Hill, N 3rd edition, 2009.
2. P. C. Sharma, “A Textbook of Production Technology (Manufacturing Processes)”, S. Chand & Company, 2006

Reference Books:

1. Material science and metallurgy for engineers”, V. D. Kodgire, Everest Publishers Pune, 12th Edition.
2. P. L. Jain, “Principles of Foundry Technology”, Tata McGraw-Hill, New Delhi, 2nd Edition, 2006.
3. O. P. Khanna, Foundry technology, Khanna Publishers, New Delhi.
4. Sindo Kou Welding Metallurgy, 3rd Edition Willey- Blackwell Publication.
5. ASTM Volumes on Welding, casting, forming and material selection

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Course Plan

Course Title : Applied Thermodynamics	
Course Code : 201MEL205	**Semester : III**
Teaching Scheme : L-T-P : 3-0-0	**Credits : 3**
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks : 50**

Prerequisite: 1. Applied Physics, 2. Applied Chemistry, 3. Basic thermodynamics

Course Description:

This course deals with the relationship between heat, work, and systems that analyse energy processes. Laws of thermodynamics and their corollaries. Properties of pure substance and vapour power cycle. Also study of steam condenser, nozzle, Impulse and Reaction turbine

Course Objectives:

1. To learn the First and Second Laws of Thermodynamics to understand the factors affecting the efficiency of thermal system.
2. To explain the thermodynamic properties of pure substances using tables, charts, and ideal gas law and apply them to thermodynamic analysis of a system
3. To learn fundamental concepts of classical thermodynamics and how to use them for solving real world thermal systems and engineering problems.
4. To learn various important vapor power cycles such as Rankine and Carnot cycle.
5.

Course Outcomes (COs):

At the end of the course the student should be able to:

CO	Statement	BTL
C205.1	Conceive and relate thermodynamic problems based on their fundamental knowledge and express them in mathematical terms	L2
C205.2	Analyze a thermodynamic steam cycles and understand them in the working of boilers and condensers.	L2
C205.3	Apply knowledge of thermodynamics concepts to understand the working heat pumps, refrigerator, entropy etc.	L3
C205.4	Apply knowledge of thermodynamics concepts to solve numerical problems using steam tables.	L3

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Course Content

Content	Hours
Unit 1: Review of laws of thermodynamics Zeroth law, first law & Second law of thermodynamics, Equivalence & Corollaries of Second Law, Numerical treatment on second law. (Numerical treatment on process only). Clausius inequality, entropy as a property of system, entropy of pure substance. T-s and h-s planes, entropy change in a reversible and irreversible processes, increase of entropy principle	7
Unit 2: Properties of Pure Substances and vapour power cycle Properties of steam, use of steam table and Mollier chart, T-S diagram Carnot cycle using steam, limitations of Carnot cycle, Rankine cycle, representation on P-V, T-s and h-s planes. Thermal efficiency, specific steam consumption. Work ratio, effect of steam supply pressure and temperature, condenser pressure on the performance. (Numerical) Reheat and regenerative steam power cycle	6
Unit 3: Steam condensers Functions, elements of condensing plant, types of steam condensers, surface and jet condensers, comparison, vacuum efficiency, condenser efficiency, loss of vacuum, sources of air leakages, methods of leak detection, air extraction methods, estimation of cooling water required, (Numericals on steam condenser.)	6
Unit 4: Steam Nozzles Functions, shapes, critical pressure ratio, Maximum discharge condition, effect of friction, design of throat and exit areas, nozzle efficiency, velocity coefficient, coefficient of discharge, Supersaturated flow, degree of under-cooling and degree of super saturation, effects of super saturation.	6
Unit 5: Impulse Turbine Principles of operation, classification, impulse and reaction steam turbine, Compounding of steam turbines. Flow through impulse turbine blades, velocity diagrams, work done, efficiencies, end thrust, blade friction, influence of ratio of blade speed to steam speed on efficiency of Single and multistage turbines and its condition curve and reheat factors. Numericals	8
Unit 6: Reaction Turbines Flow through impulse reaction blades, velocity diagram, degree of reaction, Parson's reaction turbine, and backpressure and pass out turbine. Losses in steam turbines, performance of steam turbines. Function of diaphragm, glands, turbine troubles like erosion, corrosion, vibration, fouling etc. Governing of steam turbines Reheat regenerative steam power cycles. Numericals	7

Text Book:

1. Engineering thermodynamics by P. K. Nag. Tata McGraw Hill, New Delhi, 4th Edition
2. Thermal Engineering R. K. Rajput , Laxmi Publications 3rd Edition

Reference Books:

1. "Thermal Engineering", M.M Rathod, Tata McGraw Hill Education Pvt. Ltd, 1stEdition, 2010.
2. R. Yadav, Steam & Gas Turbines CPH Allahabad

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Course Plan

Course Title : Fluid Mechanics Lab	
Course Code : 201MEP202	**Semester : III**
Teaching Scheme : L-T-P : 0-0-2	**Credits : 1**
Evaluation Scheme : ISE Marks : 25	**ESE(POE) Marks : 25**

Course Description: This course will provide the student with a basic understanding of fluid properties, fluid statics and dynamics, and fluid flow.

Course Objectives:

1. To introduce the students about various properties of fluid and pressure measuring devices.
2. To study basic concepts of fluid statics, buoyancy, floating and submerged bodies and its applications
3. To study physical significance of fluid kinematics, fluid dynamics and it‟s applications.
4. To understand the different form of governing equation related to fluid flow.
5. To analyze and evaluate fluid mechanics systems by applying principles of Physics, mathematics, science and engineering.
6. To develop skills in the analysis of fluid systems for lifelong learning.

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Course Outcomes (COs):

At the end of the course the student should be able to:

CO	Statement	BTL
C202.1	Explain fundamentals of fluid properties, pressure measurement and fluid statics	L2
C202.2	Identify the fluid flow problem and explain the theoretical concepts of fluid statics, fluid kinematics and fluid dynamics.	L2
C202.3	Apply governing equation Bernoulli's Equation and applications of fluid momentum mechanics equation i.e. for Continuity equation, different fluid flow	L3
C202.4	Apply momentum equation and make basic analysis of laminar flow to calculate the energy losses.	L3
C202.5	Analyze the energy losses in fluid flow systems.	L4
C202.6	Apply theory of boundary layer, Drag and lift forces in proper cases and concept of compressible flow.	L3

List of Assignments / Experiments			
Sr. No.	**Name of Assignments / Experiments**	**Type**	**Hrs.**
1	Study and demonstration of Pressure Measuring Devices (Compulsory)	S	2
2	I. Theoretical assignment of Dimensional analysis which may include procedure and Numerical on Rayleigh's method II. Buckingham π theorem. (Compulsory)	S	4
3	Flow visualization by plotting of streamlines (Heleshaw's apparatus).	S/O	2
4	Reynolds experiment	S/O	2
5	Verification of Bernoulli's equation	S/O	2
6	Calibration of Orifice meter	S/O	2
7	Calibration of venture meter	S/O	2
8	Calibration of notches	S/O	2
9	Determination of coefficient of friction in pipes of different sizes	S/O	2
10	Determination of minor losses in pipes-fittings	S/O	2
11	Case study on CFD	S/O	2

***Note**-Minimum Ten experiments/assignments from the above list including should be performed.

❖ **S-STUDY, O-OPERATIONAL**

Text Book:

1. "Fluid Mechanics", R. K. Bansal, Laxmi publications. New Delhi, 2018.
2. "Fluid mechanics and Hydraulic Machines", Modi and Seth, 22nd Edition 2018.

Reference Books:

1. "Fluid Mechanics", V.L. Streeter and E.B. Wylie, Tata McGraw Hill Pvt Ltd., New Delhi, 2017.
2. "Mechanics of Fluid", Merle C. Potter, Prentis HallofIndia, New Delhi, 2nd Edition.
3. "Fluid Mechanics", Fox and McDonald, John Wiley and Sons, New York, 8th Edition.
4. "Fundamentals of Fluid Mechanics", B.R. Munson, D.F. Young, T. H. Okiishi Wiley IndiaPvt. Ltd.
5. "Fluid Mechanics and Machinery", C.S. Ojha,, Oxford University Press.

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Course Plan

Course Title : Kinematics Mechanism and Machines Lab	
Course Code : 201MEP203	**Semester : III**
Teaching Scheme : L-T-P : 0-0-2	**Credits : 1**
Evaluation Scheme : ISE Marks : 25	

Course Description:

Kinematics and theory of Machines may be defined as that branch of Engineering-science, which deals with concepts of mechanisms, the study of relative motion between the various parts of a machine, and forces acting on them. The knowledge of this subject is very essential for an engineer in designing the various parts of a machine.

