

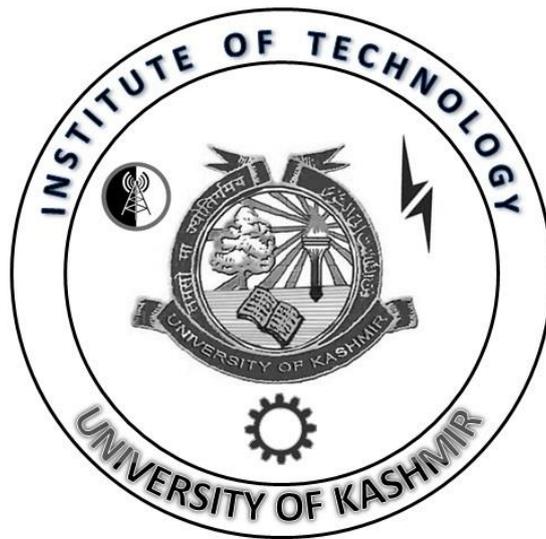
SYLLABUS

FOR

B.TECH. PROGRAMME

IN

MECHANICAL ENGINEERING



INSTITUTE OF TECHNOLOGY
ZAKURA CAMPUS
UNIVERSITY OF KASHMIR
SRINAGAR J&K, 190006

**COURSESTRUCTUREFOR
B.Tech6thSemesterMechanical
ATUNIVERSITYOFKASHMIR**

CourseCode	CourseTitle	Teaching Periods per week			Credits
		L	T	P	
MEE- 6117	Measurement and Instrumentation	3	1	0	4
MEE- 6217	Machine Design-II	3	1	0	4
MEE-6317	Fundamentals of Tribology	3	1	0	4
MEE-6417	Linear Optimization in Engineering	3	1	0	4
MEE-6517	Introduction to Mechatronics	3	1	0	4
MEE-6617	SEMINAR	0	0	6	3
MEE-6317L	Fundamentals of Tribology Lab.	0	0	2	1
MEE-6517L	Mechatronics-Lab.	0	0	2	1
	Total	15	5	10	25

MEE-6117

Measurement and Instrumentation

UNIT I

Measurement and instrumentation: definitions, significance, fundamental methods, generalized measurement system, functional elements, types of input quantities, standards, calibration, uncertainty, errors, classification of instruments, input-output configuration, interfering and modifying inputs, methods of correction, generalized performance characteristics, static characteristics, static calibration, dynamic characteristics, zero and first order instruments, time constant, second-order instruments, transient response characteristics, relative and absolute motion devices, relative displacement, resistive potentiometers, bridge circuit, LVDT, Variable inductance and variable capacitance pick-ups, piezoelectric transducers, fiber optic displacement transducer, resistance strain gage, relative velocity-translational and rotational, mechanical revolution counters and timers, stroboscopic method, moving coil and moving magnet pickups, DC and AC tachometers, eddy current drag-cup tachometer, acceleration measurement.

UNIT II

Hydraulic and pneumatic load cells: flapper nozzle principle, force transducers with elastic members, proving ring transducer, cantilever beam transducer, electromagnetic balance, dynamometers, absorption, driving and transmission type, reaction forces in shaft bearings, prony brake, eddy current brake dynamometer, instruments for high, mid and low pressure measurement, dead weight and null type, elastic element gages, differential pressure cell, high pressure measurement, low pressure measurement, Pirani gages & McLeod pressure gauge.

UNIT III

Orifice meters: venturimeter, pitot tube, flow nozzle, variable area meters, rotameter, design and accuracy, positive displacement flow meter, turbine flow meter, electromagnetic flow meter, ultrasonic flow meters, temperature sensing techniques, liquid-in-glass and bimetallic thermometers, pressure thermometers, electrical resistance thermometers, thermistors, thermocouples, thermopiles, radiation pyrometers, optical pyrometer.

Text Book:

1. Beckwith, B., "Mechanical Measurements", 6th edition, Pearson Education Int., 2008.

Reference Book:

1. Nakra B.C. "Instrumentation, Measurements & Analysis", 2nd edition, Tata McGraw Hill, N.Delhi, 2008.
2. Doebelin, E.O., "Measurement systems", 5th edition, McGraw Hill, New Delhi, 2004.

MEE-6217

Machine Design-II

UNIT-I

Design of friction elements: Various types of brakes, design equations for various types of brakes, design analysis of all types of brakes, e.g., band brake, long shoe brake, etc, design analysis of all types of clutches, design of shafts, etc, design and analysis of flat and V-belt, equations for power, slip, etc, design of chain drive.

UNIT II

Introduction to gear design: Design of spur gear, equation for σ_b and σ_c for spur gear, design analysis for bending, force analysis for helical gear, design analysis for helical gear, design of bevel gear, determination of bearing forces, horizontal and vertical shafts, design analysis for bevel gear, design analysis for worm gear.

UNIT III

Introduction to plain bearings: Design of hydrodynamic bearings, derivation of Reynolds equation for three dimensional case, journal bearing geometry, variation of viscosity with pressure and temperature, viscosity index, Sommerfeld number, analysis of h_o , h_{min} , Q_{in} , Q_{loss} , T_{in} , T_{out} , introduction to rolling element bearings, design of AFB, equations for L_{10} life, static loading and dynamic loading, use of AFB catalogue, determination of load based on radial and thrust load for ball bearings.

Text Books:

1. Mot, R.L., "Machine Elements in Mechanical Design", *Maxwell Macmillan Intl. edition* N.York, USA, 1992. Shigley, J.E.,
2. "Machine Engineering Design", *McGraw Hill, higher education*, 2004.

