



राष्ट्रीय प्रौद्योगिकी संस्थान, मिजोरम  
**NATIONAL INSTITUTE OF TECHNOLOGY, MIZORAM**  
(An Institute of National Importance under Ministry of HRD, Govt. of India)  
CHALTLANG, AIZAWL, MIZORAM - 796012

Phone/Fax: 0389-2341699 / 0389-2341236 / 0389-2341774

Email: nit\_mizoram@nitmz.ac.in

**DEPARTMENT OF MECHANICAL ENGINEERING**

**6<sup>th</sup> Semester:**

SL.No	Course code	Course Title	L-T-P	Credits
1.	MEL1628	Energy conversation	3-0-0	6
2.	MEL1629	Machine Design - II	3-1-0	8
3.	MEL1630	Manufacturing Process - II	3-0-0	6
4.	MEL1631	I.C. Engine	3-0-0	6
5.	MEL1632	Turbomachine	3-0-0	6
6.	MEP1633	Energy conversation Laboratory	0-0-3	3
7.	MEP1634	I.C. Engine Laboratory	0-0-3	3
8.	MEP1635	Turbomachine Laboratory	0-0-3	3
9.	MEP1636	Manufacturing Laboratory	0-0-3	3

Course code	Course Title	Semester	L-T-P	Credits
MEL1628	Energy Conversation	6 <sup>th</sup>	3-0-0	6

**Fossil Fuel Steam Generator:** Typical Layout of Steam Power Plant, Basic Types of Steam Generators, Fire-Tube Boilers, Water-Tube Boilers, Circulation in water tube boilers, Boiler mounting and accessories, Natural and Mechanical Draught Systems. Boiler efficiency, Factor affecting boiler efficiency, Boiler Trail, Boiler Balance.

**Fuel and Combustion:** Combustion Equipment for Burning Coal, Fuel Bed Combustion, Mechanical Stokers, Pulverized Coal Firing System, Cyclone Furnace, Fluidized Bed Combustion, Coal Gasifiers, Combined Gas Oil Burners.

**Steam nozzle:** Types of nozzles and their area of application & related calculation, Critical pressure & choked flow, Super saturated flow. Effect of friction and nozzle efficiency.

**Turbine:** Turbine types, Variation of Pressure and Velocity in different types of turbines, Simple impulse Turbines, Pressure - compounded impulse turbines and Velocity compounded impulse turbines. Turbine power and related calculations. Reaction turbines with power and related calculations with different degrees of reaction, Blade height calculations. Variation of blade velocity along blade height, Losses in steam turbines, Reheat factor & condition line, Governing of turbines.

**Condensate Feedwater system:** Need of a Condenser, Direct Contact Condensers, Surface Condensers, Performance calculation, Air removal methods, Vacuum & vacuum efficiency, Feed water Heaters,

**Circulating Water System:** Introduction, System classification, Circulating Water System, Cooling Towers, Cooling Towers Calculations.

**Books:-**

SL.No	Name of the book	Author	Publication
1	Principle of Energy Conversion	A.W. Culp	McGraw hill international.
2	Power Plant Technology	M.M. El Wakil	Tata McGraw Hill.
3	Power Plant Engineering	P.K. Nag	Tata McGraw Hill.

Course code	Course Title	Semester	L-T-P	Credits
MEL1629	Machine Design-II	6 <sup>th</sup>	3-1-0	8

**Threaded Fasteners and Power Screws:** Stresses in bolts, Effect of initial tension, Bolts under dynamic and impact loading, Eccentric loading, Power screws, Form of threads, Force analysis, Screw and nut design, Differential and compound screws. Stresses in power screws.

**Belt Drive:** Introduction, Mechanics of belt drive, Belt Materials, Selection of a pulley, Design of Flat belts, Design of V-belts.

**Springs:** 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, Critical frequency, Energy stored in springs.

**Clutches:** Positive and frictional clutches, Plate friction or disc clutches, Cone clutches.

**Brake:** Block brakes, Band brakes, Disc brakes (internal expanding and external contacting shoe).

**Gears:** Spur gears – Nomenclature, Interference in Involute gears, Beam strength of Spur tooth, Lewis equation and Lewis form factor, 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.

**Bearing:** 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.

**Books:-**

SL.No	Name of the book	Author	Publication
1	Design Of Machine Members	Spotts et.al.	Prentice Hall Publishers.
2	Mechanical Engineering Design	Shigley et.al.	McGraw hill international.
3	Introduction to Machine Design	Bhandari V.B et.al.	Tata McGraw Hill.

Course code	Course Title	Semester	L-T-P	Credits
MEL1630	Manufacturing Process-II	6 <sup>th</sup>	3-0-0	6

**Introduction:** Introduction to machine tools, motions of machine tools, generation of surfaces, types of machine tools, basic elements of machine tools.

**Mechanics of Machining (Metal Cutting):** Geometry of single point cutting tools, Conversion of tool angles from one system to another, Mechanism of chip formation, Orthogonal and oblique cutting, Use of chip breaker in machining, Machining forces and Merchant's Circle Diagram (MCD), Taylor's Tool Life Equations

**Lathe:** Principle, classification, specifications, operations performed on a lathe. Calculation for machining time, Machining parameters & performance.

**Capstan and Turret Lathes:** Introduction, comparison among Capstan, Turret and Engine lathe, Turret indexing mechanism, Feeding mechanism, cutting tools and tool holders, Turret tooling layout.

