Vision and Mission of Institute

**Vision statement**
To be one of the leading technical institutes disseminating globally acceptable education, effective industrial training and relevant research output.

**Mission statement**
To be a globally accepted centre of excellence in technical education catalysing absorption, innovation, diffusion and transfer of high technologies resulting in enhanced quality for all the stakeholders.

Vision and Mission of Department

**Vision statement**
Perceives to be globally accepted centre of quality technical education based on innovation and academic excellence.

**Mission statement**
Strives to disseminate technical knowledge to its undergraduate, post graduate and research scholars to meet intellectual, ethical and career challenges for sustainable growth of humanity, nation and global community.
Programme Educational Objectives (PEOs)

The overall educational objective of Master of Technology in Mechanical Engineering [M. Tech. (Mech.)] programme is to develop broad technical knowledge, successful career, effective communication skills and life-long learning skills for its post graduate students.

PEO1: **Knowledge:** Impart broad technical knowledge in mechanical engineering discipline with research attitude, problem solving techniques and hands-on skill.

PEO2: **Career:** Provide successful career with professional ethics and responsibilities as a leading or participating role in mechanical engineering, R & D organization, academia and other fields or to pursue Ph.D./higher studies.

PEO3: **Communication:** Communicate verbally, in writing or audio-visually with others.

PEO4: **Learning:** Encourage the importance of life-long learning skill and aware of contemporary global issues for the successful professional career through self-study, participation and professional development courses.
### COURSE STRUCTURE FOR M. TECH. (MECHANICAL)

#### SEMESTER – I

<table>
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#### SEMESTER - IV

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Syllabus

- **INTRODUCTION** (9 Hours)
  Relevance of finite element analysis in design, Modeling and discretization, Interpolation, Elements, Nodes and degrees-of-freedom, Applications of FEA. One-Dimensional Elements and Computational Procedures: Bar elements, Beam elements, Bar and beam elements of arbitrary orientation, Assembly of elements, Properties of stiffness matrices, Boundary conditions, Solution of equations, Mechanical loads and stresses, Thermal loads and stresses, Example problems.

- **BASIC ELEMENTS** (7 Hours)
  Interpolation and shape functions, Element matrices, Linear triangular elements (CST), Quadratic triangular elements, Bilinear rectangular elements, Quadratic rectangular elements, Solid elements, Higher order elements, Nodal loads-stress calculations, Example problems.

- **ISOPERIMETRIC ELEMENTS** (7 Hours)
  Introduction, Bilinear quadrilateral elements, Quadratic quadrilaterals, Hexahedral elements, Numerical integration, Quadrature, Static condensation, Load considerations, Stress calculations, Examples of 2D and 3D applications.

- **FINITE ELEMENTS IN STRUCTURAL DYNAMICS APPLICATIONS** (10 Hours)

- **HEAT TRANSFER AND FLUID MECHANICS APPLICATIONS** (7 Hours)
  Heat Transfer, Element formulation, Reduction -nonlinear problems, Transient thermal analysis, Acoustic frequencies and modes, fluid structure interaction problems, Plane incompressible and rotational flows, Example problems.

- **FEA APPLICATIONS IN OTHER FIELDS** (5 Hours)
  Applications of FEA in torsion, Potential flow seepage, Fluid flow in ducts, Metal forming and metal cutting problems

(Total Hours: 45)
**Reference Books**


**PRACTICALS:**

1. Analysis of 2-D Truss.
2. Analysis of 2-D Frame.
3. Analysis of L Shaped Bracket.
4. Analysis of Square plate with circular hole.
5. Analysis of Solid.
8. Simulation of flow over car body.
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### Syllabus

1. Modes of heat transfer.  


(12 Hours)


(14 Hours)

4. Boiling & condensation  

(03 Hours)


(02 Hours)


(12 Hours)

(Total Hour: 45)

### Reference Books

PRACTICALS:

1. Calibration of thermocouple
2. Heat transfer in natural convection
3. Heat transfer in forced convection
4. Thermal conductivity of insulating powder
5. Heat transfer from pin fin apparatus
6. Heat transfer through composite wall
**ME 641 Theory Of Elasticity & Plasticity**

