KAMARAJ
COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution - AFFILIATED TO ANNA UNIVERSITY, CHENNAI)
S.P.G.Chidambara Nadar - C.Nagammal Campus
S.P.G.C.Nagar, K.Vellakulam - 625 701, (Near Virudhunagar), Madurai District.
DEPARTMENT OF MECHANICAL ENGINEERING
ACCREDITED BY NBA, NEW DELHI

B.E.MECHANICAL ENGINEERING

Regulation - 2020

AUTONOMOUS SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM AND SYLLABI

(III & IV)

VISION:

To make the Department of Mechanical Engineering the unique of its kind in the field of Research and Development activities in the prominent field of Mechanical Engineering in this part of the world.

MISSION:

To impart highly innovative and technical knowledge in the field of Mechanical Engineering to the urban and unreachable rural students folks through “TOTAL QUALITY EDUCATION”.

PROGRAMME EDUCATIONAL OBJECTIVES:

Educational objectives of the Bachelor of Mechanical Engineering Programme can be divided into

PEO 1: Graduates of the Programme will excel in Technical Knowledge and apply Innovative Skills in the field of Mechanical Engineering.

PEO 2: Graduates will contribute to the Technological Development and Research activities through “Total Quality Education”.

PEO 3: Graduates of the Programme will accomplish the Leadership Qualities and Social responsibilities through “Life Long Learning”.

PROGRAM OUTCOMES:

After going through the four years of study, the Mechanical Engineering graduates will have the ability to

	Graduate Attribute	**Programme Outcome**
1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2	Problem analysis	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3	Design/development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5	Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7	Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering

		practice.
9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1: Graduates will be able to create and analyze the Research and Development activities related to Design and Manufacturing

PSO 2: Graduates will be able to Design and Develop need based products in Mechanical Engineering and allied Industries.

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Regulation - 2020

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CURRICULUM AND SYLLABI

(III & VI)

SEMESTER III

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA1303	Probability, Statistics and Numerical Methods	BS	3	0	0	3	3
2	ME1301	Engineering Thermodynamics	PC	3	0	0	3	3
3	ME1302	Fluid Mechanics and Machinery	PC	3	0	0	3	3
4	ME1303	Manufacturing Technology –I	PC	3	0	0	3	3
5	EE1307	Electrical Drives and Control	ES	3	0	0	3	3
PRACTICAL								
6	ME1311	Computer Aided Machine Drawing	PC	0	0	4	4	2
7	EE1317	Electrical Engineering Laboratory	ES	0	0	4	4	2
8	HS1321	Interpersonal Skills - Listening and Speaking	EEC	0	0	2	2	1
			TOTAL	**15**	**0**	**10**	**25**	**20**

SEMESTER IV

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	ME1401	Engineering Management	PC	3	0	0	3	3
2	ME1402	Engineering Metallurgy and Characterization Techniques	PC	3	0	0	3	3
3	ME1403	Manufacturing Technology- II	PC	3	0	0	3	3
4	ME1404	Strength of Materials	PC	3	0	0	3	3
5	ME1405	Thermal Engineering	PC	3	0	0	3	3
6	ME1471	Kinematics of Machinery	PC	3	0	0	3	3
PRACTICAL								
7	ME1411	Manufacturing Technology Laboratory	PC	0	0	4	4	2
8	ME1412	Strength of Materials and Fluid Mechanics Laboratory	PC	0	0	4	4	2
9	HS1421	Introduction to Advanced reading and writing	EEC	0	0	2	2	1
			TOTAL	**18**	**0**	**10**	**28**	**23**

SEMESTER III

MA1303 PRABABILITY, STATISTICS AND NUMERICAL METHODS

L	T	P	C
3	0	0	3

OBJECTIVES

- To introduce the basic concepts of probability and random variables with an objective to estimate solutions for probabilistic models using probability distributions.
- To acquaint the knowledge of testing of hypothesis for small samples.
- To introduce numerical methods with an objective to solve various Engineering problems.
- To make them understand various numerical methods of solving ordinary differential equations.

UNIT I PROBABILITY AND RANDOM VARIABLES 9

Probability – Random variables – Expectation of Random variables – Moments – Moment generating functions – Distributions: Uniform, Exponential and Normal distributions – Demo using Excel.

UNIT II TESTING OF HYPOTHESIS 9

Sampling distributions – Statistical Hypothesis – Type-I and Type-II Errors – Tests for single mean and difference of means of small samples (t-test) – F-test for variance – Chi-square test for goodness of fit – Independence of attributes – Demo using Excel.

UNIT III SOLUTION OF EQUATIONS 9

Solution of algebraic and transcendental equations: Fixed point iteration method –Newton Raphson method – Solution of linear system of equations: Gauss elimination and Gauss Jordan methods – Iterative methods: Gauss Jacobi and Gauss Seidel.

UNIT IV INTERPOLATION AND NUMERICAL INTEGRATION 9

Interpolation – Lagrange's interpolation for unequal intervals – Newton’s forward and backward difference interpolation for equal intervals – Numerical Integration: Trapezoidal, Simpson’s $1/3^{rd}$ rule – Gaussian Two point and Three point quadrature.

UNIT V NUMERICAL SOLUTION OF INITIAL VALUE PROBLEMS 9

Single step methods: Taylor's series method – Euler's method – Modified Euler's method – Fourth order Runge – Kutta method for solving first order equations – Multi step method: Milne's predictor and corrector method for solving first order equations.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Students will be able to

CO1 Apply the concepts of probability distributions to solve engineering problems.

CO2 Apply the concept of testing of hypothesis for small samples in real life problems.

CO3 Apply the numerical techniques for solving the transcendental equations and system of equations.

CO4 Apply numerical integration to solve engineering problems.

CO5 Obtain the solution of ordinary differential equation with initial condition.

TEXT BOOKS:

1. Grewal, B S, & Grewal, J S 2016, *Numerical Methods in Engineering and Science,* Khanna Publishers, 10th Edition Reprint, New Delhi, India.
2. Johnson, R A, Miller, I, & Freund, J E 2015, *Miller & Freund's Probability and Statistics for Engineers*, Pearson Education, 8th Edition, Asia.

REFERENCES:

1. Gerald, C F, & Wheatley, P O 2007, *Applied Numerical Analysis,* Pearson Education, 7th Edition, Asia, New Delhi.
2. Walpole, R E, Myers, R H, Myers, S L, & Ye, K 2007, *Probability and Statistics for Engineers and Scientists*, Pearson Education, 8th Edition, Asia.
3. Sankar Rao, K 2018, *Numerical Methods for Scientists and Engineers*, Prentice Hall of India Private, 4th Edition.
4. Kandasamy, P, Thilagavathy, K, & Gunavathy, K 2014, *Numerical Methods*, S. Chand & Co. Ltd., 3rd Edition Reprint, New Delhi.
5. Gupta, S C, & Kapoor, V K 2020, *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons, 12th Edition Reprint.

