GLOBAL INSTITUTE OF ENGINEERING AND TECHNOLOGY (AUTONOMOUS)
COURSE CATALOGUE
REGULATIONS B.TECH – GR - 25
MECHANICAL ENGINEERING
II YEAR I SEMESTER

Course Code	Course Name	Subject Area	Category	Periods Per Week			Credits	Scheme of Examination Max Marks		
				L	T	P		CIA	SEE	Total
THEORY										
ME301PC	Mechanics of Solids	PCC	CORE	3	0	0	3	40	60	100
MA302BS	Probability, Statistics & Complex Variables	BSC	Foundation	3	0	0	3	40	60	100
ME303PC	Material Science and Metallurgy	PCC	CORE	3	0	0	3	40	60	100
ME304PC	Production Technology	PCC	CORE	3	0	0	3	40	60	100
ME305PC	Fluid Mechanics and Hydraulic Machines	PCC	CORE	3	0	0	3	40	60	100
MS306HS	Quantitative Aptitude and Logical Reasoning	HSMC	Foundation	2	0	0	2	40	60	100
PRACTICAL										
ME307PC	Production Technology Lab	PCC	CORE	0	0	2	1	40	60	100
ME308PC	Material Science and Mechanics of Solids Lab	PCC	CORE	0	0	2	1	40	60	100
ME309PC	Fluid Mechanics and Hydraulic Machines Lab	PCC	CORE	0	0	2	1	40	60	100
ME310SD	Design Thinking and Ideation	SDC	SKILL	0	0	2	1	40	60	100
			Total Credits	**17**	**0**	**8**	**21**			

COURSE CONTENT

MECHANICS OF SOLIDS								
II Year - I Semester: ME								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
ME301PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 48**		
Prerequisite: Engineering Mechanics								

1. COURSE OVERVIEW

This course provides a comprehensive foundation in the mechanics of materials, focusing on stress-strain behaviour, elasticity, and structural response under various loading conditions. It covers shear force and bending moment analysis for different beam configurations, along with flexural and shear stress calculations for diverse cross-sections. Students will explore principal stresses, strain analysis, and failure theories including Mohr's circle and Von Mises criteria. The curriculum also delves into torsion in circular shafts and the design of structural elements under combined loads. Finally, it introduces column stability through Euler's and Rankine's approaches, equipping learners with essential tools for structural design and analysis.

2. COURSE OBJECTIVE

The students will try to Learn:

1) To understand the fundamental concepts of elasticity, stress-strain relationships, and strain energy to analyse material behaviour under various loading conditions.
2) To develop the ability to construct shear force and bending moment diagrams for different beam types and loading scenarios, and interpret their structural significance.
3) To apply bending and shear stress theories to calculate stresses in beams of various cross-sections and design simple structural elements based on stress distribution.
4) To analyse complex stress states using Mohr's circle and evaluate structural safety using different failure theories under combined loading conditions.
5) To examine torsional behaviour in circular shafts and assess column stability using Euler's and Rankine's theories to design safe and efficient structural members.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Analyse the stress-strain characteristics of materials under various loading conditions and compute elastic constants for different configurations.
CO 2	Construct and interpret shear force and bending moment diagrams for various types of beams subjected to different loading patterns.
CO 3	Calculate bending and shear stresses in beams of standard cross-sections and design basic structural components based on stress distribution.
CO 4	Determine principal stresses and strains using analytical and graphical methods, and apply failure theories to assess structural safety under combined loads.
CO 5	Analyse torsional behaviour in shafts and evaluate the stability of columns using classical theories, enabling safe and efficient structural design.

4. COURSE CONTENT

UNIT – I:

Simple Stresses & Strains: Elasticity and plasticity – Types of stresses & strains–Hooke's law– stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Elastic moduli & the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT-II:

Shear Force and Bending Moment: Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, U.D.L., uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT-III:

Flexural Stresses: Theory of simple bending – Assumptions – Derivation of bending equation: $M/I = f/y = E/R$ Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections – Design of simple beam sections. Shear Stresses: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections.

UNIT-IV:

Principal Stresses and Strains: Introduction – Stresses on an inclined section of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses – Two perpendicular normal stresses accompanied by a state of simple shear – Mohr's circle of stresses – Principal stresses and strains – Analytical and graphical solutions. **Theories of Failure:** Introduction – Various theories of failure - Maximum Principal Stress Theory, Maximum Principal Strain Theory, Strain Energy and Shear Strain Energy Theory (Von Mises Theory).

UNIT-V:

Torsion of Circular Shafts: Theory of pure torsion – Derivation of Torsion equations: $T/J = q/r = N\theta/L$ – Assumptions made in the theory of pure torsion – Torsional moment of resistance – Polar section modulus – Power transmitted by shafts – Combined bending and torsion and end thrust – Design of shafts according to theories of failure.

Columns and Struts: Euler's Theory, Limitations of Euler's theory, Equivalent Length, Rankine's Formula, Secant Formula.

5. TEXT BOOKS

1) Barry J. Goodno and James M. Gere, "Mechanics of Materials" Ninth Edition, Cengage Learning, 2018.
2) S. S. Rattan, "Strength of Materials", Second Edition Tata McGraw Hill Education Pvt. Ltd, New Delhi,2011.

