# K.L.N. COLLEGE OF ENGINEERING

## Pottapalayam-630612, Sivagangai District

**(An Autonomous Institution, Affiliated to Anna University, Chennai)**

**Estd: 1994**

## THIRD SEMESTER

## CURRICULUM AND SYLLABUS

## REGULATIONS 2024

## For under Graduate Program

# B.E. MECHANICAL ENGINEERING

## CHOICE BASED CREDIT SYSTEM

**(For the students admitted from the academic year 2024-2025 onwards)**

**K.L.N. COLLEGE OF ENGINEERING, POTTAPALAYAM**
**(An Autonomous Institution, Affiliated to Anna University, Chennai)**

## VISION OF THE INSTITUTION

To become a Centre of Excellence in Technical Education and Research in producing Competent and Ethical professionals to the society

## MISSION OF THE INSTITUTION

To impart Value and Need based curriculum to the students with enriched skill development in the field of Engineering, Technology, Management and Entrepreneurship and to nurture their character with social concern and to pursue their career in the areas of Research and Industry.

## VISION OF THE DEPARTMENT

To become a centre of excellence for Education and Research in Mechanical Engineering.

## MISSION OF THE DEPARTMENT

- Attaining academic excellence through effective teaching learning process and state of the art infrastructure.
- Providing research culture through academic and applied research.
- Inculcating social consciousness and ethical values through co-curricular and extra-curricular activities.

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## PROGRAMEDUCATIONALOBJECTIVES (PEOs)

**PEO1** Graduates will have successful career in Mechanical Engineering and service industries.

**PEO2** Graduates will contribute towards technological development through academic Research and industrial practices.

**PEO3** Graduates will practice their profession with good communication, leadership, ethics And social responsibility.

**PEO4** Graduates will adapt to evolving technologies through life-long learning.

## PROGRAMSPECIFICOUTCOMES(PSOs)

**PSO1** Derive technical knowledge and skills in the design, develop, analyze and manufacture of mechanical systems with sustainable energy, by the use of modern tools and techniques and applying research based knowledge.

**PSO2** Acquire technical competency to face continuous technological changes in the field of mechanical engineering and provide creative, innovative and sustainable solutions to complex engineering problems.

**PSO3** Attain academic and professional skills for successful career and to serve the society needs in local and global environment.

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## Knowledge and Attitude Profile (WK)

**WK1:** A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

**WK2:** Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

**WK3:** A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

**WK4:** Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

**WK5:** Knowledge, including efficient resource use, environmental impacts, whole-life cost, re- use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

**WK6:** Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

**WK7:** Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

**WK8:** Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

**WK9:** Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

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## Program Outcomes (POs)

**PO1: Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

**PO2: Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

**PO3: Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

**PO4: Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

**PO5: Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

**PO6: The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

**PO7: Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

**PO8: Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

**PO9: Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

**PO10: Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

**PO11: Life-Long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

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# REGULATIONS 2024

## For Under Graduate Program

## B.E. MECHANICAL ENGINEERING

## CHOICE BASED CREDIT SYSTEM

### CATEGORY OF COURSES

i. **Humanities and Social Sciences (HS) Courses** include Technical English, Environmental Science and Engineering, Engineering Ethics and human values, Communication Skills and Management courses.

ii. **Basic Sciences (BS**) **Courses** include Mathematics, Physics, and Chemistry.

iii. **Engineering Sciences (ES) Courses** include Engineering Practices, Engineering Graphics, Basics of Electrical / Electronics / Mechanical / Computer Engineering / Instrumentation etc.

iv. **Professional Core (PC) Courses** include the core courses relevant to the chosen programme of study.

v. **Professional Elective (PE) Courses** include the elective courses relevant to the chosen programme of study.

vi. **Open Elective (OE) Courses** include courses from other departments which a student can choose from the list specified in the curriculum of the students B.E. / B.Tech. Programmes.

vii. **Employability Enhancement Courses (EEC)** includes Project Work and/or Internship, Seminar, Professional Practices, Case Study and Industrial/Practical Training.

viii. **Mandatory (MC) Courses** include Personality and Character development and the courses recommended by the regulatory bodies such as AICTE, UGC, etc

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**B.E. MECHANICAL ENGINEERING**