WEB REFERENCES:

1. https://www.vfu.bg/en/e-Learning/Math--Soong_Fundamentals_of_probability_and_statistics_for_engineers.pdf

2. https://www.dcpehvpm.org/E-Content/Stat/FUNDAMENTAL%20OF%20MATHEMATICAL%20STATISTICS-S%20C%20GUPTA%20&%20V%20K%20KAPOOR.pdf
3. https://cds.cern.ch/record/644736/files/3764367156_TOC.pdf

ME1301 ENGINEERING THERMODYNAMICS

L	T	P	C
3	0	0	3

(Use of Standard Steam Table, Mollier Chart and Compressibility chart is permitted)

OBJECTIVES:

- To impart knowledge on the basics and application of zeroth and first law of thermodynamics.
- To impart knowledge on the second law of thermodynamics and availability in analysing the performance of thermal devices.
- To teach the various properties of steam through steam tables and Mollier chart and relate thermodynamic relations.
- To impart knowledge on the performance of steam power cycles.
- To impart knowledge on the macroscopic properties of idea, real gases and gas mixtures.

UNIT I BASICS, ZEROTH AND FIRST LAW OF THERMODYNAMICS 9

Review of Basics – Thermodynamic systems, properties and processes, Thermodynamic Equilibrium – Heat and work transfer, definition and comparison, sign convention – Displacement work – P-v diagram – Thermal equilibrium – Zeroth law – Concept of temperature and Temperature Scales. First law – Application to closed and open systems – Steady and unsteady flow processes.

UNIT II SECOND LAW OF THERMODYNAMICS AND AVAILABILITY 9

Second law statements and its equivalence - Heat Engine, Refrigerator, Heat pump - Carnot cycle and Reversed Carnot cycle, Efficiency and COP – Carnot theorem – Entropy – Concept and causes – Clausius inequality - Change in entropy for reversible and irreversible processes – Principle of increase in entropy. Available (Exergy) and Unavailable energy (Anergy) – Irreversibility – Simple calculations.

UNIT III PROPERTIES OF PURE SUBSTANCES AND THERMODYNAMIC RELATIONS 9

Steam – Formation and its thermodynamic properties – P-v, P-T, T-v, T-s, h-s diagrams. PVT surface – Calculation of work done and heat transfer in non-flow and flow processes using Steam Table and Mollier Chart. Maxwell relations, Tds Equations – Energy equation – Joule-Thomson Coefficient – Clausius Clapeyron equation – Phase Change Processes.

UNIT IV STEAM POWER CYCLES 9

Ideal and Actual Rankine cycles, Cycle Improvement Methods – Reheat and Regenerative cycles – Performance calculations – Binary and Combined cycles (description only).

UNIT V IDEAL, REAL GASES AND GAS MIXTURES 9

Properties of Ideal gas – Ideal and real gas comparison – Equations of state for ideal and real gases – Reduced properties. Compressibility factor – Principle of Corresponding states - Generalized Compressibility Chart and its use – Mass fraction, Dalton's and Amagat's Law. Properties of gas mixture – Molar mass, gas constant, density, change in internal energy, enthalpy and entropy.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Students will be able to,

CO 1 Apply the zeroth and first law of thermodynamics in calculating the property changes for closed and open engineering systems.

CO 2 Apply the principles of second law of thermodynamics in identifying the performance of thermal devices through energy, entropy and availability calculations.

CO 3 Evaluate the various properties of steam and thermodynamic relations of ideal & real gases.

CO 4 Determine the performance of steam power plant.

CO 5 Evaluate the properties of ideal gases, real gases and gas mixtures.

TEXT BOOKS:

1. R.K.Rajput., 2017, *A Text Book of Engineering Thermodynamics*, Laxmi Publications (P) Limited, Fifth Edition.
2. Yunus A. Cengel and Michael A. Boles., 2015, *Thermodynamics*, Tata McGraw Hill Education Private Limited, 8th edition.

REFERENCES:

1. Nag.P.K., 2013, *Engineering Thermodynamics*, Tata McGraw Hill Education Private Limited, Fifth Edition.
2. Claus Borgnakke and Richard E. Sonntag., 2009, *Fundamentals of Thermodynamics*, Wiley Eastern, 7th Edition.
3. A.Valan Arasu., 2012, *Engineering Thermodynamics*, Vijay Nicole Imprints Private Limited, Chennai,5th Edition.
4. Natarajan, E., 2014, *Engineering Thermodynamics: Fundamentals and Applications*, Anuragam Publications, Chennai, Second Edition.
5. Rathakrishnan, E., 2006, *Fundamentals of Engineering Thermodynamics*, Prentice Hall of India Private Limited, Second Edition.

ME1302 **FLUID MECHANICS AND MACHINERY**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To know about the properties of fluids and concept of control volume.
- To apply the conservation laws in flow through pipes.
- To understand the importance of dimensional analysis.
- To describe the concept and performance of various types of flow in turbines.
- To calculate the performance of various types of flow in pumps.

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS 9

Units and dimensions – Properties of fluids - mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, surface tension and capillarity. Flow characteristics – Concept of control volume – Application of continuity equation, energy equation and momentum equation – Significance of fluids in Hydraulics and Pneumatics

UNIT II FLOW THROUGH CIRCULAR CONDUITS 9

Hydraulic and energy gradient – Laminar flow through circular conduits and circular annuli - Boundary layer concepts – Types of boundary layer thickness – Darcy Weisbach equation - Friction factor – Moody diagram – Commercial pipes – Minor losses – Flow through pipes in series and parallel.

UNIT III DIMENSIONAL AND MODEL ANALYSIS 9

Need for dimensional analysis – Methods of dimensional analysis – Similitude – Types of

similitude – Dimensionless parameters – Application of dimensionless parameters – Model analysis

UNIT IV TURBINES 9

Introduction to Impact of Jets – Euler's equation – Classification of turbines – heads and efficiencies – Velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines – Working principles – Work done by water on the runner – Draft tube. Specific speed – unit quantities – Performance curves for turbines – Governing of turbines.

UNIT V PUMPS 9

Theory of roto-dynamic machines – Rotary pumps – Classification – Centrifugal pumps – Working principle – Work done by the impeller – performance curves – various efficiencies – velocity components at entry and exit of the rotor – velocity triangles – Reciprocating pump – working principle.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Students will be able to

CO1 Apply the fundamental properties of fluids and law of conservation of mass, momentum, energy concepts.

CO 2 Apply the boundary layer and Reynolds number concept to flow of fluids.

CO 3 Apply the concept of Dimensional and model analysis to build a prototype.

CO 4 Calculate the efficiencies of Pelton, Francis, Kaplan turbines.

CO 5 Determine the performance of centrifugal pump.

TEXT BOOKS :

1. R.K. Bansal., 2014, *Fluid Mechanics & Hydraulic Machines*, Laxmi Publications Pvt. Ltd.
2. Streeter, V. L. and Wylie E. B., 2010, *Fluid Mechanics*, Tata McGraw Hill.

