



4-Year Bachelor of Technology (B.Tech.) Curriculum
and Syllabus for Mechanical Engineering (ME)
Eighth Semester

| Course Code | Course Title | Contact Hrs. / Week | | | Credit |
|----------------------|---|---------------------|---|---|-----------|
| | | L | T | P | |
| Theory | | | | | |
| TIUSD-801 | Career Advancement & Skill Development-VIII | 2 | 1 | 0 | 3 |
| TIUME-801 | Material Handling | 2 | 1 | 0 | 3 |
| TIUME-802 | Refrigeration and Air Conditioning | 3 | 1 | 0 | 4 |
| TIUME-803 | Elective-I | 2 | 1 | 0 | 3 |
| TIUME-804 | Elective-II | 2 | 1 | 0 | 3 |
| Practical | | | | | |
| TIUME-891 | Heat Power Laboratory | 0 | 0 | 3 | 2 |
| TIUME-892 | Project-II | 0 | 0 | 3 | 2 |
| TIUME-806 | Comprehensive Viva Voce | 0 | 0 | 0 | 3 |
| Sessional | | | | | |
| TIUCSL-881 | Entrepreneurship Skill Development-VIII | 0 | 0 | 3 | 2 |
| Total Credits | | | | | 25 |

Syllabus

Approved By:
External Expert

VC

Registrar

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Material Handling

TIUME-802

L-T-P: 2-1-0

Credit: 3

Definition of material handling, classification of materials, bulk load, unit load, their characteristics.

Classification of mechanical handling equipment, different types of elevators and lowerers for handling materials in bulk and unit loads, their working principles and estimation of handling capacity.

Belt conveyors and their construction, capacity and power requirements, other conveyors, steel plate and slat conveyors, flight and screw conveyors, vibrating and oscillating trough conveyors – estimation of handling capacity and power requirement, Automatic feeding devices for elevators and conveyors.

Gravity chutes and gravity roller runways accessories of gravity roller conveyors viz. humper, stacker and gadget, live rollers, pneumatic and hydraulic methods of conveying, monorails, and blast furnace hoists.

Loading/unloading and operation of railway wagons, motor trucks and fork lift trucks. Wire ropes, pulley blocks, crab winch, grabs and lifting magnets, different types of cranes.

Definition and types of robots – basic concept, working principle and application of robotics, manipulators.

Automation, Automated Guided Vehicles (AGVs) and application, Automated production and transfer lines.

Recommended Books:

1. Material Handling Systems: Designing for Safety and Health by Charles Reese, Taylor & Francis.
2. Introduction to Materials Handling by S. Ray, New Age International.

Refrigeration and Air Conditioning

TIUME-803

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L-T-P: 3-1-0

Credit: 4

Introduction: Concepts of Refrigeration and Air-conditioning, Unit of refrigeration.

Simple Vapour Compression Refrigeration System (Simple VCRS): Vapour compression cycle on p-h and T-s diagrams, Cycles with subcooling and superheating, their effects. Effect of changes in evaporator pressure and condenser pressure on the performance of a simple VCRS, dry compression and wet compression of refrigerant, actual Vapour Compression cycle.

Air Refrigeration System (ARS): open-air and dense-air system, limitations of Bell-Coleman refrigerator, COP determination, actual air-refrigeration cycle.

Vapour Absorption Refrigeration System (VARs): Advantages of VARs over VCRS, working principle of simple VARs, practical VARs, limitations of VARs, maximum COP of a VARs, LiBr-water system and Aqua-ammonia systems.

Equipment and Control: Major Refrigeration Equipment – Compressors: Types, reciprocating, rotary & centrifugal, volumetric efficiency; Condensers: types used in refrigeration systems; Evaporators; Expansion devices: capillary tubes and thermostatic expansion valves.

Other Refrigeration Systems: Basic idea of Thermoelectric refrigeration system, Steam-jet (vapour-jet) refrigeration system.

Psychrometry: Basic definitions and principles related to Psychrometry, Psychrometric charts & their uses. Heating, cooling, heating & humidification & cooling & dehumidification processes. Adiabatic saturation, By-pass factor, Sensible Heat Factors. Simple cases of Heat Load estimation.

Types of Air-conditioning systems: Window air conditioners & split air conditioners. Single duct, double duct & V A V systems.

Air-conditioning equipment: chillers, air handling units, cooling towers, cooling coils.

Recommended Books:

1. Refrigeration and Air Conditioning by C.P. Arora, McGraw Hill Education (India) Private Limited.
2. Refrigeration and Air Conditioning by R.C. Arora, PHI Learning Pvt. Ltd.
3. A Textbook of Refrigeration and Air Conditioning by R.S. Khurmi and J.K. Gupta, S Chand.

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4. A Textbook of Refrigeration and Air-Conditioning by R.K. Rajput, S.K. Kataria & Sons.

Elective-I

TIUME-804

Finite Element Methods

TIUME-804A

L-T-P: 2-1-0

Credit: 3

Introduction to FEA, General Comments, Need for FEA, Solution of Differential equations.

Integral Formulations and Variational Methods: Need for Weighted Integral forms, weak formulation of boundary value problems, weighted integral and weak formulations, variational methods of approximation, Rayleigh-Ritz method, the method of weighted residuals.

Finite Element Analysis of One-Dimensional Problems: Basic Steps of Finite Element Analysis, Model BVP, Discretization and derivation of element equations, imposition of boundary conditions, applications in heat transfer, fluid mechanics and solid mechanics

Bending of Beams: The Euler-Bernoulli Beam element, governing equation, discretization, derivation and assembly of equations, imposition of boundary conditions, examples.

Finite Element Error Analysis: Approximation errors, various measures of errors, accuracy and convergence of solutions.

