



NATIONAL INSTITUTE OF TECHNOLOGY, MIZORAM
 (An Institute of National Importance under Ministry of HRD, Govt. of India)
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DEPARTMENT OF MECHANICAL ENGINEERING

6th Semester:

SL.No	Course code	Subject	Teaching Scheme			Credits
			L	T	P	
Theory						
1.	MEL1601	Internal Combustion Engine	3	0	0	3
2.	MEL1602	Computer Aided Design and Manufacturing	3	0	0	3
3.	MEL1603	Turbo Machinery	2	1	0	3
4.	MEL1604	Engineering Inspection & Quality Control	3	0	0	3
5.	MEL1605	Machine Design- II	2	1	0	3
6.	HUL1601	Macroeconomics & Business Environment	3	0	0	3
Practical						
7.	MEP1601	Thermal Laboratory- II	0	0	2	1
8.	MEP1602	Industrial Training Viva	0	0	2	1
Total						20

MEL1601: Internal Combustion Engine

1. Course Description:

Internal Combustion Engine introduces you to the concept of Engine Classifications, Review of Air Standard Cycles, Actual Cycle Analysis, Two and Four Stroke SI and CI Engines, Valve Timing Diagram for Two and Four Stroke Engine At Low and High Speed. Important Qualities of SI and CI Engine Fuels, Rating of SI Engine and CI Engine Fuels, Dopes, Additives, Concept of Gaseous Fuels, Alternative Fuels and Bio Diesel, Calculation of Performance Parameters, Emission Control Devices and Norms Like Euro and Bharat Norms. Combustion Details of SI Engine, Stages of Combustion, Flame Speed, Ignition Delay, Abnormal Combustion and Its Control, Types of Combustion Chamber, Carburetor, Fuel Injection System and Their Components, MPFI. Combustion Details of CI Engines, Stages of Combustion, Ignition Delay, Knock, Abnormal Combustion, Types of Combustion Chamber, Fuel Injection System of CI Engines and Their Components, Injection Timings. Basic Concepts and Their Applications Types of Supercharging Methods, Supercharger and Turbocharger, Calculation of Supercharger. Basic Concepts of Advanced Engines.

2. Learning Outcome:

On completion of the course, the students will be able to:

- Explain the various types of chassis, frame and functions of IC engine parts.
- Describe the engine auxiliary system used in SI and CI engine.
- Distinguish between the manual transmission systems with automatic transmission systems.
- Know about Gas Turbine and Jet Propulsion system
- Justify the importance of alternative fuels.

3. Broad Course Outline:

- Introduction
- SI Engines
- CI Engine
- Gas Turbine and Jet Propulsion

4. Text & Reference Books:

- Ganeshan: I. C. Engines: TMH, 4/e
- Heywood: Internal Combustion Engine Fundamental: TMH, 1/e
- W. W. Pulkrabek: Engineering Fundamentals of I. C. Engines
- M. L. Sharma & R.P. Sharma: A course in I. C. Engines

MEL1602: Computer Aided Design and Manufacturing

1. Course Description:

Computer Aided Design and Manufacturing introduces you to the concept of CAD/CAM, need of CAD/CAM, product cycle, automation in CAD/CAM and CAD/CAM integration. Computer graphics, principles of geometric modeling, transformations, wire frame, surface and solid modeling, Rapid Prototyping and tooling. Introduction, part families, parts classification and coding systems, GT machine cells, benefits of GT. Basic concepts of process planning, computer aided process planning (CAPP), Retrieval or variant and generative approach of CAPP, Implementation consideration of CAPP. Principles of Numerical control (NC), Computer Numerical control (CNC), Direct Numerical control (DNC), comparison between conventional and CNC systems, Classification of CNC system, NC coordinate system, positional control, system devices, interpolators, adaptive control system. Concept, format, preparatory and miscellaneous codes, manual part programming, APT programming. Introduction to flexible manufacturing system (FMS), the manufacturing cell, tool management and work piece handling system, transfer lines, types and application of industrial robots, end effectors and grippers of robots, types of manufacturing systems, components of computer integrated manufacturing (CIM), hierarchical computer system, benefits of CIM.