**Shaper:** Principle, classification, specifications, shaper mechanisms – crank and slotted lever quick return mechanism, feed mechanism, operations performed on shaper – machining horizontal, vertical, angular surfaces, cutting slots, grooves, key ways, machining irregular surfaces, splines and gears. Cutting speed, feed, depth of cut and calculation for machining time for shaping operations.

**Planer:** Principle, classification, specifications, comparison between shaper and planer.

**Milling machine:** Principle, classification, specifications, peripheral milling, up and down milling, face milling, end milling, different operations performed on milling machines, dividing heads, methods of indexing – direct, simple, compound and differential indexing, milling of spur gear, milling cutters.

**Drilling machine:** Principle, classification, specifications, operations performed on drilling machines, twist drill nomenclature.

**Grinding machines:** Principle, classification, specifications, different grinding processes, grinding wheel – components (wheel material), grit, grade and structure, standard marking system of grinding wheels. Glazing and loading in wheels, dressing, truing, balancing, and mounting of grinding wheels

**Books:-**

SL.No	Name of the book	Author	Publication
1	DeGarmo's materials & Processes in Manufacturing	J.T Black et.al.	Wiley India Pvt Ltd.
2	Elements of Workshop Technology (Volume - 2)	A. K. Hajra et.al.	MPP Pvt Ltd.
3	Manufacturing science	Ghosh and Mallik	Tata McGraw Hill.

Course code	Course Title	Semester	L-T-P	Credits
MEL1631	I.C. Engine	6 <sup>th</sup>	3-0-0	6

**Introduction:** Basic design components and nomenclature, Review of Classifications of I.C. engines, working principles of engines, comparison of S.I. and C.I. engine, comparison of two stroke and four stroke cycle engine, engine performance parameters.

**Engine Cycle:** Review of Carnot cycle, Otto cycle, Diesel cycle, Limited pressure cycle, Brayton cycle, Stirling cycle, and other cycles.

**Fuel air and Actual cycle:** Significance of Fuel Air Cycles, Effect of operating variables, Actual cycles, various losses in actual cycles, Fuels- important qualities of engine fuels.

**Carburetor:** Factors affecting carburetion, Air-fuel mixtures, the simple carburetor, Essential parts of modern carburetors, working of various carburetors.

**Injection and Ignition:** Air injection system, Solid injection system, Common rail system, Injection pump, Nozzle, Quantity of fuel and size of nozzle orifice, Injection in S.I. engine, Battery ignition system, Spark plug, Magneto ignition system, Modern ignition systems, Ignition timing and ignition parameters.

**Combustion:** Stages of combustion in S.I. engines, Combustion chambers for S.I. engines, Combustion in C.I. engines, Stages of combustion in C.I. engines, Phenomenon of knock in S.I. and C.I. engines.

**Lubrication:** Lubrication of engine components, Lubrication system, Wet sump and dry lubrication, Properties of lubricants.

**Engine Test:** William`s line method, Morse test, Motoring test, Retardation test, Prony brake, Rope brake, Hydraulic dynamometer, Emission, Fuel consumption, Volumetric type flow meter, Fuel consumption and air consumption measurements, Performance parameters and characteristic, Air pollution due to I.C. engines.

**Books:-**

SL.No	Name of the book	Author	Publication
1	Internal Combustion Engines: Applied Thermo sciences	C. R. Ferguson et.al.	Wiley India Pvt Ltd.
2	Engineering Fundamentals of I. C. Engines	W.W. Pulkrabek	Prentice Hall Publishers.
3	Internal Combustion Engine Fundamental	J.H. Heywood	Tata McGraw Hill.

Course code	Course Title	Semester	L-T-P	Credits
MEL1632	Turbo Machine	6 <sup>th</sup>	3-0-0	6

**Introduction:** Type of Turbo machine, compressible and incompressible flow Turbomachine, thermodynamic relations, energy transfer in Turbomachine, Euler's equation.

**Propulsion systems:** Various types of propulsion devices, turbojet, turboprop and Ram jet engine, thrust power, propulsion efficiency, overall efficiency, effect of altitude, thrust augmentation, rocket propulsion, liquid propellant and solid propellant rocket engines, uses of rocket propulsion devices.

**Centrifugal compressor:** Basic components, working principle, velocity triangle, enthalpy-entropy diagram, slip, power input factor, compressor efficiency, pressure coefficient, flow coefficient, degree of reaction, pre-whirl, effect of impeller blade shape on performance, vaned and vaneless diffuser, phenomenon of surging and choking.

**Axial compressor:** Basic components, principle of working, velocity triangle, enthalpy- entropy diagram, work done factor, degree of reaction, polytropic efficiency, pressure coefficient, flow coefficient, compressor stalling.

**Axial and radial flow turbines:** Enthalpy-entropy diagram, turbine and nozzle efficiencies, blade speed ratio, velocity ratio and torque, velocity compounded turbine, reaction turbine, reheat factor, working principle of radial flow turbine, comparison of turbine types.

**Gas turbine blade materials:** Different blade materials for gas turbine, factors influencing the selection of blade materials, cooling of blades, different types of cooling.

**Books:-**

SL.No	Name of the book	Author	Publication
1	Gas turbine theory	H. Rogers	Pearson Publication.
2	Gas Turbine	Ganeshan	Tata McGraw Hill.
3	Turbine, Compressors and Fans	S.M. Yahya	Tata McGraw Hill.