Course Objectives:

1. To describe various terminology related to kinematics of mechanism
2. To develop competency in drawing velocity and acceleration diagram for mechanisms.
3. To study the different types of cam and follower motion and its selection for engineering application.
4. To study basics of power transmission devices
5. To study the different types of governors and its characteristics and turning moment diagram of flywheel

Course Outcomes (COs):

At the end of the course the student should be able to:

CO	Statement	BTL
C203.1	Understand fundamental & various terminology associated with kinematics of mechanism and machine.	L2
C203.2	Prepare velocity and acceleration diagram for a given mechanism with graphical method.	L3
C203.3	Prepare cam profile with respect follower motion for different application	L3
C203.4	Explain need and modes of power transmission and their engineering application.	L2
C203.5	Explain the different types of governors and turning moment diagram of flywheel.	L2

List of Assignments

Sr. No.	Name of Assignments	Type	Hrs.
1	An assignment on basic concepts to mechanism(demonstration of models , different mechanism)	S	2
2	Draw velocity problems on A3 size drawing by relative velocity method (minimum 3 problems)	D	2
3	Draw velocity problems on A3 size drawing by I. Klein's method (minimum 2 problems for each case) II. Instantaneous method (minimum 2 problems for each case)	D	4

4	Draw acceleration problems on A3 size drawing by relative acceleration component method (minimum 3 problems) I. Basic Numerical 2-Problem on acceleration II. Advance Numerical 2-Problem on acceleration	D	4
5	Verification of ratio of angular velocities of the shafts connected by Hooke's Joint	O	2
6	Experiment on cam profile and drawing of problems on cam profile on A3 size drawing sheet	O	2
7	Study of turning moment diagram of flywheel	S	2
8	An Experiment on study of governor characteristics for Porter or Hartnell governor	O	2
9	An experiment on study of belt drive	O	2
10	An experiment on study of dynamometer	O	2

- **S-STUDY, O-OPERATIONAL D-DRAWING SHEETS**
- **Text Book:**

1. "Theory of Machines", Rattan S.S, Tata McGraw Hill New Delhi, 5thKindle Edition.2019
2. "Theory of Machines", V.P. Singh, DhanpatRai and Sons. 6 th Edition

Reference Books:

1. "Theory of Machines and Mechanism", Shigley, McGraw Hill, New York, 4 th Edition,2014
2. "Theory of Machines", Dr. R.K. Bansal, Laxmi Publication.
3. "Theory of Machines and Mechanism", G.S. Rao and R.V. Dukipatti, New Age, Delhi.
4. "Theory of Machines", P. L. Ballany, Khanna Publication, New Delhi, 3rd Edition.

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Course Plan

Course Title : Applied Thermodynamics Lab	
Course Code :201MEP205	**Semester : III**
Teaching Scheme : L-T-P : 0-0-2	**Credits : 1**
Evaluation Scheme : ISE Marks : 25	**ESE(POE) Marks : 25**

Course Description:

This course deals with the study and demonstration of water tube and fire tube boilers, boiler mountings, accessories and steam calorimeters, condenser and cooling towers. It also focus on lubrication properties and trials are conducted on grease penetrometer and dropping point apparatus, Red wood viscometer and, aniline point apparatus, flash and fire point of a lubricating oil.

Course Objectives:

1. To learn the First and Second Laws of Thermodynamics to understand the factors affecting the efficiency of thermal system.
2. To explain the thermodynamic properties of pure substances using tables, charts, and ideal gas law and apply them to thermodynamic analysis of a system
3. To learn fundamental concepts of classical thermodynamics and how to use them for solving real world thermal systems and engineering problems.
4. To learn various important vapor power cycles such as Rankine and Carnot cycle.

Course Outcomes (COs):

At the end of the course the student should be able to:

CO	Statement	BTL
C205.1	Conceive and relate thermodynamic problems based on their fundamental knowledge and express them in mathematical terms.	L2
C205.2	Analyze a thermodynamic steam cycles and understand them in the working of boilers and condensers.	L2
C205.3	Apply knowledge of thermodynamics concepts to understand the working heat pumps, refrigerator, entropy etc.	L3
C205.4	Apply knowledge of thermodynamics concepts to solve numerical problems using steam tables.	L3

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List of Assignments / Experiments			
Sr. No.	**Name of Assignments / Experiments**	**Type**	**Hrs.**
1	I. Study and demonstration of water tube. II. Study and demonstration of fire tube boilers.	S	4
2	I. Study and demonstration of boiler mountings. II. Study and demonstration of accessories and steam calorimeters.	S	4
3	Study and demonstration of condenser and cooling towers.	S	2
4	Study Significance and relevance of lubrication properties and system.	S	2
5	Test on grease penetrometer and dropping point apparatus.	O	2
6	Test on Red wood viscometer and, aniline point apparatus.	O	2
7	Test on Determination of flash and fire point of a lubricating oil.	O	2
8	Study of steam power plant.	S	2
9	Boiler safety and performance checking- Industrial visit	S	2
10.	Industrial visit to Steam Power Plant.	S	2

Note: Industrial visit on boiler safety and performance to achieve PO6. (Questionnaire will be provided to students after visit to evaluate PO6)

❖ **S-STUDY, O-OPERATIONAL**

Text Book:

1. Engineering thermodynamics by P. K. Nag. Tata McGraw Hill, New Delhi, 4th Edition
2. Thermal Engineering R. K. Rajput , Laxmi Publications 3rd Edition

Reference Books:

1. "Thermal Engineering", M.M Rathod, Tata McGraw Hill Education Pvt. Ltd, 1stEdition, 2010.
2. R. Yadav, Steam & Gas Turbines CPH Allahabad

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Course Plan

Course Title : Machine Drawing and Computer Aided Drafting	
Course Code : 201MEP206	**Semester : IV**
Teaching Scheme : L-T-P : 0-1-2	**Credits : 1**
Evaluation Scheme : ISE Marks : 25	**ESE(POE) Marks :25**

Pre-requisites: Engineering Graphics, Fundamentals of drawings

Course Description:
Computer Aided Drafting is aimed at providing basic understanding of the fundamentals of Computer Aided Drafting with industrial drafting practices to make them fit in industries. This course enables students to create 2D, Isometric, Detail Assembly, Bill of material and drafting of any mechanical components.

Course Objectives:
1. Enable them to use computer aided drafting tools for the generation of drawing.
2. To develop an ability to create 2-D drawings with appropriate dimensional and geometrical constraints by using CAD tool.
3. To create assembly and details of simple machine components with industrial approach by using CAD tool.

Course Outcomes:
At the end of the course student should be able to:

CO	Statement	BTL
C206.1	Understand modern engineering tools used for engineering drawing.	L2
C206.2	Prepare 2-D drawings with appropriate dimensional and geometrical constraints by using CAD tool.	L3
C206.3	Prepare assembly and detail of simple machine components by using CAD tool.	L3

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Course Content

Content	Hours
Unit 1: Introduction to CAD Introduction to CAD software, Standard Toolbars, Menus, Tabs, navigational tools and Basic, Editing, Modify & Viewing commands to draw 2D objects, Co-ordinate system and planes, Apply Dimensions, Lettering, and annotations as per BIS conventions.	6
Unit 2: Use of layers Use of layers in 2D drawing, Annotation and Layers toolbars any advance CAD Software	2
Unit 3: Limit, Fits and Tolerancing Entering limits, fits, tolerances surface finish symbols and Machining Symbols on drawings.	4
Unit 4: Geometric Dimensioning Geometric Dimensioning and Tolerance for 2-D Objects: Straightness, Flatness, perpendicularity, Angularity, Roundness, Concentricity, Cylindricity, Run out, Profile, Parallelism etc.	4
Unit 5: Detail Drawings Preparing detail drawings in 2D. Entering limits, fits, tolerances and surface finish symbols on detail drawings.	4
Unit 6: Assembly Drawings Preparing assembly drawings in 2D. Preparing of bill of material (BOM). Maximum no. of parts to be limited to twelve only. Entering limits, fits, tolerances and surface finish symbols on assembly drawings.	4

List of Assignments			
Sr. No.	**Name of Assignments**	**Type**	**Hrs.**
1	Computer Aided Drafting of simple components and print out of the same on A4 size sheet –Object 1	D	4
2	Computer Aided Drafting of simple components and print out of the same on A4 size sheet – Object 2	D	2
3	Drawing Details with limit, fit, tolerances & Bill of material of assembly containing 6-8 major components. Print out of the same on A4 size sheet – Object 1	D	4
4	Drawing Details with limit, fit, tolerances & Bill of material of assembly containing 6-8 major components. Print out of the same on A4 size sheet – Object 2	D	2
5	Drawing Details with limit, fit, tolerances & Bill of material of	D	2

	assembly containing 6-8 major components. Print out of the same on A4 size sheet – Object 3		
6	Drawing Assembly with limit, fit, tolerances & Bill of material of assembly containing 6-8 major components. Print out of the same on A4 size sheet – Object 1	D	4
7	Drawing Assembly with limit, fit, tolerances & Bill of material of assembly containing 6-8 major components. Print out of the same on A4 size sheet – Object 2	D	2
8	Drawing Assembly with limit, fit, tolerances & Bill of material of assembly containing 6-8 major components. Print out of the same on A4 size sheet – Object 3	D	2
9	Case Study	S/D	2

❖ **S-STUDY, O-OPERATIONAL, D-DRAWING SHEET**

*Note:

Latest drafting software like Auto cad and any advance software are to be used.