REFERENCES :

1. R.K.Rajput., 2016, *A Textbook of Fluid Mechanics & Hydraulic Machines* S. Chand Publications.
2. Robert W.Fox, Alan T. McDonald and Philip J.Pritchard., 2016, *Fluid Mechanics,* Wiley Publishers, 9th Edition.

ME1303 **MANUFACTURING TECHNOLOGY – I**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the concepts of basic manufacturing processes and fabrication techniques, such as metal casting, metal joining, metal forming and manufacturing of plastic components.
- To carry out design calculation/estimate parameters of the processes.

UNIT I METAL CASTING PROCESSES 9

Sand Casting: Sand Mould – Type of patterns - Pattern Materials – Pattern allowances – Moulding sand Properties and testing – Cores –Types and applications – Moulding machines– Types and applications; Melting furnaces: Blast and Cupola Furnaces; Principle of special casting processes: Shell - investment – Ceramic mould – Pressure die casting - Centrifugal Casting – CO_2 process – Stir casting; Defects in Sand casting. Numerical problems involving calculation of cooling time, fluid flow in the mold.

UNIT II JOINING PROCESSES 9

Operating principle, basic equipment, merits and applications of: Fusion welding processes: Gas welding - Types – Flame characteristics; Manual metal arc welding – Gas Tungsten arc welding - Gas metal arc welding – Submerged arc welding – Electro slag welding; Operating principle and applications of: Resistance welding – Plasma arc welding – Thermit welding – Friction welding and Friction Stir Welding; Brazing and soldering; Weld defects: types, causes and cure. Laser beam welding. Numerical problems involving heat output and power requirement in electric arc/resistance welding.

UNIT III METAL FORMING PROCESSES 9

Hot working and cold working of metals – Forging processes – Open, impression and closed die forging – forging operations. Rolling of metals– Types of Rolling – Flat strip rolling – shape rolling operations – Defects in rolled parts. Principle of rod and wire drawing – Tube drawing – Principles of Extrusion – Types – Hot and Cold extrusion. Numerical problems involving change in size of forged components, forging force, rolling bite angle, rolling force, draft.

UNIT IV SHEET METAL PROCESSES 9

Sheet metal characteristics – shearing, bending and drawing operations – Stretch forming operations – Formability of sheet metal – Test methods – special forming processes- Working principle and applications – Hydro forming – Rubber pad forming – Metal spinning– Introduction of Explosive forming, magnetic pulse forming, peen forming, Super plastic forming – Introduction to Micro forming**.** Numerical problems on die and punch clearance, shearing force, bending force, drawing blank size calculations.

UNIT V MANUFACTURE OF PLASTIC COMPONENTS 9

Types and characteristics of plastics – Moulding of thermoplastics – working principles and typical applications – Injection moulding – Plunger and screw machines – Compression moulding, Transfer Moulding – Typical industrial applications – Introduction to blow moulding –Rotational moulding – Film blowing – Extrusion – Thermoforming – Bonding of Thermoplastics

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Students will be able to

CO1 Apply the knowledge of different metal casting processes for casting simple components by considering its defects, merits and demerits

CO2 Explain the appropriate selection of welding process for the given situation, its construction and working principle.

CO3 Summarize the various hot working and cold working methods of metals.

CO4 Explain various sheet metal making processes.

CO5 Apply the appropriate method of manufacturing simple plastic components.

TEXT BOOKS:

1. Hajra Chouldhary S.K and Hajra Choudhury. AK.,2008, *Elements of workshop Technology,* Volume I and II, Media promoters and Publishers Private Limited, Mumbai.
2. Kalpakjian. S,2018*, Manufacturing Engineering and Technology,* Pearson Education 7th Edition.

REFERENCES:

1. Gowri P. Hariharan, A.Suresh Babu, 2008, *Manufacturing Technology I,* Pearson Education.
2. Paul Degarma E, Black J.T and Ronald A. Kosher, 1997, *Materials and*

Processes, in Manufacturing Eight Edition, Prentice – Hall of India.

3. Rao, P.N, 2019, Manufacturing *Technology Foundry, Forming and Welding,* 5th Edition, TMH.
4. Roy. A. Lindberg, 2006*, Processes and Materials of Manufacture,* PHI / Pearson education.
5. Sharma, P.C.,2019*, A Text book of production Technology , S*.Chand and Co. Ltd.,

EE1307 ELECTICAL DRIVES AND CONTROL

L	T	P	C
3	0	0	3

OBJECTIVES:

- To describe the basic concepts of different types of electrical machines and their performance.
- To explain the different methods of starting D.C motors and induction motors.
- To illustrate the conventional and solid-state speed control of DC/AC drives.

UNIT I INTRODUCTION 9

Basic Elements of a drive – Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves – Classes of duty – Selection of power rating for drive motors with regard to thermal overloading and Load variation factors.

UNIT II DRIVE MOTOR CHARACTERISTICS 9

Torque – Multi quadrant operation – Speed – Torque characteristics of DC motors: Shunt, series and compound – Single Phase and Three Phase Induction Motors(Construction and Working)-Torque Slip Characteristics – Braking – Regenerative, Dynamic and Plugging – H Electric Braking in Electric Vehicles.

UNIT III STARTING METHODS 9

Need for starter-D.C Motor starters – 3point and 4point starter – A.C. Motor starters – DOL starter, Star Delta starter, Autotransformer starter, Primary Resistance starter and Rotor Resistance starter

UNIT IV CONVENTIONAL AND SOLID STATE SPEED CONTROL OF D.C. DRIVES 9

Speed control of DC series and shunt motors – Armature and field control, Ward-Leonard

control system – Controlled rectifier-based drives – Single Phase half controlled and fully controlled – DC chopper based drive – Class A & Class E Chopper – Applications.

UNIT V CONVENTIONAL AND SOLID STATE SPEED CONTROL OF A.C. DRIVES **9**

Speed control of squirrel cage and slip ring induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Inverter based drives (Single phase and Three Phase) and AC voltage regulators based drive (Single Phase).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Students will be able to

CO1 Explain the various classes of duty and Selection of power rating.

CO2 Summarize the working principle of DC &AC motors, their characteristics and its braking methods.

CO3 Describe the Starting methods of DC &AC.

CO4 Illustrate the various methods of conventional and solid state speed control schemes of DC.

