



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

Course Code	Course Title	Contact Hrs. / Week			Credit
		L	T	P	
Theory					
TIUSD-601	Career Advancement & Skill Development-VI	2	1	0	3
TIUME-601	Dynamics of Machines	2	1	0	3
TIUME-602	Machine Design-I	3	1	0	4
TIUME-603	Internal Combustion Engines	2	1	0	3
TIUME-604	Machining Technology and Metrology	2	1	0	3
TIUME-605	Fluid Machinery-II	2	1	0	3
Practical					
TIUME-691	Dynamics of Machines Laboratory	0	0	3	2
TIUME-692	IC Engine Laboratory	0	0	3	2
TIUME-693	Machine Design Practice	0	0	3	2
Sessional					
TIUCSL-681	Entrepreneurship Skill Development-VI	0	0	3	2
Total Credits					27

Approved By:
External Expert

VC

Registrar

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Syllabus

Dynamics of Machines

TIUME-602

L-T-P: 2-1-0

Credit: 3

Force analysis of slider crank mechanism, Turning Moment Diagrams and flywheel.

Balancing of rotating masses, Balancing of Reciprocating masses. Applications to balancing of inline, V and radial engines.

Introduction to Kinetics of Mechanisms.

Review of SDOF theory - free undamped, free damped, forced vibration, detailed engineering applications inclusive of Transmissibility, rotor vibration, principles of vibration measurement etc.

Transient and Non harmonic vibration of SDOF systems.

Introduction to random vibration of SDOF systems. Preliminary treatment of MDOF systems - natural frequency and mode shape, harmonic excitation and applications inclusive of vibration absorption.

Approx. methods - Dunkerly & Rayleigh.

Recommended books

1. Theory of Machines by Sadhu Singh, Pearson Education.
2. Theory of Machines by V.P. Singh, Dhanpat Rai Publishing.
3. Theory of Machines by S.S. Rattan, McGraw Hill Education (India) Private Limited.
4. Fundamentals of Vibrations by Leonard Meirovitch, Waveland Press.



Machine Design-I

TIUME-603

L-T-P: 3-1-0

Credit: 4

Introduction to design: Design philosophy, Optimised design, Modes of failure, Review of stress calculation in various situations - axial, bending, torsion loads and combined effect, stress concentration, Factor of safety, Theories of failure and choice of failure theory of design.

Manufacturing aspects of design: Manufacturing processes (casting, forming, machining, welding etc.) Fit and tolerance, surface roughness.

Design of shaft – FOS, ASME Code /IS Code Design, strength and rigidity (Axial bending, torsion & combined loading), Effect of keyway and splined, stepped shaft.

Endurance diagram and Design criteria: Design for fatigue life, Cumulative fatigue damage, Strain life equation.

Design of pin-joints – Cotter / Knuckle & Universal joint

Screw joints / bolted joints, Transmission screws, Riveted joints, Welded joints.

Helical springs: Extension and compression spring, spring material, set removal. Design for static and dynamic loading, Failure diagram, Factor of safety, problems. Critical frequency of helical spring, surge and governing equation. Leaf spring: Multi leaf spring, graduated leaf spring, load- deflection equation, nipping, preloading, problems.

Recommended Books:

1. Design of Machine Elements by V.B. Bhandari, McGraw Hill Education (India) Private Limited.
2. Mechanical Engineering Design by J.E. Shigley, C.R. Mischke, R.G. Budynas and K.J. Nisbett, McGraw Hill Education (India) Private Limited.
3. Design of Machine Elements by M.F. Spotts, L.E. Hornberger, T.E. Shoup, S.R. Jayaram and C.V. Venkatesh, Pearson India.
4. Machine Design: An Integrated Approach by R.L. Norton, Pearson India.
5. Machine Design by U.C. Jindal, Pearson India.
6. A Textbook of Machine Design by P.C. Sharma and D.K. Aggarwal by S.K. Kataria & Sons.

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Internal Combustion Engines

TIUME-604

L-T-P: 2-1-0

Credit: 3

Introduction: Principle of working, Basic Engine Types, Components of IC Engine etc.

Cycles: Analysis of air standard cycles (Otto, Diesel, Dual), fuel-air cycles and actual cycle. Availability aspects of cycles.

Fuels: Review of the family of hydrocarbon fuels, Classification of IC engine fuels, Desirable characteristics of SI & CI engine fuels, Rating of SI & CI engine fuels, Alternative fuels for SI and CI engine (liquid, gaseous, hydrogen, LPG, CNG, Biogas etc.), Air requirement, Analysis of combustion products, HHV and LHV of fuels.

Introduction to SI engine: Carburetion: Air-fuel ratio requirement, Working principle, Analysis of a simple carburettor, Defects of a simple carburettor and its remedy.

Gasoline injection: Mechanical & electronic fuel injection systems and their control.

Introduction to CI engine: Classification of diesel fuel injection systems, Working principle, Engine requirements, Injection pumps and nozzles.

Ignition: Battery, magneto and electronic ignition systems, Ignition timing and spark advance.

Combustion: Theories of normal and abnormal combustion in SI & CI engine, parameters influencing combustion, prevention of abnormal combustion in SI & CI engine. Types of combustion chamber & principle of combustion chamber design in SI & CI engine.

Supercharging and scavenging: Engine requirements, supercharging limits, turbocharging. Scavenging of two stroke SI & CI engine, scavenging parameters, ideal & actual scavenging processes, scavenging pumps.

Lubrication: Principles of lubrication, properties of lubricating oil, lubrication systems.

Cooling: Principles of cooling, air & water cooling systems.