Case Study: Students have to visit any mechanical industry and study one industrial drawing and prepare report.

Text Book:

1. Ajeet Sing, "Working with AutoCAD 2000", Tata McGraw Hill.
2. N. D. Bhatt, "Machine Drawing", Charotor Publication House, Bombay, 46th Edition.

Reference Books:

1. "Auto cad 2014 for Engineers and Designers", Sham Tickoo, New Delhi, 2014.
2. "Auto Cad 2014", Ellen Finkelsten, Wiley India Manuals and Tutorials.
3. K. L. Narayana, "Machine Drawing", New Age Publication
4. K. Venugopal, "Engineering Drawing and Graphics", New Age Publication
5. R. K. Dhawan, "A text book of Engineering Drawing", S. Chand and Co.
6. W. J. Luzadder, "Fundamentals of Engineering Drawing", Prentice Hall of India.
7. N. B. Shaha and B. C. Rana, "Engineering Drawing", Pearson Education, 2nd Edition.

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Course Plan

Course Title : **Python Programming**	
Course Code : 201MEP207	**Semester :III**
Teaching Scheme : L-T-P : 0-**1-2**	Credits : 1
Evaluation Scheme : ISE Marks: 25	

Prerequisite: Basic knowledge of C Programming

Course Description:

This course introduces Python programming, focusing on its application in solving engineering problems. Students will learn Python syntax, data manipulation, numerical computations, and visualization using relevant libraries. Through practical sessions and tutorials, they will develop problem-solving skills and gain proficiency in using Python for engineering tasks.

Course Objectives:

1. To develop and enhance the programming skills amongst students.
2. To apply Python to solve general as well as mechanical engineering problems.
3. To explore relevant Python libraries for problem solving.
4. To enhance problem-solving and critical thinking skills through practical exercises

Course Outcomes (COs):

At the end of the course the student should be able to:

CO	Statement	BTL
C207.1	Understand various data types in Python	L2
C207.2	Demonstrate different loops and Conditions	L3
C207.3	Demonstrate various modules in python	L3
C207.4	Demonstrate various libraries in python	L3

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Course Content

Content
Unit 1: Introduction, Data Types and Operators: Installation and working with Python, Variables and data types in python, perform computations and create logical statements using Python's operators: Arithmetic, Assignment, Comparison, Logical, Membership, Identity, Bitwise operators, list, tuple and string operations
Unit 2: Python Decision making and Loops: Write conditional statements using If statement, if ...else statement, elif statement and Boolean expressions, while loop, for loop, Nested Loop, Infinite loop, Break statement, Continue statement, Pass statement.
Unit 3: Python Functions and Modules: Defining custom functions, Organizing Python codes using functions, create reference variables, Basic skills for working with lists, tuples, dates, times and dictionaries, importing modules into programs, Programming using functions, modules and external packages
Unit 4: Python File Operations: An introduction to file I/O, use text files, use CSV files, handle a single exception, handle multiple exceptions, Illustrative programs, Exercises
Unit 5: Introduction to Python libraries Discuss the different Python libraries, Numerical computing using NumPy library, data analytics using Pandas, Introduction to SciPy and Seaborn libraries, Matplotlib library for visualization, Review of different Python libraries and modules for mechanical engineering applications

List of Assignments/Experiments			
Sr. No.	**Name of Assignments/Experiment**	**Type**	**Hrs.**
1	Installation and Introduction to python IDE	O	2
2	Write Python programs to understand variables and data types	O	2
3	Write Python programs using Arithmetic, Assignment, Comparison Operators	O	2
4	Write Python programs using Logical, Membership, Identity, Bitwise operators	O	2
5	Write Python programs to understand list and tuples	O	2
6	Use conditional statements in python programs	O	2
7	Use loops in Python programs	O	2
8	Use loops in Python programs	O	2

9	Write python programs to understand functions	O	2
10	Import module and use it in Python programs	O	2
11	Write python programs to integrate text and CSV files	O	2
12	Write Program for Numerical Computation using Numpy	O	2
13	Write Program for data visualization using Matplotlib	O	2
14	Write program for data analysis using Pandas library	O	2
15	Case study on application of python programming in Mechanical engineering applications	S	2

S-STUDY, O-OPERATIONAL

Text book:

1. "Introduction to Python for Engineers and Scientists", By. Sandeep Nagar, Apress
2. "Let us Python", By Yashwant Kanetkar, BPB Publications, India.

Reference Books:

1. "Introduction to Computation and Programming Using Python", John V Guttag. Prentice Hall of India
2. "Python Programming Fundamentals- A Beginner's Handbook" by Nischay kumar Hegde
3. "Fundamentals of Python – First Programs", By Kenneth A. Lambert, CENGAGE Publication

Online sources:

1. NPTEL Video lecture on Python Programming
2. https://www.coursera.org/learn/python-programming

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Course Plan

Course Title : **Essentials of Electrical & Electronics Technology**	
Course Code : **201MEMC208**	Semester : **VI**
Teaching Scheme : L-T-P : **2-0-0**	Credits : **0**

Pre Requisite:- Fundamentals of Electrical & Electronics Engineering

Course Description:

The aim of this course is to understand construction and working principle of DC motors, Transformer and basic of Electronics technology.

Course Objectives:-

1. Produce competent Mechanical engineers with comprehensive knowledge of Electrical & Electronics Technologies to enable them to apply the relevant knowledge and technologies for the understanding and design of systems and products.
2. Prepare Mechanical Engineering students for advanced graduate studies in Mechatronics, Automation, Robotics and related field.

Course Outcomes (COs):-

At the end of this course student should be able to:

CO	Statement	BTL
C208.1	Explain the construction and operation of DC motor and transformer	L2
C208.2	Demonstrate basic electronic circuit	L3
C208.3	Understand the importance of signal conditioning	L2

Course Content

Content	Hours
Unit 1: DC motor Construction, working, types, equivalent circuit, back emf, characteristics, power losses, applications, Need of starter, 3 point starter, 4 point starter, reversal of rotation, DC servo motor - desirable features, types and applications. Stepper motor- desirable features, types and applications, Introduction of VFD, Criteria for selection of motor for application like lathe, lift, pumps, conveyor etc.	08
Unit 2:Transformers **Single phase transformer:-** Construction ,working principle, ideal and practical transformer,	04

Transformer losses, **Three phase transformer:-** Construction ,working principle, ideal and practical transformer, Transformer losses	
Unit 3: Basic electronics Circuit Resister, Capacitors, Transistor, Printed circuit board, Diode, Switches, Circuit breaker	06
Unit 4: Signal Conditioning Signal conditioning process, Op-Amplifier, (Inverting Op-Amp, Non-Inverting Op-Amp, Summing Amplifier, Differentiating amplifier), Filters, data acquisition, logic gates, Number System, multiplexing and De-multiplexing, ADC,DAC,	06

Text Books:

1. Electrical Technology (Vol-II) - B.L.Theraja, S. Chand Publication
2. Basic Electronics- Solid state - B.L.Theraja, S. Chand Publication

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Course Plan

Course Title : **AI and ML for Mechanical Engineers**	
Course Code : 201MEL209	**Semester :IV**
Teaching Scheme : L-T-P : 1-**0-0**	Credits : 1
Evaluation Scheme : ISE + MSE: 20+30 = 50	ESE Marks : - 50

Prerequisite: Python Programming

Course Description:

This course is designed to provide second-year mechanical engineering students with a comprehensive understanding of integrating artificial intelligence (AI) and machine learning (ML) in mechanical engineering applications. The course will cover the basics of AI integration in mechanical engineering, fundamental ML algorithms used in mechanical engineering, and an introduction to Power BI and advanced Excel techniques

Course Objectives:

5. To gain knowledge of the basics of AI integration in mechanical engineering and its significance.
6. To be aware of ML algorithms to solve mechanical engineering problems.
7. To become proficient in using Python libraries and modules commonly used.
8. To make students aware of data analytics tools such as Power Bi and Advance Excel tools

Course Outcomes (COs):

At the end of the course the student should be able to:

CO	Statement	BTL
C209.1	Understand fundamentals of AI and ML	L2
C209.2	Demonstrate various AI tools useful in mechanical engineering	L3
C209.3	Demonstrate various ML algorithms	L3
C209.4	Demonstrate data visualization using PowerBi	L3
C209.5	Demonstrate data analytics using Advanced Excel functions	L3

