

Haryana Engineering College, Jagadhri

Lesson Plan of M. Tech. Industrial & Production Engineering Deptt. 2nd Semester

Subject : Mechatronics (MTIP-102A)

Objective of Course :

The objective of the course is to acquaint the knowledge of electronic devices and electromechanical systems, hydraulic and pneumatic systems, CNC, Robotics and PLC's.

Day	Topic / Chapter Covered	Academic Activity	Test/Assignment
Day 1	Introduction: The Mechatronics approach	Lecture	
Day 2	A methodology for integrated design of Mechanical, Electronics and Electrical Control	Lecture	
Day 3	Computer and Instrumentation	Lecture	
Day 4	Fundamentals of Electronics and digital circuits	Lecture	
Day 5	Number systems: Binary, Octal, Hexadecimal, Conversion from Binary to Decimal, Octal and Hexadecimal and vice-versa	Lecture	
Day 6	Binary arithmetic: Addition, subtraction, Multiplication and division	Lecture	
Day 7	Boolean Algebra: Laws, De-Morgan's laws	Lecture	
Day 8	Logic Gates, Truth tables, Karnaugh maps and logic circuits	Lecture	Assignment 1
Day 9	Generation of Boolean function from truth tables and simplification	Lecture	
Day10	Electrical actuating system: Basic principle of electrical switching	Lecture	
Day11	Solenoids, Electrical relays, Representation of output devices	Lecture	
Day12	Electrical motors: A.C. motors, Stepper motors	Lecture	
Day13	Induction motor speed control	Lecture	
Day14	HYDRAULIC SYSTEMS: Direction Control Valves: Poppet Valve, Spool Valve, Sliding Spool type DCV	Lecture	
Day15	Check Valve, Pilot operated check valve	Lecture	
Day16	Restriction check valve, 2 Way vale, 3 way valve, 4 way valve	Lecture	
Day17	Manually actuated valve, Mechanically actuated valve	Lecture	
Day18	Pilot operated DCV, Solenoid Actuated valve, Rotary Valve	Lecture	Assignment 2
Day19	Centre flow path configurations for three position four way valve,	Lecture	

	Shuttle valve		
Day20	Pressure Control Valve: Simple and compound pressure	Lecture	
Day21	Relief Valve, Pressure Reducing Valve	Lecture	
Day22	Unloading valve, sequence valve, counterbalance valve, Brake Valve	Lecture	
Day23	Flow Control Valves: Fixed and non-adjustable valve, adjustable, throttling	Lecture	
Day24	Non-pressure compensated pressure control valve	Lecture	
Day25	Pressure/temperature compensated flow control valve, Shuttle and Fast exhaust valve	Lecture	
Day26	Time delay valve, Flow Control Valves, Fluid Conditioners	Lecture	
Day27	Hydraulic Symbols (ANSI),Hydraulic Circuit design	Lecture	Assignment 3
Day28	Control of Single and double acting cylinders, double pump Hydraulic System	Lecture	
Day29	PNEUMATIC SYSTEM: Air Generation and distribution, Air compressors, Air Receiver, Filters, intercoolers	Lecture	
Day30	After-coolers, Relief Valve, Air dryers, Primary and secondary lines	Lecture	
Day31	Piping layouts, Air Filters, Air Regulators	Lecture	
Day32	Air Lubricator, Actuators and output devices	Lecture	
Day33	Direction control valves, Flow control valves, junction elements	Lecture	
Day34	Pneumatic circuits, Control of Single and double acting cylinders	Lecture	
Day35	INTRODUCTION TO CNC MACHINES AND ROBOTICS:	Lecture	Assignment 4
Day36	CNC Machines: NC machines, CNC machines	Lecture	
Day37	DNC machines, Machine structure, Slidways	Lecture	
Day38	Guideways, Slide Drives, Spindle	Lecture	
Day39	Robotics:Components of robots	Lecture	
Day40	Classification of robots, Robots application	Lecture	
Day41	PROGRAMMABLE LOGIC CONTROLLERS	Lecture	
Day42	Introduction - Principles of operation - PLC Architecture and specifications	Lecture	
Day43	PLC hardware Components, Analog & digital I/O modules	Lecture	Assignment 5
Day44	CPU & memory module - Programming devices	Lecture	

Day45	PLC ladder diagram	Lecture	
Day46	Converting simple relay ladder diagram in to PLC relay ladder diagram	Lecture	
Day47	PLC programming Simple instructions - Manually operated switches	Lecture	
Day48	Mechanically operated Proximity switches - Latching relays, Applications of PLC	Lecture	

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Lesson Plan of M. Tech. Industrial & Production Engineering Deptt. 2nd Semester

Subject : Industrial Tribology (MTIP-104A)

Objective of Course :

To develop a solution oriented approach by in depth knowledge of Industrial Tribology and address the underlying concepts, methods and application of Industrial Tribology.