**REGULATIONS 2024**

**CHOICE BASED CREDIT SYSTEM**

**CURRICULUM AND SYLLABUS**

**SEMESTER III**

| S.No. | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | 24BS301 | Transforms and Partial Differential Equations (Common to B.E. MECH & B.E. EEE programmes) | BS | 4 | 3 | 1 | 0 | 4 |
| 2. | 24ME301 | Strength of Materials | PC | 3 | 3 | 0 | 0 | 3 |
| 3. | 24ME302 | Fluid Mechanics and Machinery | PC | 3 | 3 | 0 | 0 | 3 |
| 4. | 24ME303 | Manufacturing Processes | PC | 3 | 3 | 0 | 0 | 3 |
| 5. | 24ME304 | Engineering Thermodynamics | PC | 4 | 3 | 1 | 0 | 4 |
| 6. | 24HS301 | Human Values and Ethics (Common to all B.E./B.Tech. programmes) | HS | 2 | 2 | 0 | 0 | 2 |
| **PRACTICAL** | | | | | | | | |
| 7. | 24ME3L1 | Computer Aided Machine Drawing | PC | 3 | 0 | 0 | 3 | 1.5 |
| 8. | 24ME3L2 | Strength of Materials & Fluid Machinery Laboratory | PC | 3 | 0 | 0 | 3 | 1.5 |
| 9. | 24HS3L1 | Aptitude And Soft Skills – II (Common to all B.E./B.Tech. programmes) | EEC | 2 | 0 | 0 | 2 | 1* |
| | | | **TOTAL** | 27 | 17 | 2 | 8 | 22 |

* **The grades earned by the students will be recorded in the mark sheet, however the same shall not be considered for the computation of CGPA**

| 24BS301 | TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 4 |

**OBJECTIVES:**

- To learn the formation of partial differential equations and the solution of first order and higher order partial differential equations.
- To apply Fourier series to solve one dimensional wave, one and two dimensional heat equations which occur frequently in various branches of Engineering disciplines.
- To make the students familiar with the topics such as Fourier Transforms, Z-Transforms and Fourier series.

**UNIT - I PARTIAL DIFFERENTIAL EQUATIONS** **9+3**

Formation of partial differential equations – Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

**UNIT - II FOURIER SERIES** **9+3**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

**UNIT - III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS** **9+3**

Classification of PDE – Method of separation of variables - Fourier Series solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

**UNIT - IV FOURIER TRANSFORMS** **9+3**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

**UNIT - V Z -TRANSFORMS AND DIFFERENCE EQUATIONS** **9+3**

Z-transforms - Elementary properties – Inverse Z-transform (using partial fraction and residues) – Initial and final value theorems - Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transforms.

**TOTAL: 45+15 PERIODS**

**TEXT BOOKS:**

1. Grewal .B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi,44th Edition, 2017.
2. Bali.N.P. and Manish Goyal, "A Textbook of Engineering Mathematics", Laxmi publications Pvt.Ltd, 9th Edition, 2014.

**REFERENCES:**


1. Erwin Kreyszig, "Advanced Engineering Mathematics ", John Wiley, India, 8th Edition, 2016.
2. James. G., "Advanced Modern Engineering Mathematics", Pearson Education, 3rd Edition, 2007.
3. Paul Du Chateau, David W. Zachmann , " Schaum's Outline of Partial Differential Equations" , 3rd Edition, 2011.
4. Narayanan.S., Manicavachagom Pillay.T.K. and Ramanaiah.G, "Advanced Mathematics for Engineering Students", S.Viswanathan Publishers Pvt. Ltd, Chennai, Vol. II 2003 & Vol. III 2002.
5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt.Ltd, New Delhi, 2016.