CO5 Illustrate the various methods of conventional and solid state speed control schemes of AC drives

TEXTBOOK :

1. Vedam Subrahmaniam,2010, *Electric Drives (Concepts and Applications),* Tata McGraw-Hill, New Delhi.

REFERENCES :

1. Nagrath .I.J. & Kothari .D.P,2006, *Electrical Machines*, Tata McGraw-Hill. New Delhi
2. Singh. M.D., K.B.Khanchandani, 2006, *Power Electronics ,* Tata McGraw-Hill. New Delhi

ME1311 COMPUTER AIDED MACHINE DRAWING

L	T	P	C
0	0	4	2

OBJECTIVES:

- To make the students understand and interpret drawings of machine components
- To prepare assembly drawings both manually and using standard CAD packages

- To visualize the 2D and 3D conversion.
- To familiarize the students with Indian Standards on drawing practices and standard components
- To sketch the assembly drawing manually as well as Standard CAD Packages

UNIT I DRAWING STANDARDS & FITS AND TOLERANCES 12

Code of practice for Engineering Drawing, BIS specifications – Welding symbols, riveted joints, keys, fasteners – Reference to hand book for the selection of standard components like bolts, nuts, screws, keys etc. - Limits, Fits – Tolerancing of individual dimensions – Specification of Fits – Preparation of production drawings and reading of part and assembly drawings, basic principles of geometric dimensioning & Tolerancing.

UNIT II INTRODUCTION TO 2D DRAFTING 16

Drawing, Editing, Dimensioning, Layering, Hatching, Block, Array, Detailing, Detailed drawing - Bearings - Bush bearing, Plummer block - Valves – Safety and non-return valves.

UNIT III 2D GEOMETRIC MODELING AND ASSEMBLY 26

Assembly of Flange Coupling – Assembly of Muff Coupling – Assembly of Knuckle Joint – Assembly of Sleeve and Cotter Joint – Assembly of Stuffing Box – Assembly of Screw Jack - Assembly of Machine vice.

UNIT IV INTRODUCTION TO 3D MODELLING 06

Introduction to Extrude, Revolve, Sweep, Loft, Fillet, Chamfer, Pattern, Mirror in AutoCAD using basic primitives.

Note: 25% of assembly drawings must be done manually and remaining 75% of assembly drawings must be done by using AUTOCAD software.

TOTAL: 60 PERIODS

REFERENCES :

1. Gopalakrishna K.R., 2013, *Machine Drawing*, 22nd Edition, Subhas Stores Books Corner, Bangalore.
2. N. D. Bhatt and V.M. Panchal, 2013, *Machine Drawing*, 48th Edition, Charotar Publishers.
3. N.Siddeshwar, P. Kanniah and V.V.S. Sastri,., 2006, *Machine Drawing*, Tata Mc GrawHill.
4. Rao, S.S., 2005, *Finite Element method in engineering*, Pergamon press.

5. S. Trymbaka Murthy, 2007, *A Text Book of Computer Aided Machine Drawing*, CBS Publishers, New Delhi.

EQUIPMENTS NEEDED (For 30 students)

Sl No	Description of Equipment	Quantity
1	Intel core 2 duo or above versions of processor with 2GB RAM	30 Nos
2	AUTOCAD software for Drafting and Modeling	30 Licenses
3	Laser Printer	1 No

COURSE OUTCOMES:

Students will be able to

CO1 Describe the Indian Standards on drawing practices and standard components

CO2 Prepare assembly drawings using manual drafting.

CO3 Create the 2D drawing manually from Isometric view.

CO4 Prepare part drawing using 2D drafting AUTOCAD software.

CO5 Prepare assembly drawing using AUTOCAD software.

EE1317 ELECTRICAL ENGINEERING LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- To demonstrate the operation of DC drives, AC drives and transformers and give them experimental skill.
- To study the different types of DC and AC starters.

LIST OF EXPERIMENTS

1) Load test on DC Series motor
2) O.C.C & Load characteristics of DC Shunt and DC Series generator
3) Speed control of DC shunt motor (Armature, Field control)
4) O.C & S.C Test on a single phase transformer
5) Load Test on Single Phase Induction Motor
6) Load Test on Synchronous Motor
7) Load test on three phase squirrel cage Induction motor
8) Speed control of three phase slip ring Induction Motor

9) No-load and Blocked Rotor test on Single Phase Induction Motor

10) Study of DC & AC Starters

TOTAL: 60 PERIODS

EQUIPMENTS NEEDED (FOR 30 STUDENTS)

S.No.	NAME OF THE EQUIPMENT	Qty.
1	DC Shunt Motor	2 No.
2	DC Series motor	1 No.
3	DC shunt motor-DC Shunt Generator set	1 No.
4	DC Shunt motor-DC Series Generator set	1 No.
5	Single phase transformer	2 No
6	Three phase synchronous motor	1 No.
7	Three phase Squirrel cage Induction motor	1 No.
8	Three phase Slip ring Induction motor	1 No.
9	Single Phase Induction Motor	2 No.

COURSE OUTCOMES:

Students will be able to

CO1 Analyze the various characteristics and testing of DC Machine.

CO2 Analyze the various characteristics and testing of DC Generators.

CO3 Perform load test on Transformers and Induction motors

CO4 Perform load test on Induction motors.

CO5 Illustrate the use of DC and AC starters.

HS1321 INTERPERSONAL SKILLS- LISTENING AND SPEAKING

L	T	P	C
0	0	2	1

OBJECTIVES:

The Course will enable learners to

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to

engage in specific academic speaking activities.

- Improve general and academic listening skills
- Make effective presentations.

UNIT I LISTENING AS A KEY SKILL 6

Listening as a key skill- its importance- speaking – give personal information – ask for personal information – express ability – enquire about ability – ask for clarification – Improving pronunciation– pronunciation basics –– stressing syllables and speaking clearly – intonation patterns – conversation starters: small talk

UNIT II LISTEN TO A PROCESS INFORMATION 6

Listen to a process information- give information, as part of a simple explanation – taking lecture notes – preparing to listen to a lecture – articulate a complete idea as opposed to producing fragmented utterances – compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

UNIT III LEXICAL CHUNKING 6

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk – greet – respond to greetings – describe health and symptoms – invite and offer – accept – decline – take leave – listen for and follow the gist- listen for detail

UNIT IV GROUP DISCUSSION 6

Being an active listener: giving verbal and non-verbal feedback – participating in a group discussion – summarizing academic readings and lectures conversational speech listening to and participating in conversations – persuade- negotiate disagreement in group work.

UNIT V GROUP & PAIR PRESENTATIONS 6

Formal and informal talk – listen to follow and respond to explanations, directions and instructions in academic and business contexts – strategies for presentations and Interactive communication – group/pair presentations

TOTAL :30 PERIODS

COURSE OUTCOMES:

Students will be able to:

CO1 Develop their communicative competence in English with specific reference to listening

CO2 Prepare conversation with reasonable accuracy

CO3 Apply lexical Chunking for accuracy in speaking

CO4 Demonstrate their ability to communicate effectively in GDs

CO5 Explain directions and instructions in academic and business contexts

TEXT BOOKS:

1. Brooks, Margret, 2011, Skills for Success. *Listening and Speaking. Level 4,* Oxford University Press, Oxford.
2. Richards, C, Jack& David Bholke, 2010, *Speak Now Level 3,* Oxford University Press, Oxford.