6. REFERENCE BOOKS

1) U. C. Jindal, "Strength of Materials", Pearson Education India,2012
2) Egor P. Popov, Toader A. Balan, "Engineering Mechanics of Solids", PHI Learning, 2010
3) G. H. Ryder, "Strength of Materials", Macmillan Long Man Publications, 1961
4) W. A. Nash and M. C. Potter, "Strength of Materials", Fifth Edition, Schaum's Outline Series, 2011.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**	1										**2**	
CO 2	**3**	**2**	**2**										**3**	
CO 3	**3**	**2**	**3**	**2**									**3**	**2**
CO 4	**3**	**3**	**2**	**2**									**2**	**2**
CO 5	**3**	**2**	**3**	**2**									**2**	**3**

COURSE CONTENT

PROBABILITY, STATISTICS & COMPLEX VARIABLES								
II Year - I Semester: ME								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
MA302BS	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 48**		
Prerequisite: Mathematics courses of the first year of study.								

1. COURSE OVERVIEW

The course **Probability, Statistics & Complex Variables** provides fundamental mathematical tools required for analysis and problem-solving in Mechanical Engineering applications.

The First half, **Probability & Statistics**, introduces students to the concepts of probability theory, random variables, and statistical distributions, which form the basis for data analysis and decision-making. The course also develops knowledge of estimation and hypothesis testing, enabling students to apply statistical inference methods to real-life case studies.

The second half, **Complex Analysis,** covers the differentiation and integration of complex functions. Topics such as analyticity, Cauchy-Riemann equations, harmonic conjugates, conformal mappings, Möbius transformations, Cauchy's theorem, integral formula, series expansions, singularities, and residue theorem are studied. These powerful tools are widely applied in mathematical modelling and engineering problem-solving, particularly in fields involving fluid mechanics, heat transfer, and vibration analysis.

2. COURSE OBJECTIVE

The students will try to Learn:

1) The ideas of probability and random variables, and various discrete and continuous probability distributions and their properties.
2) The basic ideas of statistics, including measures of central tendency, correlation and regression.
3) The statistical methods of studying data samples.
4) Differentiation and integration of complex-valued functions.
5) Evaluation of integrals using Cauchy's integral formula and Cauchy's residue theorem.
6) Expansion of complex functions using Taylor's and Laurent's series.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Apply the concepts of Random variables and Discrete Probability distributions to some case studies.
CO 2	Correlate the concepts of one unit to the concepts in other units. Learn the concept of Continuous Probability and Fundamental Sampling Distribution.
CO 3	Test a hypothesis on large and small samples concerning means & variance of one & two samples, single & double proportions.
CO 4	Analyse the complex functions with reference to their analyticity, formation of real & complex parts of analytic functions.
CO 5	Integration using Cauchy's integral and residue theorems. Taylor's and Laurent's series expansions of a complex function.

4. COURSE CONTENT

UNIT-I: Random Variables and Probability Distributions **8 L**

Concept of a Random Variable – Discrete Probability Distributions – Continuous Probability Distributions – Mean of a Random Variable – Variance of a Random Variable.

Discrete Probability Distributions: Binomial Distribution – Poisson distribution.

UNIT-II: Continuous Distributions and sampling **10 L**

Uniform Distribution – Normal Distribution – Areas under the Normal Curve – Applications of the Normal Distribution – Normal Approximation to the Binomial Distributions. Fundamental Sampling Distributions: Random Sampling – Some Important Statistics – Sampling Distributions – Sampling Distribution of Means – Central Limit Theorem.

UNIT-III: Tests of Hypotheses (Large and Small Samples) **10 L**

Statistical Hypotheses: General Concepts – Testing a Statistical Hypothesis. Single sample: Tests concerning a single mean. Two samples: Tests on two mean (Unknown for equal variance). One sample: Test on a single proportion. Two samples: Tests on two proportions. Two- sample tests concerning variances: F-distribution.

UNIT-IV: Complex Differentiation **10 L**

Differentiation of Complex functions – Analyticity – Cauchy-Riemann equations (without proof) –Harmonic Functions – Finding harmonic conjugate – Milne Thomson method – Elementary analytic functions (exponential, trigonometric, logarithm) and their properties.

UNIT-V: Complex Integration **10 L**

Line integral – Cauchy's theorem – Cauchy's Integral formula – Zeros of analytic functions – Singularities – Taylor's series – Laurent's series. Residues – Cauchy Residue Theorem (All theorems without Proof).

5. TEXT BOOKS

1) Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, Probability & Statistics for Engineers & Scientists, 9th Ed. Pearson Publishers.
2) S C Gupta and V K Kapoor, Fundamentals of Mathematical statistics, Khanna publications.
3) R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th Edition, 2016.

