SANJIVANI RURAL EDUCATION SOCIETY'S

SANJIVANI COLLEGE OF ENGINEERING KOPARGAON

(An Autonomous Institute Affiliated to SPPU Pune)

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE STRUCTURE – 2021 PATTERN for AY 2023-24

SECOND YEAR B. TECH.

LIST OF ABBREVIATIONS			
Abbreviation	**Full Form**	**Abbreviation**	**Full Form**
ES	Engineering Science	HSMC	Humanity Science
PCC	Professional Core	CIA	Continuous Internal Assessment
PE	Professional Elective	OR	End Semester Oral Examination
OE	Open Elective	PR	End Semester Practical Examination
ISE	In-Semester Evaluation	TW	Continuous Term Work Evaluation
ESE	End-Semester Evaluation	BSC	Basic Science Course
PRJ	Project	MLC	Mandatory Learning Course

COURSE STRUCTURE- 2021 PATTERN
SECOND YEAR B. TECH: MECHANICAL ENGINEERING

SEMESTER-III 2021

Cat.	Code	Course Title	Teaching Scheme			Credits	Evaluation Scheme-Marks					
			L (hrs)	T (hrs)	P (hrs)		Theory		TW	OR	PR	Total
							CIA	ESE				
PCC	ME201	Basic Thermodynamics	3	-	-	3	40	60	-	-	-	100
BSC	BS202	Engineering Mathematics-III	3	1	-	4	40	60	-	-	-	100
PCC	ME203	Strength of Materials	3	-	-	3	40	60	-	-	-	100
PCC	ME204	Manufacturing Process	3	-	-	3	40	60	-	-	-	100
HSMC	HS205	Universal Human Values & Ethics (UHV)	3	-	-	3	40	60	-	-	-	100
PCC	ME206	Lab-I (Machine Drawing & GM)	1*		4	2	-	-	-	-	50	50
PCC	ME207	Lab-II (Foundations of IoT)		-	2	1	-	-	-	-	25	25
PCC	ME208	Lab-III (Strength of Materials)	-	-	2	1	-	-	-	25	-	25
PCC	ME209	Lab-IV (MP)	-	-	2	1	-	-	-	-	50	50
PCC	ME210	Electrical Drives and Controls Lab	-	-	2	1	-	-	50	-	-	50
MLC	MC211	Mandatory Learning Course-III	1	-	-	Non Credit	-	-	-	-	-	Pass/ Fail
		Total	17	1	12	**22**	**200**	**300**	**50**	**25**	**125**	**700**

SEMESTER-IV

Cat.	Code	Course Title	Teaching Scheme			Credits	Evaluation Scheme-Marks					
			L (hrs)	T (hrs)	P (hrs)		Theory		TW	OR	PR	Total
							CIA	ESE				
PCC	ME212	Applied Thermodynamics	3	-	-	3	40	60	-	-	-	100
PCC	ME213	Theory of Machines	4	-	-	4	40	60	-	-	-	100
PCC	ME214	Fluid Mechanics and Machinery	3	-	-	3	40	60	-	-	-	100
PCC	ME215	Numerical Methods	3	-	-	3	40	60	-	-	-	100
PRJ	HS216	Corporate Readiness - I	-	-	2	1	-	-	-	-	-	50
PCC	ME217	Materials Science & Metallurgy	3	-	-	3	40	60	50	-	-	100
PCC	ME218	Lab-I (ATD+BT+FM)	-	-	2	1	-	-		-	50	50
PCC	ME219	Lab-II (TOM)	-	-	2	1	-	-	-	-	25	25
PCC	ME220	Lab-III (NM)	-	-	2	1	-	-	-	25	-	25
PCC	ME221	Lab-IV (MSM)	-	-	2	1			-	25	-	25
PRJ	ME 222	Mini project	-	-	2	1	-	-	-	25	-	25
MLC	MC223	Mandatory Learning Course-IV	1	-	-	Non Credit	-	-	-	-	-	Pass/ Fail
		Total	17	-	12	**22**	**200**	**300**	**50**	**75**	**75**	**700**

MC211	Mandatory Course-III	Constitution of India – Basic features and fundamental principles
MC223	Mandatory Course-IV	Python Programming//2D/3D CAD Modeling Certification

Note: *For evaluation of Oral/Practical/TW, students should submit the journal regularly. Non submission of journal will be treated as absentees in concern head.*

BASIC THERMODYNAMICS (ME201)

Teaching Scheme		Examination Scheme	
Lectures:	3 Hrs. / Week	**CIA**	40 Marks
Practical:	-	**End Sem Exam:**	60 Marks
Credits:	**3**	**Total:**	100 Marks

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Prerequisite Course: Engineering Physics, Basic Mechanical Engineering, Mathematics.