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Course Content

Content	Hours
Unit 1: Introduction to AI and ML in Mechanical Engineering Introduction to AI and ML, Overview of AI and ML concepts and their relevance to mechanical engineering, Use cases and applications of AI and ML in mechanical engineering, Challenges and considerations for AI integration in mechanical engineering, Key challenges and opportunities in integrating AI in mechanical engineering processes	04
Unit 2: AI Tools: Overview of AI libraries and frameworks such as TensorFlow, Keras, and MATLAB, Integration of AI tools with mechanical engineering software packages (e.g., ANSYS), Utilizing AI tools for data analysis, modeling, and simulation in mechanical engineering, Role of AI in predictive maintenance for mechanical systems, Techniques for anomaly detection and fault diagnosis using AI,	03
Unit 3: ML Algorithms for Mechanical Engineering: Regression algorithms: Linear regression, Classification algorithms: on Logistic regression, Applications of ML in mechanical Engineering: predictive maintenance, machining performance, productivity etc.	04
Unit 4: Introduction to Power BI Overview of Power BI and its features, Importing and transforming data in Power BI, Creating visualizations and dashboards, applications and advantages of Power Bi	02
Unit 5: Advanced Excel Techniques: Advanced functions and formulas in Excel for data analysis, Pivot Tables and Pivot Charts for data summarization and visualization, Excel data modeling and automation techniques	02

Textbook:

1. “Artificial Intelligence for Mechanical Engineers" by Dr. S. S. Rathore and Dr. N. V. R. Naidu
2. “Machine Learning and Artificial Intelligence in Mechanical Engineering" by Dr. T. R. Seetharam.

Reference Books:

1. “Introduction to Artificial Intelligence for Mechanical Engineers" by Dr. S. K. Verma
2. “AI Techniques for Mechanical Engineering Applications" by Dr. A. K. Singh and Dr. R. K. Tripathy
3. “Applications of Artificial Intelligence in Mechanical Engineering" by Dr. V. K. Mittal and Dr. R. K. Jain

Online sources:

1. NPTEL Course: Introduction To Machine Learning
2. NPTEL Course: Fundamentals Of Artificial Intelligence

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Course Plan

Course Title : Strength of Materials	
Course Code : 201MEL210	**Semester : IV**
Teaching Scheme : L-T-P : 3-1-0	**Credits : 4**
valuation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks : 50**

Prerequisite: Engineering Mechanics

Course Description:

This subject deals with concepts of stress and strain, their importance in engineering applications which is useful while studying kinematics of machines, dynamics of machines and design of mechanical elements.

Course Objectives:

1. To gain knowledge of different types of stresses, strains and deformation induced in mechanical components due to external loads.
2. To study shear force and bending moment distribution for different types of loads and support conditions.
3. To study the distribution of Bending & Shear stresses in mechanical elements.
4. To study the analytical and graphical method to solve the problems in principal planes and stresses.
5. To study the effect of component dimensions and shape on stresses and deformations.
6. To study the buckling, and strain energy effect in mechanical elements.

Course Outcomes (COs):

At the end of the course the student should be able to:

CO	Statement	BTL
C210.1	Explain the concepts of Stress, Strain and deformation in mechanical components.	L2
C210.2	Understand the concept of Torsion in shafts and Draw shear force and bending moment diagrams for various types of beams subjected to various loads and support conditions.	L2
C210.3	Compute bending and shear stresses in mechanical components.	L3
C210.4	Determine plane stress, principal stress, maximum shear stress and their orientations using analytical method and Mohr's circle.	L3
C210.5	Calculate the Slope and deflection in beams.	L3
C210.6	Describe buckling in columns and strain energy in beams subject to various types of loading.	L2

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Course Content

Content	Hours
Unit 1: Stresses and Strains Concept of Stress (Normal & Shear Stress) and Strain (Linear, Lateral, Shear and Volumetric), True Stress Strain Curve, Hooke's Law, Poisson's ratio, Modulus of Elasticity, Modulus of Rigidity, Bulk Modulus, Inter-relationship between elastic constants, Factor of safety, Thermal Stress, deformation in varying sections, composite sections and principle of superposition.	6
Unit 2: Torsion, Shear force and Bending moment diagrams **I. Torsion:** Introduction to Torsion, Basic assumptions, Torsion formula, Hollow and solid circular shafts, Polar moment of Inertia, Power transmitted and replacement of shafts. **II. Shear Force and Bending Moment Diagrams:** Concept and definition of shear force and bending moment in determinate beams (Simply supported, cantilever and overhanging) due to concentrated, UDL,UVL and Couple	8
Unit 3: Stresses in Beams **I. Bending Stresses:** Symmetric pure bending of beams, Flexure formula, moment of resistance of cross-sections, Determination of bending stress in rectangular ,circular, L, I and T sections **II. Shear Stresses:** Distribution of shear stresses in beams of various commonly used sections such as circular. I, T, and angles	7
Unit 4: Principal Stresses Normal and shear stresses on any oblique planes, Concept of Principal planes, Expression for Principal stresses and maximum shear stress, Positions of principal planes and planes of maximum shear, Graphical solutions using Mohr's circle of stresses, Theories of failure.	8
Unit 5: Deflection of Beams Concept and definition, Slope and deflection by Double integration method and Areamoment method (Simply Supported Beam and Cantilever.) and conjugate beam method	6
Unit 6: Columns and Energy methods **I. Columns:** Euler's formula for different end connections, Concept of equivalent length, Rankine formula. **II. Energy Methods:** Concept of strain energy, Resilience, Proof resilience, Modulus of Resilience, derivation for deformation of axially loaded members under gradual, sudden and impact loads (including Numerical).	5

List of Assignments			
Sr. No.	**Name of Assignments**	**Type**	**Hrs.**
1	Tensile Test of Mild Steel	O	1
2	Compression Test on Aluminum Column	O	1
3	Stresses and strains	S	1
4	Torsion (Problems based on industrial applications)	S	1
5	Shear force diagram & bending moment diagram	S	2
6	Bending stresses and shear stresses in beams.	S	1
7	Principal stresses (both analytical and graphical).	S	2
8	Deflection of beams	S	1
9	Columns	S	1
10	Strain Energy	S	1

❖ **S-STUDY, O-OPERATIONAL**

Text Book:

1. "Strength of Materials", S. Ramamruthum, Dhanpat Rai and Sons, New Delhi.
2. "Strength of Materials", R. K. Bansal, Laxmi Publication, 4th Edition.

Reference Books:

1. "Strength of Materials", Beer and Johnson, CBS Publication.
2. "Strength of Materials", G.H. Rider, MacMillan India Ltd.
3. "Strength of Materials", Nag and Chanda, Willey India Publication.
4. "Advanced Mechanics of Materials", Boresi, Willey India Publication.
5. "Strength of Materials", Den Hartong, McGraw Hill Publication.
6. "Mechanical analysis and design", H. Burr and John Cheatam, PHI, New Delhi

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Course Plan

Course Title : Fluid and Turbo Machinery	
Course Code : 201MEL211	**Semester : IV**
Teaching Scheme : L-T-P : 3-0-0	**Credits : 3**
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks : 50**

Prerequisite: Fluid Mechanics, Applied Thermodynamics.

Course Description:

This course is deals with the study of working principles of water turbines & its velocity triangles, design parameters related to Turbines. Similarly understand the concept of Centrifugal pumps, selection of centrifugal pumps, and use of pumps for various engineering application. Understand the working principles & concept Compressors, selection of Compressors for various engineering application. And study the working of Gas Turbines and Jet engine and know its various configurations he knowledge of these devices is necessary in all types of power plants.

Course Objectives:

1. To understand the working principles of Impulse and Reaction water turbines also to study its velocity triangles & design parameters related to Turbines
2. To understand the concept of Centrifugal pumps and its construction. To understand NPSH terms related to centrifugal pumps. To understand selection of centrifugal pumps for various Engineering application.
3. To understand the concept, working principles of Compressors. To understand various parameters related to Compressors. And understand selection of Compressors for various engineering application.
4. To understand the working of Gas Turbines and Jet engine and know its various configurations. To determine the efficiencies of gas turbines

Course Outcomes (COs):

At the end of the course the student should be able to:

CO	Statement	BTL
C211.1	Understand & Apply working principle of Rotodyanamic machines	L3
C211.2	Understand & Apply working principle of Centrifugal Pump	L3
C211.3	Understand & Apply working principle of Compressors	L3
C211.4	Understand & Apply working principle of Gas Turbines	L3
C211.5	Analyze the machines to evaluate the performance	L3