2. Learning Outcome:

On completion of the course, the students will be able to:

- Analyse and design real world components
- Understand basics of Computer Graphics for development of CAD models
- develop different types of surfaces with the help of different curves
- Suggest whether the given component is safe or not for the applied loading conditions
- Select suitable manufacturing method for different mechanical components using CAM software.
- Implement proper Rapid Prototyping methods for designing particular components
- Select the proper automation and robotic structure for particular system
- Do Design, Analysis and Manufacture of different components using
- different CAD, CAM, and CAE softwares

3. Broad Course Outline:

- Introduction
- Group Technology (GT)
- Process Planning
- Numerical Control of Machine Tools
- NC Part Programming
- FMS and CIM

4. Text & Reference Books:

- Mehta: Machine Tools Design and Numerical Control: McGraw-Hill, 3/e,
- Yoram Koren: Computer control of manufacturing system: Mc Graw Hill Book Co.
- B. L. Jones: Computer Numerical Control: John Wiley and Sons.
- Chen and Lin: Computer Numerical Control: Glory Educational Resource Inc.
- Rao, Tiwari and Kunda: Computer Aided Manufacturing: Tata Mc Graw Hill
- Groover and Zimmer: CAD/CAM: PHI
- Groover: Automation, Production Systems and Computer Integrated Manufacturing: PHI
- Chang, Wysk and wang: Computer Aided Manufacturing: PHI

MEL1603: Turbo Machinery

1. Course Description:

Turbo Machinery introduces you to the concept of Turbo Machines. Classification of Turbo Machines. Second Law of Thermo Dynamics - Turbine/Compressor Work, Nozzle/Diffuser Work. Fluid Equations - Continuity, Euler's, Bernoulli's Equation and Its Applications. Vane Congruent Flow, Influence of Relative Circulation, Thickness of Vanes, Number of Vanes on Velocity Triangles, Slip Factor, Stodola, Stanitz and Balje's Slip Factor. Suction Pressure and Net Positive Suction Head. Axial, Radial and Mixed Flow Machines. Similarity Laws. Principles of Axial Fan and Propeller. Application of Fans for Air Circulation and Ventilation. Stage Pressure Rise and Work Done. Slip Stream and Blade Element Theory for Propellers. Performance and Characteristics of Axial Fans. Vector Diagrams, Work Done Factor, Temp and Pressure Ratio, Degree of Reaction, Dimensional Analysis, Characteristics, Surging, Polytrophic and Isentropic Efficiencies. Stage Velocity Triangles, Specific Work. Forward, Radial and Backward Swept Vanes. Enthalpy Entropy Diagram, Degree of Reaction, Slip Factor, Efficiency. Vane Less and Vaned Diffuser Systems, Volute As Spiral Casing. Surge and Stall in Compressors. Axial Turbine Stages, Stage Velocity Triangles, Work, Efficiency, Blade Loading, Flow Coefficient. Single Stage Impulse and Reaction Turbines: Degree of Reaction, 50% Reaction Turbine Stage, Radial Equilibrium and Actuator Disc Approach, Partial Admission Problems in Turbines. Losses in Turbo Machines.

2. Learning Outcome:

On completion of the course, the students will be able to:

- Understand the concept of conversion of available energy in to useful form.
- Understand the concept of Turbo Machines and to study turbines for utilizes kinetic water energy.
- Learn types and applications of Reaction Water Turbine.
- Learn the types, applications and classification of Steam Turbines.

- Understand the concept of power absorbing devices and detail understanding of Centrifugal Pump. (Incompressible Fluids)
- Understand power absorbing devices for compressible fluids–Centrifugal Compressors.
- Learn Axial Flow Compressors.

3. Broad Course Outline:

- Introduction
- Flow Through Axial Flow Fans
- Axial Flow Compressors
- Flow Through Centrifugal Compressors
- Axial Turbine

4. Text & Reference Books:

- Ganesan: Gas Turbine: McGraw-Hill Education, 3/e
- S.M. Yahya, Satyaprakashana: Turbines, Compressors and Fans: Publishers, New Delhi, 4/e
- R. Yadav: Steam & Gas Turbine and Power Plant Engineering: Central Pub. House
- R. K. Bansal: A Test Book of Fluid Mechanics and Hydraulic Machines: Laxmi Pub.
- Earl Logan: Turbomachinery: Jr. Marcel Dekker Inc.
- S. L. Dixon: Fluid Mechanics and Thermodynamics of Turbomachinery: Butterworth-Heinemann