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Course Objectives:

1. To Understand fundamental concepts and Laws of thermodynamics
2. To Apply the Laws of thermodynamics to different systems.
3. To Understand the processes governing the ideal gas behaviour.
4. To Understand reciprocating air compressor and evaluate its performance.
5. To Use of Steam Table/ Mollier chart for solving numerical.
6. To Understand steam generator and analyse its performance

Course Outcomes (COs): At the end of the course, learner will be able to

COs	Course Outcomes	Blooms Taxonomy	
		Level	**Descriptor**
CO1	Determine work and heat interaction for thermodynamic processes by applying first law of thermodynamics	3	Apply
CO2	Apply Second Law of Thermodynamics to different systems and Determine the change in entropy for various processes.	3	Apply
CO3	Calculate heat transfer, work transfer & other thermodynamic entities for the processes undergone by ideal gas.	3	Apply
CO4	Estimate performance parameters of single stage reciprocating air compressor	3	Apply
CO5	Calculate different properties of pure substance and Estimate performance of vapour power cycles.	3	Apply
CO6	Determine performance parameters of Boilers.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	0	1	1	2	1	3	3	3	-	3	-	-	2
CO2	3	3	1	2	1	2	2	3	3	3	-	3	-	-	2
CO3	3	2	2	2	1	0	0	3	2	3	-	1	-	-	2
CO4	2	3	2	3	1	3	2	3	3	3	-	1	1	-	2
CO5	2	3	2	3	1	3	2	3	3	3	-	3	1	-	2
CO6	2	3	2	3	1	0	0	3	3	3	-	3	-	-	2

Course Contents

Unit	Contents	No. of Hours	COs
1	**Thermodynamic Concepts and First Law of Thermodynamics**		
	Thermodynamic Concepts: Role of thermodynamics in mechanical Engineering, Thermodynamic Systems, Boundary, State of system, Properties of system, Classification of properties, Thermodynamic equilibrium, Zeroth law of thermodynamics. Definition of work & heat, Comparison of heat & work, types of work and their evaluation for thermodynamic processes. **First law of Thermodynamics**: First law of thermodynamics, Joules experiment, Applications of first law to flow and non-flow processes and cycles. Perpetual Motion Machine of the first kind (PMM I). Steady Flow Energy Equation (SFEE), Application of SFEE for devices such as nozzle, diffuser, throttling Device, turbine, compressor and heat exchanger.	6 Hrs.	CO1
2	**Second Law of Thermodynamics and Entropy**		
	Second Law of Thermodynamics: Limitations of first law of thermodynamics, Thermal reservoir, Heat Engine, Refrigerator and Heat pump, Schematic representation, Efficiency and Coefficient of Performance (COP), Kelvin-Planck & Clausius Statement of the Second law of Thermodynamics , Perpetual motion machine of second kind (PMM – II), Concept of Reversibility and Irreversibility. **Entropy**: Entropy as a property , Clausius' theorem, Clausius inequality, Change in entropy in reversible and irreversible processes, Principle of increase of entropy, concept of absolute temperature, introduction to third law of thermodynamics **Availability**: Available and Unavailable Energy	8 Hrs.	CO2

3	**Ideal Gas Properties and Processes**		
	Ideal Gas Laws, Equation of State, Universal Gas constant and ideal Gas constant Various processes, p-v and T-s diagrams, Calculations of heat transfer, work done, internal energy, Change in entropy and enthalpy.	6 Hrs.	CO3
4	**Air Compressor**		
	Reciprocating Air Compressor: Applications of compressed air, single stage compressor without clearance and with clearance volume, volumetric efficiency, isothermal efficiency, adiabatic efficiency, effect of clearance volume, free air delivery, actual indicator diagram for air compressor, Multi staging of compressor(Two Stage only), optimum intermediate pressure, intercooler, after Cooler, Capacity control of compressors. Introduction to pre filters, after filters, Air dryers, Reservoir and Instrumentation for Air Compressor.	6 Hrs.	CO4
5	**Properties of Pure Substance**		
	Formation of steam, phase-change phenomenon of a pure substance, Properties of steam, Use of Steam Tables, Study of P-v, T-s diagram. Mollier diagram for steam, Dryness fraction of steam and its determination, Study of steam calorimeters (Separating and throttling calorimeter only) **Vapour Power Cycle** :- Rankine cycle.(superheated steam & Reheating)	6 Hrs.	CO5
6	**Steam Generators**		
	Steam Generators: Classification, Constructional details of low pressure boilers, (water tube boiler & fire tube boiler) Primary Features of high pressure boilers, Boiler mountings and accessories, Introduction to IBR Act, Boiler performance, Specific Steam Consumption, Calculations-Equivalent Evaporation, Boiler efficiency, Heat balance Sheet	6 Hrs.	CO6

Books

Sr. No.	Title of Book	Authors	Publication House	Accession No
1.	Thermodynamics: An Engineering Approach	Yonus A Cengel and Michale A Boles	McGraw Hill Education	
2.	Fundamentals of Engineering Thermodynamics	Moran & Shapiro	John Wiley & Sons	
3.	Fundamentals of Thermodynamics	Sonntag, Borgnakke & Van Wylen	John Wiley & Sons Inc	

4.	Basic Engineering Thermodynamics	Rayner Joel	AWL-Addison Wesley	
5.	Engineering Thermodynamics	D.B. Spalding and E.H Cole	Arnold Publisher	
6.	Thermal Engineering	Domkundwar, Kothandaraman and Domkundwar	Dhanpat Rai Publishers	
7.	Engineering Thermodynamics	P. K. Nag	Tata McGraw Hill Publications	
8.	Engineering Thermodynamics	R.K. Rajput	Laxmi Publications Pvt Ltd, 3rd Edition	
9.	Applied Thermodynamics	Onkar Singh	New Age International Publishers	
10.	Thermal Engineering	P. L Ballaney	Khanna Publishers	
11.	Thermal Engineering	Sadhu Singh	Pearson India Education	
12.	Thermodynamics	C.P. Arora	Tata McGraw Hill	