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**Syllabus**

1. Plane stress and plane strain stress and strain at a point. Equilibrium and compatibility equations.
   - Two dimensional problems in rectangular and polar co-ordinates. Three dimensional problems.
   - Torsion and bending of bars.
4. Failure Criterion.
5. Strain or work hardening.
6. Large elongations & their components.
7. Experimental strain analysis
8. Uniaxial tension of a perfect & an imperfect strip.
9. Plastic Anisotropy
10. Necking in continuous bar, sheets.
11. Ductile fracture & reduction of area

**Reference Books**

## ME 650 Optimization Techniques

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### Syllabus

- Single and Multivariable optimization methods, constrained optimization methods, Kuhn–Tucker conditions—Necessary & sufficiency theorems.
- Linear programming—Traveling salesman problem and Transshipment problems—post optimization analysis.
- Integer programming—All integer, Mixed integer and zero-one programming.
- Geometric programming—concept—degree of difficulty—solution of unconstrained & constrained non-linear problems by geometric programming.
- Dynamic programming

### REFERENCES:

ME 651 Advanced Production Planning and Control (Elective-1)

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Syllabus

1. **Production planning & Control (PPC):** Organizations of PPC department, Types of production system and principles of sound production system, Operations Strategy, Advanced Manufacturing Technology (AMT), Decision Support System (DSS).

2. **Forecasting:** Elements and steps in forecasting, Types of forecasting, Advance quantitative methods, Errors in forecasting.


4. **Layout and Location Strategy:** Types of layout. Design of layout, Factors affecting location decision. Quantitative methods for evaluating location decision.

5. **Capacity Planning:** Definition and measurement of capacity, Adjusting capacity, Quantitative methods for capacity planning decision.

6. **Aggregate Planning:** Purpose, inputs of aggregate plan, Aggregate planning processes and strategies, Methods for aggregate planning, Aggregate planning in services.

7. **Material Requirement Planning and ERP:** MRP input and output, MRP structure, MRP management, Lot sizing Technique and Extension of MRP, MRP in services.

8. **Operation Scheduling:** Scheduling process, Loading job, sequencing rule, and Line of balance technique, scheduling in services.


10. **New Quality Concepts and initiatives:** Total Quality Management (TQM) and its techniques, New Seven Management Tools, Industrial Case Studies on Six Sigma, Lean Six Sigma, Lean Green Six Sigma, Kaizen, Total Productive Maintenance (TPM), Five S, Quality Function Deployment (QFD), Poka Yoke, Quality Circles, Taguchi Technique, etc. Quality Awards.

11. **Manufacturing Excellence, World Class Manufacturing (WCM) –** Model and Elements of WCM.

12. **Inventory Management** – Inventory control under risk and uncertainties, services level policy method. Methods of handling inventory uncertainties, using empirical data to set safety stock levels, using statistical distributions to set safety stock levels, Just – in – Time inventory systems, Make or buy decisions.
References Books
5. Mukhopadhyay, S. K., Production Planning & Control – Text & Cases, PHI, New Delhi Dennis P. Hobbs, Lean Manufacturing Implementation, J. Ross Publication, USA.
<table>
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Syllabus

- **VARIOUS REFRIGERANTS**: Their properties, study of mixtures of refrigerants azeotrops, secondary refrigerants. Compressor selection.
- **SYSTEM COMPONENTS**: Component balancing in Refrigeration systems.
- **LOW TEMPERATURE REFRIGERATION**:
  a) Martinovsky - Dubinesky machine, Kapitza air liquefier; Cap Philips machines, Gifford models.
  b) Refrigerators using solids as working media. Magnetic cooling; thermodynamic aspects of magnetic cooling; magnetic refrigeration systems, nuclear demagnetization.
  c) Low temperature applications.
- **FOOD REFRIGERATION**:
  a) Theories and methods of chilling, freezing and dehydration; Microbiology of foods.
- **DESIGN**: Design aspects for refrigeration components such as compressors, condensers, evaporators, expansion valves and pipes.
  Design of water coolers, locker plants, ice plants and cold storage plants.
  Design requirements for refrigeration applications.

