DEPARTMENT OF MECHANICAL ENGINEERING

M. Tech. (Mechanical)

SARDAR VALLABHBHAI NATIONAL INSTITUTE OF TECHNOLOGY
Ichchhanath, Surat- 395007, Gujarat, India
www.svnit.ac.in

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

Code No.	Subject	L	T	P	Exam Scheme				Total	Credits
					Theory		Tuto.	Pract.		
					Hrs.	Marks	Marks	Marks		
ME 601	Finite Element Methods	3	0	2	2	100	-	50	150	4
ME 603	Advance Heat Transfer	3	0	2	2	100	-	50	150	4
ME 641	Theory of Elasticity & Plasticity	3	0	0	2	100	-	-	100	3
ME 643	Mechanical Engineering Lab. – I	0	0	4	-	-	-	100	100	2
ME 650	Optimization Techniques	3	0	0	2	100	-	-	100	3
	Library Assignment	0	0	4	-	-	-	-	-	-
	Elective – I	3	0	0	2	100	-	-	100	3
ME 647 **ME 649** **ME 651** **ME 653** **ME 660**	Industrial Refrigeration I. C. Engines Production Planning and Control Advance Fluid Mechanics Computer Aided Design in Mech. Engg.									

SEMESTER – II

Code No.	Subject	L	T	P	Exam Scheme				Total	Credits
					Theory		Tuto.	Pract.		
					Hrs.	Marks	Marks	Marks		
ME 642	Mechanical Design Analysis	4	0	0	2	100	-	-	100	4
ME 644	Theory of Metal Cutting	3	0	0	2	100	-	-	100	3
ME 646	Instrumentation & Control	3	0	0	2	100	-	-	100	3
ME 648	Mechanical Engineering Lab. – II	0	0	4	-	-	-	100	100	2
	Library Assignment	0	0	4	-	-	-	-	-	-
	Elective – II	3	0	0	2	100	-	-	100	3
ME 652 **ME 654** **ME 656** **ME 658** **ME 662** **ME 682** **ME 770**	Industrial Air Conditioning Mechanical Vibration Industrial Tribology Alternate Sources of Energy Automobile Engineering - I Design of Heat Exchangers Industrial Robotics									
	Elective - III	3	0	0	2	100	-	-	100	3
ME 664 **ME 666** **ME 668** **ME 672** **ME 674** **ME 676** **ME 678**	Automobile Engineering - II Cryogenic Engineering Design of Pressure Vessels & Piping Design of Pumps and Compressors Design of CNC Machine Tools Design of Material Handling Equipments Applied Fluid Power Engg.									

SEMESTER – III

Code No.	Subject	L	T	P	Exam Scheme				Total	Credits
					Theory		Tuto.	Pract.		
					Hrs.	Marks	Marks	Marks		
ME 801	Dissertation Preliminaries	0	0	16	-	-	-	400	400	8
ME 803	Seminar	0	0	4	-	-	-	100	100	2

SEMESTER - IV

Code No.	Subject	L	T	P	Exam Scheme				Total	Credits
					Theory		Tuto.	Pract.		
					Hrs.	Marks	Marks	Marks		
ME 802	Dissertation	0	0	24	-	-	-	600	600	12

ME 601 Finite Element Methods					
Total no. of contact hours/week				**Course Assessment**	
Theory	**Lab.**	**Tutorial**	**Total hours**	**Continuous**	**End Semester**
3	2	-	5	Yes	Yes

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)**

  Solid and Structural Mechanics Applications: One dimensional problems static analysis of trusses, Analysis of plates, Solid of revolution.

  Dynamic analysis: Dynamic equations, Mass and damping matrices, Na tural frequencies and modes, Damping, Reduction of number of degrees-of-freedom-response history, Model methods, Ritz vectors, Component mode synthesis, Harmonic response, Direct integration techniques, Explicit and implicit methods, Analysis by response s spectra, Example problems.