**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name: TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS** | | **Course Code: 24BS301** | |
|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K- CO** |
| C201.1 | Solve linear partial differential equations, second and higher order with constant coefficients. | I | K3 |
| C201.2 | Solve partial differential equations using Fourier series analysis. | II | K3 |
| C201.3 | Solve one, two dimensional heat flow problems and one dimensional wave equation problems. | III | K3 |
| C201.4 | Compute the Fourier transforms of various functions. | IV | K3 |
| C201.5 | Apply Z-transforms techniques to solve difference equation. | V | K3 |


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| 24ME301 | STRENGTH OF MATERIALS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To study the concepts of simple stresses, strains, and strain energy due to external loads.
- To understand the two dimensional stress systems, stresses and deformations induced in thin and thick shells.
- To compute stresses and deformation in circular shafts and helical spring due to torsion.
- To understand the concept of shearing force and bending moment due to external loads in beams and their effect on stresses.
- To determine the deflection of beams by various methods and crippling load of columns under various conditions.

**UNIT - I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9**

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses. Stress-Strain Diagram for ductile and brittle materials, True stress, True strain. Deformation of simple and compound bars, Thermal stresses, Elastic constants, Poisson's ratio, Volumetric strain, Relation between elastic constant and poison ratio ,Strain energy and unit strain energy, Strain energy in Uniaxial loads.

**UNIT - II ANALYSIS OF STRESSES IN TWO DIMENSIONS 9**

Stresses in thin cylindrical shell, circumferential and longitudinal stresses. Deformation in thin and thick cylinders, Compound cylinders, Stresses in spherical shells, Deformation in spherical shells. Stresses on inclined planes, principal stresses and principal planes, Mohr's circle for plane stress.

**UNIT – III TORSION 9**

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

**UNIT – IV BEAMS 9**

Beams – types, Standard Rolled sections, transverse loading on beams, Shear force and bending moment in beams - Cantilever, Simply supported and over hanging. Theory of simple bending, bending stress distribution, Load carrying capacity, Proportioning of sections, Flitched beams, Shear stress distribution. Deflections of beams by Double Integration method, Macaulay's method.

**UNIT - V COLUMNS 9**

Columns – Long and short columns, Euler's formula for crippling load with different end conditions, eccentric loading, Rankine formulae.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Ferdinand P. Beer, E. Russell Johnston, John T.DeWolf, David F.Mazurek, SanjeevSangh, Mechanics of Materials,2020, 8th Edition McGraw-Hill Education, India.
2. Bansal R.K, "A Textbook of Strength of Materials", Laxmi Publications Pvt. Ltd., New Delhi, 6th Edition, 2019.
3. Khurmi R.S, Khurmi N, "Strength of Materials", S.Chand, New Delhi, 2015.

**REFERENCES:**


1. R. C. Hibbeler, “Mechanics of Materials”, 9th Edition , Pearson Education., 2018
2. Popov E.P, Nagarajan S, Lu Z. A : “Mechanics of Materials”, Prentice-Hall of India, New Delhi,SI Edition, 2015.
3. Rajput, R K, “Strength of Materials”, S.Chand& Co, New Delhi, 2015.
4. S. S. Bhavikatti, “Strength of Materials”, Vikas Publishing House-Pvt. Ltd., 4th Edition. 2013.
5. Singh D.K, “Mechanics of Solids” Pearson Education, 2008.


**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name : STRENGTH OF MATERIALS** | | **Course Code : 24ME301** | |
|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K- CO** |
| C202.1 | Determine the deformation of bars while applying loads. | I | K3 |
| C202.2 | Compute stresses due to internal pressure in cylinders and spherical shells | II | K3 |
| C202.3 | Calculate the shear stress induced in shafts and springs. | III | K3 |
| C202.4 | Construct Shear force diagram, Bending moment diagram and deflection of beam for different beam configurations | IV | K3 |
| C202.5 | Calculate crippling load of columns under various conditions. | V | K3 |


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| 24ME302 | FLUID MECHANICS AND MACHINERY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To understand the properties of fluids
- To understand the flow characteristics.
- To gain knowledge about the dynamics of fluids and boundary layer concepts.
- To study about dimensional analysis and model analysis
- To understand the working principle and performance of hydraulic machines

**UNIT - I FLUID PROPERTIES** **9**

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Compressible and incompressible fluid, Pressure measurement, Buoyancy and floatation.

**UNIT – II FLOW CHARACTERISTICS** **9**

Flow characteristics-Eulerian and Lagrangian Approach- concept of control volume and system - Reynold's transportation theorem - Application of continuity equation, energy equation and momentum equation.