Performance and Testing: Performance parameters and their measurement, different types of dynamometers, heat balance, performance characteristics, governing methods.

Pollutant Emission: Formation and control of pollutants.

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Recommended Books:

1. Internal Combustion Engines by V. Ganesan, Tata Mcgraw Hill Education Private Limited.
2. Internal Combustion Engines by M.L. Mathur and R.P. Sharma, Dhanpat Rai Publications.
3. Fundamentals of Internal Combustion Engines by H.N. Gupta, PHI Learning.
4. Engineering Fundamentals of the Internal Combustion Engine by W.W. Pulkrabek, PHI Learning.

Machining Technology and Metrology

TIUME-605

L-T-P: 2-1-0

Credit: 3

Machining: Machining principles, motions required and chief elements in machining; basic idea of machine tool; classification/ types of machine tools.

Basic machine tools: Lathe, shaping machine, planing machine, slotting machine, drilling machine, milling machine, broaching machine, and grinding machine- their important constructional features and mechanisms; basic and auxiliary motions, types, specifications and applications/ operations, including taper turning, thread cutting, gear cutting, helical milling etc.; estimation of machining time; job holding devices, indexing and elementary idea about jigs and fixtures; honing, lapping and super-finishing processes.

Preparation of process sheet.

Cutting tools: Materials of cutting tools, elementary idea of tool geometry, tool wear etc.

Introduction to the principles and applications of non-conventional machining processes; emerging areas in machining technology.

Surface quality: Waviness, roughness, surface integrity; influence of surface unevenness on performance of machined components.

Metrology: Machining accuracy, various types of error, the concepts of maximum attainable accuracy and economically feasible accuracy, the factors affecting accuracy; principles of measuring and gauging; accuracy, precision and sensitivity of measuring instruments; line and end standards of measurement; limits, fits and tolerances; plug and snap gauges; limit gauges- Taylor's principle; comparators; measurement of lengths, angles and tapers; optical flat- principle of use and applications; measurement of elements of threads and gears;

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coordinate measuring machine- an introduction; assessment of surface roughness- the various parameters and measurement principles; introduction to laser metrology.

Recommended Books:

1. Manufacturing Technology: Metal Cutting and Machine Tools by P.N. Rao, Tata Mcgraw Hill Education Private Limited.
2. Machine Tools by R. Kesavan and B. Vijaya Ramnath, Laxmi Publications.
3. Fundamentals of Metal Cutting and Machine Tools by B.L. Juneja, G.S. Sekhon and N. Seth, New Age International.
4. Metrology and Measurement by A.K. Bewoor and V.A. Kulkarni, McGraw Hill Education (India) Private Limited.
5. Engineering Metrology by R.K. Jain, Khanna Publishers.
6. Engineering Metrology and Measurements by N.V. Raghavendra and L. Krishnamurthy, Oxford University Press.

FLUID MACHINERY-II

TIUME-606

L-T-P: 2-1-0

Credit: 3

Miscellaneous Hydraulic Machinery and Devices: Fluid coupling and Torque converter – Working Principle.

Analysis of axial flow machines: Introduction to isolated aerofoil and cascade theory – C_L and C_D for blade design, blade nomenclature, degree of reaction, stalling.

Performance characteristics: Pumps and Fans – Radial, Mixed flow and Axial flow. Turbines – Francis, Kaplan and Pelton wheel-operating characteristics and Muschel curves, Governing of turbines.

Dimensional analysis for fluid machinery: Dimensionless quantities and their use in design, selection and testing.

Cavitation: NPSH, Thoma's cavitation parameter and specific speed.

Elements of pump and turbine systems: General description and functions-foot valves, NRV, Penstock, Draft tube, regulating valves etc., guide vanes and flow straightener.

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Interaction of pumps and turbines and systems: Series and Parallel operation of Pumps, Performance and selection of Pumps for different systems characteristics, Surging in Pipelines and method of control.

Introduction to sump design: Surface and sub-surface vortices, basic geometry and dimensions.

Unsteady flow: water hammer.

Recommended Books:

1. Hydraulic Machines by K. Subramanya, McGraw Hill Education (India) Private Limited.
2. Hydraulic Machines including Fluidics by J. Lal, Metropolitan Book Co.
3. Fluid Mechanics and Thermodynamics of Turbomachinery by S.L. Dixon, Elsevier India Pvt. Ltd.
4. A Treatise on Turbomachines by G.C. Gopalakrishnan, Scitech Publications.

Dynamics of Machines Laboratory

TIUME-691

L-T-P: 0-0-3

Credit: 2

Experiments to be conducted on Single DOF Vibratory Systems; Static and Dynamic balancing of rotating masses; Balancing of reciprocating masses; Governors; Gyroscope.

IC Engine Laboratory

TIUME-692

L-T-P: 0-0-3

Credit: 2

1. Study of IC engines.
2. Determination of valve timing diagram of a single cylinder CI Engine.
3. Performance test of single cylinder CI engines test rig.
4. Performance test of a variable compression ratio SI engine.
5. Performance test of an air compressor.

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6. Morse Test on four-cylinder four-stroke Petrol Engine.

Machine Design Practice

TIUME-693

L-T-P: 0-0-3

Credit: 2

Design calculation and drawings of the followings:

Assignment 1: Generation of geometric profiles of gears and cams.

Assignment 2: Dimensioning concept and detail drawing of machine components.

Assignment 3: Design and drawing of a gear box.

Assignment 4: Design and drawing of Brake or Clutch.

Assignment 5: Design of a pressure vessel/engine head (Mainly bolt joints).

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