- **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

1. Cook Robert Davis, Concepts and Applications of Finite Element Analysis, John Wiley & Sons, 1999.
2. Reddy J.N., an Introduction to the Finite Element Method, McGraw Hill, International Edition, 1993.
3. Chandrupatla & Belagundu, Finite Elements in Engineering, Prentice Hall of India Private Ltd., 1997.
4. George R. Buchaman, Schaum's Outline of Finite Element Analysis, McGraw Hill Company, 1994.
5. Rao S.S., Finite Element Method in Engineering, Elsevier Pergaman Press, 1997.

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.
6. Analysis of 2-D heat flow problem.
7. Analysis of 2-D transient heat flow in plate.
8. Simulation of flow over car body.

ME 603 Advance Heat Transfer					
Total no. of contact hours/week				**Course Assessment**	
Theory	**Lab.**	**Tutorial**	**Total hours**	**Continuous**	**End semester**
3	2	-	5	Yes	Yes

Syllabus

1. Modes of heat transfer. **(02 Hours)**
2. Conduction, Factors affecting thermal conductivity of solids, liquids & gases. General three dimensional heat conduction equation in Cartesian, cylindrical & spherical coordinates. Initial condition and various boundary conditions. Heat source systems. Critical thickness of insulation. Different types of fins & their analysis. Two dimensional steady state conduction. Electrical analogy, graphical & numerical methods. Transient heat conduction with & without temperature gradients within the system. Heat flow in Semi -infinite solids. Application of Heisler charts.

   (12 Hours)
3. Free & forced convection. Similarity & Simulation of convection heat transfer, Boundary layer theory. Turbulent flow heat transfer. Analogy between momentum & heat transfer5. Heat transfer with liquid metals. Heat transfer in high velocity flow. Recent development in theory of turbulent heat transfer. Natural convection under different situations. Empirical relations in convection heat transfer. **(14 Hours)**
4. Boiling & condensation **(03 Hours)**
5. Regimes of boiling heat transfer. Heat transfer in condensation. Drop wise & film condensation. Empirical equations. **(02 Hours)**
6. Radiation heat transfer properties. Laws of thermal radiation. Shape factors. Radiation heat transfer between back, diffuse & gray surface. Electric network method of solving radiation problems. Rediosity approach. Gas emission & absorption. **(12 Hours)**

(Total Hour: 45)

Reference Books

1. Sukhatme, S.P., Heat Transfer, Universities Press (India), 1996.
2. Holman, J.P., Heat Transfer, McGraw Hill Book Co., 1992.
3. Eckert and Drake, Heat and Mass Transfer, McGraw Hill, 1960.
4. Oziski, M. N. Heat Transfer – A Basic Approach, McGraw Hill, N. Y., 2001.
5. Roshenow, W., Hartnett, J., Ganic, P., Hand Book of Heat Transfer, Vol,1 & 2, McGraw Hill, N. Y., 2002.
6. Incropera & Hewitt, Fundamentals of Heat and Mass Transfer, John Wiley, 2000.

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

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.
2. Principles of Plastic Flow Theory.
3. Stress & Strain relationship & Condition of initiation of plastic deformation.
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
12. Determination of Forming Limit Strains for an Anisotropic material by Neck of growth. Methods for testing material properties.
13. Workability Definition, Testing & Analysis.

Reference Books

1. Thomsen, E.G., Yang, C.T., Kobayashi, Mechanics of Plastic Deformation in Metal Processing, The MacMilan Co., New York.
2. Mielnik, E.M., Metal Working Science & Engineering, McGraw - Hill, Inc., New York.
3. Marcinialy, Z., and Dancan, J.L., The Mechanics of Sheet Metal Forming, Edword Arnold, London.
4. Timoshenko and Goodier, Theory of Elasticity, McGraw Hill.

ME 650 Optimization Techniques					
Total no. of contact hours/week				**Course Assessment**	
Theory	**Lab.**	**Tutorial**	**Total hours**	**Continuous**	**End semester**
3	-	-	3	Yes	Yes

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:

1. Deb, K., "Optimization for Engineering Design", Prentice Hall of India, 1995.
2. Roa, S.S., "Optimization Theory And Application", Wiley Easter, 198 4.
3. Reklaitis G.V., Ravindram A., Ragsdell K.M., "Engineering Optimization - Methods & Application", Wiley, 1983.