ENGINEERING MATHEMATICS (BS202)

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Teaching Scheme	**Examination Scheme**
Lectures: 03 Hrs./ Week	**CIA : 40 Marks**
Tutorials: 01 Hrs./ Week	**End Sem Exam: 60 Marks**
Total: 100 Marks	**Credits: 04**

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COURSE OBJECTIVES

1 To make students familiarize with concepts and techniques of vector calculus, probability and differential calculus.

2 The intent is to furnish them with the techniques to understand engineering mathematics and its applications that would develop logical thinking power, useful in their disciplines.

COURSE OUTCOMES: At the end of the course, learner will be able to

COs	Course Outcomes After successful completion of this course student will be able to	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Apply** statistical methods for Analysis of data and calculate correlation and regression**.**	**3**	**Apply**
CO2	**Calculate** probabilityusingvarious probability distribution**.**	**3**	**Apply**
CO3	**Determine** solutionof Differential equations usingFourier transform technique.	**3**	**Apply**
CO4	**Calculate** directional derivative, divergence and curl of vector function.	**3**	**Apply**
CO5	**Determine** vector integration with the help of Green's theorem, Stoke's theorem, Gauss's theorem	**3**	**Apply**
CO6	**Determine**solution of partial differential equationsappearing inengineering	**3**	**Apply**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	1	-	-	1	1	1	-	-
CO2	3	2	-	-	1	-	-	1	1	1	-	-
CO3	3	2	-	-	-	-	-	1	1	1	-	-
CO4	3	2	-	-	-	-	-	1	1	1	-	-
CO5	3	2	-	-	-	-	-	1	1	1	-	-

CO6	3	3	-	-	-	-	-	1	1	1	-	-

COURSE CONTENTS

Unit-I	**Statistics** Data analysis, Histogram, Frequency tables, bar diagrams, histograms, Mean, Standard Deviation, Moments, Skewness and Kurtosis, Correlation, Regression lines.	**No.of Hours** 07	**COs** 1
Unit-II	**Probability** Introduction of Probability, Probability mass function, Binomial distribution, Poisson distribution, Normal distribution, Exponential distributions.	**No.of Hours** 07	**COs** 2
Unit-III	**Fourier Transform** Basic Concept of Fourier series, Definition of Fourier transform, Fourier transform of exponential and hyperbolic functions, Unit step function, Dirac delta functions, Solution of differential equations using Fourier transform.	**No. of Hours** 08	**COs** 3
Unit-IV	**Vector Differentiation** Vector Differentiation, Gradient of scalar function, Divergence and curl, Vector Identities and stream line.	**No. of Hours** 06	**COs** 4
Unit-V	**Vector Integration** Line and Surface integrals, path dependence, statements and Illustrations of Green, stokes and Gauss-Divergence theorem.	**No. of Hours** 06	**COs** 5
Unit-VI	**Applications of Partial Differential Equations** Separation of variables; solutions of one dimensional diffusion equation; first and second order one-dimensional wave equation and two dimensional Laplace equations.	**No. of Hours** 06	**COs** 6
Text Book(s)			

1. B. S. Grewal, Higher Engineering Mathematics, 42/e, Khanna Publishers, 2012, **ISBN-13: 978-8174091154.**
2. S.P. Gupta, Statistical Methods, 28th Edition, Sultan Chand and Sons., New Delhi, 1997
3. H. K. Das, Engineering Mathematics, S Chand, 2006, **ISBN-8121905209**
4. P. C. Biswal, Probability and Statistics, PHI, New Delhi, 2012, **ISBN-9788120331402 Lib-56298**
5. S.P. Gupta, Statistical Methods, 28th Edition, Sultan Chand and Sons., New Delhi, 1997

References

1. K.A. Stroud & D. S. Booth, Advanced Engineering Mathematics, Industrial Press, 5/e, 2011, **ISBN-9780831134495**
2. P. C. Matthews, Vector Calculus, Springer, 2/e, 2012, **ISBN-9783540761808**
3. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley, 9/e, 2013, **ISBN-13: 978-0471488859.**
4. John A. Rice, Mathematical Statistics and Data Analysis, International Thomson Publication, 1995**, IBSN-0534209343**

STRENGTH OF MATERIALS (ME 203)

Teaching Scheme		Examination Scheme	
Lectures:	3 Hrs. / Week	**CIA**	40 Marks
Practical:	-	**End Sem Exam:**	60 Marks
Credits:	**3**	**Total:**	100 Marks

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Prerequisite Course: Applied Mechanics, Engineering Mechanics

Course Objectives:

1. To study the concepts of stress, strain, principal stresses and principal planes.
2. To study the concept of shearing force and bending moment due to external loads in determinate beams.
3. To compute slopes and deflections in determinate beams.
4. To determine stresses and deformation in circular shafts due to torsion.
5. To determine safe load for columns for different end conditions.
6. To determine principal stresses and strains developed in mechanical structures.