6. REFERENCE BOOKS

1) T.T. Soong, Fundamentals of Probability and Statistics for Engineers, John Wiley & Sons, Ltd,2004.
2) Sheldon M Ross, Probability and statistics for Engineers and scientists, academic press.
3) J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Edition, McGraw-Hill, 2004.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**										**2**	**3**	**2**
CO 2	**2**	**3**										**2**	**2**	**3**
CO 3	**2**	**3**											**2**	**3**
CO 4	**3**	**-**	**1**		**2**								**3**	**-**
CO 5	**3**	**3**			**1**							**2**	**3**	**3**

COURSE CONTENT

MATERIAL SCIENCE AND METALLURGY								
II Year - I Semester: ME								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
ME303PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 48**		
Prerequisite: Engineering Mechanics								

1. COURSE OVERVIEW

This course offers a comprehensive exploration of materials science, beginning with crystal structures and imperfections that influence mechanical behaviour. It delves into phase diagrams and alloy systems, emphasizing microstructural evolution and transformation mechanisms. Heat treatment processes are thoroughly covered, highlighting their impact on steel properties. Advanced thermal and surface hardening techniques are introduced to enhance performance. Finally, the course surveys a wide range of engineering materials—including steels, cast irons, non-ferrous alloys, ceramics, and composites—focusing on their properties and industrial applications.

2. COURSE OBJECTIVE

The students will try to Learn:

1) To understand the relationship between crystal structures, defects, and their influence on mechanical properties of materials.
2) To interpret binary phase diagrams to predict phase transformations and microstructural evolution in alloy systems.
3) To analyse the effects of various heat treatment processes on the microstructure and mechanical behaviour of steels.
4) To evaluate continuous cooling curves and surface hardening techniques to optimize material properties for engineering applications.
5) To identify and compare the properties and applications of ferrous, non-ferrous alloys, ceramics, and composite materials.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Analyse how crystal structures and defects influence the mechanical behaviour of engineering materials.
CO 2	Interpret binary phase diagrams and predict phase transformations and resulting microstructures in alloy systems.
CO 3	Evaluate the impact of various heat treatment processes on the microstructure and mechanical properties of steels.
CO 4	Apply knowledge of cooling curves and surface hardening techniques to enhance material performance in industrial applications.
CO 5	Classify and select appropriate engineering materials—including alloys, ceramics, and composites—based on their properties and intended applications.

4. COURSE CONTENT

UNIT – I:

Crystal Structure: Unit cells, Metallic and Ceramic crystal structures. Imperfection in solids: Point, line, surface and volume defects; dislocations, strengthening mechanisms, slip systems, critical resolved shear stress**.**

UNIT-II:

Hume – Rothery Rules: Alloys, substitutional and interstitial solid solutions- Phase diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, Eutectoid, peritectoid and monotectic reactions. Iron Iron-carbide phase diagram and microstructural aspects of ledeburite, austenite, pearlite, ferrite and cementite.

UNIT-III:

Heat treatment of steels: Isothermal transformation diagrams for Fe-C alloys and microstructures development. Martensite, Bainite. Annealing. Normalising, Hardening, Tempering and Spheroidising.

UNIT-IV:

Continuous cooling curves and interpretation of final microstructures and properties-Thermo mechanical treatments like austempering, martempering, surface hardening methods like case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening.

UNIT-V:

Alloy steels, properties and applications of stainless steels and tool steels, maraging steels- Types of cast irons (grey, white, malleable and spheroidal graphite cast irons), copper and its alloys (Brass and bronze)-Aluminium and its alloys (Al-Cu Alloys). Ceramics and Composites: Types, properties and applications.

5. TEXT BOOKS

1) V. Raghavan, "Material Science and Engineering', Prentice Hall of India Private Limited, Fifth Edition.
2) William. D. Callister, David G. Rethwisch, "Materials Science and Engineering: An Introduction", John Wiley & Sons, 2018.
3) SIDNEY H AVNER, Introduction to Physical Metallurgy, McGraw Hill, 2017.

6. REFERENCE BOOKS

1) Kenneth G. Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of India Private Limited, 9th Edition, Indian Reprint, 2009.
2) U. C. Jindal, "Engineering Materials and Metallurgy", Pearson, 2011.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**											**3**	
CO 2	**3**	**3**	**2**										**3**	**2**
CO 3	**3**	**2**	**2**										**3**	**2**
CO 4	**3**	**2**	**2**	**2**									**3**	**2**
CO 5	**3**	**2**			**2**								**3**	**2**

COURSE CONTENT

PRODUCTION TECHNOLOGY								
II Year - I Semester: ME								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
ME304PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 48**		
Prerequisite: Engineering Mechanics								

1. COURSE OVERVIEW

This course introduces the core manufacturing processes used in modern industry, starting with casting techniques and pattern design, followed by an in-depth look at welding methods from basic gas welding to advanced laser and friction stir welding. It covers metal forming operations like rolling, drawing, and sheet metal work, emphasizing practical applications and force calculations. Students also explore extrusion and forging processes, including high-energy rate forming technologies. Throughout, the focus remains on understanding real-world applications, identifying defects, and optimizing production efficiency.