ME 651 Advanced Production Planning and Control (Elective-1)					
Total no. of contact hours/week				**Course Assessment**	
Theory	**Lab.**	**Tutorial**	**Total hours**	**Continuous**	**End semester**
3	-	-	3	Yes	Yes

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.
3. **Process Strategy:** Process strategies, Process analysis and Design, Selection of equipment and technology and Process redesign.
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.
9. **Lean, Agile and Quick Response Manufacturing**– Elements, Concepts, Implementation strategy, and benefits, Cellular Manufacturing.
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

1. Buffa, E.S., and Sarin, R.K., Modern Production / Operations Management, John Wiley & Sons.
2. Heizer, Jay., Render, Barry., and Rajashekhar, Jagadeesh., Operations Management, Pearson Education, 2009
3. Knajei, Lee. J., and Ritzman, L. P., Operations Management, Pearson Education, Delhi, 2002.
4. Paneerselvan, R., Production & Operations Management, PHI, New Delhi.
5. Mukhopadhyay, S. K., Production Planning & Control – Text & Cases, PHI, New Delhi Dennis P. Hobbs, Lean Manufacturing Implementation, J. Ross Publication ,USA.

ME 647 Industrial refrigeration (Elective-1)					
Total no. of contact hours/week				**Course Assessment**	
Theory	**Lab.**	**Tutorial**	**Total hours**	**Continuous**	**End semester**
3	-	-	3	Yes	Yes

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) Martinovesky - 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.
  b) Processing a storage of chilled and frozen food; (I) Meat, (ii) Poultry, (iii) Fishes, (iv) Dairy, (v) Vegetables. Commercial and house hold refrigerators, co ld storages; and deep freezers.
- 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

1. Arora, S.C. and Romkundwar, S.A., Course in Refrigeration and Air conditioning, Dhanpat Rai and Sons, (1997)
2. Thrakeld, J.L., Thermal Environmental Engineering, Prentice Hall, (1982).
3. Stoeaker, W.F., Refrigeration and Air conditioning, McGraw Hill, (1986).
4. Dossat, R.J., Principles of Refrigeration, John Wiley and Sons, (1988).
5. ASHRAE, Fundamentals, applications, systems and equipment volumes.
6. Baron, Cryogenics Engineering, by Baron.

ME 649 I. C. Engines (Elective-1)					
Total no. of contact hours/week				**Course Assessment**	
Theory	**Lab.**	**Tutorial**	**Total hours**	**Continuous**	**End semester**
3	-	-	3	Yes	Yes

Syllabus

Thermodynamics of actual working fluids, Fuel air cycles, Process of Combustion, Combustion in S.I. Engines; and C.I. Engines, Heat losses and cooling; Real cycles compares with fuel air cycles, Air capacity of 4stroke engines; Two stroke engines. Engine friction, Performance of unsuper charged engine.

Reference Books

1. Ganeshan, V, Internal Combustion Engines, McGraw Hill Company, (1992).
2. Mathur, M.L. and Sharma, R.P., A Course in internal combustion engines, Dhanpat Rai and Sons, (1980).
3. Taylor and Taylor, I.C. Engines.
4. Obert, E.F., I.C. Engines.

ME 653 Advance Fluid Mechanics (Elective-1)					
Total no. of contact hours/week				**Course Assessment**	
Theory	**Lab.**	**Tutorial**	**Total hours**	**Continuous**	**End semester**
3	-	-	3	Yes	Yes

Syllabus

1. Basic Concepts: Types of fluids and basic equations of flow, basic concepts in laminar and turbulent flows.
2. Equations Governing Fluid Motion: Navier-stokes equations, Boundary layer equations. Exact solutions of N-S equations, Flow between concentric rotating cylinders, parallel flow of a powder - law fluid.
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.
5. Turbulent Flow : Mechanism of turbulence, derivation of governing equations for turbulent flow, K-E model of turbulence, universal velocity distribution law and friction factor, kinetic energy of the mean flow and fluctuations, relaminarization.
6. Experimental Techniques: pressure tubes, thermal anemometers, laser – Doppler anemometers, P_I velocimeter.
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

1. Schlichting, H., Boundary layer Theory, McGraw Hill, 1987.
2. Hinze, Jo., Turbulence, McGraw Hill, 1975.
3. Bradshaw, P., Turbulence, Springer -Verleg, 1976.
4. Anderson, Tamehill and Pletcher, Computational Fluid Mechanics and Heat Transfer, Hemispher Pub. Co., 1984.
5. Muralidhar, K. and Sunderajan, T., Computational Fluid Flow and Heat Transfer, Narosa Pub. House, New Delhi, 1997.