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Course Content

Content	Hours
Unit 1: Impulse Water Turbines Euler's equation for work done in Rotodyanamic Machines classification of water turbines, Pelton wheel, its construction and working, velocity triangles, types. Pelton wheel design (bucket dimensions, Number of buckets, Jet diameter, Wheel diameter, Jet ratio, Speed ratio, Number of jets), Calculation of efficiency, Power, Discharge etc. Governing of Pelton wheel. Study and demonstration of Model & Testing, Unit quantities of Impulse Water turbine	7
Unit 2: Reaction Water Turbines Principle of operation, Construction and working of Francis and Kaplan Turbine, Draft tube, Cavitation calculation of various efficiencies, Power, Discharge, Blade angles, Runner dimensions etc. Governing of Francis and Kaplan turbine. Draft tube-types and analysis. Study and demonstration of Model & Testing, Unit quantities of Reaction Water turbine	7
Unit 3: Centrifugal Pumps Working principles, Construction, Types, Various heads, Multistage pumps, Velocity triangles, Minimum starting speed, Cavitation, Net positive suction head (NPSH). Efficiencies, Discharge, Blade angles, Head, Power required, Impeller dimensions etc. selection of manufacturing pump for different engineering application using manufacturing catalogue. Study and demonstration of Model & Testing, Unit quantities of pump	6
Unit 4: Reciprocating Air Compressors Application of compressed air, classification of compressor, Reciprocating compressors, construction , Work input, Necessity of cooling , Isothermal efficiency, Heat rejected, Effect of clearance volume, Volumetric efficiency, Necessity of multistage, construction, Optimum intermediate pressure for minimum work required, After cooler. Calculation for capacity of compressor for different application	8
Unit 5: Rotodyanamic Air Compressors Centrifugal compressor, velocity diagram. Theory of operation, losses, Adiabatic efficiency, Effect of compressibility, Diffuser, Prewhirl, Pressure coefficient, Slip factor, performance. Surging, Chocking, Stalling, Performance, Comparison with centrifugal. Introduction to Axial flow compressors, Roots blower and vane blower (Descriptive treatment)	7
Unit 6: Gas Turbines Working principles, Applications, Open, Closed cycle and their comparison. Cycle modified to Regeneration, Reheat, and Intercooling performance. Calculation of gas turbine work ratio, Efficiency etc. Types of fuels for gas Turbine Introduction to Jet engine	5

Text Book:

1. "Turbo machines", S.M. Yahya , Tata Mc Graw Hill , 2005
2. "Fans, compressor and turbine", S. M. Yahya, Tata Mc Graw Hill , 2005

Reference Books:

1. "Hydraulic Machines", V.P. Vasantdani, Khanna Publishers, 1996.
2. "Fluid flow machines", N.S. Govindrao, Tata McGraw-Hill, 1983.
3. "Steam and gas Turbines", R. Yadav, Central Publishing House, Allahabad, 6th Edition1997
4. "Fluid mechanics and hydraulic machines", Modi and Seth, Standard Book House, 2004
5. "Thermal Engineering", R K Rajput, Laxmi Publication.

D Y Patil College of Engineering and Technology, Kasaba Bawada, Kolhapur
Department of Mechanical Engineering

Course Plan

Course Title : Machine Tools and Processes	
Course Code : 201MEL212	**Semester : IV**
Teaching Scheme : L-T-P : 3-0-0	**Credits : 3**
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks : 50**

Prerequisite: Basic Mechanical Engineering, Manufacturing Processes.

Course Description:

The Subject Machine tools and Processes is focused on the study of introduction to various types of metal cutting processes and machine tools. It includes the study of general purpose machine tools such as center lathe, capstan lathe, turret lathe, drilling, milling, planning- shaping machines along with their accessories and attachments. It also includes study of single point and multi-point cuttings tools along with thread and gear manufacturing process. Non-conventional machining processes along with the CNC Technology and tooling's are included.

This course intends to bring the competency in the students to identify and select a proper machine tools, proper cutting tools, types of operations, and use of accessories and attachments on the machine tools.

Course Objectives:

1. To introduce students to various metal removal processes and the machine tools.
2. To study tool geometry of single and multipoint cutting tools.
3. To provide students with knowledge of different types of Thread and Gear Manufacturing processes.
4. To make students aware of fundamental principles of Non-Conventional Machining and CNC technology.

Course Outcomes (COs):

At the end of the course the student should be able to:

CO	Statement	BTL
C212.1	Identify and explain the function of the basic components of machine tools and its accessories	L2
C212.2	Identify parameters of single and multipoint cutting tools.	L2
C212.3	To acquire the knowledge and demonstrate thread and gear manufacturing operations.	L3
C212.4	Understand and be in position to appreciate the merits of non –conventional machining and CNC technology and its applications in industries.	L2

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Course Content

Content	Hours
Unit 1: Machine Tools for Metal Cutting I a) **Lathe**: Introduction, Working principle, types, specifications, principle parts, accessories, attachments, and various lathe operations, Calculations of Change gears for thread cutting. b) **Capstan, turret lathe**: Principle parts, Working, Turret indexing mechanism, bar feeding mechanism, Comparison with centre lathe. c) **Drilling & Boring Machines:** Classification of drilling machines, Construction And working of radial drilling machine, Various accessories and various operations. Introduction to boring machines, Types of boring machine, different operations.	12
Unit 2: Machine Tools for Metal Cutting II a) **Shaping & Planning Machine:** Construction & working of shaper and Planer machine, Comparison between planer and shaper machine. b) **Milling Machine:** Types- Horizontal, Vertical milling machines, Milling cutters, construction and working of column and knee type, milling operations, simple and compound indexing.	7
Unit 3: Tool Geometry Tool geometry parts, angles and types of single point cutting tools, tool geometry of single point cutting tools, geometry of multipoint cutting tools –drills, milling cutters, reamers.	4
Unit 4: Gear Manufacturing and Thread Manufacturing processes a) **Gear Manufacturing Processes:** Study of various processes like gear shaping, gear hobbling, Gear finishing processes –Gear shaving, Gear burnishing and gear rolling. b)**Thread Manufacturing Processes:** Study of various processes like thread casting, thread chasing, thread rolling, die threading and tapping, thread milling, thread grinding.	8
Unit 5: Nonconventional Machining Fundamental principle, machining unit, tool material, advantages, limitations and applications of Abrasive Jet Machining, Electrical Discharge machining, Electro- Chemical machining, Laser beam machining, Ultrasonic machining, Water jet machining.	4
Unit 6: CNC technology and Tooling Introduction, construction and working of CNC, DNC and machining centre. CNC axes and drives. Automatic tool Changer (ATC) and Automatic Pallet Changer (APC).New trends in tool materials, turning tool geometry, tool inserts (coated and uncoated),Tool presetting etc.	5

Text Book:

1. "A Text Book of Production Technology (Manufacturing Processes)", P.C. Sharma, S. Chand and Company Pvt. Ltd, New Delhi.7th Edition, 2010.
2. "Workshop Technology vol. II", B.S. Raghuvanshi, Dhanpat Rai Publications Pvt. Ltd, New Delhi.10th Edition, 2000

Reference Books:

1. "Machine Tools and Manufacturing Technology", Steve F. Krar, Mario Rapisarda, Albert F.
2. HMT Hand book- Production Technology Roy A. & Linberg- "Processes and materials of manufacturing", Prentice Hall of India Delhi.
3. Campbell J.S.: Principles of manufacturing Materials and Processes, McGraw-Hill, New York.
4. "Production technology", R. K. Jain, Khanna Publishers, Delhi, 15th Edition, 2000.
5. "Workshop Technology vol. II", W. A. J. Chapman, Viva Books Pvt. Ltd, New Delhi, 1st Edition, 2001.
6. "Elements of Workshop Technology vol.I& II", S.K. Hajra Choudhury and A.K. Hajra Choudhury , Media promoters and Publishers Pvt. Ltd, New Delhi, 13thEdition,2012.
7. "A Textbook of Manufacturing Technology (Manufacturing Processes)", R.K. Rajput, Laxmi Publications Pvt. Ltd, New Delhi. Edition, 2007

Useful Links

1. https://nptel.ac.in/course.html
2. https://nptel.ac.in/courses/112/107/112107219/
3. https://nptel.ac.in/courses/112/104/112104195/
4. https://nptel.ac.in/courses/112/105/112105127/
5. https://nptel.ac.in/courses/112/105/112105211/
6. https://nptel.ac.in/courses/112/105/112105212/

D Y Patil College of Engineering and Technology, Kasaba Bawada, Kolhapur
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Course Plan

Course Title : **Theory of Machines**	
Course Code : **201MEL213**	**Semester : IV**
Teaching Scheme : L-T-P : **3-0-0**	Credits : **3**
Evaluation Scheme : ISE + MSE Marks : **20 + 30**	ESE Marks : **50**

Prerequisite: Engineering Physics, Engineering mathematics, Fundamentals of Civil Engineering (Engineering Mechanics)

Course Description:

This course is deals with an introduction to gear geometry, types of gear teeth profile and phenomena of interference. Other topics covered include types of gear trains, Inertia forces and torques in mechanisms, balancing of rotary and reciprocating masses along with multi-cylinder in- line engines radial and V- engines, effect of gyroscopic couple in machinery, Free and forced vibrations of one-degree of freedom systems with and without viscous damping.