Course Outcomes (COs): At the end of this course, students will be able to

CO	Statements	Blooms Taxonomy	
		Level	**Descriptor**
CO1	Solve problems based on stresses and strains for engineering materials	3	Apply
CO2	Compute shear force and bending moment diagrams for determinate beams due to external loads	3	Apply
CO3	Differentiate between the bending stresses, shear stresses and their distribution diagrams	4	Analyze
CO4	Determine slope and deflection due to external loads in determinate beams.	3	Apply
CO5	Differentiate between the torque transmitting capacity of the shaft on the basis of strength and rigidity.	4	Analyze
CO6	Calculate the principal stresses and strains developed in	3	Apply

	mechanical structures.		

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	2	-	-	2	2	2	-	2	2	-	-
CO2	2	2	2	-	3	-	-	2	2	2	-	2	2	-	-
CO3	3	3	3	-	3	-	-	2	2	2	-	2	2	-	-
CO4	2	3	2	-	3	-	-	2	2	2	-	2	2	-	-
CO5	3	2	2	-	3	-	-	2	2	2	-	2	2	-	-
CO6	3	3	2	-	3	-	-	2	2	2	-	2	2	-	-

Course Contents

Unit	Contents	No. of Hours	COs
1	**Linear Elasticity - Material Behavior**		
	Stress, strain, types of stresses, Stress-strain diagram for ductile and brittle materials, Hooke's law, Poisson's ratio, Modulus of Elasticity, Modulus of Rigidity, Bulk Modulus. Interrelation between elastic constants, factor of safety, Margin of safety **Thermal stresses and strains,** Stress-strain-temperature relationships in thin-walled pressure vessels	6 Hrs.	CO1
2	**Forces and Moments Transmitted by Slender Members**		
	Shear force and bending moment diagrams for statically determinate beams due to concentrated load, uniformly distributed load and couple, Relationship between rate of loading, shear force and bending moment diagrams Maximum bending moment and point of contra shear and contra flexure.	6 Hrs.	C02
3	**Bending and Shear Stresses**		
	Bending stresses: Theory of simple bending, assumptions, derivation of flexural formula, second moment of area for circular, hollow, rectangular, I, T sections with respect to centroidal and parallel axes, bending stress distribution	6 Hrs.	C03

	diagrams. **Shear stresses:** Derivation of shear stress distribution formula, shear stress distribution diagrams for circular, hollow, rectangular, I, T sections.		
4	**Slope and Deflection of Beams**		
	Slope and deflection of determinate beams, double integration method, Macaulay's method, derivation of formula for slope and deflection for standard cases.	6 Hrs.	C04
5	**Buckling and Torsion**		
	Buckling of columns: Derivation of Euler's formula for buckling load for column with hinged ends, concept of equivalent length for end conditions-both ends hinged, both ends fixed, one end hinged and one end fixed, Rankine's formula **Torsion:** Stresses, strain and deformations in determinate homogeneous shafts of solid and hollow circular section and subjected to twisting moment, derivation of torsion equation.	6 Hrs.	C05
6	**Principal Stresses and Strains**		
	Principal stresses and strains: Normal and shear stresses on any oblique plane. Derivation of expression for principal stresses and maximum shear stress. Graphical solution using Mohr's circle of stresses.	6 Hrs.	CO6

Text Books

Sr. No.	Title of Book	Authors	Publication House	Accession No
1.	A Textbook of Strength of Materials	R K Bansal	Laxmi Publications	6th Edition
2.	Strength of Materials	S.S. Rattan	Tata McGraw Hill Education (India) Pvt.Ltd., 2nd Edition, 2010	
3.	Strength of material	Ramamurtham	Dhanpat Rai Publication	
4.	Mechanics of Solids	S.S. Bhavikatti	The New Age International Publishers	

5.	Strength of material	B.K. Sarkar	Tata McGraw-Hill Education Publication	620.12
6.	Strength of materials	R.K. Rajput	S. Chand Publications	

Reference Books

Sr. No.	Title of Book	Authors	Publication House	Accession No
1.	Mechanics of Materials	Ferdinand P. Beer, E. Russell Johnston and Jr. John T. DeWolf	Tata McGraw-Hill, Sixth Edition, 2012	
2.	Strength of Materials	G. H. Ryder	Macmillan Pub	
3.	Engineering Mechanics of Solids	E.P. Popov	Prentice Hall Publication	
4.	Strength of materials	Singer and Pytel	Harper and row Publication	
5.	Mechanics of Materials	Andrew Pytel & Jaan Kiusalaas	Global Engineering	
6.	Mechanics of Materials	R. C. Hibbeler	Prentice Hall Publication	

MANUFACTURING PROCESSES (ME204)

Teaching Scheme		Examination Scheme	
Lectures:	3 Hrs. / Week	**CIA**	40 Marks
Practical:	-	**End Sem Exam:**	60 Marks
Credits:	**3**	**Total:**	100 Marks

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Prerequisite Course: (Basic mechanical Engineering, Mathematics, Engineering graphics)

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Course Objectives:

1. To understand basics of foundry processes, pattern making and sand casting, die casting
2. To understand various metal forming processes such as forging, rolling, extrusion and wire drawing
3. To study different types of plastic molding processes.
4. To study various metal joining processes, their parameters and applications.
5. To understand various sheet metal working operations to design dies.
6. To study various types of Additive manufacturing processes.