**UNIT – III FLOW THROUGH PIPES AND BOUNDARY LAYER** **9**

Reynold's Experiment -Laminar flow through circular conduits - Darcy Weisbach equation - friction factor - Moody diagram - Major and minor losses - Hydraulic and energy gradient lines - Pipes in series and parallel - Boundary layer concepts - Types of boundary layer thickness

**UNIT – IV DIMENSIONAL ANALYSIS** **9**

Need for dimensional analysis, methods of dimensional analysis. Similitude –types of similitude. Dimensionless parameters, application of dimensionless parameters. Model analysis.

**UNIT – V HYDRAULIC MACHINES** **9**

Classification of pumps - Centrifugal pumps - Working principle - Heads and efficiencies–. Velocity triangles - Work done by the impeller - Performance curves – Specific speed- Reciprocating pump working principle.

Introduction- Classification of turbines-Working principle (Not for Examination).

**TOTAL:45 PERIODS**

**TEXT BOOKS:**

1. R. K.Bansal, "Textbook of fluid mechanics and hydraulic machine: SI units" 10th Edition, Laxmi Publication, 2019.
2. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics including Hydraulics machines", Standard Book House, 23rd Edition, 2022.
3. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House Pvt. Ltd., New Delhi, 2016

**REFERENCES:**

1. Frank White, "Fluid Mechanics", 8th Edition, McGraw Hill Education (India) Pvt. Ltd 2017.
2. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", 9th Edition, McGraw Hill Publishing Co. 2017

3. Yunus A Cengel and John A Cimbala, Fluid Mechanics-Fundamentals &Applications, 4th Edition, Tata McGraw Hill, 2017
4. S. K. Som, Gautam Biswas, Suman Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, 3rd Edition, Tata McGraw-Hill Education, 2012
5. Jain A. K. Fluid Mechanics including Hydraulic Machines, Khanna Publishers, New Delhi, 2014.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name : FLUID MECHANICS AND MACHINERY** | | **Course Code: 24ME302** | |
|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K- CO** |
| **C2O3.1** | Determine the properties of fluid for the fluid applications | I | K3 |
| **C203.2** | Discuss the flow characteristics of the fluid and its applications. | II | K3 |
| **C203.3** | Compute loses in pipes, bends and fittings using conservation laws. | III | K3 |
| **C203.4** | Predict the performance of prototype by model studies and solve dimensional analysis | IV | K3 |
| **C203.5** | Analyze the performance characteristics of hydraulic machines. | V | K3 |

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| 24ME303 | MANUFACTURING PROCESSES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To provide knowledge on working principles, process parameters and equipment of metal casting and metal joining
- To identify defects and interpret causes for defects in product of metal casting, metal joining and metal forming processes
- To provide knowledge about various bulk deformation processes.
- To understand the working principles of moulding of plastic components.
- To understand the concepts of additive manufacturing process.

**UNIT - I METAL CASTING PROCESSES 9**

Pattern –Types, Materials, allowances. Molding sand –Types and Properties, Design of, Moulds, Riser and gating design Basic steps in sand casting, Cupola furnace, Special casting processes (Shell, Investment, Pressure die casting, Centrifugal Casting), Defects in Sand casting process

**UNIT – II BULK DEFORMATION PROCESSES 9**

Hot working and cold working of metals –Forging processes – Open, impression and closed die forging, Typical forging operations. Rolling of metals – Types of Rolling mills - Flat strip rolling , Defects in rolled parts- Wire and Rod - Tube drawing

**UNIT – III FABRICATION PROCESSES 9**

Fusion welding: Oxy-fuel Welding, Arc welding- Electrodes, Coating and specifications, MIG welding, TIG welding, $CO_2$ Welding, , Plasma arc welding, Laser Beam welding, Thermit welding

Solid State welding: Resistance welding, friction stir welding, ultra sonic welding, electron beam welding. Defects, causes and remedies in welding -Brazing and soldering.

**UNIT – IV SHEET METAL PROCESSES 9**

Sheet metal Characteristics - shearing, bending and drawing– Stretch forming – Formability of sheet metal , Bending force calculations – Test methods

Working principle and applications of special forming processes - Hydro forming – Rubber pad forming – Metal spinning –Explosive forming - Magnetic pulse forming - Super plastic forming.

