

MLR INSTITUTE OF TECHNOLOGY
B.Tech. in MECHANICAL ENGINEERING
COURSE STRUCTURE and SYLLABUS (R25 Regulations)
Applicable from AY 2025-26 Batch

I YEAR I SEMESTER

S. No.	Course Code	Course Title	Course Area	L	T	P	Credits
1.	BS	Matrices and Calculus	BSC	3	1	0	4
2.	BS	Applied Chemistry	BSC	3	0	0	3
3.	ES	C Programming and Data Structures	ESC	3	0	0	3
4.	A7ME01	Engineering Mechanics	ESC	3	0	0	3
5.	ES	Elements of Electrical and Electronics Engineering	ESC	3	0	0	3
6.	BS	Chemistry Lab for Engineers	BSC	0	0	2	1
7.	ES	C Programming and Data Structures Lab	ESC	0	0	2	1
8.	A7ME03	Engineering Workshop	ESC	0	0	2	1
9.	ES	Elements of Electrical and Electronics Engineering Lab	ESC	0	0	2	1
10.		Induction Program	-	-	-	-	-
Total Credits				15	01	08	20

I YEAR II SEMESTER

S. No.	Course Code	Course Title	Course Area	L	T	P	Credits
1.	BS	Ordinary Differential Equations and Vector Calculus	BSC	3	0	0	3
2.	BS	Advanced Engineering Physics	BSC	3	0	0	3
3.	ES	Python Programming	ESC	3	0	0	3
4.	HS	English for Skill Enhancement	HSC	3	0	0	3
5.	A7ME04	Thermodynamics	ESC	3	0	0	3
6.	A7ME02	Computer Aided Engineering Drawing	ESC	2	0	2	3
7.	BS	Advanced Engineering Physics Lab	BSC	0	0	2	1
8.	ES	Python Programming Lab	ESC	0	0	2	1
9.	HS	English Language and Communication Skills Lab	HSC	0	0	2	1
Total Credits				17	00	08	21

II YEAR I SEMESTER

S. No.	Course Code	Course Title	Course Area	L	T	P	Credits
1.	BS	Probability, Statistics and Complex Variables	BSC	3	0	0	3
2.	A7ME10	Mechanics of Solids	PCC	3	0	0	3
3.	A7ME11	Material Science and Metallurgy	PCC	3	0	0	3
4.	A7ME13	Production Technology	PCC	3	0	0	3
5.	A7ME15	Thermal Engineering - I	PCC	3	0	0	3
6.	BS	Computational Mathematics Lab	BSC	0	0	2	1
7.	A7ME12	Mechanics of Solids and Material Science and Metallurgy Lab	PCC	0	0	2	1
8.	A7ME14	Production Technology Lab	PCC	0	0	2	1
9.	A7ME16	Thermal Engineering - I Lab	PCC	0	0	2	1
10.	SD	Design Thinking and Ideation	SDC	0	0	2	1
Total Credits				15	0	10	20

II YEAR II SEMESTER

S. No.	Course Code	Course Title	Course Area	L	T	P	Credits
1.	HS	Business Economics and Financial Analysis	HSC	3	0	0	3
2.	HS	Innovation and Entrepreneurship	HSC	2	0	0	2
3.	A7ME20	Kinematics of Machinery	PCC	3	0	0	3
4.	A7ME21	Design of Machine Elements	PCC	3	0	0	3
5.	A7ME22	Fluid Mechanics and Hydraulic Machines	PCC	3	0	0	3
6.	A7ME24	Metrology and Machine Tools	PCC	2	0	0	2
7.	A7ME23	Fluid Mechanics and Hydraulic Machines Lab	PCC	0	0	2	1
8.	A7ME25	Metrology and Machine Tools Lab	PCC	0	0	2	1
9.	A7ME26	Computer Aided Machine Drawing	PCC	0	0	2	1
10.	SD	Data Analytics and Python for Engineers	SDC	0	0	2	1
11.	HS	Indian Knowledge System	HSC	1	0	0	1
Total Credits				17	0	8	21

***Note:** Students who wish to exit after II Year II Semester has to register for this optional course and acquire the credits allotted by doing 6 weeks Work-based Vocational Course/ Internship or Apprenticeship. Please refer R25 Academic Regulations for more information.