Day	Topic / Chapter Covered	Academic Activity	Test/Assignment
Day 1	Fundamentals of Tribology	Lecture	
Day 2	Introduction to tribology and its historical background	Lecture	
Day 3	Economic Importance of Tribology.	Lecture	
Day 4	Friction and Wear:Genesis of friction	Lecture	
Day 5	Friction in contacting rough surfaces, sliding and rolling friction	Lecture	
Day 6	Various laws and theory of friction	Lecture	
Day 7	Stick-slip friction behavior, frictional heating and temperature rise	Lecture	
Day 8	Friction measurement techniques	Lecture	Assignment 1
Day 9	Wear and wear types	Lecture	
Day10	Mechanisms of wear - Adhesive, abrasive, corrosive, erosion, fatigue, fretting, etc.	Lecture	
Day11	Wear of metals and non-metals	Lecture	
Day12	Wear models - asperity contact, constant and variable wear rate	Lecture	
Day13	Geometrical influence in wear models, wear damage	Lecture	
Day14	Wear in various mechanical components, wear controlling techniques.	Lecture	
Day15	Materials for Tribological Applications	Lecture	
Day16	An overview of engineering materials having potential for tribological application	Lecture	
Day17	Characterization and evaluation of Ferrous and non-ferrous materials for tribological requirements/applications	Lecture	
Day18	Composite materials (PM, CMC and MMC) for tribological applications	Lecture	Assignment 2
Day19	Surface treatment techniques:Surface treatment techniques such as carburising, nitriding	Lecture	
Day20	Induction hardening, hard facing,	Lecture	

	laser surface treatments, etc with applications		
Day21	Surface coating techniques such as electrochemical depositions	Lecture	
Day22	Anodizing, thermal spraying	Lecture	
Day23	Chemical Vapour Deposition (CVD), Physical Vapour Deposition (PVD), etc. and their applications	Lecture	
Day24	Lubrication and lubricants: Boundary Lubrication	Lecture	
Day25	Mixed Lubrication, Full Fluid Film Lubrication	Lecture	
Day26	Hydrodynamic, Elastohydrodynamic lubrication	Lecture	
Day27	Primary role of lubricants in mitigation of friction and wear & heat transfer medium	Lecture	Assignment 3
Day28	Composition and properties of lubricants	Lecture	
Day29	Fundamentals - Mineral oil based liquid lubricants	Lecture	
Day30	Synthetic liquid lubricants, Solid lubricants, greases and smart lubricants	Lecture	
Day31	Characteristics of lubricants and greases, Rheology of lubricants	Lecture	
Day32	Evaluation and testing of lubricants	Lecture	
Day33	Lubricants additives and application: Introduction to lubricant additives	Lecture	
Day34	Antioxidants and bearing corrosion inhibitors, Rust inhibitors	Lecture	
Day35	Viscosity improvers, Extreme pressure additives	Lecture	Assignment 4
Day36	Consumption and conservation of lubricants: Lubricants for industrial machinery	Lecture	
Day37	Maintenance and conservation of lubricating oils	Lecture	
Day38	Storage and Handling of lubricants, Used lubricating oil	Lecture	
Day39	Environment and health hazards, Disposability and Recycling	Lecture	
Day40	Technical regulation for lubricants	Lecture	
Day41	Test specifications and standards for maintenance and management of industrial lubricants including greases and used oils	Lecture	
Day42	Selection of optimum lubricant for given application	Lecture	

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Lesson Plan of M. Tech. Industrial & Production Engineering Deptt. 2nd Semester

Subject : Metrology (MTIP-110A)

Objective of Course :

The main objective of the course is to deal with the basic principles of dimensional measuring instruments and precision measurement techniques in achieving quality and reliability in the service of any product in dimensional control.

Day	Topic / Chapter Covered	Academic Activity	Test/Assignment
Day 1	Introduction to metrology: Definition, types	Lecture	
Day 2	Need of inspection, terminologies	Lecture	
Day 3	Methods of measurement, selection of instruments	Lecture	
Day 4	Measurement errors, units	Lecture	
Day 5	Measurement standards, calibration	Lecture	
Day 6	Statistical concepts in metrology	Lecture	
Day 7	Systems of Limits and Fits: Introduction	Lecture	
Day 8	Nominal size, tolerance limits, deviations, Allowance, fits	Lecture	Assignment 1
Day 9	Types – unilateral and bilateral tolerance system	Lecture	
Day10	Hole and shaft basis systems	Lecture	
Day11	Interchangeability and selective assembly	Lecture	
Day12	Indian standard Institution system, British standard system	Lecture	
Day13	International standard system for plain and screwed work.	Lecture	
Day14	Limit Gauges: Taylor's principle	Lecture	
Day15	Design of limit gauges, computer aided tolerancing, Linear Measurement: Length standard	Lecture	
Day16	Line and end standards	Lecture	
Day17	Slip gauges – calibration of the slip gauges, Dial indicator, micrometres	Lecture	
Day18	Measurement of angles and tapers	Lecture	Assignment 2
Day19	Different methods – bevel protractor	Lecture	
Day20	Angle slip gauges – spirit levels– sine bar, Sine plate, rollers and spheres	Lecture	
Day21	Flat Surface Measurement	Lecture	
Day22	Measurement of flat surfaces – instruments used	Lecture	
Day23	Straight edges– surface plates, Optical flat and auto collimator	Lecture	
Day24	Optical Measuring Instruments: Tool maker's microscope and its	Lecture	