Recommended Books:

1. An Introduction to the Finite Element Method, by J.N. Reddy, McGraw Hill Education (India) Pvt. Ltd.
2. Concepts and Applications of Finite Element Analysis, by R.D. Cook, D.S. Malkus, M.E. Plesha and R.J. Witt, Wiley.

Non-Conventional Energy Sources

TIUME-804B

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L-T-P: 2-1-0

Credit: 3

Energy scenario and renewable energy sources: Global and Indian situation, potential of non-conventional energy sources, economics.

Solar energy: Radiation, flat plate and concentrating collectors, fluid flow and heat transfer analysis, estimation of solar radiation, Active systems, solar pond, passive space conditioning, power generation, photovoltaics.

Principles and applications of wave energy, tidal energy, biomass energy, OTEC and Geothermal energy.

MHD Engineering, Fuel Cells, Wind Energy potentials.

Recommended Books:

1. Non-Conventional Energy Resources by B.H. Khan, McGraw Hill Education (India) Private Limited.
2. Non-Conventional Energy Resources by G.S. Sawhney, PHI.
3. Non-Conventional Energy Sources and Utilisation by R.K. Rajput, S Chand.

Computer Integrated Manufacturing

TIUME-804C

L-T-P: 2-1-0

Credit: 3

Concept of Computer Integrated Manufacturing (CIM), Basic components of CIM, Distributed database system, distributed communication system, computer networks for manufacturing, future automated factory, social and economic factors.

Computer Aided Design (CAD): CAD hardware and software, product modelling, automatic drafting, engineering analysis, FEM design review and evaluation, Group Technology Centre.

Computer Aided Manufacturing (CAM): Computer assisted NC part programming, Computer assisted robot programming, computer aided process planning (CAPP), computer aided material requirement planning and MRP, computer aided production scheduling, computer aided inspection planning, computer aided inventory planning, flexible manufacturing system (FMS), concept of flexible manufacturing, Integrating NC machines, robots, AGVs, and other NC equipment, Computer aided quality control, business functions, computer aided forecasting.

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Management Information Systems (MIS), Various CIM systems - examples.

Recommended Books:

1. CAD/CAM: Theory and Practice by I. Zeid and R. Sivasubramanian, McGraw Hill Education (India) Private Limited.
2. CAD/CAM: Principles and Applications by P.N. Rao, McGraw Hill Education (India) Private Limited.

Elective-II

TIUME-805

Linear Vibrations

TIUME-805A

L-T-P: 2-1-0

Credit: 3

Concepts of Vibrations: Newtonian mechanics, concept of linearity, superposition

Response of SDOF systems to initial excitations: Free vibration of undamped, viscously damped and Coulomb damped systems to initial displacements and velocities.

Response of SDOF systems to harmonic and periodic excitations: response to harmonic excitations through frequency domain analysis, rotating eccentric masses, systems with harmonically moving support, vibration isolation and measuring instruments

Response of SDOF systems to non-periodic excitations: unit impulse, unit step and unit ramp functions, state transition matrix, shock spectrum

TDOF systems: eigenvalue problems, natural modes and frequencies, response to harmonic excitations, vibration absorbers, response to non-periodic excitations using convolution integrals.

Recommended Books:

1. Fundamentals of Vibrations by Leonard Meirovitch, Waveland Press.
2. Mechanical Vibrations by S.S. Rao, Pearson Education.

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Gas Dynamics

TIUME-805B

L-T-P: 2-1-0

Credit: 3

Introduction to compressible flow, velocity of sound and Mach number, isentropic flow, flow with friction and heat transfer, Rayleigh line and Fanno line, analysis of flows with normal and oblique shock waves, supersonic flows, Introduction to two dimensional compressible flow.

Recommended Books:

1. Modern Compressible Flow: With Historical Perspective by J.D. Anderson, McGraw Hill Education (India) Private Limited.
2. Compressible Fluid Flow by P.H. Oosthuizen and W.E. Carscallen, McGraw Hill.
3. Gas Dynamics by E. Rathakrishnan, PHI.

Rapid Prototyping

TIUME-805C

L-T-P: 2-1-0

Credit: 3

Importance and overview of Rapid Prototyping, Tooling and Manufacturing; Typical Process Chain; Introduction to CAD and Data Exchange Formats; Data format details, conversion, checking, repairing and transmission; Part slicing and orientation.

Classification of Rapid Prototyping (RP), Tooling (RT) and Manufacturing (RM) processes; Materials for RP/RT/RM; Operating principles, characteristics and analysis of current and developing RP/RT/RM processes; Selection of RP/RT/RM processes based on the product requirements; Case studies.

Recommended Books:

1. C.K. Chua, K.F. Leong and C.S. Lim, Rapid Prototyping: Principles and Applications, World Scientific.

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2. N. Hopkinson, R.J.M. Hague and P.M. Dickens, Rapid Manufacturing: An Industrial Revolution for the Digital Age, Wiley.

Comprehensive Viva Voce

TIUME-806

L-T-P: 0-0-0

Credit: 3

Each student will have to appear at a viva voce examination in front of a board of examiners comprising of faculty members from all the specializations on all subjects completed during the course of his/her undergraduate study.

Heat Power Laboratory

TIUME-891

L-T-P: 0-0-3

Credit: 2

1. Determination of dryness fraction of steam.
2. Determination of critical pressure ratio for an orifice.
3. Measurement of temperature by different methods.
4. Refrigeration laboratory unit.
5. Air conditioning laboratory unit.
6. Study of steam turbine.
7. Study of boiler.

Project-II

TIUME-892

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L-T-P: 0-0-3

Credit: 2

Syllabus common with TIUME-793.

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