Reference Books
5. ASHRAE, Fundamentals, applications, systems and equipment volumes.
6. Baron, Cryogenics Engineering, by Baron.
### ME 649 I. C. Engines (Elective-1)

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#### Syllabus


#### Reference Books

3. Taylor and Taylor, I.C. Engines.
### ME 653 Advance Fluid Mechanics (Elective-1)

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**Syllabus**

1. Basic Concepts: Types of fluids and basic equations of flow, basic concepts in laminar and turbulent flows.
3. Potential Theory: Kelvin's theorem, source, sink, vortex and doublet, development of complex potentials by super position, conformal transformation thin airfoil theory.
4. Laminar Boundary Layers: Blasius solution, Boundary -layers with non-zero pressure gradient, separation and vortex shedding.
7. Computational Fluid Dynamics: Philosophy of CFD, governing equations, thin derivation and physical meaning, mathematical behavior of P.D.E. and thin impent on CFD, Finite difference scheme, grid generation and transformation. Introduction to FEM and finite volume method.

**Reference Books**

### ME 660 Computer Aided Design in Mechanical Engineering (Elective-1)

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#### Syllabus

Fundamental of computer graphics, geometrical modeling (solid, surface & wire frame), two & three dimensional transformations (rotation, reflection & sealing), windowing, clipping, plane curves & space curves, Hidden surfaces removal, awareness & application of computer graphics software object oriented programming.

Quadratic, isoperimetric & other higher order finite elements, condensation & sub structuring, two-dimensional axisymmetric problems, application of finite elements to transient problems, various time stepping schemes, incorporation of nonlinearities.

Application of finite difference & finite element methods to design of process equipment’s.

Awareness & use of standard software for equipment design and analysis.

#### Reference Books

<table>
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**Syllabus**

1. Introduction: Failure Analysis, Limit design, Fundamentals of fracture mechanics. Fatigue designing for finite life, contact stresses and surface failures, oil films and their effects.
2. Impact: Energy methods, longitudinal stress waves in elastic media impact on beams, torsional impact on shafts and longitudinal impacts on helical springs,
5. Reliability based design: Definition normal exponential and Weibull distributions system reliability. Reliability based on strength.
6. Optimum design: Basis concepts, introduction to various techniques of optimization, optimum design of simple mechanical components.
7. Analysis and design of power transmission systems and elements such as: Spur, helical, bevel and worm gear drives, speed reducers and gear boxes, epicyclic gear drives, selection of ball and roller bearings.

**Reference Books**

4. Spotts, M.F., Mechanical Design Analysis, Prentice Hall.
ME 644 Theory of Metal Cutting

<table>
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Syllabus


2. Unconventional machining methods: Introduction, Analysis of various unconventional machining like: USM, WJM, AJM, CHM, ECM, ECG, EDM, WEDM, LBM, EBM, PAM. (20 Hours)

(Total Hours: 45)

Reference material

## ME 646 Instrumentation and Control

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### Syllabus

1. Instrumentation Review of basic concept and functional description. Generalize performance characteristics of instruments. Instruments for measurement of basic parameters such as displacement, velocity, acceleration, force, torque strain temp. Pressure, flow volume etc.
2. Analysis of experimental data. Data acquisition and processing Indicating and Recording devices.
3. Data Transmission: Telemetry, pneumatic transmission etc. Analog and digital instruments. Instrumentation for process control, power plant etc.

### Reference Books

ME 770 Industrial Robotics (Elective-2)

Total no. of contact hours/week | Course Assessment
--- | ---
Theory | Lab. | Tutorial | Total hours | Continuous | End semester
--- | --- | --- | --- | --- | ---
3 | - | - | 3 | Yes | Yes

**Syllabus**

- **INTRODUCTION AND ROBOT KINEMATICS** (8 Hours)
  - Definition need and scope of Industrial robots, Robot anatomy, Work volume, Precision movement, End effectors, Sensors. Robot Kinematics, Direct and inverse kinematics, Robot trajectories, Control of robot manipulators, Robot dynamics, Methods for orientation and location of objects.

- **ROBOT DRIVES AND CONTROL** (10 Hours)
  - Controlling the Robot motion, Position and velocity sensing devices, Design of drive systems, Hydraulic and Pneumatic drives, Linear and rotary actuators and control valves, Electro hydraulic servo valves, electric drives, Motors, Designing of end effectors, Vacuum, magnetic and air operated grippers.

- **ROBOT SENSORS** (10 Hours)
  - Transducers and Sensors, Sensors in Robot, Tactile sensor, Proximity and range sensors, Sensing joint forces, Robotic vision system, Image grabbing, Image processing and analysis, Image segmentation, Pattern recognition, Training of vision system.