MEL1604: Engineering Inspection & Quality Control

1. Course Description:

Engineering Inspection & Quality Control introduces you to the concept of Types of interchangeability, limit gauge, Taylor's gauging principle, design of inspection gauges. Surface textures, numerical assessment of surface texture, use of stylus type instruments, measurement of gear elements, gear errors, measurement of thread elements, thread errors. Mechanical, optical, optical mechanical comparators, pneumatic comparator, Optical principles of measurement, toolmaker's microscope, Interferometer. Introduction and definitions of quality, Evolution of Quality: Inspection, Quality Control Customer-Oriented: Internal & External Customer Concept, Life cycle approach to quality costs-Prevention; Appraisal and Failure costs. Seven QC tools (Histogram, Check sheets, Ishikawa diagrams, Pareto, Scatter diagrams, Control charts). Process capability concepts.

2. Learning Outcome:

On completion of the course, the students will be able to:

- Apply knowledge of various tools and techniques used to determine geometry and dimensions of components in engineering applications and used quality tools to produce quality product.
- Design gauges to meet desired needs within realistic constraints.
- Gain understanding of Quality Control Techniques and its applications in engineering industries
- Solve quality control problem using statistical method
- Understand the quality system and the need for a quality system.

3. Broad Course Outline:

- Interchangeable system of manufacture
- Surface inspection
- Measuring Instruments
- Quality

4. Text & Reference Books:

- Bewoor: Metrology & Measurement: McGraw-Hill Publishers
- Gupta: Total Quality Management: McGraw-Hill Publisher, 2/e
- Mahajan: A text book of metrology: Dhanpat Rai and Co.
- Halpern: The assurance sciences: Prentice hall of India private limited

MEL1605: Machine Design-II

1. Course Description:

Machine Design-II introduces you to the concept of Introduction, Mechanics of belt drive, Belt Materials, Selection of a pulley, Design of Flat belts, Design of V-belts. Application and classification of springs, Stress in coil springs of round, square and rectangular wires, Deflection of coil springs, Design of compression and tension springs, Coil spring subjected to impact and fluctuating loads, Material for coil springs. Positive and frictional clutches, Plate friction or disc clutches, Cone clutches; Block brakes, Band brakes, Disc brakes. Spur gears – Nomenclature, Interference in Involute gears, Beam strength of Spur tooth; velocity factor, Barth's formula, working stresses in gear teeth, dynamic loads on gear teeth, design of spur gear for wear (Buckingham equation). Helical gears – Nomenclature, Virtual number of teeth, Tooth Properties, Force Analysis. Beam strength, Dynamic loading, Wear strength. Type of bearings, Selection of bearing, Theory of lubrication, Heat balance of bearing, Mechanical aspects of bearing design. Load and life of bearings, Equivalent bearing load, Load- life relations.

2. Learning Outcome:

On completion of the course, the students will be able to:

- Understand the mechanics of belt drive
- Know about belt material
- Know about application and classification of springs
- Know about gears, parts of gears
- Know about types of springs, theory of lubrication

3. Broad Course Outline:

- Belt Drive
- Springs
- Clutches & Brakes:
- Gears
- Bearing

4. Text & Reference Books:

- Bhandari: Design of Machine Elements: McGraw-Hill Publishers, 2/e
- Shigley: Mechanical Engineering Design: McGraw Hill Publishers, 9/e
- Bhandari, V. B: Introduction to Machine Design: McGraw Hill Publishers, 3/e,
- R. S. Khurmi & J. K. Gupta: Machine Design: S. Chand & Co
- Sharma & Agarwal: Machine Design: S.K. Kataria & Sons
- Kannaiah: P Machine Design: SCITECH Publications
- Mahadevan K, Reddy KB: Design Data Handbook: CBS, New Delhi
- Spotts: Design of Machine Members: Prentice Hall Publishers

MEP1601: Thermal Laboratory-I

Laboratory work based on the subject MEL1601.

MEP1602: Industrial Training Viva

The Student will submit one training report, certificate of training and power point presentation to the Department before end semester examination.