REFERENCES:

1. Bhatnagar, Nitin& Mamta Bhatnagar, 2010, *Communicative English for Engineers and Professionals,* Pearson, New Delhi.
2. Hughes, Glyn & Josephine Moate, 2014, *Practical English Classroom*, Oxford University Press, Oxford.
3. Vargo, Mari,2013, *Speak Now Level 4*, Oxford University Press, Oxford.
4. Richards, C, Jack, 2006, *Person to Person (Starter)*, Oxford University Press, Oxford.
5. Ladousse, Gillian Porter, 2014, *Role Play*. Oxford University Press, Oxford.

WEB RESOURCES:

- https://www.cambridge.org/elt/blog/wp-content/uploads/2019/10/Learning-Language-in-Chunks.pdf
- https://english.eagetutor.com/english/628-how-to-greet-your-boss-people-in-office.html
- https://www.groupdiscussionideas.com/group-discussion-topics-with-answers/
- https://www.bbc.co.uk/worldservice/learningenglish/business/talkingbusiness/unit3presentations/1opening.shtml

SEMESTER IV

ME1401 ENGINEERING MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basic roles, skills and functions of management
- To develop the managerial and leadership skills to the students
- To practice the students for industrial environment

UNIT I INTRODUCTION TO MANAGEMENT AND PLANNING 9

Definition of Management – Types of managers - Managerial roles and skills – Evolution of Management – Types of Business organization– Nature and purpose of planning – planning process – Types of planning – Objectives – setting objectives – Policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT II ORGANISING 9

Nature and purpose – Formal and informal organization – Organization chart – Organization Structure – Types – Line and staff authority – Departmentalization – Delegation of authority – Centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development.

UNIT III DIRECTING AND CONTROLLING 9

Motivation – Motivation theories – Motivational techniques leadership – Types and theories of leadership - System and process of controlling – use of IT in Management control – Productivity & Operation Management – Globalization and Liberalization - International Management –Global Management Theory

.

UNIT IV STATISTICAL QUALITY CONTROL 9

Statistical Quality Control – Inspection, Sampling, Sample Size, Sampling Plan, AQL, OC curve, Producer Risk, Consumer Risk, AOQ, AOQL, Control Charts & Control Limits – $\bar{X}$, R & S charts and their application; causes of variations – Assignable & Random- Normal-Distribution curve and concept of Six Sigma.

UNIT V HUMAN RELATIONS AT WORK 9

Dealing Effectively with People, Communication in the Workplace, Motivating and Developing Teamwork; Diversity and Cross-Cultural Competence, Managing Stress and Personal Problems, Developing Career Thrust: Getting Ahead in Your Career, Learning Strategies.

TOTAL: 45 PERIODS

COURSE OUTCOMES :

Students will be able to

CO1 Describe the concept of strategic management, strategic planning process and policies.

CO2 Explain the principles of organizing, staffing and leading.

CO3 Identify the problems in controlling process and recommend solutions.

CO4 Identify the solution for Particular problem through statistical process control tools.

CO5 Prepare the industry ready students and improve public relationship skills.

TEXT BOOKS :

1. Harold Koontz & Heinz Weihrich., 1998, *Essentials of Management*, Tata McGraw Hill.
2. Dubrien, A., 2017, *Human Relations for Career and Personal Success: Concepts, Applications, and Skills*, Pearson.

REFERENCES :

1. Stephen P. Robbins & Mary Coulter., 2009, *Management*, Prentice Hall (India) Pvt.
2. William J. Kolarik, 1995*, Creating Quality*, McGraw Hill, Inc.
3. Greenberg, J. S. 2017, *Comprehensive stress management*, McGraw Hill.

ME1402 **ENGINEERING METALLURGY AND CHARACTERIZATION TECHNIQUES**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To impart knowledge on the structure, properties and phase changing mechanisms of ferrous metals
- To impart knowledge in heat treatment techniques of ferrous metals
- To explain the mechanical testing and applications of metals to identify and select the suitable materials for various engineering applications
- To impart knowledge on various techniques of material characterization

UNIT I ALLOYS, ELASTIC & PLASTIC BEHAVIOUR OF MATERIALS 9

Constitution of alloys – Solid solutions, substitutional and interstitial, Iron – carbon equilibrium diagram. Microstructure, properties and application. Elasticity in metals and polymers – inelastic & visco elastic behavior – Mechanism of plastic deformation and nonmetallic shear strength of perfect and real crystals, Types of fracture, Griffith theory, stress intensity factor and fracture toughness- Fatigue and creep failure mechanism.

UNIT II HEAT TREATMENT 9

Definition – Full annealing, stress relief, recrystallization and spheroidising – normalizing, hardening and Tempering of steel. Isothermal transformation diagrams – Cooling curves super imposed on I.T. diagram CCR – Hardenability, Jominy end quench test – Austempering, martempering – Case hardening, carburizing, Nitriding, cyaniding, carbonitriding – Flame and Induction hardening – Vacuum and Plasma hardening.

UNIT III FERROUS AND NON-FERROUSMETALS 9

Effect of alloying additions on steel- α and β stabilizers– stainless and tool steels – HSLA, Maraging steels – Cast Iron - Types of cast Iron – alloy cast irons, Copper and copper alloys- Brass, Bronze and Cupronickel – Aluminum and Al-Cu – precipitation strengthening – Bearing alloys, Mg-alloys, Ni-based super alloys and Titanium alloys.

UNIT IV NON METALLIC & CERAMIC MATERIALS 9

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of various thermosetting and thermoplastic polymers (PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE, Polymers – Urea and Phenol formaldehydes - Engineering Ceramics – Properties and applications of Al_2O_3, SiC, Si_3N_4, PSZ and SIALON – Composites – Classification – Metal Matrix and FRP – Applications of Composites

UNIT V CHARACTERIZATION TECHNIQUES OF MATERIALS 9

Basic Principles, Practice and Applications of X-Ray Spectrometry, Wave Dispersive X-Ray Spectrometry, Auger Spectroscopy, Secondary Ion Mass Spectroscopy, Fourier Transform Infra-Red Spectroscopy (FTIR) – Differential Thermal Analysis – Differential Scanning Calorimetry (DSC) And Thermo gravimetric Analysis (TGA) Scanning Electron Microscopy – Construction & working of SEM – various Imaging Techniques – Applications – Atomic Force Microscopy – Construction & working of AFM – Applications

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Students will be able to

CO1 Comprehend alloys, elastic and plastic behavior of materials and their mechanism.

CO2 Summarize the concepts of different heat treatment process and hardening methods used in industry.

CO3 Interpret the properties, composition and characteristics of ferrous and nonferrous metals.

CO4 Describe the properties and characteristic of different thermoplastic, thermosetting plastics and ceramics materials

CO5 Explain the various characterization techniques used for testing engineering materials.

TEXT BOOKS:

1. Avner, S.H.,1997, *Introduction to Physical Metallurgy*, McGraw Hill publications.
2. Williams D Callister., 2014, *Material Science and Engineering*., 2014, Wiley India Pvt Ltd, Revised Indian Edition2014.