- **ROBOT CELL DESIGN AND APPLICATION** (7 Hours)
  - Robot work cell design and control, Safety in Robotics, Robot cell layouts, Multiple Robots and machine interference, Robots cycle time analysis, Industrial application of robots.

- **ROBOT PROGRAMMING, ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS** (10 Hours)
  - Methods of Robot Programming, Characteristics of task level languages lead through programming methods, Motion interpolation, Artificial intelligence, Basics, Goals of artificial intelligence, AI techniques, Problem representation in AI, Problem reduction and solution techniques, Application of AI and ES in Robots.

  **(Total Hours: 45)**

**Reference Books**


2. Richard, D, Klafter, Thomas, A, Chmielewski, Michael Negin, Robotics Engineering – An Integrated
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Syllabus
1. Factors influencing the design of vessels - classification of pressure vessels, material selection, loads & types of failures.
2. Stresses in pressure vessels – stresses in circular ring, cylinder & sphere, membrane stresses in vessels under internal pressure, thick cylinders, multilayered cylinders, stress consideration in the selection of flat plate & conical closures, elliptical, tori-spherical,
3. Hemispherical heads, auto-fretage of thick cylinders, thermal stresses & their significance, fatigue of pressure vessels.
4. Design of pressure vessels as per ASME & IS codes, externally pressurized vessels, tall vertical vessels, support for vertical & horizontal vessels, nozzles & flanges. Discontinuity stresses in pressure vessels.
5. Basic concepts, flow through pipes, Fanno & Reynolds flow, pressure drop in isothermal & non-isothermal flows.
6. Head losses, loss due to contraction & expansion, loss due to fittings, equipment length, distribution & mixing losses.

Reference Books
3. ASME code Section 8th div 1, div2
6. IS 2825.
ME 652 Industrial air conditioning (Elective-2)

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Syllabus

- **LOAD CALCULATION AND APPLIED PSYCHROMETRICS**:
  Review of heat gains from solar and other sources and cooling load calculations, psychrometrics of various air conditioning processes.
  Air handling equipment such as fans, fitters, air conditioning apparatus and unitary equipment.
  Air conditioning applications such as residences, stores, public buildings and facilities, educational facilities etc.
  Air conditioning systems and its applications. All air systems air water systems, all water system and D.X. System.

- **INDUSTRIAL VENTILATION**:
  a) Ventilation of the Industrial Environment.
  b) Industrial Exhaust systems.

- **SOUND CONTROLS**:
  Definition of various terms, Noise level, pitch, attenuation, frequency, sources of sound from conditioning plants, step by step prevention. Design procedure. Air conditioning controls.

- **DESIGN**:
  Design of various components of an air conditioning plant such as fans, cooling coils, heating coils, ducts, air distributing systems, Design of residential, commercial and industrial air conditioning plants. Design of air washers and spray equipment.

**Reference Books**

2. ASH RAE Fundamentals, applications, systems and equipment volumes.
ME 654 Mechanical Vibration (Elective-2)

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Syllabus

- **FUNDAMENTALS OF VIBRATION** (10 Hours)
  Review of Single degree freedom systems, Response to arbitrary periodic Excitations, Duhamel’s Integral, Impulse Response function, Virtual work, Lagrange’s equation, Single degree freedom forced vibration with elastically coupled viscous dampers, System Identification from frequency response, Transient Vibration, Laplace transformation formulation.

- **TWO DEGREE FREEDOM SYSTEM** (8 Hours)
  Free vibration of spring coupled system, Mass coupled system, Vibration of two degree freedom system, Forced vibration, Vibration Absorber, Vibration isolation.

- **MULTI-DEGREE FREEDOM SYSTEM** (10 Hours)

- **VIBRATION OF CONTINUOUS SYSTEMS** (9 Hours)
  Systems governed by wave equations, Vibration of strings, Vibration of rods, Euler Equation for Beams, Effect of Rotary inertia and shear deformation, Vibration of plates.

- **EXPERIMENTAL METHODS IN VIBRATION ANALYSIS** (8 Hours)

(Total Hours: 45)

Reference Books

# ME 656 Industrial tribology (Elective-2)

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## Syllabus

1. Theories of Friction and wear: Causes of friction and mechanism of wear, friction and wear measurement.
2. Fluid Film Bearing: Theory of hydrodynamic lubrication, Design consideration in journal and thrust bearing, hydrostatic and boundary lubrication, Elasto-hydrodynamic lubrication, application of lubrication mechanism in bearing design.
5. Lubricant and materials: Properties and testing of lubricants, bearing materials.