Course Outcomes (COs): At the end of the course, learner will be able to

COs	Course Outcomes	Blooms Taxonomy	
		Level	Descriptor
CO1	Calculate solidification time of casting.	3	Apply
CO2	Calculate amount of forces acting and work done during forming processes.	3	Apply
CO3	Compare various types of plastic processing methods.	4	Analyse
CO4	Differentiate various types of joining processes.	4	Analyse
CO5	Design dies for sheet metal working operations.	3	Apply
CO6	Describe types of additive manufacturing processes.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	-	2		1	-	2	-	-	2	3	-
CO2	2	2	2	1	-	-	-	-	-	-	-	-	-	3	-
CO3	1	-	-	-	-	1	2	2	-	-	-	-	2	3	-
CO4	2	-	-	-	-	2	2	2	-	2	3	-	-	3	-
CO5	2	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO6	2	-	-	-	2	-	-	-	-	2	-	-	2	3	-

Course Contents

Unit	Contents	No. of Hours	COs
1	**Casting Processes**		
	SAND CASTING – Pattern- types, material and allowances, Molding sand- types, properties and testing **Molding** – types, equipment's, tools and machines, Core – types and manufacturing, Gating system and Riser – types and design (Numerical), Heating and pouring, cooling and solidification- process and time estimation (Numerical), Defects and remedies, Inspection techniques. **Die casting**, Investment casting, Centrifugal Casting, Continuous Casting. Safety measures and professional ethics.	08 Hrs.	CO1
2	**Metal Forming Processes**		
	Hot and Cold Working – Concepts and comparative study, Material behavior in metal forming, friction and lubrication in metal forming **Rolling** – Types of rolling mills, flat rolling analysis, power required (Simple Numerical) . **Forging** – Types, process parameter, Analysis of open die forging (Numerical) .Safety measures. **Extrusion** – Types, process parameter, Extrusion dies, Shape factor (Numerical), **Drawing** – Wire drawing and its analysis (Numerical), tube drawing	08 Hrs.	CO2

3	**Plastic Processing**		
	Molding – Compression molding, Transfer molding, Blow molding, Injection molding – Process and equipment. Extrusion of Plastic – Type of extruder, extrusion of film, pipe, cable and sheet Thermoforming – Principle, pressure forming and vacuum forming. Safety measures and case study on impact of plastic processing on environment. Professional ethics.	04Hrs.	CO
4	**Joining Processes**		
	Surface preparation , types of joints. Welding Classification, Defects ,Applications , safety measures and case study on impact of welding on environment. Professional ethics. **Gas welding** - Oxy acetylene gas welding, Hydrogen gas welding. **Arc welding** - Metal arc welding(SMAW), Gas metal arc welding, (MIG, MAG) Tungsten inert gas welding, (TIG) Submerged arc welding,(SAW) Flux cored arc welding(FCAW), Electrode slag metal arc welding, etc **Resistance welding** - Resistance but welding, seam welding, spot welding, percussion welding. **Solid state welding** - Forge welding, Friction welding, Pressure welding etc	08Hrs.	CO4
5	**Sheet Metal Working**		
	Types of sheet metal operations, **Types of dies** and punches, material for dies and punches, Die design for **Progressive and Drawing Die**, clearance analysis, center of pressure, blank size determination (Numerical), strip layout, sheet utilization ratio (Numerical), methods of reducing cutting forces.	08Hrs.	CO5
6	**Additive manufacturing Processes**		
	Definition, need, raw materials, types of processes: Photopolymerization , Binder jetting, Material extrusion, Powder Bed Fusion, Sheet Lamination and Direct Energy Deposition. Limitations, strengths Programming methods.	06Hrs.	CO6

Text Books

Sr. No.	Title of Book	Authors	Publication House	Accession No
1.	Elements of workshop Technology Vol. I &II	Hajara Choudhari, Bose S.K	Asian Publishing House	
2.	Fundamentals of Manufacturing Engineering	D. K. Singh	Ane's Books. Pvt. Ltd.	
3.	Manufacturing technology	P.N.Rao	The Mc Graw hill companies	

Reference Books

Sr. No.	Title of Book	Authors	Publication House	Accession No
1.	Metal Casting – Computer Aided design and analysis	B. Ravi	Prentice Hall of India	
2.	Casting: An analytical approach	Reikher	Springer publications.	
3.	Rapid tooling guidelines for sand casting	Wang	Springer publications.	
4.	Degormos Materials and process in manufacturing	J. T. Black	John Willey and sons	
5.	Fundamentals of modern manufacturing: Materials and systems	M.P Grover	Materials and systems	
6.	Material and Processes in Manufacturing	DeGarmo E P and J T Kohser R A		
7.	Injection Mold Design	David O Kazmer		
8.	Maufactucring processes for Engineering materials	Serope Kalpakjian Stevn		
9.	Additive manufacturing Processes	John O. Milewski	Springer publications.	