Reference Books:

1. Shigley, J.E., Mischke, C. Brown T., "Standard Hand book of Machine Design" *McGraw Hill*.

MEE-6317

Fundamentals of Tribology

UNIT I

Introduction to tribology: Tribology in Industry, energy saving through tribology, engineering surfaces and interaction between surface, production of engineering surface, surface roughness, rms value, average value and ten point average of surface roughness, development of engineering surface and measurement of surface roughness, tribology in industry, losses due to friction and wear in industry, tribo-elements and a systems concept in tribology, introduction to friction static and dynamic friction analysis, DaVinci concept of friction, Amonton's laws of friction, Coulomb's laws of friction, Bowden and Tabor concept of friction.

UNIT II

Wear and types of wear: Adhesive wear and its mathematical model, two body abrasive wear, three body abrasive wear, abrasive wear and its mathematical model, corrosive wear model, erosive wear model, cavitation wear, scuffing wear, delimitation wear, pitting wear, wear coefficient and wear measurement, wear measurement through pin-on-disc machine, pin-on-ring, profilometer, wear coefficient of various materials.

UNIT III

Lubricants: Types of lubricants, physical adsorption, chemisorption, self lubrication properties of materials, solid lubrication, lubrication in space, food industry, etc, high temperature lubrication, hydrodynamic lubrication, various components of Reynolds equation, Sommerfeld number and its use in hydrodynamic lubrication, materials for tribological applications.

Text Books:

1. Czichos, H., "A system approach to science and Technology of Friction, Lubrication and Wear" Volume I, Tribology series, Elsevier Publications, 1978.
2. Glaeser, J " Materials for Tribology", Tribology series Vol. 20, Elsevier Publications, 1992.

Reference Books:

1. Peterson M.B., Winner W.O, "Wear control Handbook" sponsored by *The Research Committee on Lubrication, Publisher, , 1980.*
2. Cameron A., "The principles of Lubrication", *Longman, London, 2000*

MEE-6417

Linear Optimization in Engineering

UNIT I

Overview of operations research (OR): OR methodology and techniques, introduction to linear programming (LP), application of LP techniques in production management, graphical solutions, the simplex method, duality and sensitivity analysis, transportation model problems and their variants, assignment model problems.

UNIT II

Project planning and scheduling: CPM & PERT, Project crashing and resource allocation problems, decision theory, steps in decision making, decision making under uncertainty and under risk, marginal analysis, decision trees.

UNIT III

Flow shop scheduling: Job shop scheduling, queuing theory and their applications, waiting line models and their applications, introduction and basic concepts of simulation.

Text Book:

1. Taha, H.A., "Operation Research- an Introduction", *6th edition, Prentice Hall of India, New Delhi, 2000.*

Reference Books:

1. Joseph Ecker, Michael K, "Introduction to Operations Research" *John Wiley & Son, 1998.*
2. Hillier & Lieberman, "Introduction to Operations Research", *Mc-GrawHill, Singapore, 2001.*
3. Gupta M.P, Khanna R.B., "Quantitative Techniques for Decision Making", *Prentice Hall of India, New Delhi, 2008.*

MEE-6517

Introduction to Mechatronics

UNIT I

Introduction to mechatronics: Mechatronic design approach, system interfacing, instrumentation and control systems microprocessor-based controllers and microelectronics, mechatronics; a new directions in nano, micro, and mini scale, electromechanical systems design, physical system modeling, electromechanical systems structures and materials, modeling of mechanical systems for mechatronics applications.

UNIT II

Sensors and actuators: Sensor and actuator characteristics, linear and rotational sensors, acceleration sensors, force measurement, torque and power measurement, flow measurement, temperature measurements, distance measuring and proximity sensors, light detection; image, and vision systems, integrated micro-sensors, actuators; electromechanical actuators, electrical machines, piezoelectric actuators; hydraulic and pneumatic actuation systems.

UNIT III

Role of controls in mechatronics: Role of modeling in mechatronics design, response of dynamic systems, introduction to computer and logic systems, logic concepts and design system interfaces, communication and computer networks, fault analysis in mechatronic systems, logic system design, programmable logic controllers, software and data acquisition.

Text Book:

1. Shetty D., Richard A.K., "Mechatronics system design", *Cengage learning*, 2011.

Reference Books:

1. Dan S.N., "Mechatronics" *Prentice Hall*, 2002. 2. "Micromechatronics

MEE-6617L

Fundamentals of Tribology Lab

Experiments to be conducted

Preparation of samples for friction and wear tests.

- Polishing
- Cleaning.

1. Microhardness measurement; Knoop and Vicker for metals, polymers and ceramics

- HV V/s load plots.
- HK V/s load Plots.
- Influence of indentation time.
- HV V/s indentation time
- HK V/s indentation time

2. Measurement of friction

3. Measurement of wear through weight loss, etc.

4. Plot of friction coefficient v/s load , and plot of wear volume v/s load

5. Calculation of wear coefficient for a metallic material.

6. Calculation of wear coefficient for ceramics.

7. Measurement of friction in presence of lubricant at room temperature.

8. Measurement of wear under lubricated conditions for metallic materials.

9. Influence of additives on friction and wear of metals.

MEE-6717L

Mechatronics Lab

Experiments to be conducted

1. Sensor/actuator - interfacing, calibration, frequency domain characterization, MATLAB serial interface, and serial LCD display
2. Design of electro-pneumatic circuits for L and square cycles using PLC's.
3. Sorting of components on an intelligent a conveyer system.
4. Modeling of DC motor System.
5. DC motor position tracking.
6. DC motor position set-point control via PID controller, using relay automatic tuning technique.
7. Dissection of an existing system.
8. Demonstration of recent projects on mechatronics.