REFERENCES:

1. Kenneth G.Budinski and Michael K. Budinski ., 2010, *Engineering Materials*, Prentice Hall, New Jersy.
2. Raghavan.V., 2015, *Materials Science and Engineering*, Prentice Hall, New Jersy.
3. U.C.Jindal., 2012, *Engineering Materials and Metallurgy* , First Edition, Dorling Kindersley.
4. Upadhyay. G.S. and Anish Upadhyay, 2006, *Materials Science and Engineering*, Viva Books Pvt. Ltd.
5. Khanna O.P., 2012, *Material science*, Dhanpat Rai publications.
6. George E. Dieter, 1988, *Mechanical Metallurgy*, McGraw -Hill.

ME1403 MANUFACTURING TECHNOLOGY – II

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, drilling, milling, grinding, broaching and its allied machines
- To understand the basic concepts of Computer Numerical Control (CNC) of machine tools and CNC Programming

UNIT I THEORY OF METAL CUTTING 9

Mechanics of chip formation, single point cutting tool, forces in machining, Types of chip, cutting tools – nomenclature, orthogonal metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.

UNIT II TURNING MACHINES AND DRILLING MACHINES 9

Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments, machining time and power estimation – Capstan and turret lathes – tool layout – Drilling machine types, construction of radial drilling machine. Drilling, reaming, boring, tapping operations. Estimation of drilling time.

UNIT III MILLING AND GEAR CUTTING MACHINES 9

Milling machine types, construction of column and knee type machines, operations-types of milling cutter. Estimation of machining time in milling – Gear cutting – forming and generation principle and construction of gear hobbing and gear shaping processes –finishing of gears.

UNIT IV ABRASIVE PROCESS AND BROACHING 9

Abrasive processes: grinding wheel – specifications and selection, types of grinding process– cylindrical grinding, surface grinding, centreless grinding and internal grinding-Typical applications – concepts of surface integrity, broaching machines: broach construction – push, pull, surface and continuous broaching machines

UNIT V CNC MACHINING 9

Numerical Control (NC) of machine tools – CNC types, constructional details, special features, of machining center. Manual part programs for simple milling and turning features involving only external operations – micromachining – wafer machining.

TOTAL: 45 PERIODS

COURSE OUTCOMES :

Students will be able to

CO1 Calculate the tool wear and tool life by applying the fundamentals concepts of theory of metal cutting, chip formation mechanism, various cutting tool materials and cutting fluids

CO2 Demonstrate the metal removal processes using conventional lathe and drilling machines.

CO3 Comprehend the various types milling, and gear cutting machine.

CO4 Illustrate the different types of grinding & broaching machines and their operations.

CO5 Demonstrate the elements of NC machine tools, and write manual part program.

TEXT BOOKS :

1. Hajra Choudhury, 2014, *Elements of Workshop Technology*, Vol.II., Media Promoters.
2. Rao. P.N, 2019*, Manufacturing Technology - Metal Cutting and Machine Tools,* 4thEdition, Tata McGraw-Hill, New Delhi.

REFERENCES :

1. Richerd R Kibbe, John E. Neely, Roland O. Merges and Warren J.White, 1998 *,Machine Tool Practices,* Prentice Hall of India.
2. Geofrey Boothroyd, 1984, *Fundamentals of Metal Machining and Machine Tools,* Mc Graw Hill.
3. HMT, 1998, *Production Technology,* Tata McGraw Hill.
4. Roy. A. Lindberg,2006, *Process and Materials of Manufacture,* Fourth Edition, PHI/Pearson Education.
5. Kalpakjian. S, 2018, *Manufacturing Engineering and Technology,* Pearson Education 7th Edition.

ME1404 **STRENGTH OF MATERIALS**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the concepts of stress, strain principal planes and stresses.
- To determine stresses and deformation in circular shafts and helical spring due to torsion
- To determine the stresses, deformations induced in thin and thick shells.
- To study the concept of shearing force and bending moment due to external loads in Cantilever, Simple supported and Over hanging beams and their effect on stresses.
- To compute slopes and deflections in Cantilever, Simple supported and over hanging beams by various methods and understand the concepts of Euler Column theory.

UNIT I **STRESS, STRAIN & DEFORMATION OF SOLIDS AND PRINCIPLE STRESS AND PLANES** **10**

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation

of simple and compound bars – impact and shock loading – Thermal stresses – Elastic

constants – Volumetric strains – Stresses on inclined planes – principal stresses and principal planes - Mohr's circle of stress

UNIT II TORSION 9

Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts– Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

UNIT III THIN, THICK CYLINDER & SPHERES 8

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders – spherical shells subjected to internal pressure – Deformation in spherical shells – Lame's theorem.

UNIT IV TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM 9

Beams & its types – transverse loading on beams – Shear force and bending moment in beams - Cantilevers – Simply supported beams and over hanging beams. Theory of simple bending– bending stress distribution – Load carrying capacity

UNIT V DEFLECTON OF BEAM AND EULER COLUMN THEORY 9

Double Integration method – Macaulay's method – Area moment method for computation of slopes and deflections in beams – Fundamentals of conjugate beam and strain energy - Maxwell's reciprocal theorem – Columns with different end conditions – Slenderness ratio – Euler's and Rankine's column theory.

TOTAL: 45 PERIODS

COURSE OUTCOMES :

Students will be able to

CO1 Determine the stress and strain for uniform and uniformly varying cross-sectional bar subjected to axial loading condition.

CO2 Calculate the torsional stress developed in circular shafts and springs.

CO3 Determine the stresses induced in thin, thick and spherical shells.

CO4 Draw the shear force, bending moment and induced stresses for the cantilever, simply supported and over hanging beam under the transverse load.

CO5 Determine the deformation behavior of the cantilever, simply supported and over hanging

beam under the transverse load and understand the concept of Euler Column theory.

TEXTBOOK :

1. Bansal, R.K., 2016, *Strength of Materials*, Laxmi Publications (P) Ltd.

REFERENCES:

1. Jindal U.C., 2009, *Strength of Materials*, Asian Books Pvt. Ltd., New Delhi.
2. Egor. P. Popov, 2002, *Engineering Mechanics of Solids*, Prentice Hall of India, New Delhi.
3. Ferdinand P. Been, Russell Johnson, J.r.and John J. Dewole, 2005, *Mechanics of Materials*, Tata McGraw Hill Publishing 'co. Ltd., New Delhi.
4. Hibbeler, R.C., 2013, *Mechanics of Materials*, Pearson Education, Low Price Edition.
5. Subramanian R., 2016, *Strength of Materials*, Oxford University Press, Oxford Higher Education.

ME1405 THERMAL ENGINEERING

L	T	P	C
3	0	0	3

(Use of standard Steam table and Psychrometric chart is permitted)

COURSE OBJECTIVES:

- To understand the working of gas power cycles and their applications.
- To understand the construction, operation and performance of IC engines.
- To gain the knowledge about steam turbines and their performance behaviour.
- To acquire the knowledge on working and performance of air compressors.
- To gain the knowledge on refrigeration and air-conditioning systems by understanding the various thermodynamic processes.