2. COURSE OBJECTIVE

The students will try to Learn:

1) To understand the principles, materials, and design considerations involved in casting operations, including pattern making, moulding techniques, gating systems, and casting defects.
2) To gain foundational knowledge of welding processes, joint types, welding positions, and cost estimation, with emphasis on gas and arc welding techniques.
3) To explore specialized welding methods and develop the ability to identify welding defects and apply appropriate testing procedures.
4) To analyse hot and cold working processes, sheet metal operations, rolling, and drawing techniques, focusing on force calculations and equipment used in industrial forming.
5) To understand the mechanics and applications of extrusion and forging processes, including high-energy rate forming methods and their role in modern manufacturing.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Analyse and apply casting techniques, design gating and riser systems, and identify casting defects to optimize manufacturing quality.
CO 2	Demonstrate proficiency in basic welding operations, select appropriate welding methods for different joints, and estimate time and cost for welding tasks.
CO 3	Evaluate advanced welding processes, diagnose welding defects, and implement suitable testing methods to ensure weld integrity and performance.
CO 4	Apply principles of hot and cold working, perform sheet metal operations, and calculate forces and power requirements for rolling and drawing processes.
CO 5	Distinguish between various extrusion and forging methods, analyse forming forces, and assess the suitability of high-energy rate forming techniques for specific applications.

4. COURSE CONTENT

UNIT – I:

Casting: Steps involved in making a casting – Advantage of casting and its applications; Patterns - Pattern making, Types, Materials used for patterns, pattern allowances; Properties of moulding methods. Methods of Melting - Crucible melting and cupola operation – Defects in castings; Principles of Gating – Requirements – Types of gates, Design of gating systems – Riser – Function, types of Risers and Riser design. Casting processes – Types – Sand moulding, Centrifugal casting, die- casting, Investment casting, shell moulding**.**

UNIT-II:

Arc Welding: Classification, Types of welds and welded joints and their characteristics, Welding Positions, Arc welding, shielded metal arc welding, Submerged arc welding, Resistance welding, Thermit welding.

UNIT-III:

Gas Welding: Gas welding, Types, Oxyfuel gas cutting, Standard time and cost calculations. Inert Gas Welding, TIG Welding, MIG welding, Friction welding, Friction Stir Welding, Induction welding, Explosive welding, Laser Welding. Soldering, Brazing, Heat affected zone in welding. Welding defects, Causes and remedies, Destructive and non, Destructive testing of welds.

UNIT-IV:

Hot Working and Cold Working: Strain hardening, Recovery, Recrystallization and grain growth. Sheet metal Operations: Stamping, Blanking and piercing, Coining, Strip layout, Hot and cold spinning, Bending and deep drawing. Rolling fundamentals, Theory of rolling, Types of Rolling mills and products. Forces in rolling and power requirements. Drawing and its types, Wire drawing and Tube drawing, Types of presses and press tools. Forces and power requirement in the above operations.

UNIT-V:

Extrusion of Metals: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion – Extruding equipment – Tube extrusion, Hydrostatic extrusion. Forces in extrusion.

Forging Processes: Forging operations and principles – Tools – Forging methods – Smith forging, Drop Forging – Roll forging – Forging hammers: Rotary forging – forging defects – cold forging, swaging, Forces in forging operations.

High Energy Rate Forming Processes: Principles of Explosive Forming, Electro-hydraulic Forming, Electro-magnetic forming and rubber pad forming.

5. TEXT BOOKS

1) Manufacturing Technology / P.N. Rao/ Vol.1 / Mc Graw Hill Education/ 5th Edition, 2018.
2) Manufacturing Engineering & Technology / Serope Kalpakjian / Steven R. Schmid / Pearson, 7th Edition,2014.

6. REFERENCE BOOKS

1) Production Technology Vol.: 1, WILEY, Sreeramulu M, 2018.
2) A Text book of Production Technology (Manufacturing Processes) / Dr.P.C. Sharma / S. Chand Publications /1st Edition, 2006.
3) Manufacturing processes H. S. Shan, Second Edition, Cambridge University Press, 2017.
4) Production Technology: Manufacturing Processes, Technology and Automation / R. K. Jain / Vol.1/Khanna Publishers /19th Edition, 2009.
5) Elements of Workshop Technology/ S.K. Hajra Choudhury, A.K. Hajra Choudhury, Nirjhar Roy/Vol.1/ Media Publishers & Promoters Pvt. Ltd./1st Edition,2008.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**	**3**	**2**	**1**							**1**	**3**	**3**
CO 2	**3**	**2**	**3**	**2**	**2**							**1**	**3**	**2**
CO 3	**3**	**3**	**3**	**2**	**2**							**2**	**3**	**2**
CO 4	**3**	**2**	**3**	**2**	**2**							**1**	**3**	**2**
CO 5	**3**	**2**	**3**	**2**	**2**							**1**	**3**	**2**

COURSE CONTENT

FLUID MECHANICS & HYDRAULIC MACHINES								
II Year - I Semester: ME								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
ME305PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**40**	**60**	**100**
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 48**		
Prerequisite:								

1. COURSE OVERVIEW

This course introduces the fundamentals of fluid mechanics, covering fluid properties, pressure measurement, and flow classification. It explores fluid kinematics and dynamics, including Bernoulli's and momentum equations. Boundary layer theory and closed conduit flow are examined with emphasis on losses and flow measurement techniques. Students study hydraulic machinery, focusing on turbines, pumps, and their performance characteristics. Practical applications and efficiency analysis are integrated throughout for engineering insight.