**UNIT – V PROCESSING OF PLASTICS AND ADDITIVE MANUFACTURING 9**

Plastics and its classification , working principles- processing of plastics such as Injection molding, Compression molding, Transfer Molding, Blow molding, Rotational molding, Film blowing, Extrusion, Thermoforming.

Additive Manufacturing: Classification – Fused Deposition Modeling, Selective Laser Sintering, Stereo lithography, Metal additive Manufacturing, Benefits, Applications.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Kalpak jian. S, “Manufacturing Engineering and Technology”, Pearson Education India 9th Edition, 2023.
2. Hajra Choudhary S.K. and Hajra Choudhury. A. K., Elements of Workshop Technology, Volume I , Media Promoters and Publishers Pvt. Limited, Mumbai, 16th Reprint 2017
3. Anup goel , “Manufacturing processess”,Technical publications ,3rd edition 2024.

**REFERENCES:**


1. Gosh A, Mallik, A.K., Manufacturing Science, East-West Press Pvt Ltd, 2010.
2. Rajput R.K, "A text book of Manufacturing Technology", Lakshmi Publications, 2018.
3. Rao. P. N., "Manufacturing Technology Foundry, Forming and Welding", 5th Edition, Tata McGraw Hill, 2018.
4. Shaikh Ubaid ,Palaskar Ravikiran, "Additive manufacturing ", Technical publications,3rd edition 2021.
5. Roy. A. Lindberg, "Processes and materials of manufacture:, PHI / Pearson education, 2015


**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name : MANUFACTURING PROCESSES** | | **Course Code :24ME303** | |
|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K- CO** |
| C204.1 | Explain the various applications of the casting process. | I | K2 |
| C204.2 | Illustrate the different bulk deformation processes | II | K2 |
| C204.3 | Describe about various welding techniques. | III | K2 |
| C204.4 | Apply the various sheet metal forming process. | IV | K2 |
| C204.5 | Choose a suitable plastic molding process and additive manufacturing process for producing a given part | V | K2 |


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| 24ME304 | ENGINEERING THERMODYNAMICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 4 |

**OBJECTIVES:**

- To understand the first law of thermodynamics for various systems.
- To understand the second law of thermodynamics and Entropy.
- To understand the properties of pure substance.
- To understand behaviour of ideal and real gas.
- To understand Psychrometric properties.

**UNIT - I BASIC CONCEPT AND FIRST LAW** **9+3**

Thermodynamic systems, Properties and processes - Thermodynamic Equilibrium - Displacement work - P-V diagram - Thermal equilibrium - Zeroth law – Concept of temperature and Temperature Scales- First law – application to closed and open systems – steady flow energy equation(SFEE) and its application to nozzle, diffuser, compressor, turbine, heat exchanger.

**UNIT – II SECOND LAW AND ENTROPY** **9+3**

Heat engine – Refrigerator – Heat pump. Statements of Second law of thermodynamics. Carnot cycle – reversed Carnot cycle – Performance. Clausius Inequality. Concept of Entropy – T-S diagram - Entropy change for pure substances – Principle of increase of entropy. Availability and irreversibility.

**UNIT – III PROPERTIES OF PURE SUBSTANCE** **9+3**

Steam – formation and its properties- property diagrams (PV, PT, TV, TS & HS). Latent heat, Dryness fraction of steam. Heat transfer and work done in Non-Flow and flow Processes using Steam Tables and Mollier chart

**UNIT – IV IDEAL AND REAL GASES, THERMODYNAMIC RELATIONS** **9+3**

Properties of Ideal gas, real gas. Equations of state for real gases – Vanderwaal's equation of state. Reduced properties-Law of corresponding states- Generalized Compressibility chart. Thermodynamic relations: Partial derivatives - Maxwell relations – Joule -Thomson experiment Clausius - Clapeyron equation.

**UNIT – V GAS MIXTURES AND PSYCHROMETRY** **9+3**

Mixture of non-reacting gases - Dalton's and Amagat's model - Calculation of changes in properties (Cp, Cv, R, u, h and s) for gas mixtures. Psychrometry- dry and atmospheric air, Psychrometric properties of moist air specific and relative humidity, dew point temperature - Psychrometric chart.