ME 660 Computer Aided Design in Mechanical Engineering (Elective-1)					
Total no. of contact hours/week				**Course Assessment**	
Theory	**Lab.**	**Tutorial**	**Total hours**	**Continuous**	**End semester**
3	-	-	3	Yes	Yes

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 non linarites.

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

1. Rogers, David F. and Alan, Adams J., Mathematical Elements for Computer Graphics. Mc.Graw Hill International Edition, 1990.
2. Krishnamoorthy, C.S. and Rajeev, S., Computer Aided Design, Narosa Publishing House, 1991.
3. Groover, M.P. and Zimmers, E.W., Computer Aided Design and Manufacturing, Prentice Hall of India Pvt. Ltd., New Delhi, 1997.
4. Vera, B. Anand, Computer graphics and geometric modelling for Engineers, John Wiley & Sons Inc. (1993).
5. Zienkiwicz, O.C., Finite Element Method.

ME 642 Mechanical Design Analysis					
Total no. of contact hours/week				**Course Assessment**	
Theory	**Lab.**	**Tutorial**	**Total hours**	**Continuous**	**End semester**
4	-	-	4	Yes	Yes

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,
3. Thermal properties and stresses: Effect of short term and long term properties of materials on design, creep and stress relaxation. Elementary analysis of thermal stresses, thermal fatigue.
4. Design with composite materials: Polymers and F. R. P. as materials for mechanical components.
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

1. Burr, Arthur H., and Cheatham, Johj B., Mechanical Analysis and Design, Prentic -Hall of India, 1997
2. Edwards, Kenneth, and Robert, B. Makee., Fundamentals of Mechanical Component Design, Mc. Graw Hill international ed. 1991.
3. Shigley, Joseph Edward and Mischke, Charles R., Mechanical Engineering Design, Mc. Graw Hill, 1989 .
4. Spotts, M.F., Mechanical Design Analysis, Prentice Hall.
5. Deutschmanetal, Aaron D., Machine Design, Collier Macmillan Publ. international edition.

ME 644 Theory of Metal Cutting					
Total no. of contact hours/week				**Course Assessment**	
Theory	**Lab.**	**Tutorial**	**Total hours**	**Continuous**	**End semester**
3	-	-	3	Yes	Yes

Syllabus

1. Mechanics of metal cutting: Chip formations, Thick and thin shear zone theories, merchant's theory, tool forces, specific cutting energy, friction in metal cutting, Heat generation in machining metal cutting as moving heat sources system, measurements of temperature tool life, tool wear, economics of machining chip breakers, Tool Dynamometers. Analysis of milling, grinding and drilling processes.

   (25 Hours)

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

1. Boothroyd, Geoffry, and Knight, Winston A., Fundamentals of machining and machine Tools, Marcel Dckker, Inc. New York, 1989.
2. Malik, Amitabhaghosh and Kumar, Ashok, Manufacturing Science, Assiliated East-West Press Pvt. Ltd., New Delhi, 1985
3. Pandey, P.C. and Shah, H., modern machining process, tata McGraw Hill, New Delhi, 1995.
4. Mishra, P.K., Non-conventional machining, Narosa Pub. House, New Delhi, 1997.
5. Stephenson, David A., Agapion, John, Metal cutting theory and practice, Marcel Dekker, Inc., New York 1997.

ME 646 Instrumentation and Control					
Total no. of contact hours/week				**Course Assessment**	
Theory	**Lab.**	**Tutorial**	**Total hours**	**Continuous**	**End semester**
3	-	-	3	Yes	Yes

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.
4. Automatic Controls: Review of linear control theory, stability criteria, compensation of feedback control systems. Nonlinear systems. Technique of analysis, State variable Technique in linear and nonlinear systems. Sampled Data feedback control systems.
5. Optimal Control: The static and dynamic case. Hydraulic and Pneumatic control systems, Combination controls, components study and design, Numerical control, Fluid logic and control circuits, Process control analysis. Control applications.