LAB-I MACHINE DRAWING AND GEOMETRICAL MODELLING (ME206)

Teaching Scheme		Examination Scheme	
Lectures:	-	**PR Exam**	50 Marks
Practical:	4 Hrs./ Week		
Credits:	**2**		

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Prerequisite Course: Basic Mechanical Engineering, Engineering Graphics

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Course Objectives:

1. To understand requirements of industrial drawings.
2. To read, understand and explain basic Geometric Dimensioning & Tolerancing concepts.
3. To apply various geometric and dimension tolerances based on type of fit
4. To understand requirements for manufacturing and assembly

Course Outcomes (COs): At the end of the course, learner will be able to

COs	Course Outcomes	Blooms Taxonomy	
		Level	Descriptor
CO1	Understand the standards used in Machine Drawing and IS Conventions.	2	Understand
CO2	Apply limits , Fits and Tolerance, Surface Finish Symbols In Drawing of machine parts.	3	Apply
CO3	Demonstrate Geometrical Dimensions and Tolerances for machine parts	2	Understand
CO4	Apply modelling and assembly commands to develop 3D models of any machine parts	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	-	3	3	2	-	2	2	-	-
CO2	3	1	1	-	-	-	-	3	3	2	-	2	2	-	-
CO3	3	1	1	-	3	-	-	3	3	2	-	2	2	-	-
CO4	3	1	1	-	3	-	-	3	3	2	-	2	2	-	-

Course Contents

SN	Contents	No. of Hours	COs
1	**IS Conventions**		
	Introduction to machine drawing, Dimensioning technique for machine components, Conventional representation of machine components as per IS code: SP-46 such as screw threads, springs, gears, bearing, tapped holes, knurling, splined shafts, tapers, chamfers, countersunk and counter bores, keys, & welded joints, Surface Roughness Introduction, terminology, machining symbol with all parameters, roughness values (Ra) indicating surface roughness on drawing.		CO1
2	**Limits, Fits and Tolerances**		
	Definitions applied to tolerances, types of tolerance, types of fits, fit system. Geometrical tolerances – Nomenclature, tolerance frame, types of geometrical tolerances & their symbols, indicating geometric tolerances on drawing. Interference and clearance fit calculation for 2 part assembly.		CO2
3	**Geometrical Dimensions and Tolerances**		
	Importance of GD&T, difference between position tolerance and plus minus tolerance , datum selection process from assembly & manufacturing approach, concept & calculation of MMC,LMC,RFS, concept & reading of feature control frame, tolerance selection criteria for ideal assembly approach, ASME Standards: ASME Y14.5, Rules.		CO3
4	**Part Modelling and Assembly**		
	Introduction to Graphic User Interface of modeling software,Sketching of simple machine parts in 2D, Parametric solid modeling (3D) using any modeling software. Dimensional and Geometrical Constraints, Assembly of Machine Components, examples- Wheel support assembly, Bench-vice, Universal coupling, Butterfly valve etc. using bottom up approach.		CO4

Guidelines for Laboratory Conduction

The student shall complete the following activity as a Journal (LAB)

Practical:

The student shall complete the following Practical in laboratory.

Learner will demonstrate skills to communicate drawings as per industry standards:

SN	Content	Duration
1	One A2 size sheet based on various IS conventions (Manual Drawing).	[08 Hr.]
2	Two A2 size sheets: one on Assembly & other on Details of simple mechanical system (By using AUTODesk or Cadian software).	[10 Hr.]
3	Interference and clearance fit calculation for 2 part assembly (Numericals)	[04 Hr.]
4	Tolerance selection criteria for ideal assembly approach (Numericals)	[04 Hr.]
5	Solid Modeling of Machine Components using Modeling Software.	[06 Hr.]
6	Assembly and Production Drawing of Machine Parts using Modeling Software.	[10 Hr.]
7	Drawing views from assembly.	[04 Hr.]

Text Books

Sr. No.	Title of Book	Authors	Publication House	Accession No
1.	Standards: ASME Y14.5 – 2018			
2.	Machine Drawing	Narayana, K. L., Kannaiah, P., Venkata Reddy, K.	New Age International Publishers, New Delhi, India, ISBN-13: 978-8122440546	
3.	Machine Drawing	Bhatt, N. D. and Panchal, V. M	Charotar Publishing House Pvt. Ltd, Anand, India, ISBN-13: 978-9385039232	

Reference Books

Sr. No.	Title of Book	Authors	Publication House	Accession No
1.	Geometric Dimensioning and Tolerancing for Mechanical Design	Cogorno, G. R.,	3rd edition, McGraw-Hill Education	
2.	Geometric Dimensioning and Tolerancing: A Complete Guide	Blokdyk, Gerardus,	5STARCooks	
3.	Standards: ISO/TR 23605:2018, ISO 1101:2017, SP 46, IS 15054(2001)			

LAB-II FOUNDATIONS OF IOT (ME207)

Teaching Scheme		Examination Scheme	
Practical:	2 Hrs./ Week	**TW**	25 Marks
Credits:	**1**	**Total:**	25 Marks

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Prerequisite Course: (if Any)

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Course Objectives:

1. To identify and study different control system components.
2. To understand simulation on controllers.
3. To demonstrate working of different actuating systems and sensors.
4. To learn and demonstrate IoT