**TOTAL: 45+15 PERIODS**

**TEXT BOOKS:**

1. Nag.P.K., Engineering Thermodynamics, 6th Edition, McGraw Hill Education, 2017.
2. R.K.Rajput, "A Text Book Of Engineering Thermodynamics", 5th Edition, 2017.
3. Cengel. Y and M.Boles, "Thermodynamics - An Engineering Approach", 9th Edition, McGraw Hill, 2019.

**REFERENCES:**


1. Sonntag, R.E., Borgnakke, C., and Van Wylen, Fundamentals of Thermodynamics, 7th Edition, Wiley Eastern Ltd, 2009.
2. Michael J. Moran, Howard N. Shapiro, "Fundamentals of Engineering Thermodynamics", 8th Edition, 2003
3. Prasannakumar, "Thermodynamics", Pearson – Dorling Kindersley (India) Pvt. Ltd., 2013.
4. Single.O.P., Engineering Thermodynamics, Macmillan Publishers India Limited, 2000
5. William C. Reynolds, Henry C. Perkins, Engineering thermodynamics, Mc Graw Hill, 2009


**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name : ENGINEERING THERMODYNAMICS** | | **Course Code :24ME304** | |
|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K- CO** |
| C205.1 | Calculate energy exchange in closed systems and flow process | I | K3 |
| C205.2 | Determine the performance limits of thermodynamic cycles and entropy change during thermodynamic processes | II | K3 |
| C205.3 | Compute heat transfer and work done during non-flow and flow Processes using Steam. | III | K3 |
| C205.4 | Derive simple thermodynamic relations of ideal gases | IV | K3 |
| C205.5 | Calculate properties of gas mixtures and moist air using thermodynamic relations and psychrometric chart. | V | K3 |


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| 24HS301 | HUMAN VALUES AND ETHICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 1 | 0 | 2 |

**OBJECTIVES:**

- To create an awareness on Engineering Ethics and Human Values.
- To understand social responsibility of an engineer.
- To appreciate ethical dilemma while discharging duties in professional life.

**UNIT - I INTRODUCTION TO VALUE EDUCATION 3+3**

Value Education – Definition - Concept and Need for Value Education - Natural acceptance, Self exploration - Fundamentals of value education - Happiness and Prosperity as parts of Value Education- fulfilling human aspirations.

**Practice Session:** Sharing about Oneself, Exploring Human Consciousness – self exploration, Exploring Natural Acceptance.

**UNIT – II HARMONY IN THE HUMAN BEING 3+3**

Understanding Myself as Co-existence of the Self and the Body - I' and Body synchronization - Realization of Self, Body needs - Self-regulation and Health.

**Practice Session:** Exploring the difference of Needs of Self and Body, Exploring Sources of Imagination in the Self, Harmony of Self with the Body - program for ensuring health vs dealing with disease.

**UNIT – III HARMONY IN THE FAMILY, SOCIETY AND NATURE 3+3**

Family as a basic unit of Human Interaction-Values in Relationships - The Basics for Trust and Respect in today's Crisis: Affection, e-Guidance, Reverence, Glory, Gratitude and Love – Harmony in society: Resolution, Prosperity, Fearlessness and Co-existence as Comprehensive Human Goal- Harmony in Nature: The Four Orders in Nature - The Holistic Perception of Harmony in Existence.

**Practice Session:** Exploring the Feelings of Trust, Respect and Gratitude, Exploring Systems to fulfil Human Goals considering society and nature - Co-existence in Existence

**UNIT – IV SOCIAL ETHICS 3+3**

The Basics for Ethical Human Conduct - Defects in Ethical Human Conduct - Holistic Alternative and Universal Human Order and Ethical Conduct - Human Rights violation and Social Disparities. **Practice Session:** Exploring Ethical Human Conduct, Humanistic Models in Education, Exploring Steps of Transition towards Universal Human Order.

**UNIT – V PROFESSIONAL ETHICS 3+3**

Value based Life and Profession - Professional Ethics and Right Understanding - Competence in Professional Ethics - Issues in Professional Ethics – The Current Scenario - Vision for Holistic Technologies.