III YEAR I SEMESTER

S. No.	Course Code	Course Title	Course Area	L	T	P	Credits
1.	A7ME30	Design of Transmission Elements	PCC	3	0	0	3
2.	A7ME31	Thermal Engineering - II	PCC	3	0	0	3
3.	A7ME33	Instrumentation and Control Systems	PCC	3	0	0	3
4.	PE	Professional Elective-I	PEC	3	0	0	3
5.	OE	Open Elective-I	OEC	2	0	0	2
6.	A7ME32	Thermal Engineering - II Lab	PCC	0	0	2	1
7.	A7ME34	Instrumentation and Control Systems Lab	PCC	0	0	2	1
8.	A7ME35	Modeling and Drafting Lab	PCC	0	0	2	1
9.	A7ME36	Field Based Research Project	PWC	0	0	4	2
10.	SD	Modeling and Simulation Tools	SDC	0	0	2	1
11.	HS	Gender Sensitization Lab*/ Human Values and Professional Ethics*	HSC	1	0	0	0.5 + 0.5
Total Credits				15	0	12	21

***Note: For the courses Gender Sensitization Lab and Human Values and Professional Ethics -** one hour of instruction will be conducted on alternate weeks. For example, if a one-hour class for Gender Sensitization Lab is conducted this week, then a one-hour class for Human Values and Professional Ethics will be conducted in the following week.

III YEAR II SEMESTER

S.No.	Course Code	Course Title	Course Area	L	T	P	Credits
1.	A7ME40	Operations Research	PCC	3	0	0	3
2.	A7ME41	Dynamics of Machinery	PCC	3	0	0	3
3.	A7ME43	Heat Transfer	PCC	3	0	0	3
4.	PE	Professional Elective-II	PEC	3	0	0	3
5.	OE	Open Elective – II	OEC	2	0	0	2
6.	A7ME42	Kinematics and Dynamics Lab	PCC	0	0	2	1
7.	A7ME44	Heat Transfer Lab	PCC	0	0	2	1
8.	A7ME45	Applied Manufacturing Lab	PCC	0	0	2	1
9.	HS	Advanced English Communication Skills Lab	HSC	0	0	2	1
10.	SD	Trouble Shooting of Mechanical Systems (or) Digital Twin and Ideation	SDC	0	0	2	1
11.	HS	Environmental Science	HSC	1	0	0	1
Total Credits				15	0	10	20

IV YEAR I SEMESTER

S. No.	Course Code	Course Title	Course Area	L	T	P	Credits
1.	A7ME50	Industrial Engineering and Management	PCC	3	0	0	3
2.	A7ME51	Finite Element Methods	PCC	3	0	0	3
3.	A7ME53	Composite Materials	PCC	3	0	0	3
4.	PE	Professional Elective - III	PEC	3	0	0	3
5.	PE	Professional Elective – IV	PEC	3	0	0	3
6.	OE	Open Elective – III	OEC	2	0	0	2
7.	A7ME52	Computer Aided Analysis Lab	PCC	0	0	2	1
8.	A7ME54	Composite Materials Lab	PCC	0	0	2	1
9.	A7ME55	Industry Oriented Mini Project / Internship	PWC	0	0	4	2
Total Credits				17	0	08	21

IV YEAR II SEMESTER

S. No.	Course Code	Course Title	Course Area	L	T	P	Credits
1.	PE	Professional Elective – V	PEC	3	0	0	3
2.	PE	Professional Elective – VI	PEC	3	0	0	3
3.	A7ME60	Project Work	PWC	0	0	28	14
Total Credits				6	0	28	20