Course Outcomes (COs): At the end of the course, learner will be able to

COs	Course Outcomes	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	Select sensors for automation system	2	Understand
CO2	Understand the components of IoT system and ThingSpeak	2	Understand
CO3	Simulate circuits in simulation software tinker CAD	3	Apply
CO4	Understand programing of Arduino in Arduino IDE for actuators	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	3	2	3	2	2	-	1	-	-	1	-	-	2
CO2	3	2	3	2	3	2	1	-	1	-	-	-	-	-	2
CO3	3	2	3	2	3	2	1	-	1	-	-	1	-	-	2
CO4	3	2	3	2	3	2	2	-	1	-	-	1	-	-	2

List of Practical

Sr.No	Name of Practical	Hrs	Course Outcome
1	Determination of Ambient Temperature using Arduino	**2**	**CO1**
2	Determination of light intensity using Photo-resistor and LED using Arduino	**4**	**CO1**
3	Generation of temperature data using IoT based ThingSpeak,Arduino and ESP8266 and LM32	**4**	**CO2**
4	Generation of humidity data using IoT based ThingSpeak,Arduino and ESP8266	**4**	**CO2**
5	Identification of gas leakage using gas sensor	**2**	**CO3**
6	Detection of obstacle using ultrasonic sensors and simulate in TinkerCAD	**2**	**CO3**
7	Classification of Vibration level using Accelerometer, Arduino	**4**	**CO4**
8	Controlling speed of stepper motor using Arduino	**2**	**CO4**

Text Books

Sr. No.	Title of Book	Authors	Publication House	Accession No
1.	Designing IoT	Mcewen Adrian	Wiley	63818-N
2.	IoT	Bagha Arshdeep	Universities Press	64434-N
3.	Getting Started with IoT	Cuno Pfister	O. Reilly	59825-N,59826-N
4.	IoT connecting objects with Web	Chauchi Hakima	Willey	63310 to 63314-N
5.	IoT hands on Approach	Bagha and modisetty	Universities Press	63299-N to 63303-I
6	IoT	Paj Pathari	Universities Press	64303-N

LAB-III STRENGTH OF MATERIALS [ME208]

Teaching Scheme

Practical: 2 Hrs./week

Credits: 1

Examination Scheme

Oral: 25 Marks

Total Marks: 25 Marks

Pre-requisite Course: Applied Mechanics, Mathematics

Course Objectives :

1. To conduct tension test on the given mild steel rod for determining mechanical properties
2. To determine the ultimate stress to which the specimen can withstand
3. To conduct shear test on given specimen under single and double shear.
4. To determine the Young's modulus of the given specimen by conducting bending test.
5. To use software to verify theoretical values

Course Outcomes (COs): At the end of the course, learner will be able to

Course Outcome	Statements	Level	Descriptor
CO1	Conduct various tests to determine mechanical properties of the given specimen	3	Apply
CO2	Plot SFD, BMD and slope-deflection curves	3	Apply
CO3	Compare analytical solution of principal stresses with graphical solution.	3	Apply

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Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	3	3	2	-	2	3	3	-	3	2	-	-
CO2	3	-	-	3	3	2	-	2	3	3	-	3	2	-	-
CO3	3	-	-	3	3	2	-	2	3	3	-	3	2	-	-

LIST OF PRACTICALS:

Sr. No.	Title	CO	PO	PSO
1	Tension test on a ductile material to determine its mechanical properties.	1	1, 4,5, 6,9, 10,12	1
2	Tension test on a Aluminium material to draw stress-strain diagram and to evaluate its ultimate stress	1		1
3	To determine Compressive strength of materials	1		1
4	To determine Shear strength of mild steel material under single and double shear	1		1
5	To find the values of bending stresses and young's modulus of the material of a simply supported beam	1		1
6	Plotting of shear force and bending moment diagrams for different boundary conditions and loading conditions of beam (using software)	2		1
7	Comparison of numerical and analytical analysis on Slope and deflection (by using software)	2		1
8	Determination of Principal stresses by graphical method and verification through analytical method	2		1

LAB IV MANUFACTURING PROCESS (ME209)

Teaching Scheme		Examination Scheme	
Lectures:	-	**Pr Work:**	25 Marks
Practical:	2 Hrs./ Week		
Tutorials :	-		
Credits:	**1**	**Total:**	25Marks

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Prerequisite Course: (Basic mechanical Engineering, Mathematics, Engineering graphics, Manufacturing Processes)

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Course Objectives:

1. To select appropriate lathe machine process parameters and perform operations turning, facing, taper turning and threading.
2. To select appropriate process parameter for arc welding.
3. To understand sand casting, gating system, types of cores, patterns.
4. To print 3D component on additive manufacturing (3D printing).