Course Objectives:

1. To describe basic gear geometry, gear profile and theory of gearing.
2. To study the various types of gear trains used for transmission of motion and power.
3. To study the gyroscopic effects on vehicles, aero plane, ship, four wheeler and two wheeler.
4. To study the problems on velocity and acceleration of slider crank mechanism analytically.
5. To study static and dynamic balancing of rotary and reciprocating masses.
6. To study basic concepts of vibration analysis.

Course Outcomes (COs):

At the end of the course the student should be able to:

CO	Statement	BTL
C213.1	**Understand** various terminology associated with gear.	L2
C213.2	**Identify** various terminology related to gear train.	L2
C213.3	**Understand** the gyroscopic effects on vehicles, aeroplane, ship, four wheeler and two wheeler.	L2
C213.4	**Solve** the problems on velocity and acceleration of slider crank mechanism analytically.	L3
C213.5	**Understand** the static and dynamic balancing of rotary and reciprocating masses.	L2
C213.6	**Apply** the basic concepts of vibration analysis.	L3

Course Content

Content	Hours
Unit 1:Toothed Gearing Geometry of motion, Gear geometry, Types of gear profile- Involute & cycloid, Theory of Spur gear, Interference in Involute tooth gears and methods for its prevention, Path of contact, Contact ratio.	7
Unit 2: Gear Trains Types of Gear trains - Simple, Compound, Reverted, Epicyclic gear train, Tabular method for finding the speeds of elements in epicyclic gear train, Torque in epicyclic gear train, Differential gear box(theoretical gearing).	7
Unit 3:Gyroscope Gyroscopic couple, spinning and precessional Motion, Gyroscopic couple and its effect on i) Aero plane ii) Ship iii) Four-Wheeler iv) Two –Wheeler.	7
Unit 4:Static and dynamic Force analysis of Mechanisms Velocity and acceleration of slider crank mechanism by analytical method, Inertia force and torque, D'Alembert's principle, Dynamically equivalent system, force analysis of reciprocating engine mechanism and four bar chain mechanism.	7

Unit 5: Balancing Static and dynamic balancing of rotary and reciprocating masses, primary and secondary forces and couples. direct and reverse cranks, balancing of single cylinder, multi cylinder, in-line and radial engines for four wheeler.	8
Unit 6: Mechanical Vibrations Basic concepts and definitions, types of vibrations, equivalent springs, equation of motion, types of damping, SDOF free vibrations with and without damping, logarithmic decrement. SDOF forced vibrations with and without damping.	8

Text Books:

1. "Theory of Machines", Rattan S.S, Tata McGraw Hill New Delhi, 5th Kindle Edition.2019
2. "Mechanical Vibrations „by Grover G.K., Nemchand Publications.

Reference Books:

1. "Mechanisms and Dynamics of Machinery", Hamilton H Mabie and Charles F Reinholtz, (1987) Fourth Edition, John-Wiley and Sons, Inc., New York.
2. "Theory of Vibration with applications", William T Thomson, Marie Dillon Dahleh and Chandramouli Padmanabhan, (2004) Fifth Edition, Pearson Education Publishers.
3. "Theory of Machines and Mechanism", Shigley, McGraw Hill, New York, 4thEdition,2014
4. "Theory of Machines", P.L.Ballany, Khanna Publication, New Delhi, 3rd Edition.

Online Resources:

1. Course Name: Theory of Mechanics
   By Prof. Sujata Srinivasan | IIT Madras
   Link: https://archive.nptel.ac.in/courses/112/106/112106270/.
2. Course Name: Gear and Gear Unit Design: Theory and Prcatice
   By Prof. Ratindranath Maiti | IIT Kharagpur
   Link: https://archive.nptel.ac.in/courses/112/105/112105234/.
3. Course Name: Dynamics of Machines
   By Prof. C.Amarnath,K.Kurren Issac,P.Sheshu | IIT Bombay
   Link: https://archive.nptel.ac.in/courses/112/105/112105234/.
4. Course Name: Gyroscopic Action in Machines
   By Prof. Amitabha Ghosh | IIT Kanpur
   Link: http://nptel.iitm.ac.in/.

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Course Plan

Course Title : **AI and ML for Mechanical Engineers Lab**	
Course Code : 201MEP209	**Semester :IV**
Teaching Scheme : L-T-P : 0-**0-2**	Credits : 1
Evaluation Scheme : ISE: 25	

Prerequisite: Python Programming

Course Description:

This course is designed to provide second-year mechanical engineering students with a comprehensive understanding of integrating artificial intelligence (AI) and machine learning (ML) in mechanical engineering applications. The course will cover the basics of AI integration in mechanical engineering, fundamental ML algorithms used in mechanical engineering, and an introduction to Power BI and advanced Excel techniques

Course Objectives:

9. To gain knowledge of the basics of AI integration in mechanical engineering and its significance.
10. To be aware of ML algorithms to solve mechanical engineering problems.
11. To become proficient in using Python libraries and modules commonly used.
12. To make students aware of data analytics tools such as Power Bi and Advance Excel tools

Course Outcomes (COs):

At the end of the course the student should be able to:

CO	Statement	BTL
C209.1	Understand fundamentals of AI and ML	L2
C209.2	Demonstrate various AI tools useful in mechanical engineering	L3
C209.3	Demonstrate various ML algorithms	L3
C209.4	Demonstrate data visualization using PowerBi	L3
C209.5	Demonstrate data analytics using Advanced Excel functions	L3

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List of Assignments/Experiments			
Sr. No.	**Name of Assignments/Experiment**	**Type**	**Hrs.**
1	Case Study on implementation of AI in mechanical engineering	S	2
2	Case study on various AI tools	S	2
3	Data manipulation using NumPy and Pandas	O	2
4	Data visualization using Matplotlib	O	2
5	Linear Regression analysis using Python	O	2
6	Logistic Regression analysis using Python	O	2
7	Case study on applications of ML in mechanical engineering	S	2
8	Case study on applications of ML in mechanical engineering	O	2
9	Introduction to Power BI	O	2
10	Importing and Transforming data in PowerBi	O	2
11	Creating interactive visualizations and dashboards in PowerBi	O	2
12	Creating interactive visualizations and dashboards in PowerBi	O	2
13	Advanced data analysis using Excel functions and formulas	O	2
14	Creating dynamic reports and automation using Excel	O	2
15	Creating dynamic reports and automation using Excel	S	2

S-STUDY, O-OPERATIONAL

Textbook:

1. “Artificial Intelligence for Mechanical Engineers" by Dr. S. S. Rathore and Dr. N. V. R. Naidu
2. “Machine Learning and Artificial Intelligence in Mechanical Engineering" by Dr. T. R. Seetharam.

Reference Books:

1. “Introduction to Artificial Intelligence for Mechanical Engineers" by Dr. S. K. Verma
2. “AI Techniques for Mechanical Engineering Applications" by Dr. A. K. Singh and Dr. R. K. Tripathy
3. “Applications of Artificial Intelligence in Mechanical Engineering" by Dr. V. K. Mittal and Dr. R. K. Jain

Online sources:

3. NPTEL Course: Introduction To Machine Learning
4. NPTEL Course: Fundamentals Of Artificial Intelligence

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Course Plan

Course Title : Fluid and Turbo Machinery Lab	
Course Code : 201MEP211	**Semester : IV**
Teaching Scheme : L-T-P : 0-0-2	**Credits : 1**
Evaluation Scheme : ISE Marks : 25	**ESE(POE)Marks :25**

Prerequisite: Fluid Mechanics, Applied Thermodynamics.