2. COURSE OBJECTIVE

The students will try to Learn:

1) To understand fluid properties and pressure concepts to analyse their impact on fluid behaviour and measurement techniques.
2) To apply principles of fluid kinematics and dynamics to classify flow types and solve problems using continuity, Bernoulli's, and momentum equations.
3) To examine boundary layer phenomena and pipe flow characteristics including energy losses and flow measurement methods.
4) To analyse hydraulic machinery operations such as turbines and pumps, focusing on design, efficiency, and performance parameters.
5) To evaluate real-world fluid systems through practical applications involving flow measurement, energy transfer, and hydraulic design.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Demonstrate understanding of fluid properties and pressure measurement techniques used in analysing static and dynamic fluid systems.
CO 2	Apply fluid flow principles and equations to solve problems involving continuity equation, Bernoulli's equation, and momentum equation in various flow conditions.
CO 3	Analyse boundary layer behaviour and pipe flow characteristics including energy losses and flow measurement using standard instruments
CO 4	Evaluate the performance of hydraulic turbines and pumps through velocity diagrams, efficiency calculations, and design considerations
CO 5	Interpret and assess fluid machinery characteristics for selection and operation in engineering applications involving fluid transport and energy conversion.

4. COURSE CONTENT

UNIT – I:

Fluid statics: Dimensions and units: physical properties of fluids- specific gravity, viscosity, and surface tension - vapour pressure and their influence on fluid motion- atmospheric, gauge and vacuum pressures – measurement of pressure- Piezometer, U-tube and differential manometers.

UNIT – II:

Fluid kinematics: Stream line, path line and streak lines and stream tube, classification of flows-steady & unsteady, uniform & non-uniform, laminar & turbulent, rotational & irrotational flows-equation of continuity for one dimensional flow and three-dimensional flows.

Fluid dynamics: Surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its application on force on pipe bend.

UNIT – III:

Boundary Layer Concepts: Definition, thicknesses, characteristics along thin plate, laminar and turbulent boundary layers (No derivation) boundary layer in transition, separation of boundary layer, submerged objects – drag and lift.

Closed conduit flow: Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line. Measurement of flow: Pitot tube, venturi meter, and orifice meter, Flow nozzle.

UNIT – IV:

Basics of turbo machinery: Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

Hydraulic Turbines: Classification of turbines, Heads and efficiencies, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design –draft tube theory- functions and efficiency.

Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

UNIT – V:

Centrifugal pumps: Classification, working, work done – barometric head- losses and efficiencies specific speed- performance characteristic curves, NPSH.

5. TEXT BOOKS

1) Hydraulics, Fluid Mechanics and Hydraulic Machinery - MODI and SETH, 22nd Edition, Standard Book House.
2) Fluid Mechanics and Hydraulic Machines by Er. R. K. Rajput, S. Chand,2019.

6. REFERENCE BOOKS

1) Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S.K. Kataria & Sons, 2018
2) Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International Publishers.
3) Hydraulic Machines by T.R. Banga & S.C. Sharma, 7th Edition, Khanna Publishers.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**	**1**									**1**	**3**	**3**
CO 2	**3**	**3**	**2**	**2**								**1**	**3**	**3**
CO 3	**3**	**2**	**2**	**2**								**1**	**2**	**1**
CO 4	**3**	**2**	**3**	**2**	**1**								**2**	**3**
CO 5	**3**	**2**	**3**	**2**	**1**								**3**	**3**

COURSE CONTENT

QUANTITATIVE APTITUDE AND LOGICAL REASONING								
II Year - I Semester: ME								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
MS306HS	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		2	**-**	**-**	**2**	**40**	**60**	**100**
Contact Classes: 32	Tutorial Classes: Nil	Practical Classes: Nil				**Total Classes: 32**		
Prerequisite: Nil								

1. COURSE OVERVIEW

The **Quantitative Aptitude and Logical Reasoning** course is designed to strengthen numerical ability, analytical thinking, and problem-solving skills required for competitive examinations, campus placements, and professional aptitude tests. The course covers fundamental arithmetic, algebra, data interpretation, and logical reasoning techniques, enabling learners to analyze problems systematically, apply appropriate methods, and arrive at accurate solutions efficiently. Emphasis is placed on speed, accuracy, and logical thinking to enhance overall aptitude and decision-making skills.

2. COURSE OBJECTIVE

The students will try to Learn:

1) To answer general problems in his everyday life within in short time and to improves the certain skills of a student such as numerical and logical ability, mental capacity and also in sharpening minds.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Apply concepts of number systems, HCF and LCM, averages, ages, and ratio and proportion to solve quantitative problems.
CO 2	Solve problems related to various important topics of quantitative aptitude using appropriate mathematical techniques.
CO 3	Analyze and solve problems involving mensuration and data interpretation.
CO 4	Apply logical reasoning techniques to solve analytical and reasoning-based problems.
CO 5	Solve problems based on Venn diagrams, cubes and dice, and clock and calendar concepts.