Reference Books

1. Dransfield, Peter, Engineering Systems and Automatic Control, Prentice Hall of India Pvt. Ltd., New Delhi.
2. Holman, J.P., and Gajda, W.J., Experimental Methods for Engineers, McGraw Hill International Book Company, New Delhi 1989.
3. Doebalin, E.O., Measurement System – Application and Design, McGraw – Hill Book Company, New York, 1975.
4. Beckwith, T.G., and Buck, W.L., Mechanical Measurements, 2nd Edition, Addison Wesely publishing Company, Inc., Reading, mass, 1969.
5. Nagrath, I.J., and Gopal, M., Control Systems Engineering, Wiley Eastern Ltd., New Delhi.

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 EXP ERT 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

1. Fu, K.S., Gonzalez, R.C. and Lee, C.S.G., Robotics Control, Sensing, Vision and Intelligence, Mc-Graw Hill, 1987.
2. Richard, D, Klafter, Thomas, A, Chmielewski, Michael Negin, Robotics Engineering – An Integrated

Approach, Prentice-Hall of India Pvt. Ltd., 1984.

3. Deb, S.R. Robotics Technology and Flexible Automation, Tata McGraw -Hill, 1994.
4. Groover, Mikell, P., Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey, Industrial Robotics Technology, Programming and Applications, McGraw -Hill, Int. 1986.
5. Timothy, Jordanides et al, Expert Systems and Robotics, Springer –Verlag, New York, May 1991.

ME 668 Design Of Pressure Vessel & Piping (Elective-3)					
Total no. of contact hours/week				**Course Assessment**	
Theory	**Lab.**	**Tutorial**	**Total hours**	**Continuous**	**End semester**
3	-	-	3	Yes	Yes

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, equip mental length, distribution & mixing losses.

Reference Books

1. Joshi, M.V., & Mahajani, V.V., Process Equipment Design, Macmillan, India, Ltd., 1996.
2. Hanvey, J.F., Pressure Vessels Design , Von Nostrand Co. Inc.
3. ASME code Section 8^{th} div 1, div2
4. Singh, K.P., & Soler, A.L., Mechanical Design of Heat Exchangers, Arcturus Pub. Inc. N.J. 08003, USA. 1984.
5. Moss, Demis.R., Pressure Vessel Design Manual, Gulf Publishing Co., Houston, 1987.
6. IS 2825.
7. Hand Book of piping Design.
8. ASHRAE fundamentals -1985.

ME 652 Industrial air conditioning (Elective-2)					
Total no. of contact hours/week				**Course Assessment**	
Theory	**Lab.**	**Tutorial**	**Total hours**	**Continuous**	**End semester**
3	-	-	3	Yes	Yes

Syllabus

- LOAD CALCULATION AND APPLIED PSYCHROMETRICS :

  Review of heat gains from solar and other sources and cooling load calculations, psycho metrics 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 is 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 fa ns, 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

1. Corroier, Hand Book of Air - Conditioning system Design.
2. ASH RAE Fundamentals, applications, systems and equipment volumes.

ME 654 Mechanical Vibration (Elective-2)					
Total no. of contact hours/week				**Course Assessment**	
Theory	**Lab.**	**Tutorial**	**Total hours**	**Continuous**	**End semester**
3	-	-	3	Yes	Yes

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 coup led 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)**

  Normal mode of vibration, Flexibility Matrix and Stiffness matrix , Eigen values and Eigen vectors, Orthogonal properties, Modal matrix-Modal Analysis, Forced Vibration by matrix inversion, Modal damping in forced vibration , Numerical methods for fundamental frequencies.

- **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)**

  Vibration instruments, Vibration exciters Measuring Devices , Analysis, Vibration Tests: Free and Forced Vibration tests. Examples of Vibration tests : Industrial case studies.