	uses		
Day25	Collimators, optical projector, Optical flats and their uses, interferometer	Lecture	
Day26	Surface Roughness Measurement: Introduction, terminology	Lecture	
Day27	Specifying roughness on drawings, surface roughness parameters	Lecture	Assignment 3
Day28	Factors affecting surface roughness, ideal surface roughness	Lecture	
Day29	Roughness measurement methods, precautions in measurement	Lecture	
Day30	Surface microscopy, surface finish softwares	Lecture	
Day31	Screw Thread Measurement, Elements of measurement – errors in screw threads	Lecture	
Day32	Measurement of effective diameter, angle of thread	Lecture	
Day33	Thread pitch, profile thread gauges	Lecture	
Day34	Measurement through Comparators, Comparator: Features of comparators	Lecture	
Day35	Classification of comparators, different comparators	Lecture	Assignment 4
Day36	Advanced comparators, thread comparators	Lecture	
Day37	Metrology of machine tools: Alignment and practical tests.	Lecture	
Day38	Gear Measurement: Gear measuring instruments	Lecture	
Day39	Gear tooth profile measurement, measurement of diameter	Lecture	
Day40	Pitch, pressure angle and tooth thickness	Lecture	
Day41	Advanced Metrology: Advanced measuring machines	Lecture	
Day42	CNC systems, Laser vision, In-process gauging	Lecture	
Day43	3D metrology, metrology softwares	Lecture	Assignment 5
Day44	Nano technology instrumentation, stage position metrology	Lecture	
Day45	Testing and certification services, optical system design	Lecture	
Day46	Lens design, coating design, precision lens assembly techniques	Lecture	
Day47	Complex opto mechanical assemblies	Lecture	
Day48	Contact bonding and other joining technologies	Lecture	

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Lesson Plan of M. Tech. Industrial & Production Engineering Deptt. 2nd Semester

Subject : Quality Engineering and Management (MTIP-114A)

Objective of Course :

The main objective of the course is to impart the students with the knowledge of quality tools and engineering for the improvement of product quality.

Day	Topic / Chapter Covered	Academic Activity	Test/Assignment
Day 1	Introduction to Quality	Lecture	
Day 2	An Historical Overview: Defining Quality	Lecture	
Day 3	The Total Quality System	Lecture	
Day 4	Total Quality Management	Lecture	
Day 5	Economics of Quality	Lecture	
Day 6	Quality	Lecture	
Day 7	Productivity	Lecture	
Day 8	Competitive Position	Lecture	Assignment 1
Day 9	Quality Costs	Lecture	
Day10	Success Stories	Lecture	
Day11	Statistics for Quality	Lecture	
Day12	Variability in Populations	Lecture	
Day13	Some Definitions	Lecture	
Day14	Quality vs. Variability	Lecture	
Day15	Section I: Empirical Methods for Describing Populations	Lecture	
Day16	Section II: Mathematical Models for Describing Populations	Lecture	
Day17	Section III: Inference of Population Quality from a Sample	Lecture	
Day18	Quality in Design	Lecture	Assignment 2
Day19	Planning for Quality	Lecture	
Day20	Product Planning, Product Design	Lecture	
Day21	Process Design	Lecture	
Day22	Quality in Production-Process Control I	Lecture	
Day23	Process Control, The Control Charts	Lecture	
Day24	Measurement Control Charts	Lecture	
Day25	Attribute Control Charts	Lecture	
Day26	Summary on Control Charts	Lecture	
Day27	Process Capability, Measurement System Analysis	Lecture	Assignment 3
Day28	Quality in Production-Process Control II	Lecture	
Day29	Derivation of Limits	Lecture	
Day30	Operating Characteristics of Control Charts	Lecture	
Day31	Measurement Control Charts for Special Situations.	Lecture	

Day32	Quality in Procurement: Importance of Quality in Supplies	Lecture	
Day33	Establishing a Good Supplier Relationship	Lecture	
Day34	Choosing and Certifying Suppliers	Lecture	
Day35	Specifying the Supplies Completely, Auditing the Supplier	Lecture	Assignment 4
Day36	Supply Chain Optimization Using Statistical Sampling for Acceptance	Lecture	
Day37	Continuous Improvement of Quality	Lecture	
Day38	The Need for Continuous Improvement	Lecture	
Day39	The Problem-Solving Methodology	Lecture	
Day40	Quality Improvement Tools	Lecture	
Day41	Lean Manufacturing	Lecture	
Day42	A System for Quality: The Systems Approach	Lecture	
Day43	Dr. Deming's System, Dr.Juran's System	Lecture	Assignment 5
Day44	Dr.Feigenbaum's System	Lecture	
Day45	Baldrige Award Criteria	Lecture	
Day46	ISO 9000 Quality Management Systems	Lecture	
Day47	ISO 9001:2008 Requirements	Lecture	
Day48	The Six Sigma System	Lecture	

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