## Reference Books

## ME 658 Alternate Sources of Energy (Elective-2)

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### Syllabus


4. Concentrating Collectors : Ideal concentration ratios for line & point focusing collectors,


### Reference Books

<table>
<thead>
<tr>
<th>Syllabus</th>
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<tbody>
<tr>
<td>1. Power Plant: Constructional features of different types of engines used in automobiles. Their characteristics, selections.</td>
<td></td>
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<tr>
<td>2. Vehicle Performance: Resistance to motion of vehicle, Air, rolling and g radiant resistances, Power requirement for acceleration and tradability, selection of suitable rear axle and gear rations.</td>
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<tr>
<td>3. Chassis: General consideration relating to chassis layout, power plant location, types of automobiles, weight distribution stability, type of frame, materials.</td>
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<tr>
<td>5. Suspension: Types of suspensions, leaf springs, materials, shackles and mountings, independent suspension coil, torsion bar, rubber and pneumatic suspension, shock absorbers, type and construction, vibration and riding comforts.</td>
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<tr>
<td>7. Testing: Testing procedures, types of tests on chassis component equipment for laboratory and road tests, preparation of test reports.</td>
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### Syllabus

1. Review of heat transfer principles & convection correlation. (03 Hours)
2. Introduction to heat exchangers and classification (03 Hours)
3. Basic design methodologies, Net Transferable Units method and Logarithmic Mean Temperature Difference method (04 Hours)
4. Design of double pipe heat exchangers (05 Hours)
5. Shell & tube type heat exchangers, nomenclature, J-factors, conventional design methods, bell, Delaware method (05 Hours)
6. Compact heat exchangers, J-factors, design method (08 Hours)
7. Condensers classification and design methods for surface condensers (05 Hours)
8. Evaporators Classification and design methods (03 Hours)
9. Plate type Heat exchangers (03 Hours)
10. Regenerators (03 Hours)
11. Furnace design (03 Hours)

(Total Hours: 45)

### Reference Books

ME 664 Auto mobile engineering-II (Elective-3)

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**Syllabus**

1. **Front Axle and Steering Systems**: Axle parts and materials. Load and stresses on front axle design, steering heads, axle bearing wheel alignment, steering geometry, Ackerman and Davis steering gases, conventional layout of steering system. Steering systems for independent suspension, wheel wobble and shimmy.

2. **Wheels & Tyres**: Types of wheels, construction, principal of design, tytestyle of construction, static and rolling properties of pneumatic tyres.

3. **Clutch**: Necessity of clutch in automobile, different types of clutches and their principles. Coefficient of reserve, torque carrying capacity, clutch, damper, allowable pedal pressure. General description and working of different types of clutches. Centrifugal automatic clutch, vacuum operated clutch, hydraulic clutch. Fluid transmission advantages and disadvantages.

4. **Gear Boxes**: Necessity of a gear box, sliding mesh, constant mesh and synchromesh and epicyclical types, overdrives. Electric transmission - advantages and disadvantages.


6. **Garage Practice**: Planning & layout for washing, greasing and plant and equipment display, storage lighting and amenities.

7. **Maintenance of Transport Vehicles**: Preventive maintenance, flow of work in maintenance and repair shop, general principles of large scale overhauls, shop s, plant and equipment, repair process of fuel injection system petrol system etc.

**Reference Books**

<table>
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<th>Syllabus</th>
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<tbody>
<tr>
<td>1. Introduction and application.</td>
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<tr>
<td>5. Cryogenic Insulation : Vacuum insulation, Multilayer insulation (MLI), Methods of measuring effective thermal conductivity of MLI, liquid &amp; vapor shield, evacuated porous insulation, Gas filled powders and fibrous materials, Solid foams.</td>
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<tr>
<td>6. Cryogenic Instrumentation: Peculiarities of cryogenic strain measurement, pressure, flow, density, temperature and liquid level measurement for cryogenic application.</td>
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<td>8. Storage &amp; handling Systems: Dewar vessel design, piping, support systems, vessel safety devices and storage systems, Industrial storage systems.</td>
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<td>9. Transfer Systems: Transfer from storage, un -insulated transfer lines, insulated lines, transfer system components.</td>
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<td>13. Laboratory Demonstration.</td>
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ME 672 Design of pumps and Compressors (Elective-3)

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**Syllabus**

1. Centrifugal Pump Design: Selection of speed, impeller design, blade geometry, meridional geometry, volute and vanned diffuser design.
2. Axial Flow Pumps: Casing geometry, No. of blades, cascade solidity, selection of blade profile, diffuser design.
3. Centrifugal Compressors: Inlet sections, impeller passages, blade shape, vane less and vaned diffuser, Mach number consideration.
4. Axial Flow Compressors: Stage design parameters, blade loading, blading efficiency, lift coefficient and solidity, three dimensional design consideration.