4. COURSE CONTENT

UNIT – I **(6L)**

Number System: Test for Divisibility, Test of prime number, Division and Remainders – HCF and LCM of Numbers–Fractions and Decimals -Average-Problems on Ages- Problems on Numbers- Ratio and Proportion.

UNIT -- II **(6L)**

Percentage – Profit, Loss and Discount – Partnership and Share-Simple Interest – Compound Interest. Time and Work- Pipes and Cisterns-Time and Distance- Problems on Trains- Boats and Streams.

UNIT -- III **(6L)**

Allegation or Mixtures, Clocks &Calendar, Mensuration : Area of Plane Figures, Volume and Surface Area of Solid Figures.

Data Interpretation: Tabulation, Bar Graphs, Pie Charts, Line Graphs.

UNIT -- IV **(7L)**

Series Completion: Number Series, Alphabet Series, Alpha – Numeric Series.

Classification: Word Classification, Number Classification and Letter Classification.

Mathematical Operations-Arithmetical Reasoning. Puzzle Test: Classification Type Questions, Seating Arrangements, Comparison Type Questions, Sequential Order of Things, Selection Based on Given Conditions, Jumbled Problems.

UNIT -- V **(7L)**

Logical Venn Diagrams –Cubes and Dice – Analytical Reasoning-Assertions and Reason– Logical Deductions-Syllogism -Statement and Arguments-Statement and Conclusions- -Data Sufficiency.

5. TEXT BOOKS:

1. R. S. Agarwal, *Quantitative Aptitude*, Revised Edition, S. Chand Publishing, New Delhi.
2. R. S. Agarwal, *Verbal and Non-Verbal Reasoning*, Revised Edition, S. Chand Publishing, New Delhi.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**										**2**	**3**	**1**
CO 2	**3**	**3**	**1**									**2**	**2**	**1**
CO 3	**2**	**3**	**2**	**1**								**1**	**3**	**1**
CO 4	**2**	**3**	**1**						**1**			**2**	**2**	**1**
CO 5	**2**	**2**	**1**									**1**	**2**	**1**

COURSE CONTENT

PRODUCTION TECHNOLOGY LABORATORY								
II Year - I Semester: ME								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
ME307PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	**-**	**2**	**1**	**40**	**60**	**100**
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 32				**Total Classes: 32**		
Prerequisite: Production Technology								

1. COURSE OVERVIEW

This course offers hands-on training in key manufacturing processes, beginning with metal casting techniques including pattern design, sand testing, and molten metal handling. Students gain practical welding experience through ARC, TIG, spot, plasma welding, and brazing exercises. Mechanical press working covers blanking, piercing, deep drawing, extrusion, and bending operations using both compound and progressive tools. The curriculum also introduces plastic processing methods such as injection and blow moulding. This course builds foundational skills in fabrication, forming, and joining technologies essential for industrial applications.

2. COURSE OBJECTIVE

The students will try to Learn:

1) To develop foundational skills in pattern making, sand testing, and executing basic casting operations.
2) To gain hands-on experience in diverse welding techniques and understand their industrial applications.
3) To understand and perform essential press working operations using various tooling methods.
4) To explore and apply plastic moulding techniques for manufacturing polymer-based components.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Design casting patterns, assess sand properties, and successfully perform basic casting operations with quality control awareness.
CO 2	Demonstrate competence in executing various welding techniques and understand their applications in fabrication and repair processes.
CO 3	Apply press working principles to perform operations like blanking, deep drawing, and bending using appropriate tooling methods.
CO 4	operate injection and blow moulding equipment to produce plastic components, understanding process parameters and product quality.

4. COURSE CONTENT

Minimum of 12 Exercises need to be performed

I. Metal Casting Lab:

1. Pattern Design and making - for one casting drawing.

2. Sand properties testing - Exercise -for strengths, and permeability – 1

3. Moulding Melting and Casting - 1 Exercise

II. Welding Lab:

1. ARC Welding Lap & Butt Joint - 2 Exercises

2. Spot Welding - 1 Exercise

3. TIG Welding - 1 Exercise

4. Plasma welding and Brazing - 2 Exercises (Water Plasma Device)

III. Mechanical Press Working:

1. Blanking & Piercing operation and study of simple, compound and progressive press tool.

2. Hydraulic Press: Deep drawing and extrusion operation.

3. Bending and other operations

IV. Processing of Plastics

1. Injection Moulding

2. Blow Moulding

5. REFERENCE BOOKS

1) Dictionary of Mechanical Engineering – G.H.F. Nayler, Jaico Publishing House.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**3**	**3**
CO 2	**3**	**2**	**3**	**2**	**2**	**1**	**1**	**1**	**2**	**2**	**1**	**2**	**3**	**2**
CO 3	**3**	**2**	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**3**	**2**
CO 4	**3**	**2**	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**3**	**2**

COURSE CONTENT

MATERIAL SCIENCE & MECHANICS OF SOLIDS LABORATORY								
II Year - I Semester: ME								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
ME308PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	**-**	**2**	**1**	**40**	**60**	**100**
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 32				**Total Classes: 32**		
Prerequisite: Metallurgy & Material Science and Mechanics of Solids								