PROFESSIONAL ELECTIVES:**Professional Elective-I**

1	A7ME61	AI / ML Applications in Mechanical Engineering
2	A7ME62	Mechatronic Systems
3	A7ME63	Advanced Welding Techniques & NDT
4	A7ME64	Renewable Energy Sources

Professional Elective-II

1	A7ME66	Additive Manufacturing
2	A7ME67	Micro Manufacturing (or) Automation in Manufacturing
3	A7ME68	Robotics and Automation (or) Industry 4.0 / 5.0 (Digital Twin)
4	A7ME69	Advanced Machining Processes

Professional Elective – III

1	A7ME71	Power Plant Engineering
2	A7ME72	Automobile Engineering
3	A7ME73	Refrigeration and Air-Conditioning
4	A7ME74	Electric and Hybrid Vehicles

Professional Elective-IV

1	A7ME76	Plant Maintenance and Reliability Engineering
2	A7ME77	Total Quality Management
3	A7ME77	Production Planning and Control
4	A7ME78	Product Life Cycle Management

Professional Elective-V

1	A7ME81	Product Design and Manufacturing
2	A7ME82	Computational Fluid Dynamics
3	A7ME83	Mechanical Vibrations
4	A7ME84	Design for Manufacturing and Assembly

Professional Elective-VI

1	A7ME86	Hydraulics and Pneumatics
2	A7ME87	Sustainable Engineering
3	A7ME88	AI/ML for Design Analysis
4	A7ME89	Project Management and Finance

OPEN ELECTIVES OFFERED BY DEPARTMENT OF MECHANICAL ENGINEERING:**Open Elective-I:**

1	A7ME91	Engineering Materials
2	A7ME92	Digital Manufacturing

Open Elective-II:

1	A7ME94	Artificial Intelligence in Mechanical Engineering
2	A7ME95	Non-Conventional Sources of Energy

Open Elective-III:

1	A7ME97	Optimization Methods
2	A7ME98	Industrial Robotics

A7ME01: ENGINEERING MECHANICS**(Common to AERO / MECH)****B.Tech. I Year I Sem.**

L	T	P	C
3	0	0	3

Course Objectives: The objectives of this course are to

1. Explain the resolution of a system of forces, compute their resultant and solve problems using equations of equilibrium
2. Perform analysis of bodies lying on rough surfaces.
3. Locate the centroid of a body and compute the area moment of inertia and mass moment of inertia of standard and composite sections
4. Explain kinetics and kinematics of particles, projectiles, curvilinear motion, centroidal motion and plane motion of rigid bodies.
5. Explain the concepts of work energy method and its applications to translation, rotation and plane motion.

Course Outcomes: At the end of the course, students will be able to

1. Determine resultant of forces acting on a body and analyse equilibrium of a body subjected to a system of forces.
2. Solve problem of bodies subjected to friction.
3. Find the location of centroid and calculate moment of inertia of a given section.
4. Understand the kinetics and kinematics of a body undergoing rectilinear, curvilinear, rotatory motion and rigid body motion.
5. Solve problems using work energy equations for translation, fixed axis rotation and plane motion.

UNIT - I: Introduction to Engineering Mechanics

Force Systems: Basic concepts, Rigid Body equilibrium, System of Forces, Parallelogram law, Coplanar Concurrent Forces, Resultant, Moment of Forces and its Application. Couples and Resultant of Force System: Equilibrium of Force Systems, Free body diagrams, Equations of Equilibrium of Coplanar Systems.

UNIT - II: Friction and

Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction. Motion of Bodies, Wedge Friction, Ladders, Screw Jack and Differential Screw Jack.

UNIT - III: Centroid, Centre of Gravity and Moment of Inertia

Centroid and Centre of Gravity: Centroid of Lines, Areas and Volumes from first principles, centroid of composite sections, Centre of Gravity and its implications.