(Total Hours: 45)

Reference Books

1. Thomson, W.T., Theory of Vibration with Applications, CBS Publishers and Distributors New Delhi, 1990.
2. Rao, J.S., & Gupta, K., Ind. Course on Theory and Practice Mechanical Vibration, New Age International (P) Ltd., 1984.
3. Den Hartog, J.P, Mechanical Vibrations, Dover Publications, 1990.
4. Rao, S.S., Mechanical Vibrations, Addison Wesley Longman, 1995.
5. Shriniwasan P., Mechanical Vibration Analysis, Tata McGraw Hill, 1982.

ME 656 Industrial tribology (Elective-2)					
Total no. of contact hours/week				**Course Assessment**	
Theory	**Lab.**	**Tutorial**	**Total hours**	**Continuous**	**End semester**
3	-	-	3	Yes	Yes

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.
3. Anti-friction Bearing: Elasto-hydrodynamic lubrication, rolling element bearings.
4. Squeeze film Bearing: Theory and application of squeeze film bearing.
5. Lubricant and materials: Properties and testing of lubricants, bearing mate rials.

Reference Books

1. Arnell, R.D., Davies, P.B., Halling, J. and Whomes, T.L., Tribology - Principles and Design Application, Springer - Verlag Publication, (1991).
2. Majumdar, B.C., Introduction to Tribology of Bearings, A.h. Wheeler and Co. Pvt. Ltd., (1986).
3. Cameron: Basic Lubrication Theory, wiley Eastern Ltd.., (1987).

ME 658 Alternate Sources of Energy (Elective-2)					
Total no. of contact hours/week				**Course Assessment**	
Theory	**Lab.**	**Tutorial**	**Total hours**	**Continuous**	**End semester**
3	-	-	3	Yes	Yes

Syllabus

1. Estimation of Solar Radiation: Basic definitions, Estimation of monthly average of daily global radiation on horizontal and inclined surfaces - Page's co-relation, Reddy's correlations. Prediction of daily diffuse radiation on horizontal & inclined surfaces - Liu- Jordan co-relation Sulhatme's co-relation & Gupta's co-relation, ASHRAE model for prediction of instantaneous radiation.
2. Theory of Flat Plate Collectors Radiation transmission through covers - product, Basic Energy Equation of Collector, Temperature Distribution - Overall loss coefficients - thermal analysis of collectors - overall design methodology - performance test of collector.
3. Solar Air Heaters, Cookers & Cabinet Drives. Geometry & thermal analysis of solar air heaters - Channiwala's Correlation - Transient Analysis of solar cooker - Design concepts for cooker - Energy balance of cabinet driver.
4. Concentrating Collectors : Ideal concentration ratios for line & point focusing collectors,
5. Basic energy equation for cylindrical parabolic collector - Performance Testing – Compound Parabolic collector & its performance evaluation - Solar Tower Concepts, Solar Chimney concept.
6. Economics of Solar Thermal Systems, Klein's Method f -charts - P-charts, Long term economics of solar thermal system.

Reference Books

1. Peter, Auer. Advance in Energy Technologies vo1: 1&2. Academic Press, 1977.
2. Twidell, J.W., Weir A.D., Renewable Energy Resources, ELBS Pub., 1986.
3. Chawla, O.P. Advances in Biogas Technology, Indian Council of Agricultural Research New Delhi, 1986.
4. Mani, A. and Mooley D.A., Wind Energy Data for India.
5. Sukhatme, S.P., Solar Energy Principles of Thermal a Collection and Storage, 2 nd Edi. Tata MC-Graw hill, New Delhi, 1996
6. Duffie, J.A. and Beckman, W.A., Solar Engineering of Thermal Processes 2 nd Edi, John Wiley & Sons, N.Y., 1991.
7. Tiwari, G.N., Juneja Saneeta., Solar Thermal Engineering Systems, Narosa Publishin House, New Delhi,1997.
8. Sayigh, A.A.M., Solar Energy Engineering. Academic Press, N.Y., 1977.
9. Kreith, F. and Kreider, J.F., Handbook of Solar Energy. Mc Graw Hill, N.Y., 1980.