**Practice Session:** Holistic Technologies - Production Systems and Management Models, Holistic vision of life - Socially responsible behaviour and environmentally responsible work

**TOTAL: 15+15 PERIODS**

**TEXT BOOKS:**

1. R.R. Gaur, R. Asthana, G.P. Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd revised edition, Excel Books, New Delhi, Reprint 2019.
2. A N Tripathy, Human Values, New Age International Publishers, New Delhi, 2003.

**REFERENCES:**


1. E G Seebauer & Robert L.Berry, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press, 2000.
2. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd, Reprint 2011.
3. Mike Martin and Roland Schinzinger "Ethics in Engineering" McGraw Hill, New York, 4th edition, Reprint 2017.
4. Charles E. Harries, Michael S. Protchard and Michael J. Rabins, "Engineering Ethics- concepts and Cases", Thomson Learning, 2000.
5. S.K. Chakraborty and Dabangshu Chakraborty, "Human Values and Ethics: Achieving Holistic Excellence", ICFAI University Press, 2006.


**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name : HUMAN VALUES AND ETHICS** | | **Course Code : 24HS301** | |
|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K-CO** |
| **C206.1** | Explain the significance of value inputs and start applying them in their life and profession to ensure happiness and prosperity. | I | AD |
| **C206.2** | Differentiate between Thyself & the Body to ensure competency of an individual. | II | AD |
| **C206.3** | Explain the role of a human being in ensuring harmony in family, society, and nature. | III | AD |
| **C206.4** | Develop an awareness of human values to appreciate the rights of others and to enable social balance. | IV | AD |
| **C206.5** | Differentiate between ethical and unethical professional practices, and apply suitable strategy to actualize a harmonious working environment. | V | AD |


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| 24ME3L1 | COMPUTER AIDED MACHINE DRAWING | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |

**OBJECTIVES:**

- To gain the skills and practical experience in handling 2D drafting
- To gain knowledge in 3D modelling software systems
- To have standard drawing practices using fits and tolerances.
- To prepare assembly drawings both manually and using standard CAD packages.
- To prepare standard drawing layout for modeled parts, assemblies with BoM.

**LIST OF EXPERIMENTS**

**Part I DRAWING STANDARDS & FITS AND TOLERANCES**

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 IS919- Specification of Fits – Preparation of production drawings and reading of part and assembly drawings, basic principles of Geometric Dimensioning &Tolerancing.

**PART II 2D DRAFTING**

Drawing, Editing, Dimensioning, Layering, Hatching, Block, Array, Detailing, Detailed Drawing of the Components

**Manual Drawing:**

1. Sleeve & Cotter Joint
2. Knuckle Joint
3. Universal Joint
4. Flange Coupling

**Drawing with Software:**

1. Piston
2. Connecting Rod
3. Screw Jack
4. Machine Vice

**Total:** 20% of classes for theory classes and 80% of classes for practice

**Note:** 25% of assembly drawings must be done manually and remaining 75% of assembly drawings must be done by using any CAD software. The above tasks can be performed manually and using standard commercial 2D CAD software

**TOTAL: 45 PERIODS**

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

| S. No. | Name of the equipment | Quantity |
|---|---|---|
| 1 | Computer Work Station | 30 |
| 2. | Printer | 1 |
| 3. | Drafting Software | 30 License |

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name : COMPUTER AIDED MACHINE DRAWING** | | **Course Code :24ME3L1** | |
|---|---|---|---|
| **CO** | **Course Outcomes** | **Expt.** | **K- CO** |
| C207.1 | Sketch the given part drawing with fits and tolerances | 1-12 | K3 |
| C207.2 | Prepare standard drawing layout for modeled assemblies with BoM | 1-12 | K3 |
| C207.3 | Model orthogonal views of machine components | 1-12 | K3 |
| C207.4 | Prepare standard drawing layout for modeled parts | 1-12 | K3 |
| C207.5 | Draw the given parts and assembly using 2D CAD sofware | 1-12 | K3 |

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| 24ME3L2 | STRENGTH OF MATERIALS & FLUID MACHINERY LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |

**OBJECTIVES:**

- To study the mechanical properties of materials when subjected to different types of loading and to measure loads, displacements and strains.
- To determine the stiffness properties of structural elements and to understand the hardening and tempering process
- To determine the coefficient of discharge for Orificemeter /Venturimeter
- To study the performance characteristics of various hydraulic pumps and hydraulic turbines
- To gain practical knowledge about friction factor and flow measurement

**LIST OF EXPERIMENTS**

**STRENGTH OF MATERIALS LABORATORY**

1. Tensile test on Mild Steel rod
2. Torsion test on Mild Steel rod
3. Impact test – Izod / Charpy
4. Hardness test – Brinell & Rockwell Hardness Number
5. Effect of hardening- Improvement in hardness and impact resistance of steels.
6. Compression test on helical springs

**FLUID MACHINERY LABORATORY**

1. Determination of coefficient of discharge for Orificemeter / Venturimeter.
2. Performance characteristics of Centrifugal pump/ Submersible pump
3. Performance characteristics of Reciprocating pump/ Gear pump
4. Performance characteristics of Francis/ Pelton turbine.
5. Performance characteristics of Kaplan turbine.
6. (a)Determination of friction factor for flow through pipes.
   (b) Determination of rate of flow using Rotameter and its calibration

**TOTAL: 45 PERIODS**

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

**STRENGTH OF MATERIALS LABORATORY**

| S. No. | Name of the equipment | Quantity |
|---|---|---|
| 1. | Universal Tensile Testing machine | 1 |
| 2. | Torsion Testing Machine | 1 |
| 3. | Impact Testing Machine | 1 |
| 4. | Brinell Hardness Testing Machine | 1 |
| 5. | Rockwell Hardness Testing Machine | 1 |
| 6. | Muffle Furnace | 1 |
| 7. | Metallurgical Microscope | 1 |

**FLUID MACHINERY LABORATORY**

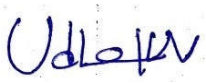
| S. No | Name of the equipment | Quantity |
|---|---|---|
| 1. | Orifice meter / Venturi meter | 1 |
| 2. | Centrifugal pump /Submersible Pump | 1 |
| 3. | Reciprocating pump/Gear Pump | 1 |
| 4. | Francis turbine/ Pelton turbine | 1 |
| 5. | Kaplan turbine. | 1 |

| | | |
|---|---|---|
| 6. | Pipe friction apparatus | 1 |
| 7. | Rotameter | 1 |

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name : STRENGTH OF MATERIALS & FLUID MACHINERY LABORATORY** | | **Course Code :24ME3L2** | |
|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K- CO** |
| C208.1 | Determine the mechanical properties of metals by testing | 1,2,3,4,5 | K3 |
| C208.2 | Determine the stiffness properties of helical spring | 6 | K3 |
| C208.3 | Determine the coefficient of discharge for Orifice meter/ Venturi meter | 1 | K3 |
| C208.4 | Predict performance characteristics of pump and turbines | 2,3,4,5 | K3 |
| C208.5 | Determine the friction factor for flow through pipes and measure the rate of flow using rotameter | 6 | K3 |



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| 24HS3L1 | APTITUDE AND SOFT SKILLS – II | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**Module I Aptitude Skills II** **15**

Pipes and cisterns, boats and streams, Problems on trains, Alpha Numeric Puzzles, Simple Interest, Compound Interest, Mixtures and Allegations, calendar, clock, permutation and combination, probability, height and distance.

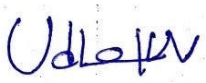
**Module II Soft Skills II** **15**

Introduction to Soft skills – Non-Verbal Communication - Role play - Learning styles – Writing Bio-data and Process description - Peak Life Moment / Challenging moment - People management – team work, leadership, Decision making – problem identification - Email and Essay writing - Just a minute (JAM).

**TOTAL: 30 PERIODS**

**REFERENCES:**


1. Quantitative aptitude for competitive examinations , R.S.Agarwal, S.Chand publications
2. Quantitative Aptitude – AbijithGuha, TMH
3. Quantitative Aptitude for Cat – ArunSharma,TMH
4. Gulati. S., (2006) “Corporate Soft Skills”, New Delhi, India: Rupa& Co.
5. Prasad, HariMohan,A Handbook of Spotting Errors, Mcgraw Hill Education, 2010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