Course Description:

This course is deals with the study of working principles of water turbines & its velocity triangles, design parameters related to Turbines. Similarly understand the concept of Centrifugal pumps, selection of centrifugal pumps, and use of pumps for various engineering application. Understand the working principles & concept Compressors, selection of Compressors for various engineering application. And study the working of Gas Turbines and Jet engine and know its various configurations he knowledge of these devices is necessary in all types of power plants

Course Objectives:

1. To understand the working principles of Impulse and Reaction water turbines also to study its velocity triangles & design parameters related to Turbines
2. To understand the concept of Centrifugal pumps and its construction. To understand NPSH terms related to centrifugal pumps. To understand selection of centrifugal pumps for various Engineering application.
3. To understand the working principles & concept of Compressors. To understand various parameters related to Compressors. And understand selection of Compressors for various engineering application.
4. To understand the working of Gas Turbines and Jet engine and know its various configurations. To determine the efficiencies of gas turbines

Course Outcomes (COs):

At the end of the course the student should be able to:

CO	Statement	BTL
C211.1	Understand & Apply working principle of Rotodyanamic machines	L3
C211.2	Understand & Apply working principle of Centrifugal Pump	L3
C211.3	Understand & Apply working principle of Compressors	L3
C211.4	Understand & Apply working principle of Gas Turbines	L3
C211.5	Analyze the machines to evaluate the performance	L3

List of Assignments / Experiments			
Sr. No.	**Name of Assignments / Experiments**	**Type**	**Hrs.**
1	Trial on Pelton wheel with characteristics curve	O	2
2	Study of Francis turbine with characteristics curve	S	2
3	Study of Kaplan turbine with characteristics curve	S	2
4	Study of various types of pumps	S	2
5	I. Trial on Centrifugal pump with characteristics curve. II. Selection of on Centrifugal pump for application like boiler, feed pump, multistage in building and other application. Using manufacturing catalogue	O	4
6	I. Trial on reciprocating compressor. II. calculation of compressor for various application like service station, spray painting, and dentist	O	4
7	Trial on Gear Pump	O	2
8	Study of hydraulic devices- Intensifier, Accumulator, Hydraulic jacks, Press, Crane. Hydraulic ram.	S	2
9	Study of other types of pumps- Reciprocating pump, Gear pump, Jet pump, Submersible Pump, Air lift pump	S	2
10	Industrial visit to Pump/Turbine Manufacturing Industry or Hydro Power	S	2

❖ **S-STUDY, O-OPERATIONAL**

Text Book:

1. "Turbo machines", S.M. Yahya , Tata Mc Graw Hill , 2005
2. "Fans, compressor and turbine", S. M. Yahya, Tata Mc Graw Hill , 2005

Reference Books:

1. "Hydraulic Machines", V.P. Vasantdani, Khanna Publishers, 1996.
2. "Fluid flow machines", N.S. Govindrao, Tata McGraw-Hill, 1983.
3. "Steam and gas Turbines", R. Yadav, Central Publishing House, Allahabad, 6th Edition1997
4. "Fluid mechanics and hydraulic machines", Modi and Seth, Standard Book House, 2004
5. "Thermal Engineering", R K Rajput, Laxmi Publication.

D Y Patil College of Engineering and Technology, Kasaba Bawada, Kolhapur
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Course Plan

Course Title : **Theory of Machines Lab**	
Course Code : **LC201MEP213**	**Semester : IV**
Teaching Scheme : L-T-P : **0-0-2**	Credits : **1**
Evaluation Scheme : ISE Marks : **25**	ESE(POE)Marks :

Prerequisite: Engineering Physics, Engineering mathematics, Fundamentals Engineering Mechanics.

Course Description:

This course is deals with an introduction to gear geometry, generation of gear teeth profile and phenomena of interference. Study and Experiment to find Inertia forces and torques in components, static and dynamic balancing of rotary and reciprocating masses in machines, effect of gyroscopic couple in machinery, Free and forced vibrations of one-degree of freedom systems with and without viscous damping.

Course Objectives:

1. **To describe** basic gear geometry, gear profile and theory of gearing
2. **To study** the various types of gear trains used for transmission of motion and power.
3. **To study** the gyroscopic effects on vehicles, aero plane , ship, four wheeler and two wheeler
4. **To study** the problems on velocity and acceleration of slider crank mechanism analytically.
5. **To study** static and dynamic balancing of rotary and reciprocating masses
6. **To study** basic concepts of vibration analysis

Course Outcomes (COs):

At the end of the course the student should be able to:

CO	Statement	BTL
C213.1	Draw gear tooth profile using rack and cutter method.	L3
C213.2	Identify various Gear Trains.	L2
C213.3	Explain the concepts of gyroscope on vehicles, aeroplane, ship, two and four wheeler.	L2
C213.4	Evaluate static and dynamic forces , Moment of Inertia of a mechanical body by various suspension methods and torque in mechanisms.	L4
C213.5	Apply static and dynamic balancing principles to the Rotary and Reciprocating masses.	L3
C213.6	Apply Basics Concepts of Vibration to measure vibrational Parameter.	L3

List of Assignments/Experiments			
Sr. No.	**Details**	**Type**	**Hrs.**
1	Generation of involute profile using rack cutter method.	O	2
2	Demonstration of different Gear Trains and its velocity ratios	S	2
3	Experiment on Torque Measurement in epicyclical Gear Train.	O	2
4	Experiment on Gyroscope	O	2
5	Determination of M.I. using bifilar suspension system.	O	2
6	Determination of M.I. using trifilar suspension system.	O	2
7	Experiment on Balancing of rotary masses (Static and Dynamic).	O	2
8	Problems on balancing of reciprocating masses.	S	2
9	Problems on balancing of reciprocating masses.	S	2
10	Determination of M.I. of connecting rod by Compound pendulum method.	O	2
11	Computer aided force analysis of Slider crank mechanism (Program using Python/C)	O	2
12	Computer aided force analysis of Four bar mechanism (Program using Python/C)	O	2
13	Determination of natural Frequency of equivalent spring Mass system	O	2
14	Vibration measurement of a system by using vibration measuring instrument	O	2
15	Case Study on balancing of machine components of any practical application	O	2

❖ **S-STUDY, O-OPERATIONAL**

Text Books:

1. “Theory of Machines”, Rattan S.S, Tata McGraw Hill New Delhi, 5th Kindle Edition.2019
2. “Mechanical Vibrations „by Grover G.K., Nemchand Publications

Reference Books:

1. “Mechanisms and Dynamics of Machinery”, Hamilton H Mabie and Charles F Reinholtz, (1987) Fourth Edition, John-Wiley and Sons, Inc., New York.

2. “Theory of Vibration with applications”, William T Thomson, Marie Dillon Dahleh and Chandramouli Padmanabhan, (2004) Fifth Edition, Pearson Education Publishers.

3. “Theory of Machines and Mechanism”, Shigley, McGraw Hill, New York, 4thEdition,2014

4. “Theory of Machines”, P.L.Ballany, Khanna Publication, New Delhi, 3rd Edition.

Online Resources:

1. Course Name: Theory of Mechanics
By Prof. Sujata Srinivasan | IIT Madras
Link: https://archive.nptel.ac.in/courses/112/106/112106270/
2. Course Name: Gear and Gear Unit Design: Theory and Prcatice
By Prof. Ratindranath Maiti | IIT Kharagpur
Link: https://archive.nptel.ac.in/courses/112/105/112105234/
3. Course Name: Dynamics of Machines
By Prof. C.Amarnath,K.Kurren Issac,P.Sheshu | IIT Bombay
Link: https://archive.nptel.ac.in/courses/112/105/112105234/
4. Course Name: Gyroscopic Action in Machines
By Prof. Amitabha Ghosh | IIT Kanpur
Link: http://nptel.iitm.ac.in/

D Y Patil College of Engineering and Technology, Kasaba Bawada, Kolhapur
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Course Plan

Course Title : Machining Technology Lab-I	
Course Code : 201MEP214	**Semester : IV**
Teaching Scheme : L-T-P : 0-0-2	**Credits : 1**
Evaluation Scheme : ISE Marks : 25	**ESE (POE) Marks : 50**

Prerequisite: Engineering Graphics, Basic Mechanical Engineering

Course Description:

The course Machining Technology Lab-I is focused on the study of various types of metal cutting processes and machine tools. It includes the study of general purpose machine tools such as center lathe, drilling, milling machines along with their accessories and attachments.

This course intends to bring the competency in the students to identify and select and use proper machine tools, proper cutting tools, types of operations, and use of accessories and attachments on the machine tools.

Course Objectives:

1) To impart basic knowledge of Machine layout, installation of Machine Tools, selection of Tools.
2) To understand Lathe Machine, Drilling Machine, Milling Machine.
3) To study machining operations and prepare Job with its process sheet on Lathe machine.
4) To study basics of CNC and VMC Machine

Course Outcomes (COs):

At the end of the course the student should be able to:

CO	Statement	BTL
C214.1	Understand Machine layout, method of Machine Tool installation, selection of Tools for various machining operation.	L2
C214.2	Understand Construction, Mechanism and Application of Lathe Machine, Drilling Machine, and Milling Machine.	L2
C214.3	Demonstrate effect of variables such as speed, feed and depth of cut on machining process andproduce Job with plain turning, taper turning, external threading and knurling operation along with its process sheet.	L6
C214.4	Understand the basics of CNC and VMC Machine along with simple program using G & M codes.	L3

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Course Content

List of Practical's &Assignments			
Sr. No.	**Name of Practical's &Assignments**	**Type**	**Hrs.**
1	Machine layout, existing machine specifications, Installation procedure of Machine Tools	S	2
2	Selection of tools for metal cutting based on work piece materials	S	2
3	Study of Construction, Mechanism and Application of LatheMachine	S	2
4	Study of Construction, Mechanism and Application of Drilling Machine	S	2
5	Study of Construction, Mechanism and Application of Milling Machine	S	2
6	Study and construction of Shaper and Planer Machine	S	1
7	Study and construction of Grinding Machine	S	1
8	One Job of MS material plain turning, Taper turning, External threading, knurling operation, with its process sheet.	O	8
9	Introduction to CNC (Construction working theoretical treatmentonly). Introduction to VMC Machine (Construction working theoretical treatment only)	S	4
10	Industrial visit to study gear manufacturing processes or thread manufacturing Processes	-	-

- **S-STUDY, O-OPERATIONAL**
- **Note:**

1. **The load of Machining Technology Lab-I will be allotted to the Teaching Faculty.**
2. **Assessment of Journal based on above Term Work and Industrial Visit Report.**
3. **Term work will consist of Job Carrying 15 Marks, Journal Assessment along with internaloral 10 marks.**
4. **Practical Examination is on basis of Job done (50 Marks)**

Text Book:

1. "A Textbook of Production Technology (Manufacturing Processes)", P.C. Sharma, S. Chand and Company Pvt. Ltd, New Delhi.7th Edition, 2010.
2. "Workshop Technology vol. II", B.S. Raghuvanshi, Dhanapat Rai Publications Pvt. Ltd, New Delhi.10th Edition, 2000

Reference Books:

1. HMT Hand book- Production Technology Roy A. & Linberg- "Processes and materials of manufacturing", Prentice Hall of India Delhi.
2. Campbell J.S.: Principles of manufacturing Materials and Processes, McGraw-Hill, New York.