Definition, Area Moment of Inertia, Moment of inertia of Plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections.

Mass Moment of Inertia: Moment of Inertia of Masses, Radius of Gyration, Transfer Formula for Mass Moments of Inertia, Mass moment of inertia of composite bodies.

UNIT - IV: Dynamics of a Particle

Rectilinear motion, Plane curvilinear motion: Rectangular and Polar coordinates. Relative and constrained motion, Newton's law of motion for a particle (rectangular, path, and polar coordinates).

Impulse and momentum: Linear, Angular, Elastic Impact (Direct and oblique).

UNIT - V: Kinetics of Rigid Bodies

Introduction, Types of motion, simple problems, D' Alembert's principle and its applications in plane motion and connected bodies.

Work-Energy Method: Work-Energy principle and its application in plane motion of connected bodies or Systems, Work energy Applied to particle motion, Kinetics of rigid body rotation.

TEXT BOOKS:

1. Singer's Engineering Mechanics – Statics and Dynamics, Reddy Vijay Kumar K. and J. Suresh Kumar. B.S Publications, 3rd Edition, Rpt. 2024.
2. Engineering Mechanics, Shames and Rao, Pearson Education, 1st Edition, 2005.

REFERENCE BOOKS:

1. Vector Mechanics for Engineers – Statics and Dynamics, Beer F.P and Johnston E.R Jr., Mc Graw Hill, 12th Edition, 2019.
2. Engineering Mechanics, Dumir P.C, Sengupta and Srinivas, Universities Press, 1st Edition, 2020.
3. Engineering Mechanics, Hibbeler R.C, Pearson, 14th Edition, 2017.
4. Engineering Mechanics, Arshad Noor, Zahid and Goel, Cambridge University Press, 1st Edition, 2018.
5. Engineering Mechanics, Basudeb Bhattacharyya, Oxford University Press, 2nd Edition, 2014.

A7ME03 : ENGINEERING WORKSHOP
(Common to all Branches)

B.Tech. I Year I Sem.

L	T	P	C
0	0	2	1

Prerequisites: Practical skill

Course Objectives:

1. To introduce students to basic manufacturing processes and workshop practices.
2. To provide hands-on training in carpentry, fitting and sheet metal.
3. To develop skills in using hand tools and measuring instruments.
4. To enhance safety awareness and proper handling of workshop equipment.
5. To build a foundational understanding of industrial production and fabrication.

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

1. Understand the basic manufacturing processes and operations.
2. Use hand tools and equipment safely and efficiently.
3. Perform basic operations in carpentry, fitting and sheet metal work.
4. Read and interpret workshop drawings
5. Develop teamwork, time management, and quality awareness in a workshop environment.

1. TRADES FOR EXERCISES:

At least two exercises from each trade:

- i. **Carpentry:** T- Lap Joint, Dovetail Joint, Mortise and Tenon Joint
- ii. **Fitting:** V- Fit, Dovetail Fit and L - fit
- iii. **Tin Smithy:** Square Tin, Rectangular Tray and Conical Funnel
- iv. **Soldering:** Parallel and Series, Wheat stone bridge circuit.
- v. **House wiring:** Parallel and Series, Two-way Switch and Tube Light

2. TRADES FOR DEMONSTRATION AND EXPOSURE:

Black Smithy: Round to Square and S – Hook

Plumbing: PVC Pipe Fittings

TEXT BOOKS:

1. Workshop Practice, B. L. Juneja, Cengage Learning India, 1st edition, 2015.
2. Workshop Practice Manual, K. Venkata Reddy, BS Publication,6th Edition, Rpt.2025.

REFERENCE BOOKS:

1. Workshop Manual, K. Venugopal, Anuradha Publications, 2012th edition, 2012.

A7ME04: THERMODYNAMICS
(Common to AERO / MECH)

B.Tech. I Year II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Engineering Chemistry and Physics

Course Objective:

1. To introduce the basic concepts and laws of thermodynamics.
2. To apply the first and second laws to closed and open systems.
3. To understand the properties of pure substances and their use in thermodynamic processes.
4. To study the working principles and performance of thermodynamic cycles.
5. To prepare students for applications in engines and power plants.