ME 662 Automobile engineering-I (Elective-2)					
Total no. of contact hours/week				**Course Assessment**	
Theory	**Lab.**	**Tutorial**	**Total hours**	**Continuous**	**End semester**
3	-	-	3	Yes	Yes

Syllabus

1. Power Plant: Constructional features of different types of engines used in automobiles. Their characteristics, selections.
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.
3. Chassis: General consideration relating to chassis layout, power plant location, types of automobiles, weight distribution stability, type of frame, materials.
4. Drive mechanisms: Torque reaction, driving thrust, propeller shaft, universal joints, and constant velocity universal joints. Differential, action of differential, constructional details, types of rear axles, materials, bearing loads, double reduction and 2speed axle, front wheel drive, all-wheel drive.
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.
6. Brakes: Types, stopping time and distances, braking efficiency, weight transfer during raking, shoe brakes/disk brakes. Brakes power ratio, hydraulic and power brakes. Layout and details of components.
7. Testing: Testing procedures, types of tests on chassis component equipment for laboratory and road tests, preparation of test reports.
8. Electrical Equipment: Electrical circuits, wiring system. Ignition system coil, magneto and electronics. Charging system, battery regulators lighting and auxiliary circuits.

Reference Books

1. Crouse, W.H., Automotive Mechanics, 5 th Ed. McGraw Hill, N.Y.65.
2. Crouse, W.H., Automotive Transmission & Power Trains, 4 th Ed. McGraw Hill, N.Y. 1971.
3. Heitner, Automotive Mechanics, Ea st Ewest Press, New Delhi, 1971.
4. Newton, & Steeds, Motor Vehicle, London, ELBS, 1972.

ME 682 Design of Heat Exchangers (Elective-2)					
Total no. of contact hours/week				**Course Assessment**	
Theory	**Lab.**	**Tutorial**	**Total hours**	**Continuous**	**End semester**
3	-	-	3	Yes	Yes

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 Deference 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 , Delware 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

1. Saunders, E.A.D., Heat Exchangers Selection Design and Construction, Longmann Scientific and Technical, N.Y., 2001.
2. Kays, V.A. and London, A.L., Compact Heat Exchangers, McGraw Hill, 2002.
3. Holger, Martin, Heat Exchangers. Hemisphere Publ. Corp., Washington, 2001.
4. Kuppan, T., Heat Exchanger Design Handbook, Macel Dekker, Inc., N.Y. , 2000
5. Seikan Ishigai, Steam Power Engineering, Thermal and Hydraulic Design Principles, Cambridge Univ. Press, 2001.

ME 664 Auto mobile engineering-II (Elective-3)					
Total no. of contact hours/week				**Course Assessment**	
Theory	**Lab.**	**Tutorial**	**Total hours**	**Continuous**	**End semester**
3	-	-	3	Yes	Yes

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 typestyle 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.
5. Hydro-Dynamic Torque Converter: Principle of torque conversion, velocity diagram for single - stage torque converter. Single stage and multi -stage torque convectors, characteristics curves. General description of working of automatic transmission.
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

1. Steeds, Wiliffe & Sons, Mechanicsa of Road Vehicles, London 1960.
2. Mechanics of Automobiles, Barnacle Pergaman Press, 1964.
3. Judge, Modern Motor Enginee r, Asia Publisity Mart Vol.I & V, 1962.
4. Newton & Steeds, Motor Vehicle, ELBS, London, 1972.
5. Giles, J.G., Engine Design, ILIFEE, London, 1969.
6. Giles, J.G., Engine Design, ILIFFE, London, 1968.

ME 666 Cryogenic engineering (Elective-3)					
Total no. of contact hours/week				Course Assessment	
Theory	**Lab.**	**Tutorial**	**Total hours**	**Continuous**	**End semester**
3	-	-	3	Yes	Yes