Course Outcomes (COs): At the end of the course, learner will be able to

CO's	Course Outcomes	Blooms Taxonomy	
		Level	Descriptor
CO1	Perform lathe operation and study the corresponding set up parameters.	3	Apply
CO2	Select appropriate process parameter for arc welding.	3	Apply
CO3	Understand the basic principles and concepts of casting processes and identify common casting defects with remedies.	2	Understand
CO4	Perform an operation on additive manufacturing machine	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	-	2	2	2	1	-	2	3	-	-
CO2	3	3	2	3	-	-	2	2	2	1	-	2	3	-	-
CO3	3	3	2	3	-	-	2	2	2	3	2	2	3	-	-
CO4	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-

Course Contents

Jobs	Contents	COs
1	Manufacturing of any one job consisting of all the lathe operations.	CO1
2	Job on TIG/ MIG welding.	CO2
3	Demonstration of Sand Moulding Process	CO3
4	Create a mechanical component using Additive manufacturing (3D printing)	CO4

Text Books

Sr. No.	Title of Book	Authors	Publication House	Accession No
1.	Elements of Workshop Technology	S. K. Hajra Choudhary, A. K. Hajra Choudhary	Media promoters	
2.	A Course in Workshop Technology Vol. II	B. S. Raghuwanshi	Dhanpat Rai & CO	
3.	Workshop Technology Part 1, 2 and 3	W. A. J. Chapman	Taylor & Francis	
4.	Manufacturing Process – 2,	Anul Goel	Technical Publication	
5.	Production Technology (Manufacturing Processes)	P C Sharma,	S Chand Publication	
6.	Additive manufacturing Processes	John O. Milewski	Springer publications	

Reference Books

Sr. No.	Title of Book	Authors	Publication House	Accession No
1.	HMT Handbook for Production Technology		Tata McGraw-Hill,	
2.	Metal Casting – Computer Aided design and analysis	B. Ravi	Prentice Hall of India	
3.	Casting: An analytical approach	Reikher	Springer	
4.	Rapid tooling guidelines for sand casting	Wang	Springer	
5.	Degormos Materials and process in manufacturing	J. T. Black	John Willey and sons	

MLC III - CONSTITUTION OF INDIA (MC211)

Teaching Scheme **Lectures: 01 Hrs. / Week** **Credit : No Credit**	

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Prerequisite Course: (if Any)

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Course Objectives: (Please specify Six Objectives)

1 To study the historical background, salient features and preamble of Indian constitution

2 To study the provision of fundamental right in the Indian constitution.

3 To study the directive principle of state policy and fundamental duties.

4 To study the system of government through parliamentary and federal system.

5 To understand the formation, structure and legislative framework of central government.

6 To understand the formation, structure and legislative framework of state government.

Course Outcomes (COs): At the end of the course, learner will be able to

COs No	Course Outcomes	Blooms Taxonomy	
		Level	Descriptor
CO1	Describe background, salient features of constitution of India	1	Remember
CO2	Explain the system of government, it's structure and legislative framework.	2	Understand
CO3	Apply the fundamental rights and duties in their life	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	--	--	--	--	--	1	--	--	--	---	--	--
CO2	--	--	--	--	--	2	--	---	--	---	--	--
CO3	--	--	--	--	--	2	--	---	--	--	--	--

Course Contents

Unit No.	Unit Title	No. of Hrs.	COs
I	**Introduction to Constitution of India**	07	
	Historical background, Salient features, Preamble of constitution		
II	**Fundamental Rights**	05	
	Features of fundamental rights, Basic rights 1. Right to equality; 2. Right to freedom; 3. Right against exploitation; 4. Right to freedom of religion; 5. Cultural and educational rights; 6. Right to property; 7. Right to constitutional remedies		
III	**Directive principle of State Policy (B) Fundamental Duties**	05	
	Features of directive principle, Classification of directive principle, Criticism of directive principle, Utility of directive principle, Conflict between Fundamental rights and directive principle List of fundamental duties, Features of fundamental duties, Criticism of fundamental duties, Significance of fundamental duties, Swaran Singh Committee Recommendations		
IV	**System of Government**	05	
	Parliamentary system: Features of parliamentary government, Features of presidential government, merits and demerit of Parliamentary system, Federal system: Federal features of constitution, unitary features of constitution, Centre and state relation: Legislative relation, administrative relations and financial relation, Emergency provision: National emergency, Financial emergency and criticism of emergency provision		
V	**Central Government**	05	
	President: Election of president, powers and functions of president, and Veto power of president, Vice-president: Election of vice-president, powers and functions of vice-president, Prime minister: Appointment of PM, powers and functions of PM, relationship with president, Central council of ministers: Appointment of ministers, responsibility of ministers, features of cabinet committees, functions of cabinet committees, Parliament: Organization of parliament, composition of the two houses, duration two houses, membership of parliament, session of parliament, joint sitting of two houses, budget in parliament, Supreme court (SC): Organization of supreme court, independence of supreme court, jurisdiction and powers of supreme court		

VI	**State Government**	05	
	Governor: Appointment of governor, powers and functions of governor, constitutional position, Chief minister: Appointment of CM, powers and functions of CM, relationship with governor, State council of ministers: Appointment of ministers, responsibility of ministers, cabinet, High court (HC): Organization of HC, independence of HC, jurisdiction and powers of HC, Sub-ordinate court: Structure and jurisdiction, LokAdalats, Family court, Gram Nyayalayas		

Reference Book:

1. Indian Polity for Civil Service Examination, M Laxmikanth, Mc GrawHill Education, Fifth Edition.
2. Introduction to the Constitution of India, Durga Das Basu, LexisNexis, 22nd Edition