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

1. Understand the basic thermodynamic concepts, systems, and properties.
2. Apply the first law to both closed and open systems.
3. Analyze thermodynamic processes using property diagrams and tables.
4. Apply the second law and evaluate entropy changes and efficiency.
5. Solve real-world thermodynamic problems related to mechanical systems.

Tables, Codes: Steam Tables and Mollier Chart

UNIT – I: Basic Concepts and First Law of Thermodynamics

System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium State, Property, Process, Exact and Inexact Differentials, Cycle, Reversibility, Quasi – static Process, Irreversible Process, Causes of Irreversibility, Energy in State and in Transition, Types, Displacement and Other forms of Work, Heat Point and Path functions, Zeroth Law of Thermodynamics, Concept of Temperature, PMM - I, Joule's Experiments, First law of Thermodynamics, Corollaries, First law applied to a Process, applied to a flow system, Steady Flow Energy Equation.

UNIT – II: Second Law of Thermodynamics and Availability

Limitations of the First Law, Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance, Second Law of Thermodynamics, Kelvin, Planck and Clausius Statements and their Equivalence , Corollaries, PMM of Second kind, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation, Availability and Irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations – Elementary Treatment of the Third Law of Thermodynamics.

UNIT – III: Pure Substance and Perfect Gas

Pure Substances, P - V- T surfaces, T- S and h- s diagrams, Mollier Charts, Phase Transformations: Triple point at critical state properties during change of phase, Dryness Fraction, Clausius - Clapeyron Equation, Property tables and application of these concepts in various thermodynamic processes, including steam calorimetry.

Perfect Gas Laws, Equation of State, Specific and Universal Gas constants, various Nonflow processes, Properties, end states, Heat and Work Transfer, changes in Internal Energy, Throttling and Free Expansion Processes, Flow processes.

UNIT – IV: Real Gas models and Perfect Gas Mixtures

Deviations from perfect Gas Model, Vander Waals Equation of State, Compressibility charts, variable specific Heats, Gas Tables. Mixtures of perfect Gases: Mole Fraction, Mass fraction Gravimetric and volumetric Analysis. Dalton's Law of partial pressure, Avogadro's Laws of additive volumes. Mole fraction, Volume fraction and partial pressure, Equivalent Gas constant and Molecular Internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect Gases and Vapour.

UNIT – V: Psychrometry

Atmospheric air, Psychrometric Properties, Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, Saturated Air, Vapour pressure, Degree of saturation, Adiabatic Saturation, Carrier's Equation, Psychrometric chart.

TEXTBOOKS:

1. Engineering Thermodynamics, P.K. Nag, Mc Graw Hill, 7th Edition, 2020.
2. Fundamentals of Thermodynamics, Richard E. Sonntag and Claus Borgnakke, Wiley, 8th Edition, 2014.

REFERENCE BOOKS:

1. Thermodynamics, Yunus A Cengel, Michael A Boles, Mehmet Kanoglu, McGraw-Hill, 9th Edition, 2019.
2. Thermodynamics, J.P. Holman, McGraw Hill Education, 10th Edition, 2010.
3. Engineering Thermodynamics, Chattopadhyay, Oxford, 2nd Edition, 2015.
4. Engineering Thermodynamics, Rogers, Pearson, 4th Edition, 1996.
5. Engineering Thermodynamics, M Achuthan, PHI, 2nd Edition, 2009.
6. Thermodynamics for Engineers, Kenneth A. Kroos, Merle C. Potter, Cengage, 1st Edition, 2014.