**Reference Books**

2. Stapanoff, A.J., Centrifugal and Axial Flow Pumps, John Wiley,
3. Horlock, J.H., Axial Flow Compressors, Butterworth,
4. Yaheja, S.M., Turbines, Compressor and Fans, Tata McGraw Hill,
**ME 674 Design of CNC Machine Tools (Elective-3)**

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**Syllabus**

Introduction, Scope of Mechatronics, Introduction of CNC machines and manufacturing systems, Electronics for Mechanical Engineers, Design of CNC machine elements, Guideways, ball screw and nut, feedback elements, spindles, bearings, drives, programming and operation of CNC machines, testing of CNC machine tools.

**Reference Books**

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**Syllabus**

- **MATERIALS HANDLING EQUIPMENT** (2 Hours)
  
  Types, Selection and applications.

- **DESIGN OF HOISTS** (15 Hours)
  

- **DRIVES OF HOISTING GEAR** (9 Hours)
  
  Hand and power drives, Traveling gear, Rail traveling mechanism, Cantilever and monorail cranes, Slewing, Jib and luffing gear, Cogwheel drive, selecting the motor ratings.

- **CONVEYORS** (9 Hours)
  
  Types, Description, Design and applications of Belt Conveyors, Apron Conveyors and Escalators Pneumatic Conveyors, Screw conveyors and vibratory conveyors.

- **ELEVATORS** (10 Hours)
  
  Bucket elevators: design, Loading and bucket arrangements, Cage elevators, Shaft way, Guides, counter weights, Hoisting machine, Safety devices, Design of form lift trucks.

  *(Total Hours: 45)*

**Reference Books**

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<td>Theory Lab. Tutorial Total hours</td>
<td>Continuous End semester</td>
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**Syllabus**

- Types of fluid power systems & their application, desirable properties, symbols used.
- Fluid Power Pumps: Classification principle of working, design & selection.
- Pressure Accumulators.
- Fluid Reservoirs, filter and strainers.
- Temp, pressure and flow control devices.
- Fluid Seals.
- Fluid Power Actuators.
- Pneumatic pressure regulating valves and actuators, Basic pneumatic circuits.
- Design of simple Hydraulic and pneumatic systems
- Fluidics: Coanda effect, fluidic sensors, fluid logic circuits, Analysis design.

**Reference Books**

1. Pippenger, J.O., Industrial Hydraulics, Tata McGraw Hill,
2. Yeapple, F.D., Hydraulic and Pneumatic Power & Control,
Programme Outcomes (POs)

Following are the Programme Outcomes (POs) of Master of Technology in Mechanical Engineering; after completion of programme, student should demonstrate:

(a) An ability to apply engineering fundamentals and core engineering specialization to mechanical engineering discipline.

(b) An ability to identify, search, formulate, and analyze problems related to design engineering, thermal engineering, and production & industrial engineering with valid conclusions using appropriate analytical tools.

(c) An ability to design/develop solutions for design, thermal, and production & industrial engineering/technology problems to meet specified needs with given constraints.

(d) An ability to select relevant data from literature and databases, design and conduct experiments with required analysis to derive valid conclusions.

(e) An ability to apply an appropriate prediction and modeling tools to design, thermal, and production & industrial engineering activities with an understanding of the limitations.

(f) An understanding of the ethical, societal, health, safety, legal and cultural issues and consequent responsibilities relevant to engineering technology practice.

(g) An ability to understand the impact of engineering/technology solutions in societal and environmental context for sustainable development.

(h) An ability to work effectively as an individual and as a member or leader in diverse technical teams.

(i) An ability to communicate verbally, in writing and audio-visually.

(j) An ability to understand and apply the engineering management principles to one’s own work.

(k) An ability to engage in independent and life-long learning in specialized technologies and contemporary issues.