UNIT I GAS POWER CYCLES 9

Otto, Diesel, Dual and Brayton cycle - Performance calculation, Improvisations of gas turbines – Intercooling, Reheating and Regeneration (Description only)

UNIT II IC ENGINE AND ITS PERFORMANCE 9

Classification - Components and their function. Valve timing diagram and port timing diagram – Actual and theoretical P-v diagram of four stroke and two stroke engines. Simple and complete Carburettor. MPFI, Diesel pump and injector system. Battery and Magneto Ignition System – Principles of Combustion and knocking in SI and CI Engines. Lubrication and

Cooling systems. Performance calculations.

UNIT III STEAM TURBINES 9

Impulse and Reaction principles, compounding, velocity diagrams for simple stage turbines and multi stage turbines, speed regulations – Governors.

UNIT IV AIR COMPRESSOR 9

Classification and working principle of various types of compressors, work of compression with and without clearance – Volumetric efficiency – Isothermal efficiency and Isentropic efficiency of reciprocating compressors – Multistage air compressor and inter cooling – work of multistage air compressor.

UNIT V REFRIGERATION AND AIR CONDITIONING 9

Refrigerants - Vapour compression refrigeration system – Principles and Performance calculations - Working principle of vapour absorption system, Ammonia – Water, Lithium bromide – water systems (Description only). Psychrometric properties, Psychrometric charts. Property calculations of air vapour mixtures by using chart and expressions. Psychrometric process – Simple Applications. Air conditioning system - Types and Working Principles. Recent developments in HVAC systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Students will be able to

CO 1 Apply the concepts, laws and methodologies of thermodynamics in gas power cycles.

CO 2 Explain the various terminologies of IC engines and their performance.

CO 3 Evaluate the performance of steam turbines.

CO 4 Determine the performance of single stage and multistage air compressor.

CO 5 Calculate the performance parameters in refrigeration and air-conditioning systems.

TEXT BOOKS:

1. Rajput. R. K., 2000, *Thermal Engineering,* S. Chand Publishers.
2. Kothandaraman.C.P., Domkundwar. S, Domkundwar. A.V., 2002, *A course in Thermal Engineering,* Dhanpat Rai & sons, Fifth Edition.

REFERENCES :

1. Sarkar. B.K., 2007, *Thermal Engineering*, Tata McGraw-Hill Publishers.
2. Arora.C.P., 1994, *Refrigeration and Air Conditioning*, Tata McGraw Hill Education Private Limited,
3. Ganesan V., 2007, *Internal Combustion Engines*, Tata McGraw Hill Education Private Limited, Third Edition.
4. Rudramoorthy. R., 2003, *Thermal Engineering*, Tata McGraw Hill Education Private Limited.
5. Ramalingam. K.K., 2009, *Thermal Engineering*, SCITECH Publications (India) Private Limited.

ME1471 **KINEMATICS OF MACHINERY (Common to MECH&MTR)**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basic components and layout of linkages in the assembly of a system machine.
- To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
- To understand the motion resulting from a specified set of linkages, design few linkage mechanisms and cam mechanisms for specified output motions.
- To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machine components.

UNIT I BASICS OF MECHANISMS 9

Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, Mobility – Kutzbach criterion, Gruebler's criterion – Grashof's Law – Kinematic inversions of four bar chain and slider crank chains – Limit positions – Mechanical advantage – Transmission Angle – Description of some common mechanisms – Quick return mechanisms, Straight line generators, Universal Joint – rocker mechanisms.

UNIT II KINEMATICS OF LINKAGE MECHANISMS 9

Displacement, velocity and acceleration analysis of simple mechanisms – Graphical method– Velocity and acceleration polygons – Velocity analysis using instantaneous centres – kinematic analysis of simple mechanisms – Coincident points – Coriolis component of Acceleration – Introduction to linkage synthesis problem.

UNIT III KINEMATICS OF CAM MECHANISMS 9

Classification of cams and followers – Terminology and definitions – Displacement diagrams – Uniform velocity, parabolic, simple harmonic and Cycloidal motions – Derivatives of follower motions – Layout of plate cam profiles – Specified contour cams – Circular arc and tangent cams – Pressure angle and undercutting – sizing of cams

UNIT IV GEARS AND GEAR TRAINS 9

Law of toothed gearing – Involutes and Cycloidal tooth profiles – Spur Gear terminology and definitions –Gear tooth action – contact ratio – Interference and undercutting. Helical, Bevel, Worm, Rack and Pinion gears [Basics only]. Gear trains – Speed ratio, train value – Parallel axis gear trains – Epicyclic Gear Trains.

UNIT V FRICTION IN MACHINE ELEMENTS 9

Surface contacts – Sliding and Rolling friction – Friction in Plate clutches – Axial clutches – Cone Clutches-Internal expanding rim clutches – Electromagnetic clutches. Friction in Band and Block brakes – External shoe brakes – Internal expanding shoe brake

TOTAL: 45 PERIODS

COURSE OUTCOMES :

Students will be able to

CO1 Explain various components of mechanisms and its inversions used in machineries.

CO2 Illustrate the kinematic linkages with respect to displacement, velocity, and acceleration at any point

CO3 Draw the cam profile for specified follower motions

CO4 Demonstrate the basic concepts of toothed gearing and the kinematics of gear trains

CO5 Compute the frictional forces in various power transmission systems such as Clutches and Brakes

TEXT BOOKS:

1. Rattan, S.S, 2014, *Theory of Machines,* 4th Edition, Tata McGraw-Hill.
2. F.B.Sayyad, 2011, *Kinematics of Machinery*. MacMillan Publishers Pvt Ltd., Tech-max educational resources.
3. Uicker J.J., 2014, Pennock G.R and Shigley, J.E., *Theory of Machines and Mechanisms*,4th Edition, Oxford University Press.

REFERENCES :

1. Khurmi, R.S., 2005, *Theory of Machines* ,14th Edition, S Chand Publications.
2. Allen S.Hall Jr., 1961*, Kinematics and Linkage Design*, Prentice Hall.
3. Thomas Bevan, 2005, *Theory of Machines*, 3rd Edition, CBS Publishers and Distributors.
4. Robert L. Norton, 2009, *Kinematics and Dynamics of Machinery*, Tata McGraw-Hill.

ME1411 MANUFACTURING TECHNOLOGY LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- To practice sand molding, arc welding and resistance welding techniques, smith forging, sheet metal forming.
- To acquire knowledge on various basic machining operations in special purpose machines and its applications in real life manufacture of components in the industry.