1. COURSE OVERVIEW

This integrated lab course offers hands-on experience in both Material Science and Mechanics of Solids, essential for understanding the behaviour of engineering materials. Students will explore crystal structures and analyse microstructures of metals, steels, cast irons, and non-ferrous alloys. The course emphasizes practical techniques for studying material science. In the Mechanics of Solids segment, learners perform tension, bending, torsion, hardness, and impact tests to evaluate mechanical properties. Together, these labs build foundational skills for material selection and structural analysis in engineering applications

2. COURSE OBJECTIVE

The students will try to Learn:

1) To develop practical understanding of material structures by examining crystal models and microstructures of metals, steels, and alloys.
2) To enhance analytical skills through microscopic evaluation of various ferrous and non-ferrous materials.
3) To build proficiency in mechanical testing techniques, including tension, bending, torsion, hardness, and impact tests.
4) To correlate material properties with mechanical behaviour, enabling informed decisions in engineering design and manufacturing.
5) To prepare students for real-world applications by integrating theoretical knowledge with hands-on laboratory experience.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Understand crystal structures and demonstrate the ability to model and differentiate between various lattice arrangements.
CO 2	Analyse microstructures of pure metals, steels, cast irons, and non-ferrous alloys to interpret their physical and mechanical properties.
CO 3	Perform and interpret mechanical tests such as tension, bending, torsion, hardness, and impact to evaluate material behaviour under various loading conditions.
CO 4	Assess steel hardenability using the Jominy End Quench Test and relate it to practical heat treatment applications.
CO 5	Correlate microstructural features with mechanical performance, enabling informed material selection and design decisions in engineering practice.

4. COURSE CONTENT

Material Science Lab

1) Preparation and study of crystal models for simple cubic, body centred cubic, face centred cubic and hexagonal close packed structures.
2) Preparation and study of the Microstructure of pure metals like Iron, Cu and Al.
3) Preparation and study of the Microstructure of Mild steels, low carbon steels, high Carbon steels.
4) Study of the Microstructures of Various Cast Irons.
5) Study of the Microstructures of Non-Ferrous alloys. (Al, Cu, Mg)
6) Hardenability of steels by Jominy End Quench Test.

Mechanics of Solids Lab

1) Tension test
2) Bending test
3) Torsion test
4) Brinell hardness test/ Rockwell hardness test
5) Test on springs
6) Izod Impact test/ Charpy Impact test

5. TEXT BOOKS

1) Laboratory manual in engineering materials SK Hajra Choudhury Asian Books Pvt. Ltd.
2) Laboratory manual for strength of materials JP Singh Katson books.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**	**2**									**1**	**3**	**3**
CO 2	**3**	**3**											**3**	**2**
CO 3	**3**	**3**	**2**										**3**	**2**
CO 4	**3**	**2**											**3**	**2**
CO 5	**3**	**3**	**2**									**1**	**3**	**2**

COURSE CONTENT

FLUID MECHANICS & HYDRAULIC MACHINES LABORATORY								
II Year - I Semester: ME								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
ME309PC	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	**-**	**2**	**1**	**40**	**60**	**100**
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 32				**Total Classes: 32**		
Prerequisite: Fluid Mechanics & Hydraulic Machines								

1. COURSE OVERVIEW

This course is designed to provide hands-on experience with fluid flow measurement techniques and hydraulic machines. Through a series of structured experiments, students will gain practical insights into the behaviour of fluids under various conditions and the performance characteristics of turbines and pumps used in engineering applications.

2. COURSE OBJECTIVE

The students will try to Learn:

1) To understand fluid dynamics principles.
2) To evaluate performance of hydraulic machines.
3) To develop experimental and analytical skills.
4) To apply theoretical knowledge to real systems.
5) To foster technical reporting and communication.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Practically understand core fluid mechanics concepts such as Bernoulli's theorem, frictional losses, and flow measurement techniques.
CO 2	Conduct performance tests on turbines and pumps, interpret efficiency curves, and assess operational characteristics under varying conditions.
CO 3	Set up experiments, collect accurate data, and analyse results using scientific methods and engineering calculation.
CO 4	Bridge the gap between classroom theory and industrial applications by exploring the behaviour of fluid systems and hydraulic machines in controlled lab environments.
CO 5	Document experimental procedures, observations, and conclusions effectively through structured lab reports and oral presentations

4. COURSE CONTENT

List of Experiments:

Fluid Mechanics

1. Venturi meter.
2. Orifice meter.
3. Friction factor for a given pipe line.
4. Loss of head due to sudden contraction in a pipeline.
5. Application of Bernoulli's Theorem.

Hydraulic Machinery: Performance Test on

1. Impact of jets on Vanes.
2. Pelton Wheel.
3. Francis Turbine.
4. Kaplan Turbine.
5. Single Stage Centrifugal Pump.
6. Multi Stage Centrifugal Pump.
7. Reciprocating Pump.