Syllabus

1. Introduction and application.
2. Cryogenics Fluids: Properties of Air, Oxygen, Nitrogen, Hydrogen, Helium and its isotopes.
3. Cryogenics Refrigeration Systems : Recuperative & Regenerative Cycles, Joule Thomson cycle ; Gifford - Mach Mohan cycle, stirling cycle, Pulse Tube refrigeration, Magneto caloric refrigeration, vuilleumier refrigerator.
4. Gas liquefaction systems : Ideal systems, Linde, Linde Dual Pressure System, Claude Heylandt, Kapitza systems, Cascade cycle.
5. Cryogenic Insulation : Vacuum insulation, Multilayer insulation (MLI), Methods of measuring effective thermal conductivity of MLI, liquid & vapor shield, evacuated porous insulation, Gas filled powders and fibrous materials, Solid foams.
6. Cryogenic Instrumentation: Peculiarities of cryogenic strain measurement, pressure, flow, density, temperature and liquid level measurement for cryogenic application.
7. Purification and separation of Gases, Liquefied Natural Gas : Principles of gas separation : separation by condensation & flashing, separation by Distillation. Air separation system: Linde single column system. Lindedoubl e - column systems etc, Liquefaction of Natural Gas.
8. Storage & handling Systems: Dewar vessel design, piping, support systems, vessel safety devices and storage systems, Industrial storage systems.
9. Transfer Systems: Transfer from storage, un -insulated transfer lines, insulated lines, transfer system components.
10. Properties and selection of Materials: Study of material properties & their selection for cryogenic application.
11. Vacuum Systems, Cryo. Pumping.
12. Equipment’s for Law-Temperature Systems: Heat Exchang ers, Compressor, Expanders.
13. Laboratory Demonstration.

Reference Books

1. Hastlden, C. Cryogenic Fundamentals, Academic Press, 1970.
2. Barron, R. , Cryogenic Systems, Plenum Press, 1966.
3. Walker, Cryocoolers Vol. 1 & 2, Plenum Press, 1980.
4. Mikulin, Y., Theory and Design of Cryogenic systems, MIR Publication, 1985.

ME 672 Design of pumps and Compressors (Elective-3)					
Total no. of contact hours/week				**Course Assessment**	
Theory	**Lab.**	**Tutorial**	**Total hours**	**Continuous**	**End semester**
3	-	-	3	Yes	Yes

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

1. Kovats, A., Design and Performance of Centrifugal and A xial Flow Pumps and Compressors, Pergamon.
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)					
Total no. of contact hours/week				**Course Assessment**	
Theory	**Lab.**	**Tutorial**	**Total hours**	**Continuous**	**End semester**
3	-	-	3	Yes	Yes

Syllabus

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

Reference Books

1. HMT, Mechatronics, Tata McGraw Hill, 1998.
2. Mehta, N.K., Machine Tool Design, Tata McGraw Hill, 1996.
3. Basu, S.K., Pal D.K., Design of Machine Tools, Oxford & IBH publishing Co., 1983.
4. Sen, G.C., A. Bhattacharya, Principles of Machine Tools, New Central Book Agencies, 1971.

ME 676 Design of Material Handling Equipments (Elective-3)					
Total no. of contact hours/week				**Course Assessment**	
Theory	**Lab.**	**Tutorial**	**Total hours**	**Continuous**	**End semester**
3	-	-	3	Yes	Yes

Syllabus

- **MATERIALS HANDLING EQUIPMENT** **(2 Hours)**

  Types, Selection and applications.

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

  Design of hoisting elements: Welded and roller chains - Hemp and wire ropes - Design of ropes, pulleys, Pulley systems, Sprockets and drums, Load handling attachments. Design of forged hooks and eye hooks, Crane grabs, Lifting magnets, Grabbing attachments, Design of arresting gear, Brakes: shoe, Band and cone types.

- **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

1. ASME, Materials Handling Handbook, Wiley -Interscience, 1985.
2. Spivakovsy, A.O. and Dyachkov, V.K., Conveying Machines, Volumes I and II, MI Publishers, 1985.
3. Alexandrov, M., Materials Handling Equipments, MIR Publishers, 1981.
4. Tech. P.S.G., Design Data Book", Kalaikathir Achchagam, Coimbatore, 2003.
5. Chary, S. N, Production and Operations Management, Tata McGraw Hill, New Delhi 2004.

ME 678 Applied Fluid Power Engineering (Elective-3)					
Total no. of contact hours/week				**Course Assessment**	
Theory	**Lab.**	**Tutorial**	**Total hours**	**Continuous**	**End semester**
3	-	-	3	Yes	Yes

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,
3. Andrew, Parr, Hydraulics and Pneumatics, Jlaico Pub. Co. 1994.
4. Turnbull, O.E., Fluid Power Engineering, Newness -Butterworth, 1976.

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.