D Y Patil College of Engineering and Technology, Kasaba Bawada, Kolhapur
Department of Mechanical Engineering
Course Plan

Course Title : **3D Modeling lab**	
Course Code : **201MEP215**	Semester :**IV**
Teaching Scheme : L-T-P : **0-0-2**	Credits : **1**
Evaluation Scheme : ISE Marks : **50**	ESE(POE) Marks :-

Pre-requisites: Engineering Graphics , Fundamentals of drawings, Machine Drawing, Auto CAD

Course Description:

The student will emphasize the use of CAD on computer workstations as a major graphical analysis and design tool. Students will develop design skills, and practice applying these skills. Hands-on creativity, teamwork, and effective communication are emphasized.

Course Objectives:

1.	Understand Parametric Modeling Fundamentals and Procedure
2.	Develop an ability to create constrained 2-D Sketches.
3.	Create 3 D Models of machine components.
4.	Create assembly model with drafting.
5.	Create detailed drawings using suitable 3 D modeling software

Course Outcomes:

At the end of the course student should be able to:

CO	Statement	BTL
C215.1	**Understand** Parametric Modeling Fundamentals and Procedure	L2
C215.2	**Develop** an ability to create constrained 2-D Sketches.	L3
C215.3	**Prepare** 3 D Models of machine components.	L3
C215.4	**Prepare** assembly model with drafting.	L3

***Note: PO5 (Justification):** Prepare models by using 3 D modeling software like NX, CATIA to achieve PO5.

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Course Content

Content	Hours
Unit 1: Introduction to CAD Introduction to CAD, Introduction to different CAD software, Introduction to graphical user interface (GUI), Application and modification of contents and dimensions, Concept of feature based and parametric modeling	4
Unit 2: Sketching 2D sketching of elements like line, circle, arc, spline etc Geometrical constraints like parallel, perpendicular, co-incident, vertical, horizontal, tangent, symmetric etc.	8
Unit 3: Part Modeling -I Conversions of 2D into 3D modeling, Extrude, revolve commands, Boolean operations, hole features, editing features and transformation features.	10
Unit 4: Part Modeling -II Introduction to import and export of 3D models, Physical properties like volume, surface area, center of gravity etc of 3 D model.	8
Unit 5: Assembly Modeling Introduction to the assembly environment, creating assembly and sub-assemblies, Editing and modifying assembly relationships, Creating exploded view of the assembly	8
Unit 6: Drafting Generation of Orthographic views [working drawings] from 3D model. Generation of title block in sheet. Orthographic views of assembly drawings, generation of Bill of Materials (BOM). Plotting of drawings.	7

List of Assignments			
Sr. No.	**Name of Assignments**	**Type**	**Hrs.**
1	Prepare two 2 D drawings in Sketcher environment- Sketch 1	D	2
2	Prepare two 2 D drawings in Sketcher environment- Sketch 2	D	2
3	Prepare two 2 D drawings in Sketcher environment- Sketch 3	D	2
5	Drafting of above sketches.	D	2
6	Prepare 3 D models using 3 D modeling features (Model 1)	D	2
7	Prepare 3 D models using 3 D modeling features (Model 2)	D	2
8	Prepare 3 D models using 3 D modeling features (Model 3)	D	2
10	Prepare 3 D models using 3 D modeling features (Model 4)	D	2
11	Drafting of above 3D models.	D	2

12	Prepare assembly of 5-6 components. (Assembly-1)	D	2
13	Prepare assembly of 5-6 components. (Assembly-2)	D	2
14	Drafting of above assemblies along with exploded view	D	2
15	Retrieving physical properties for different component materials.	D	2

❖ **S-STUDY, O-OPERATIONAL, D-DRAWING SHEET**

Note: Latest 3D modeling software like NX, CATIA and any advance software are to beused.

Textbook:

1. N. D. Bhatt, "Machine Drawing", Charotor Publication House, Bombay, 46th Edition.
2. CAD / CAM, Theory and Practice by Zeid, (TMH)
3. CAD / CAM, Principles & Applications by P. N. Rao (TMH)

Reference Books:

1. K. L. Narayana, "Machine Drawing", New Age Publication
2. K. Venugopal, "Engineering Drawing and Graphics", New Age Publication
3. R. K. Dhawan, "A text book of Engineering Drawing", S. Chand and Co.
4. W. J. Luzadder, "Fundamentals of Engineering Drawing", Prentice Hall of India.
5. N. B. Shaha and B. C. Rana, "Engineering Drawing", Pearson Education, 2nd Edition.
6. Various 3D modeling Software Manuals.

Online Resources:

1. https://archive.nptel.ac.in/courses/112/102/112102304/

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Course Plan

Course Title: Environmental Studies	
Course Code: 201MEMC216	**Semester: IV**
Teaching Scheme: L-T-P : 2-0-0	**Credits: Non Credit**
Evaluation Scheme: ISE + MSE Marks : - Nil	**ESE Marks: 50**

Prerequisite: Understanding of Environmental Education course.

Course Description:

Environmental Studies course enhance a student's knowledge in a variety of currently relevant topics related to environmental awareness and pollution. The course aims to identify environmental problems, come-up with suitable solutions and create awareness for a hygienic and eco-friendly environmental.

Course Objectives:

1 Recognize the structure and functions of ecosystems with their importance.

2 Understand the environmental and social problems with global concern.

3 Understand the importance of environmental management for its protection.

4 Acquire problem solving skills through visits to different locations, identifying the environmental problems, proposing the solution models and exhibiting to the society and government authorities.

Course Outcomes (COs):

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

CO	Statement	BTL
C216.1	Understand the importance of ecosystem and biodiversity in view of its conservation.	L2
C216.2	Understand the concept of hazardous waste and to promote healthier environment.	L2
C216.3	Explain the importance of environmental management through pollution control boards.	L2
C216.4	Propose solutions for problems related with environmental well beings through location visits and model exhibitions.	L3

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Course Content	Hours
Unit 1.Ecology and Biodiversity Definition, types, importance and examples of ecology, types of community relationships: Symbiosis, predation and competition. Ecosystem: structure and functions, biotic and abiotic components, energy flows, ecological succession, food chain, food web & ecological pyramid, types of ecosystems, degradation of ecosystems and its impact. Biodiversity hotspots: Western ghats, eastern Himalayas, threats to biodiversity and conservation of biodiversity, environmental ethics.	8
Unit 2.Environment and Health Air Pollution, water pollution. E-waste, waste minimization technology, Plastic waste, Population growth of the world and reduced health content of the environment, energy crisis, bio fuels, Occupational health hazards, Concept of Carbon footprint.	7
Unit 3.Environmental Management Role of Central Pollution Control Board (CPCB) and Maharashtra Pollution Control Board (MPCB) in environmental protection of India. Concept of sustainability, ISO Certification.	5
Unit 4.Field Work Visit to a local area for documentation of environmental assets-River/forest/grassland/hill/mountain OR Visit to a local polluted site-Urban/Rural/Industrial/Agricultural OR Study of common plants, insects, birds OR Study of simple ecosystems- Ponds, Lakes, Rivers, Hill slopes, etc.	5

Text Books:

1. Trivedi R.K. and P.K Goel, Introduction to Air Pollution, Tech-science Publications.
2. Mhaskar A.K, Matter Hazardous, Techno-Science Publication**.**

Reference Books:

1. Bharucha, Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd. Ahmedabad 380013, India
2. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay
3. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I & II, Environmental Media.
4. Miller T. G. Jr., Environmental Science, Wadsworth Publications Co.
5. Sharma B.K., Environmental Chemistry, Gokel Publ. House, Meerut.