5. TEXT BOOKS

1) Fluid Mechanics and Machinery Laboratory Manual, Sadhu Singh, Khanna Publishers 2022.
2) Fluid Mechanics and Hydraulic Machines, K Subramanya, McGraw Hill Education, 2022.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**2**	**2**	**2**	**1**							**1**	**3**	**2**
CO 2	**3**	**2**	**3**	**2**	**2**							**1**	**3**	**3**
CO 3	**3**	**3**	**2**	**3**	**2**								**3**	**2**
CO 4	**2**	**2**	**3**	**2**	**3**					**1**			**2**	**3**
CO 5	**1**	**2**	**2**	**2**	**2**								**1**	**2**

COURSE CONTENT

DESIGN THINKING AND IDEATION								
II Year - I Semester: ME								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
ME310SD	**Skill**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	**-**	**2**	**1**	**40**	**60**	**100**
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 32				**Total Classes: 32**		
Prerequisite: Nil								

1. COURSE OVERVIEW

Design Thinking and Ideation equips students with a human-centered approach to problem solving, guiding them through empathy, ideation, prototyping, and testing. The course blends theory with hands-on practice, fostering creativity, teamwork, and communication skills to develop innovative solutions for real-world challenges.

2. COURSE OBJECTIVE

The students will try to Learn:

1) To introduce the concept and importance of design thinking in solving complex problems.
2) To enable students to empathize with users and identify genuine needs.
3) To facilitate ideation and creative thinking for problem solving.
4) To guide students in developing prototypes and testing solutions.
5) To build storytelling and communication skills for presenting ideas effectively.

3. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Understand the principles and stages of the design thinking process.
CO 2	Apply empathy and user research tools to understand user needs.
CO 3	Use ideation techniques like brainstorming and mind mapping to generate solutions.
CO 4	Develop and refine prototypes through iterative testing.
CO 5	Present solutions using storytelling and plan for implementation and collaborate on real world challenges using end to end design thinking.

4. COURSE CONTENT

UNIT – I:

Fundamentals of Design Thinking: Design Thinking Process: Types of the thinking process, Common methods to change the human thinking process, Design thinking: Definition, Origin of design thinking, Importance of design thinking, Design vs Design thinking, Problem solving, the need of design thinking; An approach to design thinking, Design thinking Process model, Design thinking tools.

Case Studies: General, Engineering and Service applications, Activities: Identify an Opportunity and Scope of the Project Explore the possibilities and prepare a design brief.

UNIT-II:

Empathize and Understanding User Needs: Design thinking phases, how to empathize, Role of empathy in design thinking, the purpose of empathy maps, Things to be done prior to empathy mapping, Activities during and after the session, Understanding empathy tools: Customer Journey Map, Personas.

Define: Methods of Define Phase: Storytelling, Critical items diagrams, Define success.

Activities: Apply the methods of empathizing and Define Phases Finalize the problem statement (User Interview practice, empathy mapping, shadowing or observation study).

UNIT-III:

Ideation and Generating Solutions: Challenges in idea generation, Visualize, Empathize, and Ideate method, Importance of visualizing and empathizing before ideating, Applying the method, Create Thinking, Generating Design Ideas, Lateral Thinking, Analogies, Brain storming, Mind mapping, National Group Technique, Synectic's, Development of work, Analytical Thinking, Group Activities.

Ideation Tools: How Might We? (HMW), Storyboard, Brainstorming. What is design innovation? A mindset for innovation, and asking "What if?" asking "What wows?" and "What works?".

Activities: Apply the methods of Ideate Phase: Generate Lots of Ideas (Brain Storming Sessions, SCAMPER Technique Activity and Rapid Sketching.

UNIT-IV:

Prototyping and Building the Solution: What is a prototype? Prototyping as a mindset, prototype examples, prototyping for products; Why we prototype? Fidelity for prototypes, Process of prototyping, Minimum Viable prototype.

Activities: Apply the Methods of the Prototype Phase: Create prototypes for selected ideas (Paper prototyping, digital prototyping and story board creation).

UNIT-V:

Testing Prototypes and Validation: Prototyping for digital products: What's unique for digital products, Preparation; Prototyping for physical products: What's unique for physical products, Preparation; Testing prototypes with users. Create a Pitch Plan for scaling up Road map for Implementation, Fine tuning and Submission of the project report.

Activities: Collect feedback; iterate and improve the ideas Present your solution using the Storytelling method (Usability testing, Feedback Grid Exercise and Iteration Activity).

Capstone Activity:

Mini Design Challenge: Apply all stages of design thinking on a real-world problem provided by industry/community.

5. TEXT BOOKS

1) Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, Tim Brown, HarperCollins Publishers Ltd., 2009.
2) Design Thinking for Strategic Innovation, Idris Mootee, John Wiley and Sons Inc., 2013.

6. TOOLS AND TECHNIQUES USED

1) Sticky Notes, Whiteboards, Canva, Figma, TinkerCAD, Mind Mapping tools, Sketching Kits, Empathy Maps, Journey Maps and related software.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	**3**	**3**		**3**								**3**	**3**	**1**
CO 2					**3**	**3**		**3**	**3**				**3**	**1**
CO 3				**3**					**3**	**3**	**3**		**3**	
CO 4			**3**	**3**	**3**						**3**		**3**	
CO 5							**3**		**3**	**3**	**3**	**3**	**3**	**1**