LIST OF EXPERIMENTS

1. Preparation of green sand mold
2. Joining of plates using arc welding and sheets
3. Making simple sheet metal components involving shearing and bending operation.
4. Turing a component involving features; taper turning, knurling, grooving and thread cutting.
5. Eccentric turning
6. Cutting internal threads
7. Shaping a hexagon and slotting internal keyway
8. Cutting a helical gear using horizontal milling machine.
9. Cutting a slot and measuring cutting force during end milling.
10. Surface grinding square rod
11. Cylindrical grinding
12. Single point tool grinding
13. Hobbing a spur gear
14. Shear angle measurement
15. Manual part program to turn a component
16. Manual part program to mill a component
17. Study on Capstan lathe

18. Demonstration of plastic processing machines (Injection, blow, extrusion, and compression molding)

TOTAL: 60 PERIODS

EQUIPMENTS NEEDED (FOR 30 STUDENTS)

Sl. No.	NAME OF THE EQUIPMENT	Qty.
1	Centre Lathes	7 Nos.
2	Shaper and slotting machine	1 No each
3	Sheet metal forming tools and equipment	2 Nos.
4	Arc welding transformer and resistance welding unit with cables and holders	1 No each
5	Molding table, Molding equipment	2 Nos.
6	Sheet metal forming tools and equipment	2 Nos.
7	Turret and Capstan Lathes	1 No each
8	Horizontal Milling Machine	1 No
9	Vertical Milling Machine	1 No
10	Surface Grinding Machine	1 No.
11	Cylindrical Grinding Machine	1 No.
12	Milling Tool Dynamometer	1 No
13	Gear Hobbing Machine	1 No
14	CNC Lathe	1 No
15	CNC Milling machine	1 No
16	Tool and cutter grinder	1 No

COURSE OUTCOMES:

Students will be able to

CO1 Demonstrate the use of molding tools, welding processes and sheet metal fabrication tools

CO2 Practice making simple components comprising steps, taper, eccentric turning, knurling and thread cutting using lathe

CO3 Utilize shaping machine, milling and other machines to convert round work into other forms like hexagon and cut slot and gears

CO4 Apply various machine tools to grind specimen and tools

CO5 Construct manual part program for machining in CNC

ME1412 **STRENGTH OF MATERIALS AND FLUID MECHANICS LABORATORY**

L	T	P	C
0	0	4	2

OBJECTIVES:

- To study the mechanical properties of materials when subjected to different types of loading.
- To verify the principles of various flow control and measurements experiment in lab.
- To verify the principle of various turbines and pumps performance.
-

STRENGTH OF MATERIALS **30**

LIST OF EXPERIMENTS

1. Tension test on a mild steel rod
2. Double shear test on Mild steel rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels.
10. Tempering- Improvement Mechanical properties Comparison
    (i) Unhardened specimen
    (ii) Quenched Specimen and
    (iii) Quenched and tempered specimen.

EQUIPMENTS NEEDED (FOR 30 STUDENTS)

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Universal Tensile Testing machine with double shear attachment –40 Ton capacity	1
2	Torsion Testing Machine (60 Nm capacity)	1
3	Impact Testing Machine (300 J capacity)	1

4	Brinell Hardness Testing Machine	1
5	Rockwell Hardness Testing Machine	1
6	Spring Testing Machine for tensile and compressive loads (2500 N)	1
7	Muffle Furnace	1
8	Strain Gauge	1

FLUID MECHANICS LABORATORY **30**

LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump/ Submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

EQUIPMENTS REQUIRED (FOR 30 STUDENTS)

S. NO.	NAME OF THE EQUIPMENT	Qty.
1	Orifice meter setup	1
2	Venturi meter setup	1
3	Rota meter setup	1
4	Pipe Flow analysis setup	1
5	Centrifugal pump/submergible pump setup	1
6	Reciprocating pump setup	1
7	Gear pump setup	1
8	Pelton wheel setup	1
9	Francis turbine setup	1
10	Kaplan turbine setup	1

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Students will be able to

CO1 Estimatethe mechanical properties of materials when subjected to axial load, transverse load & shear loading.

CO2 Evaluate the properties of material by using various heat treatment processes.

CO3 Calculate the Coefficient of discharge and friction for the given various test rigs.

CO4 Experiment and draw the characteristic curves of various pumps.

CO5 Experiment and draw the characteristic curves of various turbines.

HS1421 INTRODUCTION TO ADVANCED READING AND WRITING

L	T	P	C
0	0	2	1

OBJECTIVES :

The Course will enable learners to:

- To strengthen the reading skills of students of engineering.
- To enhance their writing skills with specific reference to technical writing
- To develop their critical thinking skills.
- To provide more opportunities to develop their project and proposal writing skills

UNIT I EFFECTIVE READING 6

Reading – Strategies for effective reading – Use glosses and footnotes to aid reading comprehension – Read and recognize different text types – Predicting content using photos and title. Reading-Read for details – Use of graphic organizers to review and aid comprehension

UNIT II CRITICAL READING 6

Reading – Understanding pronoun reference and use of connectors in a passage – speed reading techniques. Reading – Genre and Organization of Ideas – Reading – Critical reading and thinking – understanding how the text positions the reader.

UNIT III PARAGRAPH WRITING 6

Writing – Plan before writing – Develop a paragraph: topic sentence, supporting sentences, concluding sentence – Write a descriptive paragraph Writing – State reasons and examples to support ideas in writing – Write a paragraph with reasons and examples – Write an opinion paragraph

UNIT IV ESSAY WRITING 6

Writing – Elements of good essay – Types of essays – descriptive-narrative – issue-based-argumentative – analytical.

UNIT V EFFECTIVE WRITING 6

Writing – letter of recommendation – Email writing – visumes – Job application – project writing-writing convincing proposals.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

Students will be able to

CO1 Understand how the text positions the reader.

CO2 Develop critical thinking while reading a text

CO3 Develop a descriptive paragraph

CO4 Make use of sentence structures effectively when creating an essay

CO5 Demonstrate proper usage of grammar in writing E-Mails, Job application and project proposals

TEXT BOOKS:

1. Gramer, F, Margot & Colin, S, Ward, 2011*, Reading and Writing (Level 3)*, Oxford University Press, Oxford.
2. Debra Daise, CharlNorloff, and Paul Carne, 2011, *Reading and Writing (Level 4)* Oxford University Press: Oxford

REFERENCES :

1. Davis, Jason & Rhonda LIss, 2006, *Effective Academic Writing (Level 3)*, Oxford University Press: Oxford,
2. E. Suresh Kumar and et al.2012, *Enriching Speaking and Writing Skills. Second Edition.* Orient Black swan: Hyderabad.
3. Withrow, Jeans and et al.2004, *Inspired to Write. Readings and Tasks to develop writing skills*. Cambridge University Press: Cambridge.
4. Goatly, Andrew, 2000, *Critical Reading and Writing,* Routledge: United States of America.
5. Petelin, Roslyn & Marsh Durham, 2004, *the Professional Writing Guide: Knowing Well and Knowing Why,* Business& Professional Publishing: Australia.

WEB RESOURCES:

- http://learnenglishteens.britishcouncil.org/skills/reading
- https://learnenglish.britishcouncil.org/skills/reading
- https://www.readingrockets.org/article/25-activities-reading-and-writing-fun
- https://linguapress.com/advanced.htm