A7ME02: COMPUTER AIDED ENGINEERING DRAWING**(Common to all Branches)****B.Tech. I Year II Sem.**

L	T	P	C
2	0	2	3

Course Objectives:

1. To develop foundational knowledge in engineering drawing, projection systems, and CAD applications
2. To build skills in drawing engineering curves and in representing projections of points and planes
3. To enable students to prepare and analyze technical drawings using computer-aided design tools
4. To develop an understanding of standard dimensioning methods and drafting conventions
5. To enhance the ability to visualize engineering components in three dimensions

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

1. Explain various commands and create 2D Engineering Drawings using AutoCAD.
2. Construct the various curves used for engineering applications
3. Prepare orthographic projections of lines, planes by visualizing them in different positions..
4. Solve the problems of projections of solids and development of surfaces for industrial needs.
5. Construct the isometric view into orthographic views and vice versa.

UNIT – I: Introduction to Engineering Drawing and Computer Aided Drafting

Introduction to Engineering Drawing: Principles and their significance,

Introduction to Computer Aided Drafting: Initial Setup Commands, Draw Commands, Modify Commands, 2D Drawings - Simple Exercises.

UNIT - II: Engineering Curves

Engineering Curves: Ellipse, Parabola, and Hyperbola (General Method only).

Special curves: Cycloid, Epi-cycloid, Hypocycloid and Involute (simple Exercises).

UNIT – III: Projections of Points, Lines and Planes Regular Solids

Principles of Orthographic Projections: Conventions, First and Third angle projections.

Projections of points, Projection of Lines inclined to both the planes.

Projections of Planes: Projections of regular planes inclined to both planes.

UNIT – IV: Projections of Solids and Development of Surfaces

Projection of Solids: Regular Solids inclined to both planes (Prisms, Pyramids, Cylinders and Cone).

Development Of Surfaces: Theory of development, development of lateral surface with base (Prisms, Pyramids, Cylinders and Cone).

UNIT – V: Isometric and Orthographic Projections

Principles of Isometric Projection, Isometric Scale, Isometric Views, Conventions, Isometric Views of Lines, Plane Figures, Simple and Compound Solids, Isometric Projection of objects having non, isometric lines. Isometric Projection of Spherical Parts.

Conversion of Isometric view to Orthographic views and Orthographic views to isometric view.

TEXT BOOKS:

1. Engineering Drawing, N. D. Bhatt, Charotar, 54th Edition, 2023.
2. Engineering Drawing and graphics Using AutoCAD, T. Jeyapoovan and Vikas, S. Chand and company Ltd., 3rd Edition, 2010.

REFERENCE BOOKS:

1. Engineering Drawing, Basant Agrawal and C.M. Agrawal, McGraw Hill, 3rd Edition, 2019.
2. Engineering Graphics and Design, WILEY, John Wiley and Sons Inc, 3rd Edition, 2020.
3. Engineering Drawing, M. B. Shah and B.C. Rane, Pearson, 2nd Edition, 2009.
4. Engineering Drawing, N. S. Parthasarathy and Vela Murali, Oxford, 1st Edition, 2015.
5. Computer Aided Engineering Drawing, K. Balaveera Reddy, CBS Publishers, 2nd Edition, 2015.

Distribution of Marks and Evaluation of Computer Aided Engineering Drawing Course:**CIE: (40 Marks)**

For Computer Aided Engineering Drawing Course: Each Mid – Term, 20 marks will be allocated for day-to-day assessments conducted during drawing practice sessions, and another 20 marks will be allocated for the mid-term examination. In the mid-term examination, students shall attempt any four out of six given questions.

The average of the two Mid Term Examinations shall be taken as the final marks for Mid Term Examination (40 Marks)

SEE: (60 Marks)

For Computer Aided Engineering Drawing Course: Question paper consists of five questions carrying 12 marks each. There shall be two questions asked in the question paper from each unit with either-or choice and the student should answer either of the two questions. The student shall answer one question from each of five units. There shall be no section with short answer questions.